Regulations 2022
Curriculum and Syllabi
(Updated upto April 2023, as per 20th Academic Council)

M.Sc. (Actuarial Science)

REGULATIONS 2022

CURRICULUM AND SYLLABI

(Updated upto April 2023, as per 20th Academic Council)

M.SC. ACTUARIAL SCIENCE

VISION AND MISSION OF THE INSTITUTION

VISION

B.S. Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in multidisciplinary areas of importance and to play a vital role in the Socio-Economic progress of the Country in a sustainable manner.

MISSION

- To blossom into an internationally renowned Institute.
- To empower the youth through quality and value-based education.
- To promote professional leadership and entrepreneurship.
- To achieve excellence in all its endeavors to face global challenges.
- To provide excellent teaching and research ambience.
- To network with global Institutions of Excellence, Business, Industry and Research Organizations.
- To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation.

DEPARTMENT OF MATHEMATICS & ACTUARIAL SCIENCE

VISION AND MISSION

VISION

To be a leader in providing quality education and to carryout research in the field of Mathematics and Statistics and their applications in Science, Engineering and Technology

MISSION

- To provide quality education in higher mathematics through well designed programs

- To provide quality mathematical foundation for all science and engineering programs

- To offer programs in specialized areas such as Actuarial Science to meet the needs of Insurance and other Industries

- To undertake fundamental, applied and interdisciplinary research

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M.Sc (Actuarial Science)

PROGRAMME EDUCATIONAL OBJECTIVES:

- **PEO1:** To provide opportunities of higher studies in the professional area of Actuarial Science.

- **PEO2:** To impart knowledge on various theoretical and practical aspects of Actuarial Science.

- **PEO3:** To enable the students to apply their newly gained knowledge and skills in their workplace.

- **PEO4:** To develop independent learning skills and transferable skills among the students.

- **PEO5:** To help the students extend and develop their career plan and pursue their own professional development.

- **PEO6:** To provide the students with a structured programme of study covering all Core Actuarial Science subject contents.

- **PEO7:** To contribute to the education of academics, allowing the University to play an active role in the production of advanced studies in the areas of the Master in Actuarial Science.

PROGRAMME OUTCOMES:

On Completion of the Programme, the students will be able to

- **PO1:** Understand the fundamental probability tools for quantitatively assessing risk and demonstrate an ability to apply these tools to problems encountered in Actuarial Science.

- **PO2:** Use the fundamental concepts of Financial Mathematics and demonstrate an ability to use those concepts to calculate present and accumulated values for various streams of cash flows as a basis for future use.

- **PO3:** Demonstrate an understanding of the financial instruments, including derivatives, and the concept of no–arbitrage as it relates to financial mathematics.

- **PO4:** Understand the theoretical bases of certain Actuarial Models and Life Contingent models and can apply those models to insurance and other financial risks.

- **PO5:** Understand the frequency and severity models and an ability to carry out the steps involved in the modelling process in solving Actuarial Science problems.

- **PO6:** Demonstrate the ability to summarize and communicate, orally and in writing, Actuarial problems, and the ability to communicate solutions to Actuarial problems to specialized and non-specialized audiences, and,

- **PO7:** Demonstrate highest standards of Actuarial ethical conduct and Professional Actuarial behaviour, critical, interpersonal and communication skills as well as a commitment to life-long learning.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY, CHENNAI – 600 048.
REGULATIONS 2022
M.Tech. / MCA / M.Sc. / M.Com. / M.A. DEGREE PROGRAMMES
(Under Choice Based Credit System)

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) **"Programme"** means post graduate degree programme (M.Tech. / MCA / M.Sc. / M.Com. / M.A.)

ii) **"Branch"** means specialization or discipline of programme like M.Tech. in Structural Engineering, Food Biotechnology etc., M.Sc. in Physics, Chemistry, Actuarial Science, Biotechnology etc.

iii) **"Course"** means a theory / practical / laboratory integrated theory / mini project / seminar / internship / project and any other subject that is normally studied in a semester like Advanced Concrete Technology, Electro Optic Systems, Financial Reporting and Accounting, Analytical Chemistry, etc.

iv) **"Institution"** means B.S. Abdur Rahman Crescent Institute of Science and Technology.

v) **"Academic Council"** means the Academic Council, which is the apex body on all academic matters of this Institute.

vi) **"Dean (Academic Affairs)"** means the Dean (Academic Affairs) of the Institution who is responsible for the implementation of relevant rules and regulations for all the academic activities.

vii) **"Dean (Student Affairs**)" means the Dean (Students Affairs) of the Institution who is responsible for activities related to student welfare and discipline in the campus.

viii) **"Controller of Examinations"** means the Controller of Examinations of the Institution who is responsible for the conduct of examinations and declaration of results.

ix) **"Dean of the School"** means the Dean of the School of the department concerned.

x) **"Head of the Department"** means the Head of the Department concerned.

2.0 PROGRAMMES OFFERED AND ADMISSION REQUIREMENTS

2.1 Programmes Offered

The various programmes and their mode of study are as follows:

Degree	Mode of Study
M.Tech.	Full Time
MCA	
M.Sc.	
M.Com.	
M.A.	

2.2 ADMISSION REQUIREMENTS

2.2.1 Students for admission to the first semester of the Master's Degree Programme shall be required to have passed the appropriate degree examination as specified in the clause 3.2 [Eligible entry qualifications for admission to programmes] of this Institution or any other University or authority accepted by this Institution.

2.2.2 The other conditions for admission such as class obtained, number of attempts in the qualifying examination and physical fitness will be as prescribed by the Institution from time to time.

3.0 DURATION, ELIGIBILITY AND STRUCTURE OF THE PROGRAMME

3.1. The minimum and maximum period for completion of the programmes are given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
M.Tech.	4	8
MCA	4	8
M.Sc.	4	8
M.Com.	4	8
M.A.	4	8

3.1.1 Each academic semester shall normally comprise of 90 working days. Semester end examinations shall follow within 10 days of the last Instructional day.

3.1.2 Medium of instruction, examinations and project report shall be in English.

3.2 ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO PROGRAMMES

Sl. No.	Name of the Department	Programmes offered	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
1.	Aeronautical Engineering	M.Tech. (Avionics)	B.E. / B.Tech. in Aeronautical Engineering / Aerospace Engineering / Mechanical Engineering / Mechatronics / EEE / ECE / EIE / or Equivalent degree in relevant field.
2.	Civil Engineering	M.Tech. (Structural Engineering)	B.E. / B.Tech. in Civil Engineering / Structural Engineering or Equivalent degree in relevant field.
		M. Tech. (Construction Engineering and Project Management)	B.E. / B.Tech. in Civil Engineering / Structural Engineering / B.Arch. or Equivalent degree in relevant field.
3.	Mechanical Engineering	M.Tech. (CAD/CAM)	B.E. / B.Tech. in Mechanical / Automobile / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace / Aeronautical / Material Science / Polymer / Plastics / Marine Engineering or Equivalent degree in relevant field.
4.	Electrical and Electronics Engineering	M.Tech. (Power Systems Engineering)	B.E. / B.Tech. in EEE / ECE / EIE / ICE / Electronics / Instrumentation Engineering or Equivalent degree in relevant field.
5.	Electronics and Communication Engineering	M.Tech. (VLSI and Embedded Systems)	B.E. / B.Tech. in ECE / EIE / ICE / EEE / IT or Equivalent degree in relevant field.
6.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering)	B.E. / B.Tech. in CSE / IT / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.

Sl. No.	Name of the Department	Programmes offered	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
		M.Tech. (Artificial Intelligence and Data Science)	B.E. / B.Tech. in CSE / IT / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.
7.	Information Technology	M.Tech. (Information Technology)	B.E. / B.Tech. in IT / CSE / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.
8.	Computer Applications	MCA	BCA / B.Sc. Computer Science / B.E. / B.Tech. / B.Sc. Mathematics, B.Sc. Physics / Chemistry / B.Com. / BBA / B.A. with Mathematics at graduation level or at 10 + 2level or equivalent degree in relevant field.
9.	Mathematics	M.Sc. (Actuarial Science)	Any under graduate degree with Mathematics / Statistics as one of the subjects of study at 10 + 2 level.
10.	Physics	M.Sc.(Physics)	B.Sc. in Physics / Applied Science / Electronics /Electronics Science / Electronics & Instrumentation or Equivalent degree in relevant field.
11.	Chemistry	M.Sc.(Chemistry)	B.Sc. in Chemistry / Applied Science or Equivalent degree in relevant field.
12.	Life Sciences	M.Sc. Biochemistry & Molecular Biology	B.Sc. in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
		M.Sc. Biotechnology	B.Sc. in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
		M.Sc. Microbiology	B.Sc.in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
		M.Tech. Biotechnology	B.Tech. / B.E. in Biotechnology or Equivalent degree in relevant field.

Sl. No.	Name of the Department	Programmes offered	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
		M.Tech. Food Biotechnology	B.E. / B.Tech. in Biotechnology / Food Biotechnology / Chemical Engineering / Biochemical Engineering / Industrial Biotechnology or Equivalent degree in relevant field.
13.	Commerce	M.Com	B.Com. / BBA
14.	Arabic and Islamic Studies	M.A. Islamic Studies	B.A. in Islamic Studies / Arabic (or) Afzal-ul-Ulama (or) Any under graduate degree with Part 1 Arabic (or) Any under graduate degree with Aalim Sanad / Diploma / Certificate in Arabic or Islamic Studies.

3.3. STRUCTURE OF THE PROGRAMME

3.3.1 The PG. programmes consist of the following components as prescribed in the respective curriculum:

  i. Core courses
  ii. Elective courses
  iii. Laboratory integrated theory courses
  iv. Project work
  v. Laboratory courses
  vi. Open elective courses
  vii. Seminar
  viii. Mini Project
  ix. Industry Internship
  x. MOOC courses (NPTEL-Swayam, Coursera etc.)
  xi. Value added courses

3.3.2 The curriculum and syllabi of all programmes shall be approved by the Academic Council of this Institution.

3.3.3 For the award of the degree, the student has to earn a minimum total credits specified in the curriculum of the respective specialization of the programme.

3.3.4 The curriculum of programmes shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits specified below:

Programme	Range of credits
M.Tech.	76 -80
MCA	86
M.Sc.	77 - 85
M.Com.	88
M.A.	72

3.3.5 Credits will be assigned to the courses for all programmes as given below:

- ❖ One credit for one lecture period per week or 15 periods of lecture per semester.
- ❖ One credit for one tutorial period per week or 15 periods per semester.
- ❖ One credit each for seminar/practical session/project of two or three periods per week or 30 periods per semester.
- ❖ One credit for 160 hours of industry internship per semester for all programmes (except M.Com.)
- ❖ Four credits for 160 hours of industry internship per semester for M.Com.

3.3.6 The number of credits the student shall enroll in a non-project semester and project semester is as specified below to facilitate implementation of Choice Based Credit System.

Programme	Non-project semester	Project semester
M.Tech.	9 to 32	18 to 26
MCA	9 to 32	18 to 26
M.Sc.	9 to 32	10 to 26
M.Com.	9 to 32	16 to 28
M.A.	9 to 32	NA

3.3.7 The student may choose a course prescribed in the curriculum from any department offering that course without affecting regular

class schedule. The attendance will be maintained course wise only.

3.3.8 The students shall choose the electives from the curriculum with the approval of the Head of the Department / Dean of School.

3.3.9 Apart from the various elective courses listed in the curriculum for each specialization of programme, the student can choose a maximum of two electives from any other similar programmes across departments, aliter to open electives, during the entire period of study, with approval of Head of the department offering the course and parent department.

3.4. ONLINE COURSES

3.4.1 Students are permitted to undergo department approved online courses under SWAYAM up to 40% of credits of courses in a semester excluding project semester (in case of M.Tech. M.Sc. & MCA programmes) with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean Academic Affairs during his/ her period of study. The credits earned through online courses shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

3.4.2 Students shall undergo project related online course on their own with the mentoring of the project supervisor.

3.5 PROJECT WORK

3.5.1 Project work shall be carried out by the student under the supervision of a faculty member in the department with similar specialization.

3.5.2 A student may however, in certain cases, be permitted to work for the project in an Industry / Research organization, with the approval of the Head of the Department/ Dean of School. In such cases, the project work shall be jointly supervised by a faculty of the Department and an Engineer / Scientist / Competent authority from the organization and the student shall be instructed to meet the faculty periodically and to attend the review meetings for evaluating the progress.

3.5.3 The timeline for submission of final project report / dissertation is within 30 calendar days from the last instructional day of the semester in which project is done.

3.5.4 If a student does not comply with the submission of project report / dissertation on or before the specified timeline he / she is deemed to have not completed the project work and shall re-register in the subsequent semester.

4.0 CLASS ADVISOR AND FACULTY ADVISOR

4.1 CLASS ADVISOR

A faculty member shall be nominated by the HOD/ Dean of School as Class Advisor for the class throughout their period of study.

The class advisor shall be responsible for maintaining the academic, curricular and co-curricular records of students of the class throughout their period of study.

4.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling, the Head of the Department / Dean of School of the students shall attach a maximum of 20 students to a faculty member of the department who shall function as faculty advisor for the students throughout their period of study. Such faculty advisor shall guide the students in taking up the elective courses for registration and enrolment in every semester and also offer advice to the students on academic and related personal matters.

5.0 COURSE COMMITTEE

5.1 Each common theory / laboratory course offered to more than one group of students shall have a "Course Committee" comprising all the teachers handling the common course with one of them nominated as course coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending upon whether all the teachers handling the common course belong to a single department or from several departments. The Course Committee shall meet as often as possible to prepare a common question paper, scheme

of evaluation and ensure uniform evaluation of the assessment tests and semester end examination.

6.0 CLASS COMMITTEE

6.1 A class committee comprising faculty members handling the classes, student representatives and a senior faculty member not handling the courses as chairman will be constituted in every semester:

6.2 The composition of the class committee will be as follows:

  i) One senior faculty member preferably not handling courses for the concerned semester, appointed as chairman by the Head of the Department

  ii) Faculty members of all courses of the semester

  iii) All the students of the class

  iv) Faculty advisor and class advisor

  v) Head of the Department – Ex officio member

6.3 The class committee shall meet at least three times during the semester. The first meeting shall be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment shall be decided for the first and second assessment. The second meeting shall be held within a week after the date of first assessment report, to review the students' performance and for follow up action.

6.4 During these two meetings the student members, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process, curriculum and syllabi of courses.

6.5 The third meeting of the class committee, excluding the student members, shall meet within 5 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be

presented to the class committee(s) by the concerned course coordinator.

7.0 REGISTRATION AND ENROLLMENT

7.1 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees. For the subsequent semesters registration for the courses shall be done by the student one week before the last working day of the previous semester.

7.2 Change of a Course

A student can change an enrolled course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

7.3 Withdrawal from a Course

A student can withdraw from an enrolled course at any time before the first continuous assessment test for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

7.4 A student can enroll for a maximum of 32 credits during a semester including Redo / Predo courses.

8.0 BREAK OF STUDY FROM PROGRAMME

8.1 A student may be allowed / enforced to take a break of study for two semesters from the programme with the approval of Dean (Academic Affairs) for the following reasons:

8.1.1 Medical or other valid grounds

8.1.2 Award of 'I' grade in all the courses in a semester due to lack of attendance

8.1.3 Debarred due to any act of indiscipline

8.2 The total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1).

8.3 A student who has availed a break of study in the current semester (odd/even) can rejoin only in the subsequent corresponding

(odd/even) semester in the next academic year on approval from the Dean (Academic affairs).

8.4 During the break of study, the student shall not be allowed to attend any regular classes or participate in any activities of the Institution. However, he / she shall be permitted to enroll for the 'I' grade courses and appear for the arrear examinations.

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT WORK

9.1 A student is permitted to register for project semester, if he/she has earned the minimum number of credits specified below:

Programme	Minimum no. of credits to be earned to enroll for project semester
M.Tech.	18
MCA	22
M.Sc.	18
M.Com	NA
M.A.	NA

9.2 If the student has not earned minimum number of credits specified, he/she has to earn the required credits, at least to the extent of minimum credits specified in clause 9.1 and then register for the project semester.

10.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

10.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% to become eligible to appear for the semester end examination in that course, failing which the student shall be awarded "I" grade in that course.

10.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in the concerned course to the class advisor. The class advisor shall consolidate and furnish the list of students who have earned less than 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head

of the Department / Dean of the School. Thereupon, the Dean (Academic Affairs) shall officially notify the names of such students prevented from writing the semester end examination in each course.

10.3 If a student secures attendance between 65% and less than 75% in any course in a semester, due to medical reasons (hospitalization / accident / specific illness) or due to participation in the institution approved events, the student shall be given exemption from the prescribed attendance requirement and the student shall be permitted to appear for the semester end examination of that course. In all such cases, the students shall submit the required documents immediately after joining the classes to the class advisor, which shall be approved by the Head of the Department / Dean of the School. The Vice Chancellor, based on the recommendation of the Dean (Academic Affairs) may approve the condonation of attendance.

10.4 A student who has obtained an "I" grade in all the courses in a semester is not permitted to move to the next higher semester. Such students shall repeat all the courses of the semester in the subsequent academic year. However, he / she is permitted to redo the courses awarded with 'I' grade / arrear in previous semesters. They shall also be permitted to write arrear examinations by paying the prescribed fee.

10.5 The student awarded "I" grade, shall enroll and repeat the course when it is offered next. In case of "I" grade in an elective course either the same elective course may be repeated or a new elective course may be taken with the approval of the Head of the Department / Dean of the School.

10.6 A student who is awarded "U" grade in a course shall have the option to either write the semester end arrear examination at the end of the subsequent semesters, or to redo the course when the course is offered by the department. Marks scored in the continuous assessment in the redo course shall be considered for grading along with the marks scored in the semester end (redo) examination. If any student obtains "U" grade in the redo course,

the marks scored in the continuous assessment test (redo) for that course shall be considered as internal mark for further appearance of arrear examination.

10.7 If a student with "U" grade, who prefers to redo any particular course, fails to earn the minimum 75% attendance while doing that course, then he / she is not permitted to write the semester end examination and his / her earlier "U" grade and continuous assessment marks shall continue.

11.0 REDO COURSES

11.1 A student can register for a maximum of two redo courses per semester without affecting the regular semester classes, whenever such courses are offered by the department oncerned, based on the availability of faculty members, and subject to a specified minimum number of students registering for each of such courses.

11.2 The number of contact hours and the assessment procedure for any redo course shall be the same as regular courses, except there is no provision for any substitute examination and withdrawal from a redo course.

12.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

12.1 Every theory course shall have a total of three assessments during a semester as given below:

Assessments	Weightage of Marks
Continuous Assessment 1	25%
Continuous Assessment 2	25%
Semester End Examination	50%

12.2 Theory Course

Appearing for semester end theory examination for each course is mandatory and a student shall secure a minimum of 40% marks in

each course in semester end examination for the successful completion of the course.

12.3 Laboratory Course

Every practical course shall have 75% weightage for continuous assessments and 25% for semester end examination. However, a student shall have secured a minimum of 50% marks in the semester end practical examination for the award of pass grade.

12.4 Laboratory Integrated Theory Courses

For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory component and 25% for practical component. Grading shall be done for this consolidated mark. Assessment of theory components shall have a total of three assessments with two continuous assessments carrying 25% weightage each and semester end examination carrying 50% weightage. The student shall secure a separate minimum of 40% in the semester end theory examination. The evaluation of practical components shall be through continuous assessment.

12.5 The components of continuous assessment for theory/practical/laboratory integrated theory courses shall be finalized in the first class committee meeting.

12.6 Industry Internship

In the case of industry internship, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also submit an internship completion certificate issued by the industry / research / academic organisation. The weightage of marks for industry internship report and viva voce examination shall be 60% and 40% respectively.

12.7 Project Work

In the case of project work, a committee of faculty members constituted by the Head of the Department / Dean of the School will carry out three periodic reviews. Based on the project report submitted by the students, an oral examination (viva voce) shall be

conducted as semester end examination by an external examiner approved by the Controller of Examinations. The weightage for periodic reviews shall be 50%. Of the remaining 50%, 20% shall be for the project report and 30% for the viva voce examination.

12.8 The assessment of seminar course including its component and its weightage shall be decided by a committee of faculty members constituted by the Head of the Department. This committee shall ensure the conduct of assessment of components and award marks accordingly.

12.9 For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be used for grading along with the marks scored in the arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination and the internal assessment marks secured during the course of study shall become invalid.

In case of laboratory integrated theory courses, after one regular and one arrear appearance, the internal mark of theory component is invalid and full weightage shall be assigned to the marks scored in the semester end examination for theory component. There shall be no arrear or improvement examination for lab components.

13.0 SUBSTITUTE EXAMINATIONS

13.1 A student who is absent, for genuine reasons, may be permitted to write a substitute examination for any one of the two continuous assessment tests of a course by paying the prescribed substitute examination fee. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc. by a committee constituted by the Head of the Department / Dean of School for that purpose. However, there is no substitute examination for semester end examination.

13.2 A student shall apply for substitute exam in the prescribed form to the Head of the Department / Dean of School within a week from the date of assessment test. However, the substitute

examination will be conducted only after the last working day of the semester and before the semester end examination.

14.0   SUPPLEMENTARY EXAMINATION

14.1   Final Year students can apply for supplementary examination for a maximum of three courses thus providing an opportunity to complete their degree programme. Likewise, students with less credit can also apply for supplementary examination for a maximum of three courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within three weeks of the declaration of results in both odd and even semesters.

15.   PASSING, DECLARATION OF RESULTS AND GRADE SHEET

15.1   All assessments of a course shall be made on absolute marks basis. However, the Class Committee without the student members shall preferably meet within 5 days after the semester end examination and analyze the performance of students in all assessments of a course and award letter grades. The letter grades and the corresponding grade points are as follows:

Letter Grade	Grade Points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
I	0

"I"   denotes inadequate attendance and hence prevented from appearing for semester end examination

"U"   denotes unsuccessful performance in the course.

15.2 A student who earns a minimum of five grade points ('E' grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student for improvement of grade.

15.3 The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department/Dean of School and it shall be declared by the Controller of Examinations.

15.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed fees to the Controller of Examinations. Subsequently the Head of the Department/ Dean of School offered the course shall constitute a revaluation committee consisting of Chairman of the Class Committee as convener, the faculty member of the course and a senior faculty member knowledgeable in that course as members. The committee shall meet within a week to re-evaluate the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

15.5 After results are declared, grade sheets shall be issued to each student, which contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA is the ratio of the sum of the products of the number of credits of courses registered and the grade points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester.

If C_i, is the number of credits assigned for the ith course and GP_i is the Grade Point in the ith course

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GP_i)}{\sum_{i=1}^{n} C_i}$$

Where n = number of courses

The Cumulative Grade Point Average (CGPA) is calculated in a similar manner, considering all the courses enrolled from first semester.

"I" grade is excluded for calculating GPA.

"U" and **"I"** grades are excluded for calculating CGPA.

The formula for the conversion of CGPA to equivalent percentage of marks is as follows:

Percentage Equivalent of Marks = CGPA X 10

15.6 After successful completion of the programme, the Degree shall be awarded upon fulfillment of curriculum requirements and classification based on CGPA as follows:

Classification	CGPA
First Class with Distinction	8.50 and above and passing all the courses in first appearance and completing the programme within the minimum prescribed period.
First Class	6.50 and above and completing the programme within a minimum prescribed period plus two semesters.
Second Class	Others

15.6.1 Eligibility for First Class with Distinction

- A student should not have obtained 'U' or 'I' grade in any course during his/her study
- A student should have completed the PG programme within the minimum prescribed period of study (except clause 8.1.1)

15.6.2 Eligibility for First Class

A student should have passed the examination in all the courses not more than two semesters beyond the minimum prescribed period of study (except clause 8.1.1)

15.6.3 The students who do not satisfy clause 15.6.1 and clause 15.6.2 shall be classified as second class.

15.6.4 The CGPA shall be rounded to two decimal places for the purpose of classification. The CGPA shall be considered up to three

decimal places for the purpose of comparison of performance of students and ranking.

16.0 DISCIPLINE

16.1 Every student is expected to observe discipline and decorum both inside and outside the campus and not to indulge in any activity which tends to affect the reputation of the Institution.

16.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HOD / Dean shall be referred to a Discipline and Welfare Committee constituted by the Registrar for taking appropriate action.

17.0 ELIGIBILITY FOR THE AWARD OF THE MASTER'S DEGREE

17.1 A student shall be declared to be eligible for the award of the Master's Degree, if he/she has:

   i. Successfully acquired the required credits as specified in the curriculum corresponding to his/her programme within the stipulated time.

   ii. No disciplinary action is pending against him/her.

   iii. Enrolled and completed at least one value added course.

   iv. Enrollment in at least one MOOC / SWAYAM course (non-credit) before the final semester.

17.2 The award of the degree must have been approved by the Institute.

18.0 POWER TO MODIFY

Notwithstanding all that have been stated above, the Academic Council has the right to modify any of the above regulations from time to time.

<center>**************</center>

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

M.SC ACTUARIAL SCIENCE
CURRICULUM & SYLLABI, REGULATIONS 2022

Semester 1

Course Code	Course Title	L	T	P	C
MAE 6101	Fundamentals of Financial Mathematics	3	1	0	4
MAE 6102	Probability and Distributions	3	1	0	4
MAE 6103	Business Economics	3	1	0	4
MAE 6104	Financial Reporting and Accounting	3	1	0	4
MAE 6105	Principles of Insurance	2	0	0	2
MAE 6106	Actuarial Computational Laboratory (MS-EXCEL)	0	0	4	2
ENE 6182	Professional Communication	1	0	2	2
	Credits				**22**

Semester 2

Course Code	Course Title	L	T	P	C
MAE 6201	Applications of Financial Mathematics	3	1	0	4
MAE 6202	Fundamentals of Life Contingencies	3	1	0	4
MAE 6203	Descriptive Statistical Methods in Actuarial Science	3	1	0	4
MAE 6204	Stochastic Models	3	1	0	3
MAE 6205	Mathematical Statistics	3	1	0	4
MAE 6206	R – Programming	0	0	4	2
GEE 6202	Research Methodology and IPR	3	0	0	3
----	Value Added Course	--	--	--	--
	Credits				**24**

Semester 3

Course Code	Course Title	L	T	P	C
MAE 7101	Applications of Life Contingencies	3	1	0	4
MAE 7102	Financial Economics	3	1	0	4
MAE 7103	Applied Statistical Methods in Actuarial Science	3	1	0	4
MAE 7104	Survival Models	3	1	0	4
MAE 7105	Actuarial Computational Laboratory Python	0	0	4	2
	Elective – I	3	0	0	3
	Elective – II	3	0	0	3
MAE 7201	Project Phase – I	0	0	8	4*
MAE 7106	Industry Internship #				1
----	MOOC Course	--	--	--	--
	Credits				**25**

Semester 4

Course Code	Course Title	L	T	P	C
MAE 7201	Project Phase – II	0	0	24	8
	Credits			**(4 + 8 - 12)**	

Total Credits (22+24+24+12) = 83

∗   Credits for Project Work Phase – I to be accounted along with Project Work Phase – II in IV Semester.

Industrial training will be undertaken during first year summer vacation for 15 days. The credit will be awarded in the 3rd Semester.

LIST OF ELECTIVES

Elective – I

Course Code	Course Title	L	T	P	C
MAEY 01	Financial Management of Life Office	3	0	0	3
MAEY 02	Islamic Investments	3	0	0	3
MAEY 03	Corporate Finance	3	0	0	3
MAEY 04	Mortality projection & Machine Learning	3	0	0	3

Elective – II

Course Code	Course Title	L	T	P	C
MAEY 05	Financial Markets	3	0	0	3
MAEY 06	Islamic Asset and Fund Management	3	0	0	3
MAEY 07	Portfolio and Credit Risk Management	3	0	0	3

MAE 6101 **FUNDAMENTALS OF FINANCIAL** **L T P C**
SDG 4 **MATHEMATICS** **3 1 0 4**

COURSE OBJECTIVES:

To make the student conversant with

COB1: Basic of data analysis and cash flow model

COB2: Various types of Interest rate used in application

COB3: Real and money interest rates

COB4: Types of level annuity contract

COB5: Types of variable annuity contract

COB6: Preparing a loan Schedule

MODULE I   DATA ANALYSIS AND CASH FLOW MODEL   7+2

Aims, process and sources of a data analysis-Reproducible research-Cash flow model: Cash flow process, outflows-Cash flow model for a zero coupon bond – Time value of money – Simple and Compound interest problems-Present value and Simple discount- Investing over a period.

MODULE II   INTEREST RATES   7+2

Interest rates: Nominal and effective rate of interest. Accumulation factors- Principle of consistency- The force of interest- Present values-The basic compound interest functions- Interest payable monthly.

MODULE III   REAL AND MONEY INTEREST RATES   7+2

Real and money interest rates: Definition- Deflationary conditions-Usefulness. Discounting and accumulating: Present value of continuous cash flows- Valuing cashflows- Interest income.

MODULE IV   LEVEL ANNUITIES   8+3

Level annuities: Present values and Accumulations -Payments made in arrear- Payments made in advance- Continuously payable annuities-Annuities payable monthly- Non-integer values- Perpetuities.

MODULE V   DEFERRED AND INCREASING ANNUITIES   8+3

Deferred and increasing annuities: Deferred annuities- Varying annuities- Decreasing payments- Irregular payments- Sudden changes in interest rates- Simple and Compound increasing annuities.

MODULE VI   LOAN SCHEDULES   8+3

Equations of value: Uncertain payment or receipt- Loan schedules- Calculation of capital outstanding- Calculation of interest and capital elements- Installments payable more frequently than annually- Consumer credit: flat rates and APRs

L – 45; T – 15; TOTAL – 60

REFERENCES:

1. Mark S. Joshi, "The concepts and practice of Mathematical Finance", Cambridge University Press, 2nd Edition (2008).
2. Paul Wilmott, Sam Howison, and Jeff Dewynne "The Mathematics of Financial derivatives" Cambridge University press, 1995.
3. S.M. Ross "An Introduction to Mathematical finance" Cambridge University Press.
4. J J McCutcheon and Dr W F Scott, "An Introduction to the Mathematics of Finance" Heinemann, 1986.
5. Bowers, Newton L et al. "Actuarial mathematics" – 2nd ed. – Society of Actuaries, 1997.
6. Butcher, M V; Nesbitt, Cecil J. "Mathematics of compound interest". Ulrich's Books, 1971.
7. Ingersoll, Jonathan E. Rowman & Littlefield, "Theory of financial decision making" 1987.
8. Kellison, Stephen G. "The theory of interest".2nd ed. Irwin, 1991.

COURSE OUTCOMES:

On completion of the course the students will be able to

- **CO1:** describe how to use a generalised cash-flow model to describe financial transactions
- **CO2:** describe how to consider the time value of money using the concepts of compound interest and discounting.

- **CO3:** show how interest rates or discount rates may be expressed in terms of different time periods.
- **CO4:** demonstrate a knowledge and understanding of real and money interest rates.
- **CO5:** calculate the present value and the accumulated value of a stream of equal or unequal payments using specified rates of interest and the net present value at a real rate of interest, assuming a constant rate of inflation.
- **CO6:** describe how a loan may be repaid by regular installments of interest and capital.

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1			L				
CO2		L				M	
CO3							
CO4				M			
CO5	H				M		
CO 6						H	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: This course provides a basic grounding in financial mathematics like simple interest, compound interest and their simple applications to calculate accumulate value, present value, and loan calculation.

MAE 6102 **PROBABILITY AND DISTRIBUTIONS** **L   T   P   C**

SDG 4 **3   1   0   4**

COURSE OBJECTIVES:

To make the student conversant with

COB1: the aspects of Basic probability concepts

COB2: Discrete probability distributions

COB3: Continuous probability distributions

COB4: Various Generating functions

COB5: functions of two or more variables

COB6: Conditional expectation and law of large numbers

MODULE I **BASIC PROBABILITY** **9+3**

Basics of probability- The addition and multiplication rule – Conditional Probability- and Total probability – Baye's Theorem. Random Variables and Expectation of a random variable –Continuous random variables Functions of a random variable.

MODULE II **DISCRETE PROBABILITY DISTRIBUTION** **6+2**

Discrete distributions- Uniform, Bernoulli, Binomial, Geometric, Negative binomial, Hypergeometric and Poisson distribution.

MODULE III **CONTINUOUS PROBABILITY** **9+3**
  DISTRIBUTIONS

Continuous distributions- Uniform, Gamma, exponential, chi-square, Beta, Normal distribution, Lognormal distribution, t-distribution, F-distribution. Deriving the Poisson process, Random number simulation.

MODULE IV **GENERATING FUNCTIONS** **6+2**

Probability generating functions, Moment generating functions, Cumulant generating functions, Linear functions.

MODULE V **JOINT DISTRIBUTIONS** **7+2**

Joint distributions- Expectations of functions of two variables- Convolutions- Using generating functions to derive distributions of linear combinations of independent random variables.

MODULE VI   CONDITIONAL EXPECTATION AND LAW   8+3
OF LARGE NUMBERS

Conditional expectation and Conditional variance - Compound distributions- Functions of vector random variables. Weak and strong law of large numbers - Central Limit Theorems - Normal approximations. The continuity correction.

L – 45; T – 15; TOTAL – 60

REFERENCES:

1. Miller, I.; Miller, M.; [Freund, J. E.], "Mathematical statistics", 7th ed. Prentice Hall International, 1999
2. S.C Gupta,V.K Kapoor, "Fundamentals of mathematical statistics ", Sultan chand and sons , New Delhi.
3. S.C Gupta,V.K Kapoor, "Fundamentals of Applied statistics ", Sultan chand and sons , New Delhi.
4. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. "A Modern Introduction to Probability and Statistics" Springer text series, 2nd Edition
5. Chin Long chiang " Statistical Methods of Analysis " World Scientific Books, 2003

COURSE OUTCOMES:

On completion of the course the students will be able to

- **CO1:** summarize the main features of a data set (exploratory data analysis).
- **CO2:** explain the concepts of probability.
- **CO3:** explain the concepts of random variable, probability distribution, distribution function, expected value, variance and higher moments, and calculate expected values and probabilities associated with the distributions of random variables.
- **CO4:** define a probability generating function, a moment generating function, a cumulant generating function and cumulants, derive them in simple cases, and use them to evaluate moments.
- **CO5:** explain the concepts of independence, jointly distributed random variables and conditional distributions, and use generating functions to

establish the distribution of linear combinations of independent random variables.

- **CO6:** state the central limit theorem, and apply

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4							
CO5							
CO6				H			L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: This subject provides a grounding in the aspects of Basic probability, Random variables, probability distributions, joint distribution that are of relevance to actuarial work.

MAE 6103　　　　**BUSINESS ECONOMICS**　　　**L　T　P　C**

SDG 4　　　　　　　　　　　　　　　　　　　　　　**3　1　0　4**

COURSE OBJECTIVE:

To make the student conversant with

COB1: Different economic systems, Demand and Supply

COB2: Perfect competition and monopoly

COB3: Products, marketing, and advertising

COB4: Types of market failure and government intervention

COB5: International trade

COB6: The macroeconomic environment

MODULE I　ECONOMIC CONCEPTS, SUPPLY AND　　8+3
　　　　　　　DEMAND

Economic concepts and systems- Different economic systems- Main strands of economic thinking- Demand- Supply- Price and output determination- Price elasticity of demand- The time dimension- The control of prices- Indirect taxes and subsidies- Marginal utility theory- Indifference analysis- Demand under conditions of risk and uncertainty- Behavioural economics- The short-run and long-run theory of production and Costs Revenue-　　　　　　　　　Profit　　　　　　　　maximization.

MODULE II　MONOPOLY AND OLIGOPOLY　　　　8+2

Production and costs- Costs in the short run and long run- Revenue and profit maximization- Perfect competition and monopoly- Comparing monopoly with perfect competition- contestable markets-Imperfect competition- Monopolistic competition- Oligopoly- Collusive oligopoly- Non-collusive oligopoly.

MODULE III　PRODUCTS, MARKETING AND ADVERTISING　7+3

Products, marketing, and advertising- Growth strategy and globalization- Growth and profitability- Constraints on growth- Alternative growth strategies- Internal and External growth- Globalization-Pricing strategies- Pricing and market structure- Price discrimination- Multiple product pricing.

MODULE IV   GOVERNMENT INTERVENTION IN MARKETS   7+2

Government intervention in markets- objectives- Types of market failure- Types of government intervention- Government and the firm- Competition policy- Policies towards R&D- Supply-side policy- Market-orientation- Industrial policy.

MODULE V   INTERNATIONAL TRADE   7+3

International trade- Trading patterns- advantages- The world trading system and the WTO-Balance of payments and exchange rates- The balance of payments account- Fixed versus floating exchange rates- Business activity, unemployment and Inflation- Keynesian model- The "disappearance" of the Phillips curve- Business cycles.

MODULE VI   THE MACROECONOMIC ENVIRONMENT   8+2

The macroeconomic environment- objectives- The circular flow of income- The measurement and determination of national income- Economic growth- The AD-AS model Money and interest rates- The financial system- The supply and demand of money- Equilibrium in the money market- The effect of a change in the money supply- Demand-side macroeconomic policy- Fiscal policy- Monetary policy- The supply-side problem.

L – 45; T – 15; TOTAL – 60

REFERENCES:

1. Sloman, John; Hinde, Kevin. "Economics for business"- 4th ed.- Prentice Hall, 2007. ISBN: 9780273709084. [No: 38420]
2. Frederik Mishkin " Economics of Money banking and Financial Markets ", Prentice Hall, July , 2009.

COURSE OUTCOMES: On completion of the course the students will be able to

- **CO1:** discuss the interaction between supply and demand in the provision of a product and the way in which equilibrium market prices are determined, define elasticity of demand and supply and discuss the effects on a market of different levels of elasticity.

- **CO2:** describe how profit maximizing firms make short run and long run production choices. Describe what is meant by different sorts of competition, or lack of it, and discuss the practical effect on supply and demand.
- **CO3:** define what is meant by GDP, GNP and net national product, show how these concepts may be useful in describing the economy and in making comparisons between countries, and discuss their limitations.
- **CO4:** describe how the propensity to save or to consume by the private sector or the corporate sector affects the economy. describe and discuss the impact of fiscal and monetary policy and other forms of government intervention on different aspects of the economy, and in particular on financial markets.
- **CO5:** discuss the role of exchange rates and international trade in the economy and the meaning of the term balance of payments.
- **CO6:** describe the major factors affecting the rate of inflation, the level of interest rates, the exchange rate, the level of unemployment, and the rate of economic growth in the economy of an industrialized country.

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4							
CO5							
CO 6	L			H			

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: Business Economics subject is to provide a grounding in the fundamental concepts of economics as they affect the operation of insurance and other financial systems, both from the point of view of individuals and their requirements for financial security, and from the point of view of financial institutions and their ability to provide products that meet customer needs

MAE 6104	FINANCIAL REPORTING AND	L	T	P	C
SDG 4	ACCOUNTING	3	1	0	4

COURSE OBJECTIVE:

To make the student conversant with

COB1: Finance and the real resources of an organization

COB2: Financial instruments

COB3: Accounts and Accounting Standards

COB4: Preparing Income statement and Balance Sheet

COB5: Group accounts and insurance company accounts-

COB6: Interpretation and limitation of accounts

MODULE I   THE KEY PRINCIPLES OF FINANCE   8+3

The key principles of finance- Finance and the real resources of an organization-Business objectives- The maximisation of shareholder wealth- Company ownership- Types of business entity - Types of medium-term company finance- Types of short-term company finance- Taxation- Personal taxation- Corporation tax- Capital gains Tax- Double taxation relief.

MODULE II   FINANCIAL INSTRUMENTS   7+2

Financial instruments- Debenture - Unsecured loan stocks- Subordinated debt- Eurobond loan capital- Share capital-Convertible- Warrants- Use of derivatives- Financial futures- Options- Interest rates and currency swaps- Issue of shares- Obtaining stock exchange quotation- Rights issues- Scrip issues.

MODULE III   INTRODUCTION TO ACCOUNTS   7+2

Introduction to accounts- Users- regulation- requirements- Accounting Standards Board- The auditors' report- Accounting concepts- The main accounts- balance sheet- income statement- cash flow statement- Statement of changes in equity- Notes to the accounts.

MODULE IV   GENERATING ACCOUNTS   7+2

Depreciation- purpose of depreciation- straight line basis -reducing balance method- Generating accounts -The trial balance- Constructing financial statements.

MODULE V   **GROUP AND INSURANCE COMPANY**   **8+3**
                                 ACCOUNTS

Group accounts and insurance company accounts- Subsidiary companies-
Consolidated balance sheets- Goodwill on consolidation- Minority interests-
Associated companies.

MODULE VI   **INTERPRETATION AND LIMITATION OF**   **8+3**
                                 ACCOUNTS

Interpretation of accounts- security of loan capital - Income cover and income
priority percentages- Asset cover and asset priority percentages- Gearing-
shareholder analysis- Ratios involving share information- Profitability ratios-
Liquidity ratios- Efficiency ratios- Limitations in the interpretation of accounts.

L – 45; T – 15; TOTAL – 60

REFERENCES:

1. Anne Britton, Chris waterston " Financial Accounting", Pearson Education,2009
2. Barry Elliott, Jamie Elliott "Financial Accounting and reporting", Trans-Atlantic publications, 2005.
3. Lawrence Revsine "Financial Reporting and Analysis", Mc Graw Hill, 2008.
4. Samuels, J M; Brayshaw, R E; Craner, J M. "Financial statement analysis in Europe" -Chapman & Hall, 1995.
5. Brigham, Eugene F; Houston, Joel F. "Fundamentals of financial management" 9th Edition - Harcourt Brace, 2000.
6. Brett, M. "How to read the financial pages", 2nd Edition-Random House Business Books, 2003.
7. Holmes, Geoffrey; Sugden, Alan; Gee, Paul. – "Interpreting company reports and accounts"- 8th Edition - Pearson Education, 2002.
8. Brealey, Richard A; Myers, Stewart C. – "Principles of corporate finance" - 7th Edition -McGraw-Hill, 2003.

COURSE OUTCOMES: On completion of the course the students will be able to

CO1: demonstrate a knowledge and understanding of the principal terms which is used in investment and asset management.

CO2: demonstrate an awareness of the key principles of finance and basic principles of personal and corporate taxation.

CO3: describe the structure of a joint stock company and the different methods by which it may be financed.

CO4: demonstrate a knowledge and understanding of the characteristics of the principal forms of financial instrument issued or used by companies and the ways in which they may be issued.

CO5: describe the basic construction of accounts of different types and the role and principal features of the accounts of a company.

CO6: interpret the accounts of a company or a group of companies and discuss the limitations of such interpretation and show how financial techniques can be used in the assessment of capital investment projects.

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4							
CO5	M						
CO 6				L			

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: This subject provides a basic understanding of corporate finance including knowledge of the instruments used by companies to raise finance and manage financial risk. Also, it provide the ability to interpret the accounts and financial statements of companies and financial institutions.

MAE 6105   **PRINCIPLES OF INSURANCE**   **L   T   P   C**

SDG 4   **2   0   0   2**

COURSE OBJECTIVES:

To make the student conversant with

COB1: The concept of risk, its kinds and classification

COB2: The business of insurance

COB3: Insurance customers

COB4: Pprinciples of Insurance

COB5: Insurance terminology-terms that are specific to life insurance

COB6: Insurance terminology-terms that are specific to general insurance

MODULE I   THE CONCEPT OF RISK   5

The concept of risk- kinds and classification of risk – assessment – transfer- risk appraisal-risk selection- underwriting risk appraisal – Mortality tables- physical and moral hazards- representations- warranties- conditions.

MODULE II   THE BUSINESS OF INSURANCE   5

The business of insurance-risk managed by individuals- risk managed by insurers-premium fixing- reinsurance and its important-role of insurance in economic development-the insurance market-role of-intermediaries- specialists-regulator.

MODULE III   INSURANCE CUSTOMERS   5

Insurance customers-types of customers-customer mindset and customer satisfaction-importance of ethical behavior-History of insurance- History of insurance in India.

MODULE IV   BASIC PRINCIPLES OF INSURANCE   5

Basic principles of Insurance – Utmost good faith- Insurable Interest- Material facts- Economic principles of Insurance- Sharing – Subrogation – contribution –Legal principles of Insurance –Actuarial principles.

MODULE V   INSURANCE TERMINOLOGY, LIFE INSURANCE   5

Insurance terminology-terms that are specific to life insurance-traditional product offered by life insurance companies-features of MODULE linked policies-features of annuities and group policies.

MODULE VI   INSURANCE TERMINOLOGY, GENERAL   5
INSURANCE

Insurance terminology-terms that are specific to general insurance-product offered by non-life insurance companies-fire insurance-marine insurance-various product under miscellaneous category.

L – 30; TOTAL – 30

REFERENCES:

1. Neelam C Gulati "Principles of Insurance Management", Excel Books, New Delhi.
2. Harriett E Jones "Principles of Insurance "FLMI Insurance Education Program. Life Management Institute LOMA, (Dec 1995).
3. Robert I Mehr "Principles of Insurance" Richar D Irwin edition,(8th edition, 1985).
4. Ben G Baldwin "The New Life Insurance Investment Advisor" 2nd Edition. Mc Graw Hill.

COURSE OUTCOMES: On completion of the course the students will be able to

CO1: describe the basic principle of insurance.

CO2: identify different kind of insurable risk.

CO3: describe the history of insurance.

CO4: plan new products-based on the market need

CO5: demonstrate the insurance terminology in life insurance.

CO6: demonstrate the insurance terminology in life insurance.

Board of Studies (BoS) :   **Academic Council:**

14th BOS of Mathematics & AS held   19th AC held on 29.09.2022
on 30.06.2022.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4							
CO5	M						
CO6				M			M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: The subject Principles of Insurance gives introduction about the various types of insurable risk, principle of insurance, insurance products and markets with a brief history of Insurance.

MAE 6106   **ACTUARIAL COMPUTATIONAL**   **L   T   P   C**
SDG 4   **LABORATORY, (MS – EXCEL)**   **0   0   4   2**

COURSE OBJECTIVES:

To make the student conversant with

COB1: Basic calculation using MS-Excel

COB2: Pivot Tables

COB3: Mathematical and statistical function

COB4: Plot and display information through Charts

COB5: Simulation and calculation of probability value

COB6: Excel Macros and VBA

MODULE I   INTRODUCTION TO MS-EXCEL   5

Custom Toolbar/Custom Menu Bar-Paste Options/Paste List/Paste Special-Managing Comments/Protect Worksheet-Create Lists/Data Form-Custom Sort/Auto Filters/Subtotals-Labels in Formulas-IF/AND/OR Conditions-Basic Formatting Techniques-Conditional Formatting-Naming Ranges and Cells-Auto-Filter and Advanced Data Filtering-Data Validation with In-Cell Drop-Down List

MODULE II   PIVOT TABLES   5

Introduction to Pivot Tables-Drill-down functionality-show/hide totals, error/empty cell display options, Value calculation-label layout, sorting labels

MODULE III   FUNCTION & FORMULA   5

Mathematical and statistical function-Lookup and reference function-Index and Match function-Date and Time function-Text function-Logical function

MODULE IV   DATA DISPLAY   5

Bar charts and dot charts-Pie charts-Histograms- Formatting/editing chart axes, data labels, legends, data series, and chart titles- Sparklines

**MODULE V SIMULATING VALUES AND CALCULATING   5
              PROBABILITIES**

Basic probability- discrete distributions - continuous distributions - Confidence interval- hypothesis testing- Simple linear regression- Introduction to multiple regression

MODULE VI EXCEL MACROS AND VBA   5

Macro in Excel- Developer Options - Record a Macro – Advance Macro- Run Macro- Introduction to VBA

L – 0; T – 0; P – 30; TOTAL – 30

REFERENCES:

1. D.M. Levine, D.F.Stephan, T.C. Krehbiel, M.L. Berenson. "Statistics for Managers Using Microsoft Excel" 5th Edition, Pearson Education Ltd., 2008.

COURSE OUTCOMES: On completion of the course the students will be able to

- **CO1:** entering data.
- **CO2:** calculating a set of data.
- **CO3:** displaying the data in a meaningful way.
- **CO4:** Sharing data so that other can understand.
- **CO5:** formatting cells for the need.
- **CO6:** using functions and formulae and inserting charts and graphs.

Board of Studies (BoS) :   **Academic Council:**

14th BOS of Mathematics & AS held   19th AC held on 29.09.2022
on 30.06.2022.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4							
CO5						M	

CO 6		L					

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: The laboratory course is to provide grounding in Microsoft Excel so that students can perform the actuarial calculation in an effective way.

ENE 6182   **PROFESSIONAL COMMUNICATION**   **L   T   P   C**

SDG: 4 and 8   **1   1   0   2**

COURSE OBJECTIVES:

COB1: To enhance the Employability and Career Skills of students

COB2: To orient the students towards grooming as a professional

COB3: To make them Employability Graduates

COB4: To train students making effective presentations and discussion various topics.

MODULE I   COMMUNICATION AT WORKPLACE   3+1

Language and communication-Communication at the workplace- Formal and informal communication- Direction of flow of communication- Non-verbal communication- Communication and organizational culture-Communication and inter- personal relations- Importance of the 'U' in communication

MODULE II   PRESENTATION SKILLS   3+5

Importance of presentation skills-Overcoming the fear of public speaking towards making effective presentations- A step-by-step approach to presentations –planning the presentation-Gathering feedback- Making the presentation

MODULE III   CORRESPONDENCE AT WORK   3+3

Importance of workplace correspondence-Types of correspondence-Mechanics of effective business correspondence-Tips for effective correspondence-The seven Cs of communication- Writing effective emails- Email etiquette-Personal touch in business communication

MODULE IV   TEAM WORK   3+5

Importance of team work-Understanding team behavior-Team as an employability skill- Team formation and development-Pooling competencies in a team- Significance of team spirit-How to be an effective team player – Group Discussion

MODULE V   WORKPLACE ETIQUETTE   **3+1**

Etiquette in modern workplace- Workplace etiquette- global and local Culture sensitivity-Gender sensitivity- importance of grooming-Etiquette in interaction-Netiquette

L-15, T-15; TOTAL HOURS - 30

REFERENCES:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015.
2. Interact English Lab Manual for Undergraduate Students,.OrientBalckSwan: Hyderabad, 2016.
3. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014.
5. S. Hariharan etal. Soft Skills. MJP Publishers: Chennai, 2010.
6. Pillai, Sabina & Fernandez, Agna.Soft skills & Employability Skills,Cambridge University Press India Pvt.Ltd.,New Delhi.

.

COURSE OUTCOMES: On completion of the course the students will be able to

CO1: Identify the flows of communication

CO2: Make effective presentations

CO3: Write effective business correspondences.

CO4: Participate in group discussions and team work confidently.

CO5: Follow appropriate workplace etiquette

Board of Studies (BoS) :   **Academic Council:**

15th BoS of the Department of English held on 14.6.2022   19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4							
CO5							

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement: This course ensures that the students acquire quality education and are also made eligible to obtain productive and decent employment.

MAE 6201	APPLICATIONS OF FINANCIAL	L	T	P	C
SDG 4	MATHEMATICS	3	1	0	4

COURSE OBJECTIVES:

To make the student conversant with

COB1: Project appraisal

COB2: Elementary compound interest problems

COB3: Uncertain income securities

COB4: Arbitrage and forward contracts

COB5: Term structure of interest rates

COB6: Stochastic interest rate models

MODULE I   PROJECT APPRAISAL   8+2

Project appraisal- Accumulated value- Net present values-Internal rate of return-Comparison of two investment projects-Different interest rates for lending and borrowing-payback periods.

MODULE II   ELEMENTARY COMPOUND INTEREST   7+2
                        PROBLEMS

Elementary compound interest problems-Fixed interest securities-Calculating the price-Calculating yields-The effect of the term to redemption on the yield-Optional redemption dates-Deferred income tax- Capital gains tax.

MODULE III   BONDS, EQUITY AND PROPERTY   8+3

Uncertain income securities-Equities-Property-Real rates of interest-Inflation adjusted cash flows-Calculating real yields using an inflation index-Index-linked bonds.

MODULE IV   ARBITRAGE AND FORWARD CONTRACTS   7+2

Arbitrage and forward contracts-The "No Arbitrage" assumption-Why do we assume "No Arbitrage"?-Forward contracts-Calculating the forward price for a security with no income-Calculating the forward price for a security with fixed cash income-Calculating the forward price for a security with known dividend yield-Hedging-The value of a forward contract.

MODULE V   TERM STRUCTURE OF INTEREST RATES   8+3

Term structure of interest rates-Discrete time-spot rates-forward rates-Continuous time-spot rates-forward rates-Instantaneous forward rates-Theories of the term structure of interest rates-Yields to maturity-Pay yields-Duration, convexity and immunization

MODULE VI   STOCHASTIC INTEREST RATE MODELS   7+3

Stochastic interest rate models-Simple models-Preliminary remarks-Fixed interest rate model-Varying interest rate model-Log-normal distribution.

L – 45; T – 15; TOTAL – 60

REFERENCES:

1. Mark S. Joshi, "The concepts and practice of Mathematical Finance", Cambridge University Press, 2nd Edition (2008).
2. Paul Wilmott, Sam Howison, and Jeff Dewynne "The Mathematics of Financial derivatives" Cambridge University press, 1995.
3. S.M. Ross "An Introduction to Mathematical finance" Cambridge University Press..
4. J J McCutcheon and Dr W F Scott, "An Introduction to the Mathematics of Finance Heinemann",1986.
5. Bowers, Newton L et al. "Actuarial mathematics" – 2nd ed. – Society of Actuaries, 1997.
6. Butcher, M V; Nesbitt, Cecil J. "Mathematics of compound interest". Ulrich's Books, 1971.
7. Ingersoll, Jonathan E. Rowman & Littlefield, "Theory of financial decision making" 1987.
8. Kellison, Stephen G. "The theory of interest".2nd ed. Irwin, 1991.

COURSE OUTCOMES:

On completion of the course the students will be able to

- **CO1:** show how discounted cash flow techniques can be used in investment project appraisal.
- **CO2:** describe the investment and risk characteristics of the different types of asset available for investment purposes.

- **CO3:** estimate the value of equity, property and index linked bonds
- **CO4:** calculate the delivery price and the value of a forward contract using arbitrage free pricing methods.
- **CO5:** show an understanding of the term structure of interest rates.
- **CO6:** show an understanding of simple stochastic interest models for investment returns.

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4	M			M			
CO5						H	
CO 6							L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Statement: This course provides advance knowledge on financial mathematics like project evaluation, calculation of bond price in tax environment, Investment decision, and calculation of forward price and idea of stochastic interest rate model.

MAE 6202 **FUNDAMENTALS OF LIFE** **L T P C**
SDG 4 **CONTINGENCIES** **3 1 0 4**

COURSE OBJECTIVES:

To make the student conversant with

COB1: Construction and use of a life table

COB2: Various types of life assurance contracts

COB3: Various types of life annuity contracts

COB4: Calculation of Net premiums and reserves

COB5: Variable benefits and with-profit policies

COB6: Gross premiums and reserves for fixed and variable benefit contracts

MODULE I THE LIFE TABLE 7+2

The life table-Constructing a life table-Using the life table-The pattern of human mortality-Life table functions at non-integer ages-uniform distribution of deaths (UDD)- constant force of mortality (CFM)-The general pattern of mortality-Select mortality-Constructing select and ultimate life tables-Evaluation of assurances and annuities-Premium conversion equations-Variance of benefits-Expected present values of annuities payable m times each year.

MODULE II LIFE ASSURANCE CONTRACTS 8+3

Life assurance contracts: Pricing of life insurance contracts, Whole life assurance contracts, Term assurance contracts, Pure endowment contracts, Endowment assurance contracts, Critical illness assurance contracts, Deferred assurance benefits, Mean and Variance of the present value random variable Claim acceleration approximation.

MODULE III LIFE ANNUITY CONTRACTS 8+3

Life annuity contracts: Whole life annuities payable annually in arrears, Whole life annuities payable annually in advance, Temporary annuities payable annually in arrear, Temporary annuities payable annually in advance, Deferred annuities, Deferred annuities-due, Continuous annuities, Immediate annuity, Mean and Variance of the present value random variable approximations.

MODULE IV NET PREMIUMS AND RESERVES 8+3

Net premiums and reserves-The basis-The net premium-The insurer's loss random variable-Reserves- Prospective reserve-Retrospective reserves-Conditions for equality of prospective and retrospective reserves-Net premium reserves-Recursive calculation of reserves.

MODULE V WITH-PROFIT POLICIES 7+2

Variable benefits and with-profit policies-Variable payments-Payments varying at a constant compound rate-Payments changing by a constant monetary amount-With-profit contracts-Types of bonus-Calculating net premiums and net premium reserves for with-profit contracts- Accumulating with-profits contracts.

MODULE VI GROSS PREMIUMS AND RESERVES 7+2

Gross premiums and reserves for fixed and variable benefit contracts-Types of expenses incurred in writing a life insurance contract-The influence of inflation on expenses-Gross future loss random variable for standard contracts- Determining gross premiums using the equivalence principle-Gross premium reserves-Equality of gross premium prospective and retrospective reserves.

L – 45; T – 15; TOTAL – 60

REFERENCES:

1. B H Smith "Contingencies of Value", Harvard University Press, 1988.
2. Alistair Neil "Life Contingencies", Butterworth-Heinemann Ltd; illustrated edition (1977).
3. Griffith Davis "Table of Life Contingencies", Longman & Co, 1825: University of California Library.
4. Micheal M Parmenter, "Theory of Interest and Life contingencies with Pension", 3rd Edition.
5. Bowers, Newton L et al. – "Actuarial mathematics". 2nd Edition – Society of Actuaries, 1997.

6. Benjamin, Bernard; Pollard, John H. – "The analysis of mortality and other actuarial statistics" 3rd Edition – Faculty and Institute of Actuaries, 1993.

7. Gerber, Hans U. – "Life insurance mathematics" 3rd Edition– Springer. Swiss Association of Actuaries, 1997.

8. Booth, Philip Metal. "Modern actuarial theory and practice"– Chapman & Hall,1999.

COURSE OUTCOMES: On completion of the course the students will be able to

- **CO1:** define the different life table function and how to use it
- **CO2:** define simple assurance and annuity contracts, and develop formulae for the means and variances of the present values of the payments under these contracts, assuming constant deterministic interest.
- **CO3:** describe practical methods of evaluating expected values and variances of the simple contracts defined in objective.
- **CO4:** describe and calculate, using ultimate or select mortality, net premiums and net premium reserves of simple insurance contracts.
- **CO5:** describe the calculation, using ultimate or select mortality, of net premiums and net premium reserves for increasing and decreasing benefits and annuities.
- **CO6:** describe the calculation of gross premiums and reserves of assurance and annuity contracts.

Board of Studies (BoS) :

14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:

19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4							

CO5	M			M		
CO 6						L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: This subject provides grounding in the mathematical techniques which can be used to model and value cash flows dependent on death, survival, or other uncertain risks and also help to calculate premium and reserve for the insurance company.

MAE 6203   DESCRIPTIVE STATISTICAL METHODS   L   T   P   C
SDG 4   IN ACTUARIAL SCIENCE   3   1   0   4

COURSE OBJECTIVES:
To make the student conversant with
COB1: Bayesian statistics
COB2: Basic loss distributions
COB3: Reinsurance arrangements
COB4: Credibility theory-
COB5: Empirical Bayes credibility theory
COB6: Generalized linear models

MODULE I   BAYESIAN STATISTICS   6+2

Bayesian statistics-Bayes' Theorem- Prior and posterior distributions-Conjugate priors-Improper prior distributions-The loss function-Quadratic loss-Absolute error loss-All-or-nothing loss.

MODULE II   LOSS DISTRIBUTIONS   7+2

Loss distributions- MGFs and basic loss distributions- exponential-gamma-normal-Pareto and generalised Pareto distributions- lognormal distribution-Weibull distribution- The Burr distribution-Estimation-The method of moments-Maximum Likelihood Estimation-Goodness-of-fit-tests-Mixture distributions.

MODULE III   REINSURANCE   8+3

Reinsurance- Reinsurance arrangements- Excess of loss reinsurance – the insurer-Excess of loss reinsurance – the reinsurer-Proportional reinsurance-Particular   distributions-Lognormal   distribution-Normal distribution-Inflation-Estimation-Policy excess.

MODULE IV   CREDIBILITY THEORY   9+3

Credibility   theory-Credibility-The   credibility   premium   formula-The credibility factor-Bayesian credibility-The Poisson/gamma model-The normal/normal model-Bayesian approach to credibility.

MODULE V   EMPIRICAL BAYES CREDIBILITY THEORY   9+3

Empirical Bayes credibility theory - EBCT Model to estimate risk premium - EBCT Model to estimate claim frequency.

MODULE VI   GENERALISED LINEAR MODELS   6+2

Generalized linear models-Exponential families-Normal distribution-Poisson distribution-Binomial distribution-Gamma distribution-Link functions and linear predictors-Deviance of model fitting-Residuals analysis and assessment of model fit.

L – 45; T – 15; TOTAL – 60

REFERENCES:

1. Dobson, Annette J. – "An introduction to statistical modeling"- Chapman & Hall, 1983.
2. Hossack, Ian B; Pollard, John H; Zehnwirth, Benjamin. "Introductory statistics with applications in general insurance"- 2nd ed. - Cambridge University Press, 1999.
3. Klugman, Stuart A; Panjer, Harry H; Willmot, Gordon E; Venter, Gary G. "Loss models: from data to decisions"- John Wiley & Sons, 1998.
4. Daykin, Chris D; Pentikainen, Teivo; Pesonen, Martti. "Practical risk theory for actuaries" - Chapman & Hall, 1994.
5. Critian P Robert "Monte Carlo Statistical Methods", 2nd Edition, Springer- Verlag.
6. George W Snedecor "Statistical Methods", 8th Edition, Iowa State University Press.
7. G.S. Maddala C.R Rao" Statistical methods in Finance", Jan 1996, Elsevier Science and technology.
8. Philip J Boland "Statistical and Probabilistic Methods in Actuary Science", Chapman & Hall Press, 2007.

COURSE OUTCOMES: On completion of the course the students will be able to

- **CO1:** explain the concepts of decision theory and apply them.

- **CO2:** calculate probabilities and moments of loss distributions both with and without limits and risk-sharing arrangements.
- **CO3:** construct risk models involving frequency and severity distributions and calculate the moment generating function and the moments for the risk models both with and without simple reinsurance arrangements.
- **CO4:** explain the fundamental concepts of bayesian statistics and use these concepts to calculate bayesian estimators.
- **CO5:** describe the fundamental concepts of rating and apply them to simple experience rating systems.
- **CO6:** Construct risk models involving frequency and severity distributions and calculate the moment generating function and the moments for the risk models both with and without simple reinsurance arrangements.

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							M
CO2			H				
CO3		H			M		
CO4							
CO5	H						
CO 6				H			L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statements: This subject provides grounding in Decision theory, Bayesian statistics, Loss distributions, Reinsurance, and Credibility theory which have particular relevance to General Insurance.

MAE 6204 **STOCHASTIC MODELS** **L T P C**
SDG 4 **2 1 0 3**

COURSE OBJECTIVES:
To make the student conversant with

COB1: Principles of actuarial modelling
COB2: Types of stochastic processes
COB3: Markov chains and The Chapman-Kolmogorov equations
COB4: The two-state Markov model
COB5: Time-homogeneous Markov jump processes
COB6: Time-inhomogeneous Markov jump processes

MODULE I PRINCIPLES OF ACTUARIAL MODELING 5+2

Principles of actuarial modelling-Models-Modelling - the benefits and limitations-Stochastic and deterministic models-Discrete and continuous state spaces and time sets-Suitability of a model-Short-term and long-term properties of a model-Analysing the output of a model-Sensitivity testing-Communication of the results.

MODULE II STOCHASTIC PROCESSES 5+2

Stochastic processes-Types of stochastic processes-Defining a stochastic process-Sample paths-Stationarity-Increments-The Markov property-Filtrations-White noise-General random walk-Poisson process-Compound Poisson process.

MODULE III MARKOV CHAINS 5+3

Markov chains-The Chapman-Kolmogorov equations-Time-homogeneous Markov chains-No Claims Discount policy-Simple random walk on $Z = \{...-2, -1, 0, 1, 2, ...\}$ and $\{0, 1, 2, ... , b\}$-A model of accident proneness-The long-term distribution of a Markov chain-The stationary probability distribution-Estimating transition probabilities-Assessing the fit-Simulation.

MODULE IV   TWO-STATE MARKOV MODEL   5+2

The two-state Markov model-Assumptions underlying the model-Comparison with other models-Probabilities-Statistics-Joint density function-The maximum likelihood estimators-The distribution of $\overline{\mu}$

MODULE V   TIME-HOMOGENEOUS MARKOV JUMP   5+3
PROCESSES

Time-homogeneous Markov jump processes: Poisson process- Chapman-Kolmogorov equations- transition matrix- Transition rates- health-sickness-death model- Kolmogorov's forward and backward differential equations- Holding times and occupancy probabilities- Expected time to reach state k starting from state i- Jump chain- Two-decrement model-MLE.

MODULE VI   TIME-INHOMOGENEOUS MARKOV JUMP   5+3
PROCESSES

Time-inhomogeneous Markov jump processes: Chapman-Kolmogorov equations- Transition rates- Kolmogorov's forward and backward differential equations- Occupancy probabilities- Residual holding times-Integrated form of the Kolmogorov forward and backward equations-Applications.

L – 30; T – 15; TOTAL – 45

REFERENCES:

1. Brzezniak, Zdzislaw; Zastawniak, Tomasz. "Basic stochastic processes; A course through exercises"- Springer, 1998.
2. Hickman, James C. "Introduction to actuarial modeling" – North American Actuarial Journal (1997) 1(3) 1-5.
3. Kulkarni, Vidyadhar G. "Modeling, analysis, design, and control of stochastic systems" – Springer, 1999.
4. Grimmett, Geoffrey; Stirzaker, David. – "Probability and random processes" – 3rd ed. – Oxford University Press, 2001.

5. Bowers, Newton L; Gerber, Hans U; Hickman, James C; Jones, Donald A; Nesbitt, Cecil J. – "Actuarial mathematics"-2nd ed. - Society of Actuaries, 1997.
6. Haberman, Steven; Pitacco, Ermanno." Actuarial models for disability insurance"– Chapman & Hall, 1999.
7. Vlamidir I Rotar "Actuarial Models" Chapman & Hall, 2006.
8. A.C. Davison "Statistical models "Cambridge University Press, 2008.

COURSE OUTCOMES: On completion of the course the students will be able to

- **CO1:** describe the principles of actuarial modeling.
- **CO2:** describe the general principles of stochastic processes, and their classification into different types.
- **CO3:** define and apply markov chain.
- **CO4:** define and apply two state model for transition intensity.
- **CO5:** Solve insurance related problem based on markov chain.
- **CO6:** apply Integrated form of the Kolmogorov forward and backward equations

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4							
CO5				H			
CO 6	H					L	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: This subject provides basic understanding of actuarial modeling, stochastic processes, Markov chains and its application in framing NCD, HSD models.

MAE 6205   **MATHEMATICAL STATISTICS**   L T P C

SDG 4   3 1 0 4

COURSE OBJECTIVE:

To make the student conversant with

COB1: Types of Sampling and Sampling distributions

COB2: Point estimation

COB3: Confidence intervals

COB4: Hypothesis testing

COB5: Bivariate correlation analysis

COB6: Regression Analysis

MODULE I   SAMPLING   7+2

Types of Sampling - Moments of the sample mean and variance, Sampling distributions for the normal, t-test, F-test.

MODULE II   POINT ESTIMATION   7+2

Point estimation - method of moments- method of maximum likelihood- one and two parameter cases-Incomplete samples, Unbiasedness- Mean square error- Asymptotic distribution of MLEs.

MODULE III   CONFIDENCE INTERVALS   8+3

Confidence intervals in general, Derivation of confidence intervals, Confidence intervals for the normal distribution, Confidence intervals for binomial & Poisson, Confidence intervals for two-sample problems, Paired data.

MODULE IV   HYPOTHESIS TESTING   8+3

Hypothesis testing- Hypotheses, test statistics, decisions and errors- Classical testing, significance and p-values- Basic tests — single samples- two independent samples- paired data- Tests and confidence intervals- Chi square test- Fisher's exact test.

MODULE V   CORRELATION ANALYSIS   8+3

Bivariate correlation analysis- Pearson's correlation coefficient- Spearman's rank correlation coefficient- The Kendall rank correlation coefficient. Multivariate correlation analysis. Principal component analysis.

MODULE VI   REGRESSION ANALYSIS   7+2

The simple bivariate linear model- The multiple linear regression model-The full normal model and inference- Analysis of variance (ANOVA).

L – 45; T – 15; TOTAL – 60

REFERENCES:

1. Mathematical statistics. Miller, I.; Miller, M.; [Freund, J. E.] 7th ed. Prentice Hall International, 1999.
2. **Dekking,** F.M., **Kraaikamp**, C., **Lopuhaä,** H.P., **Meester**, L.E. "A Modern Introduction to Probability and Statistics" Springer, 2nd Edition.
3. **Chin Long chiang "Statistical Methods of Analysis "World Scientific Books, 2003.**

COURSE OUTCOMES: On completion of the course the students will be able to

- **CO1:** explain the concepts of random sampling, statistical inference and sampling distribution, and state and use basic sampling distributions.
- **CO2:** Describe the main methods of estimation and the main properties of estimators, and apply them.
- **CO3:** Construct confidence intervals for unknown parameters
- **CO4:** define the test statistics and Test the hypotheses.
- **CO5:** Investigate linear relationships between variables using correlation analysis and regression analysis.
- **CO6:** Explain the concepts of analysis of variance and use them.

Board of Studies (BoS) :

Academic Council:

14th BOS of Mathematics & AS held on 30.06.2022.

19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4							
CO5	M						
CO 6					L		

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: Mathematical Statistics subject provides grounding in Advance Probability and in particular sampling, Hypothesis testing, correlation-regression and Analysis of variance that are of relevance to actuarial work.

MAE 6206 **R – PROGRAMMING** **L T P C**

SDG 4 **0 0 4 2**

R: A Language and Environment for Statistical Computing

COURSE OBJECTIVES:

To make the student conversant with

COB1: Basic mathematical calculation using R

COB2: Constructing matrix objects-Accessing matrix elements

COB3: Writing own function to solve the problems

COB4: Bar charts and different types of plots

COB5: Simulation values and calculation of probabilities

COB6: Statistical test and R packages

MODULE I **Introduction to the R language** **5**

Calculating with R-Named storage-Listing the objects in the workspace-Vectors-Missing values and other special values-Extracting elements from vectors-Data frames-Dates and times-Lists-Logical operations in R-Relational operators

MODULE II **Vectors and matrices** **5**

Constructing matrix objects-Accessing matrix elements; row and column names- Matrix multiplication and inversion-Solving linear systems-Eigen values and eigenvectors

MODULE III **Programming with R** **5**

Flow control- The for() loop-The if() statement-The while() loop-The repeat loop, and the break and next statements-Writing own function to solve the problems

MODULE IV **High-level plots** **5**

Bar charts and dot charts-Pie charts-Histograms-Box plots-Scatter plots-QQ plots-The plotting region and margins-Adding to plots-Setting graphical parameters- Time series plot-ggplot-fit a linear model to a bivariate data frame

MODULE V   Simulating values and calculating   5
probabilities

uniform-binomial-geometric-negative binomial-hypergeometric-Poisson-gamma-exponential-chisquare-beta-normal-lognormal-t distribution- F distribution-Monte Carlo simulation.

MODULE VI   Statistical test and R packages   5

Markov chain-Weibull distribution-flexsurv-survival-Mortality Smooth-Time series- Comparing simulated samples-confidence interval-hypothesis test-Pearson correlation coefficient-Spearman rank correlation coefficient-Kendall rank correlation coefficient-regression model

P – 30; TOTAL – 30

COURSE OUTCOMES: On completion of the course the students will be able to

- **CO1: perform simple mathematical calculations**.
- **CO2:** use the vector and matrices to solve linear problem.
- **CO3:** write simple program.
- **CO4:** draw different plot.
- **CO5:** Simulate values and calculate different probabilities.
- **CO6:** perform statistical test using R

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M						
CO2			H				
CO3		H			M		
CO4							

CO5						
CO 6		L				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: R-Programming is to give the basic knowledge of a system for statistical and Actuarial computation and graphics.

GEE 6202   **RESEARCH METHODOLOGY AND IPR**   L   T   P   C

SDG: 4, 9,   3   0   0   3

11 & 15

COURSE OBJECTIVES:

 Students will be trained to

>   **COB1:** Basic concepts of Research.

>   **COB2:** Select and Define a research problem

>   **COB3**: Analyze and Interpret the Results

>   **COB4:** write Scientific and Technical reports & thesis

>   **COB5:** Apply the Copyrights, Patents and Intellectual Property Rights.

MODULE I   INTRODUCTION TO RESEARCH METHODOLOGY   9

Research: Objectives, Motivation and types - Approaches, Significance of Research, Research process, Criteria of good research, Problems encountered by researchers - Introduction to ethics, scientific conduct and misconduct, misconduct and why it occurs, fabrication, authorship issues, The investigation and punishment of scientific misconduct (Erratum).

MODULE II   RESEARCH FORMULATION AND DESIGN   9

Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, identifying gap areas from literature and research database, development of working hypothesis. Definition and importance of Journal Impact factor, Cite Scores and Citation Indexes.

MODULE III   DATA COLLECTION, ANALYSIS AND INTERPRETATION   9
OF DATA

Observation and Collection of data, methods of data collection, sampling methods, data processing, analysis strategies and tools, data analysis with statistical tools (Sigma STAT, SPSS student, ANOVA), hypothesis testing. Importance and scientific methodology in recording results, importance of negative results, conceptions of error of measurement - absolute and relative errors, true score theory and generalisability theory. Measures of central tendency – mean median and mode.

MODULE IV SCIENTIFIC AND TECHNICAL WRITING   9

Different types of scientific and technical publications in the area of research - Technical writing skills for report, synopsis and thesis – organisation of contents and layout of the research reports, oral presentation, mechanics of writing a research report, precautions for writing research reports, conclusions. Preparing papers for international journals - software for paper formatting like LaTeX/MS Office, Grammarly - reference management software – Mendeley and detection of similarity index / plagiarism by Turnitin.

MODULE V   INTELLECTUAL PROPERTY RIGHTS   9

The concept, Intellectual Property system in India, development of TRIPS complied regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, Commercialization, Copy Right, Royalty, Trade related aspects of Intellectual Property Rights (TRIPS); Geographical indications, Industrial designs, Enforcement of Intellectual Property Rights, Function of UNSECO in IPR maintenance. Patents, Patentable subject matter, Rights conferred, Exceptions, Term of protection, Conditions on Patent applicants, Process patents.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Cooper Donald R, Schindler Pamela S and Sharma JK., 2012. "Business Research Methods", Tata McGraw Hill Education, 11e.
2. Kothari C.R., "Research Methodology, Methods and Techniques", Wiley Eastern Ltd., NewDelhi, 1991.

REFERENCES:

1. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
3. Day, R.A., 1992.How to Write and Publish a Scientific Paper, Cambridge University Press.
4. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes .
5. Essentials of Research Design and Methodology Geoffrey R. Marczyk, David DeMatteo, David Festinger, 2005. John Wiley & Sons Publishers, Inc
6. Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry, 2nd Edition, Irwin H. Segel, 1976. John Wiley & Sons Publishers, Inc

7. R Arora. Encyclopaedia of Research Methodology in Biological Sciences., Anmol Publishing, 2004.
8. Coghill M. and Gardson L.R., The ACS Style Guide Effective Communicationof Scientific Information, 3rd Edn., Oxford University Press, 2006.

COURSE OUTCOMES:

The students will be able to

CO1: recognize the basic concepts of research and its methodologies

CO2: select and define appropriate research problem and parameters

CO3: apply packages for data collection, analyze and interpretation of data into reports.

CO4: write scientific report as journal article, thesis and technical proposal for funding.

CO5: propose research findings as publications, copyrights, trademarks and IPR.

Board of Studies (BoS) :   **Academic Council:**

12th BoS of Chemistry held on 22.07.2022   19th AC held on 29.09.2022

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12	PSO 1	PSO 2	PSO 3
CO1													M		
CO2			H					M						M	
CO3		H			M										
CO4													H		M
CO5										H			H		

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4   : Quality Education

SDG 9 : Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

SDG 11 : Sustainable Cities and Communities

SDG 15 : Life on Land

Statement: The understanding of concepts of high quality research, innovative thinking, knowledge on sustainable development and service to the society and mankind through quality research.

MAE 7101   **APPLICATIONS OF LIFE**   L   T   P   C
SDG 4   **CONTINGENCIES**   3   1   0   4

COURSE OBJECTIVE:

To make the student conversant with

COB1: The basic knowledge of life annuities and assurance contracts involving two lives and provide the knowledge about different types of reversionary annuities.

COB2: Mortality profit of the insurance company using DSAR, EDS and ADS values.

COB3: Decrement models and construction of decrement tables to compete with future risks.

COB4: Unit linked insurance policies and how it differs from traditional insurance policies.

COB5: Evaluation of various cashflows for profit testing.

COB6: The effect of profit testing, pricing of cashflows in finding the reserves of the company.

MODULE I   SIMPLE ANNUITIES AND ASSURANCES   9+3
                 INVOLVING TWO LIVES

Simple annuities and assurances involving two lives-Random variables to describe joint life functions-Determining simple probabilities involving two lives-Determining present values involving two lives-Contingent and reversionary benefits-Contingent probabilities of death-Present values of contingent assurances-Present values of reversionary annuities-Present values of functions with specified terms- Expected present value of annuities payable m times a year-Premium conversion relationships.

MODULE II   MORTALITY PROFIT   7+2

Mortality profit-Death strain at risk (DSAR)-Expected death strain (EDS) for a single policy-Actual death strain (ADS) for a single policy-Mortality profit.

MODULE III   COMPETING RISKS   7+2

Competing risks-Multiple state modelling-Valuing benefits that are contingent upon competing risks-Multiple decrement tables-Multiple

decrement service table for pensions calculations-Updating a service table-How to obtain multiple decrement table rates under the assumption of uniformity in the single decrement tables-Consistency with the multiple state approach.

MODULE IV   UNIT-LINKED CONTRACT   8+3

Unit-linked contracts-Evaluating expected cashflows for various contract types-profit tests for annual premium contracts-Determining premiums using a profit test.

MODULE V   PROFIT TESTING   7+3

Evaluating expected cashflows for various contract- Profit tests for annual premium contracts- Profit testing using the present value random variable-Pricing using a profit test.

MODULE VI   RESERVING ASPECT OF PROFIT TESTING   7+2

Determining reserves using profit testing-Pricing and reserving bases-Determining reserves for a unit-linked policy using cashflow techniques-Determining reserves for a conventional policy using cashflow techniques-Effect of pricing and reserving bases on a profit test.

L – 45; T – 15; TOTAL – 60

REFERENCES:

1. B H Smith "Contingencies of Value "Harvard University Press, 1988.
2. Alistair Neil "Life Contingencies", Butterworth-Heinemann Ltd; illustrated edition (1977).
3. Griffith Davis "Table of Life Contingencies", Longman &Co, 1825: University of California Library.
4. Micheal M Parmenter, 'theory of Interest and Life contingencies with Pension", 3rd edition.
5. Bowers, Newton L *et al.* – "Actuarial mathematics". 2nd ed. – Society of Actuaries, 1997.
6. Benjamin, Bernard; Pollard, John H. – "The analysis of mortality and other actuarial statistics" 3rd ed. – Faculty and Institute of Actuaries, 1993.

7. Gerber, Hans U. – "Life insurance mathematics"3rd ed. – Springer. Swiss Association of Actuaries, 1997.

8. Booth, Philip M *et al.* "Modern actuarial theory and practice"– Chapman & Hall, 1999.

COURSE OUTCOMES: On completion of the course the students will be able to

- **CO1:** define and use straightforward functions involving two lives.
- **CO2:** Estimate the mortality profit or loss for a group of policies
- **CO3:** describe methods which can be used to model cash flows contingent upon competing risks.
- **CO4:** describe the technique of discounted emerging costs, for use in pricing, reserving, and assessing profitability.
- **CO5:** describe the principal forms of heterogeneity within a population and the ways in which selection can occur.
- **CO6:** perform the profit testing for ULIP

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H						
CO2			H				
CO3		H			M		
CO4				H			H
CO5						L	
CO 6	M				H		

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: The subject gives the basic knowledge of different types of insurance contract involving two life's, Idea of Profit testing and ULIP policies.

MAE 7102   **FINANCIAL ECONOMICS**   **L**   **T**   **P**   **C**

SDG 4   **3**   **1**   **0**   **4**

COURSE OBJECTIVE:

To make the student conversant with

COB1: The concepts of the efficient market hypothesis and the economic models.

COB2: The relationship between stochastic dominance and utility theory in the consumers choice.

COB3: The relationship between various risk measures and utility functions.

COB4: Various asset pricing models and its constructions using portfolio theory.

COB5: Brownian motion, its properties and Martingales in discrete and continuous time.

COB6: Stochastic differential equations and The Ornstein - Uhlenbeck process

MODULE I   INTRODUCTION TO FINANCIAL ECONOMICS   7+2

Introduction to financial economics- Economic models- Mathematical models- Efficient market hypothesis- The three forms of the efficient markets hypothesis- The evidence for or against each form of the efficient markets hypothesis- Informational efficiency- Volatility tests.

MODULE II   CONSUMER CHOICE THEORY   8+3

Consumer choice theory- Utility theory- The expression of economic characteristics in terms of utility functions- Measuring risk aversion- Construction of utility functions-Stochastic dominance-Relationship between dominance concepts and utility theory.

MODULE III   MEASURES OF INVESTMENT RISK   7+2

Measures of investment risk- Measures of risk-Variance of return-Semi-variance of return-Shortfall probabilities-Value at risk-Tail value at risk (TailVar) and expected shortfall-Relationship between risk measures and utility functions.

MODULE IV   PORTFOLIO THEORY   8+3

Portfolio theory-Lagrangian function-Benefits of diversification-Models of asset returns-Multifactor models- Macroeconomic factor models- Fundamental factor models-Statistical factor models-Construction of models- The single-index model- The capital asset pricing model (CAPM)- Limitations of CAPM-Arbitrage pricing theory

MODULE V   BROWNIAN MOTION AND MARTINGALES   8+3

Introduction to Brownian motion- standard Brownian motion- Properties of Brownian motion- Geometric Brownian motion- Martingales- Martingales in discrete time- Martingales in continuous time.

MODULE VI   STOCHASTIC CALCULUS   7+2

Stochastic calculus- The Ito Integral- Ito's lemma- Stochastic differential equations- Diffusion and Ito process models- The Ornstein-Uhlenbeck process.

L – 45; T – 15; TOTAL – 60

REFERENCES:

1. Baxter, Martin & Andrew Rennie, Financial calculus; "An introduction to derivative pricing" Cambridge University Press, 1996.
2. Panjer, Harry H (ed), "Financial economics: with applications to investments, insurance and pensions", The Actuarial Foundation, 1998.
3. Elton, Edwin J, Martin J Gruber, Stephen J Brown, & William N Goetzmann, "Modern portfolio theory and investment analysis" (6th edition), John Wiley, 2003.
4. Hull, John C, "Options, futures and other derivatives" (5th edition), Prentice Hall, 2002.

COURSE OUTCOMES: On completion of the course the students will be able to

- **CO1:** discuss the various forms of the efficient markets hypothesis and discuss the evidence for and against the hypothesis.
- **CO2:** discuss the advantages and disadvantages of different measures of investment risk.
- **CO3:** describe and discuss the assumptions of mean-variance portfolio theory and its principal results.
- **CO4:** describe and discuss the properties of single and multifactor models of asset returns.
- **CO5:** describe asset pricing models, discussing the principal results and assumptions and limitations of such models.
- **CO6:** define and apply the main concepts of Brownian motion, Martingales, and Ito integral.

Board of Studies (BoS) :   **Academic Council:**

14th BOS of Mathematics & AS held on   19th AC held on 29.09.2022
30.06.2022.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4							H
CO5	L						
CO 6				M			

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: Financial Economics subject is to provide basic grounding in Financial Economics such as efficient market hypothesis, Measures of investment risk, Utility theory and portfolio theory with Brownian motion-Martingales which help them to understand the economic environment and value the security price in different situation.

MAE 7103   **APPLIED STATISTICAL METHODS**   **L**   **T**   **P**   **C**
SDG 4   **IN ACTUARIAL SCIENCE**   **3**   **1**   **0**   **4**

COURSE OBJECTIVE:
To make the student conversant with
COB1: The concept of probability of ruin of the company and the effect of reinsurance in ruin for the insurer.
COB2: Basic risks associated with the products like insurable interest, types of the product & its coverage etc.
COB3: Individual risk model and collective risk model like aggregate claims model.
COB4: Various methods of finding future claims using run off projections.
COB5: The four main linear univariate time series models.
COB6: Multivariate time series models and Bilinear models.

MODULE I   RUIN THEORY   7+2

Ruin theory-Basic concepts-The surplus process-The probability of ruin in continuous time-The probability of ruin in discrete time-Probability of ruin in the short term-Premium security loadings-Reinsurance.

MODULE II   RISK MODEL – I   7+2

Risk models-General features of a product -Insurable interest- Insurable risk- types of cover and types of product-Products liability-Property damage-Financial loss-Fixed benefits-Models for short term insurance contracts.

MODULE III   RISK MODEL – I   7+2

The collective risk model- Aggregate claim distributions under proportional and excess of loss reinsurance-The individual risk model-Parameter variability/uncertainty.

MODULE IV   RUN-OFF TRIANGLES   8+3

Run-off triangles-Projections using development factors-Run-off patterns-The chain ladder method-Model checking-Other methods of

deriving development factors-Adjusting for inflation-The inflation adjusted chain ladder method-The average cost per claim method-Loss ratios-The Bornhuetter-Ferguson method.

MODULE V TIME SERIES – I 8+3

Time series-Properties of a univariate time series-Stationary random series-Main linear models of time series- Autoregressive process (AR)-Moving average process (MA)- Autoregressive moving average process (ARMA)- ARIMA Model.

MODULE VI TIME SERIES – II 8+3

Compensating for trend and seasonality-Identification of MA(q) and AR(p) models- Box-Jenkins method-Forecasting-Multivariate time series models- Bilinear models-Threshold autoregressive models-Random coefficient autoregressive models-Autoregressive models with conditional heteroscedasticity.

L – 45; T – 15; TOTAL – 60

REFERENCES:

1. Dobson, Annette J. – "An introduction to statistical modeling"-Chapman & Hall, 1983.
2. Hossack, Ian B; Pollard, John H; Zehnwirth, Benjamin. "Introductory statistics with applications in general insurance"- 2nd ed. - Cambridge University Press, 1999.
3. Klugman, Stuart A; Panjer, Harry H; Willmot, Gordon E; Venter, Gary G. "Loss models: from data to decisions"- John Wiley & Sons, 1998.
4. Daykin, Chris D; Pentikainen, Teivo; Pesonen, Martti. "Practical risk theory for actuaries" - Chapman & Hall, 1994.
5. Critian P Robert "Monte Carlo Statistical Methods", 2nd Edition, Springer- Verlag.
6. George W Snedecor " Statistical Methods", 8th Edition, Iowa State University Press,
7. G.S. Maddala C.R Rao" Statistical methods in Finance", Jan 1996, Elsevier Science and technology.

8. Philip J Boland "Statistical and Probabilistic Methods in Actuary Science", Chapman & Hall Press, 2007.

COURSE OUTCOMES: On completion of the course the students will be able to

- **CO1:** Explain the concept of ruin and calculate the probability of ruin.
- **CO2:** explain the concept of risk model
- **CO3:** describe and apply techniques for analyzing a delay (or run-off) triangle and projecting the ultimate position.
- **CO4:** explain the fundamental concepts of a generalized linear model (glm), and describe how a glm may apply.
- **CO5:** define and apply the main concepts underlying the analysis of time series models.
- **CO6:** explain the concepts of "monte carlo" simulation using a series of pseudorandom numbers.

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4	M						
CO5							
CO 6				H			

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: This subject is to provide grounding in Risk models, Ruin theory, Run-off triangles and Time series which have relevance to fix the premium and calculation of reserve in General Insurance.

MAE 7104   **SURVIVAL MODELS**   **L   T   P   C**

SDG 4   **3   1   0   4**

COURSE OBJECTIVE:

To make the student conversant with

COB1: The concept of survival probabilities using life expectation functions.

COB2: Lifetime distribution function using Kaplan – Meir and Nelson – Aalen methods.

COB3: The parametric regression models to estimate the regression parameters (Cox Model)

COB4: The concept of exposed to risk calculation for different ages.

COB5: Graduation, its features, purpose and testing the smoothness of graduation.

COB6: Some applications of statistical tests to validate the graduation rates.

MODULE I   SURVIVAL MODELS   6+2

Survival models and the life table-Future Lifetime-Probabilities of death and survival The force of mortality μ_x-Survival probabilities-The probability density function of T_x Initial rates and central rates of mortality-Complete and curtate expectation of life-Gompertz' and Makeham's laws-Calculating the parameter values-Survival probabilities.

MODULE II   ESTIMATING THE LIFETIME DISTRIBUTION   7+2
              FUNCTION

Estimating the lifetime distribution function – the Kaplan-Meier and Nelson-Aalen models-Statistical Inference-Censoring mechanisms-The Kaplan-Meier (product-limit) estimator-Comparing lifetime distributions-The Nelson-Aalen estimate-Relationship between the Kaplan-Meier and Nelson-Aalen estimates.

MODULE III   THE COX REGRESSION MODEL   7+2

The Cox regression model-Fully parametric models-Parametric models for the hazard function-Covariates-The Cox model-Estimating the regression parameters-The partial likelihood-Model fitting.

MODULE IV   EXPOSED TO RISK   7+3

Exposed to risk-Homogeneity-The principle of correspondence-Exact calculation of E_x^c-Census approximations to E_x^c-Different definitions of age.

MODULE V   GRADUATION AND STATISTICAL TESTS   8+3

Graduation -The need for graduation-Reasons for graduation-Desirable features of a graduation-Testing the smoothness of a graduation.

MODULE VI   STATISTICAL TESTS OF GRADUATION RATES   9+3

Statistical tests of a mortality experience-Chi square (χ^2) test-Standardised deviations test-Signs test-Cumulative deviations-Grouping of signs test-Serial correlations test-Testing actual versus expected rates.

L – 45; T – 15; TOTAL – 60

REFERENCES:

1. Vlamidir I Rotar "Actuarial Models" Chapman & Hall, 2006.
2. Elke Korn, Ralf Korn "Monte Carlo Simulation of financial and Actuarial model" Chapman & Hall, (Feb 2010).
3. Dick London "Survival models and their estimation "ACTEX Publication. 1998.
4. A.C. Davison "Statistical models "Cambridge University Press, 2008.
5. Regina C Elandt Johnson "Survival models and data Analysis", Wiley, Inter science, 1999.

COURSE OUTCOMES: On completion of the course the students will be able to

- **CO1:** explain the concept of survival models and estimation for lifetime distributions.
- **CO2:** Describe estimation procedures for lifetime distributions based on Kaplan-Meier and Nelson-Aalen estimator

- **CO3:** Describe models for proportional hazards, and how these models can be used to estimate the impact of covariates on the hazard.
- **CO4:** Estimate transition intensities dependent on age (exact or census).
- **CO5:** Describe the reasons for graduating crude estimates of transition intensities or probabilities, and state the desirable properties of a set of graduated estimates.
- **CO6:** Describe the process of graduation, and state the advantages and disadvantages of each

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	H						
CO2			H				
CO3		H			M		
CO4							
CO5				H			H
CO6	L					M	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: Survival Models subject is to provide grounding in survival models such as Estimating the lifetime distribution function, calculating crude mortality rate and testing for best feet which will help the Insurance companies to model the premium rates.

MAE 7105   **ACTUARIAL COMPUTATIONAL**   **L**   **T**   **P**   **C**
SDG 4   **LABORATORY**   **0**   **0**   **4**   **2**
(Python)

COURSE OBJECTIVE:

To make the student conversant with

COB1: Basics of Python programming and its functions.

COB2: Loops in python coding

COB3: Strings and its various types.

COB4: Different Files and Lists for references in python.

COB5: Different applications of tuples in dictionaries.

COB6: The basic statistical calculations like mean, median, mode in python

MODULE I   PYTHON BASICS AND FUNCTIONS   5

Variables – Operators – statements – Getting in Puts – Boolean Conditions – Alternative, Chained and Nested Conditions – Catching Expectations – Function Calls – Built-in Functions – Type Conversion Function and Math Function – creating New Functions, Parameters and Arguments – Need for Functions.

MODULE II   LOOPS – WHILE   5

Statement – Infinite Loops – Continue Statement – For Loops – Counting and Summing Loops – Maximum and Minimum loops.

MODULE III   STRINGS   5

Traversal through Strings – String Slice – looping and Counting in Strings – The in Operator – String Comparison – String Methods – Parsing Strings – Format Operator.

MODULE IV   FILES AND LISTS   5

Opening Files – Text Files – Reading Files – Searching Through Files – Selecting Files Names from User – Writing Files - Traversing List – List Operations – List Slice – List Methods – Deleting elements – Built – in List functions – Objects, Value, Aliasing – List Arguments.

MODULE V   DICTIONARIES AND TUPLES   5

Dictionaries – Files and dictionaries – Looping and dictionaries – Advanced text processing – Tuples – Comparing tuples – Tuple assignments – Dictionaries and tuples – Tuples as keys in dictionaries.

MODULE VI   STATISTICS IN PYTHON   5

Types of Measures – Central Tendency - Quartile – Population and Samples – Basic Statistical Packages – Basic Statistical Modelling.

L – 0; T – 0; P – 30; TOTAL – 30

REFERENCES:
1. Nischay Kumar Hegde, Python Programming Fundamentals – A beginners Hand book, 2018.
2. Charles R. Severance, Python for Everybody, "Exploring data using Python 3", Schroff Publishers, 1 Edition, 2017
3. Allen Downey, Think Python, "How to think like a computer scientist", Schroff / O'Reilly Publishers, 2 Edition, 2016.

COURSE OUTCOMES: On completion of the course the students will be able to
- **CO1:** Apply basic function of python
- **CO2:** use the loops to create a function
- **CO3:** use the strings to control the flow
- **CO4:** perform the task for different type of data sets
- **CO5:** use the dictionaries and tuples
- **CO6:** perform basic statistical modeling

Board of Studies (BoS) :   **Academic Council:**
14th BOS of Mathematics & AS held on   19th AC held on 29.09.2022
30.06.2022.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4				M			M
CO5	M						
Co 6					M		

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Statement: Python lab provides the practical knowledge of the various technical tools that are available for the use of Actuarial calculation.

LIST OF ELECTIVES

MAEY 01   **FINANCIAL MANAGEMENT OF LIFE**   **L**   **T**   **P**   **C**

SDG 4   **OFFICE**   **3**   **0**   **0**   **3**

COURSE OBJECTIVE:

To make the student conversant with

COB1: The Ethics and scientific managing of financial aspects of the company.

COB2: Actuaries role in controlling and monitoring the companies finance in various ways.

COB3: Maintaining the accounts expenditure and budgeting of the company with resources available.

COB4: Managing the asset types of the life insurance companies.

COB5: Maintaining the Reversionary bonuses and terminal bonuses of the company.

COB6: Reserving aspects of Life insurance companies.

MODULE I   **ETHIC OF FINANCIAL MANAGEMENT**   **7**

Financial Management development - scientific management - Management Vs Administration, Ethics in management – Social responsibilities of managers-roles & responsibilities – duties

MODULE II   **ROLE OF ACTUARY**   **8**

Role of Actuary : Investment policy – Product pricing and design Control cycle Profit testing- Model office and uses – Analysis of surplus - marketing- underwriting and reinsurance policies- reserving – profit distribution – sales policy – Surrender and transfer policy

MODULE III   **LIABILITY AND FISCAL RESPONSIBILITY**   **8**

Liability and fiscal responsibility – Budgeting - Financial ledgers – Accounts expenditure requests – Petty cash - Limited purchase orders (LPO) - Direct pay/cheque request – Journal vouchers – funding opportunities – Resources and services.

MODULE IV   ASSET TYPES OF LIFE COMPANIES   7

Reversionary and terminal bonuses- Solvency for a life insurance company – Mechanical and model based solvency margins – fair values of life insurance liabilities.

MODULE V   REVERSIONARY AND TERMINAL BONUSES   8

Asset types of life companies - Insurer's liabilities - surplus on portfolio of insurance -Nonprofit premiums- owner ship of surplus and types of bonus system – Asset shares and uses.

MODULE VI   RESERVING   7

Mismatching reserves- capital requirements for life office – lognormal and Willkie models of equity returns - asset/liability investigation.

L – 45; T – 0; TOTAL – 45

REFERENCES:

1. Peter J Booth " Modern actuary theory and practice " 2nd Edition (2004)CRC Press.
2. http://www.ma.hw.ac.uk/~niall/lopcourse/
3. J David Cummins "Financial management of Life Insurance Companies", June 1993, Huebner International.

COURSE OUTCOMES: On completion of the course the students will be able to

- **CO1:** understand the ethic of financial management
- **CO2:** explain the role of actuary and their work.
- **CO3:** explain the Liability and fiscal responsibility of financial manager
- **CO4:** explain what are the asset and liabilities of an insurance companies.
- **CO5:** differentiate the different type of bonuses.
- **CO6:** explain why insurance companies need to keep reserve.

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M						
CO2			H				
CO3		H			M		
CO4							M
CO5	M						
CO 6				L		H	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: This subject provides the basic idea about the financial management of companies in particular Life insurance companies.

MAEY 02　　　　　　**ISLAMIC INVESTMENTS**　　**L　T　P　C**

SDG 4　　　　　　　　　　　　　　　　　　　**3　0　0　3**

COURSE OBJECTIVE:

To make the student conversant with

COB1: Growth of Islamic Finance Industry

COB2: principle of business contracts in Islamic law

COB3: Hedging and Islamic derivatives

COB4: Islamic Insurance (Takaful)

COB5: Sale based Islamic Finance

COB6: Islamic Asset management

MODULE I　　ISLAMIC INVESTMENT AND GLOBAL TRENDS　　8

Islamic finance- Growth of Islamic Finance Industry- Expansion of Sharia-Compliant Investment Products- Fintech and Islamic Investment- International Collaboration and Standardization

MODULE II　　ISLAMIC LAW　　　　　　　　　　　　7

Objectives and Sources of Islamic law – principle of business contracts in Islamic law- Islamic banking Models.

MODULE III　　ISLAMIC DERIVATIVES　　　　　　　8

Hedging and Islamic derivatives – Islamic Bonds (Sukuk) – Islamic Fund Management – Islamic Structured products- risk management for Islamic funds, derivatives, structured products.

MODULE IV　　ISLAMIC INSURANCE　　　　　　　　8

Islamic Insurance (Takaful): Introduction–Takaful models and Mechanism – Reinsurance (Re takaful) – Concerns in the provision of Takaful – Business models – retailing.

MODULE V　　JURISPRUDENCE AND ARBITRAGE　　　7

Jurisprudence and Arbitrage – Sale based Islamic Finance – Derivatives like sales – Partnership and Equity Investment.

MODULE VI   ISLAMIC ASSET MANAGEMENT   7

Islamic Asset management: Screening criteria for Islamic Equity funds- Islamic Indexes- Equities- Sukuk – Private equity investment – Investing in real estate and leasing funds.

L – 45; T – 0; TOTAL – 45

REFERENCES:

1. Munawar Iqbal "A Guide to Islamic Finance "Risk Books ,UK, 2007.
2. Mahmoud A El-Gamal "Inslamic Finance: Law, Economics and Practice" Cambridge university Press, 2008.
3. Sohail Jaffar "Islamic Asset management" Euromoney books, London, 2006.
4. Michael Mahlknecht "Islamic capital markets and risk management" Risk Books UK 2007.
5. Aly Khorshid "Islamic Insurance" Routledge Curzon, London, 2004.
6. Sohail Jaffar "Islamic Insurance" Euromoney books, London, 2006

COURSE OUTCOMES: On completion of the course the students will be able to

CO1: demonstrate the concept of Islamic banking Models

CO2: describe the fundamental concept of Islamic law

CO3: use Islamic derivatives to reduce the risk in investment

CO4: demonstrate the concept of Islamic Insurance

CO5: demonstrate the concept of Islamic Finance

CO6: demonstrate the concept of islamic asset management

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3	L	H			M		
CO4							
CO5				L			
CO 6		L					L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: This subject provides the basic idea about Islamic investment in insurance sector and how it differs from other investment.

MAEY 03   **CORPORATE FINANCE**   **L   T   P   C**

SDG 4   **3   0   0   3**

COURSE OBJECTIVE:

To make the student conversant with

COB1: Role of various financial institutions in the economy development of the country.

COB2: The applications of derivatives like Options, Forwards and futures.

COB3: Asset pricing model through WACC to measure risk and adjust Beta coefficient to gear he risk.

COB4: The components of capital Structure that has an impact on the dividend decisions.

COB5: Project appraisal phase I which evaluates and values the project by NPV, AP DPP, IRR.

COB6: Identifying, Analysing, Mitigating the risks.

MODULE I   FINANCIAL INSTITUTIONS   8

Government agencies- The Stock Exchange- The roles of the Stock Exchange- Derivatives exchanges- Institutional investors- Investment banks- Clearing banks- Building societies- Investment trusts- Unit trusts- Open-ended investment companies (OEICs)- Investment management companies- Self-administered pension schemes- Life insurance companies- General insurance companies.

MODULE II   USE OF DERIVATIVES   7

Financial futures- Types of futures- Uses of financial futures- Forwards- Options- Types of options- Uses of options- Interest rate and currency swaps- Types of swaps- Uses of swaps.

MODULE III   WEIGHTED AVERAGE COST OF CAPITAL   8

Importance and definetion of WACC- Theoretical background- The traditional view- Modigliani and Miller- Cost of equity- The capital asset pricing model (CAPM) and risk- Specific risk- Systematic risk- Beta as a measure of systematic risk- Adjusting beta for gearing- Measuring beta- Cost of debt- calculation of WACC.

MODULE IV   CAPITAL STRUCTURE AND DIVIDEND POLICY   7

Components of capital structure- aims of the financial manager- Theoretical background to the gearing decision- Factors affecting the gearing decision- Fundamentals of dividend policy- Factors influencing the decision on dividend policy- Other methods of reward- Scrip or stock dividends- Share buybacks.

MODULE V   CAPITAL PROJECT APPRAISAL – I   8

capital project- Initial appraisal- Evaluation of cashflows- Methods of project evaluation- Net present value (NPV)- Internal rate of return (IRR)- Annual capital charge- Shareholder value approach- Payback period- Nominal returns- Strategic fit- Opportunity cost- Hurdle rates- Receipts/costs ratio- Results of the evaluation- Simulations.

MODULE VI   CAPITAL PROJECT APPRAISAL – II   7

Choice of discount rate- Risk analysis – an overview- Identification of risks- Analysis of risks- Obtaining a distribution of NPVs in practice- Risk mitigation- investment submission.

L – 30; T – 0; TOTAL – 30

REFERENCES:

1. S A Ross, Wester Field, Jaffe "Corporate Finance" 8th Edition , Mc Graw Hill, 2008.
2. Interpreting company reports and accounts. Holmes, G.; Sugden, A.; Gee, P. 10th ed. 336 pages. FT Prentice Hall, 2008. ISBN: 978-0273711414.
3. S.R Vishwanath "Corporate Finance Theory and Practice", Sage Publications (ca), 2007.
4. Principles of corporate finance (Global edition). Brealey, R. A.; Myers, S. C.; Allen, F. 10th ed. McGraw-Hill, 2010. ISBN: 978-0071314176.
5. IIBF "International Corporate Finance", Macmillan (I) Publishing , Delhi,2007

COURSE OUTCOMES: On completion of the course the students will be able to

- **CO1:** explain the basic concepts of corporate finance.
- **CO2:** explain the various financial institutions and its purpose.
- **CO3:** identify the components and factors of capital structure.
- **CO4:** identify the factors and important of dividend policies.
- **CO5:** interpret the accounts of a company or a group of companies and discuss the limitations of such interpretation
- **CO6:** show how financial techniques can be used in the assessment of capital investment projects.

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4				M			
CO5							M
CO6	M					M	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Statement: The subject provides the basic idea about corporate finance and Capital project appraisal.

MAEY 04
SDG 4

MORTALITY PROJECTION &
MACHINE LEARNING

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

To make the student conversant with

COB1: Evaluating Graduation by the statistical tests.

COB2: Various ways of projecting mortality values – Lee Carter model and Age period cohort model.

COB3: Extreme value theory through GEV and Generalized pareto distribution.

COB4: Copulas, its properties, types and calculating probabilities.

COB5: Basics of Machine Learning.

COB6: Applications of Machine learning in supervised and unsupervised learnings and its perspectives.

MODULE I   METHOD OF GRADUATION   7

Methods of graduation-Graduation by parametric formula-Graduation by reference to a standard table-Comparison of different methods- Statistical tests of a graduation- The effect of duplicate policies.

MODULE II   MORTALITY PROJECTION   8

Mortality projection- Methods based on expectation, extrapolation and explanation- the Lee-Carter model, the age-period-cohort model, Sources of error in mortality forecasts.

MODULE III   EXTREME VALUE THEORY   8

Extreme events and extreme value theory- Generalised extreme value (GEV) distribution- Generalised Pareto distribution- Measures of tail weight.

MODULE IV   COPULAS   7

Copulas-Marginal and joint distributions- properties of copulas- Sklar's theorem- Fundamental copulas- Explicit copulas- Implicit copulas- Choosing and fitting a suitable copula function- Calculating probabilities using copulas.

MODULE V   MACHINE LEARNING – I   8

What is machine learning?- An overview of machine learning- Concepts in machine learning- Branches of machine learning- Stages of analysis in machine learning.

MODULE VI   MACHINE LEARNING – II   7

Applications: supervised learning- Applications: unsupervised learning- Perspectives of statisticians, data scientists and other quantitative researchers.

L – 45; T – 0; TOTAL – 45

REFERENCES:

1. Vlamidir I Rotar "Actuarial Models" Chapman & Hall, 2006.
2. Elke Korn, Ralf Korn "Monte Carlo Simulation of financial and Actuarial model" Chapman & Hall, (Feb 2010).
3. Dick London "Survival models and their estimation "ACTEX Publication. 1998.
4. A.C. Davison "Statistical models "Cambridge University Press, 2008.
5. Regina C Elandt Johnson "Survival models and data Analysis", Wiley, Inter science, 1999.

COURSE OUTCOMES: On completion of the course the students will be able to

CO1: explain the method of Graduation.

CO2: Project the mortality rate.

CO3: Recognize extreme value distributions, suitable for modelling the distribution

CO4: of severity of loss and their relationships.

CO5: Describe how a copula can be characterized

CO6: Explain and apply elementary principles of machine learning.

Board of Studies (BoS) :   **Academic Council:**

14th BOS of Mathematics & AS held   19th AC held on 29.09.2022
on 30.06.2022.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H			M	
CO4	H						H
CO5		M					
CO 6				H			

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: This subject provides the basic idea about the mortality projection and machine Learning.

MAEY 05　　　　**FINANCIAL MARKETS**　　　L　T　P　C

SDG 4　　　　　　　　　　　　　　　　　　　3　0　0　3

COURSE OBJECTIVE:

To make the student conversant with

COB1: Basics facts of financial markets with respect to time variation and different business cycle.

COB2: Interest rate model, liquidity preference theory, market segmentation theory.

COB3: Production, investment and general equilibrium and the challenges for future.

COB4: Financial risk processes and its measurement.

COB5: Signals, indicators of market trading in various time frames in the trading systems.

COB6: The basics of Islamic trading, finance, capital markets and wealth management practices.

MODULE I　　FACTS OF FINANCIAL MARKETS　　　　　　7

Facts of financial markets – time variation and business cycle – equity premiums – consumption models.

MODULE II　　INTEREST RATE MODEL　　　　　　　　　8

The rate of interest - liquidity preference theory- structure of interest rates- Market segmentation theory- Forward interest rates and yield curve.

MODULE III　　PRODUCTION, INVESTMENT AND GENERAL　　8
**　　　　　　　　EQUILIBRIUM**

Production, investment and general equilibrium – labour income - Idiosyncratic risk – challenges for the future.

MODULE IV　　FINANCIAL RISK PROCESSES　　　　　　　7

Financial risk processes- risk measurement – team structure dynamics – financial risk management.

MODULE V　　SCIENCE OF MARKET TRADING　　　　　　7

Science of Market trading: Signals and indicators – trending, oscillator, vertex indicators – various time frames- wavelet analysis – trading systems.

MODULE VI ISLAMIC FINANCE   8
Islamic banking and finance: Socio economic responses – resilience and stability – current developments – Islamic structured products – Islamic capital markets- trust and wealth managements.

L – 45; TOTAL – 45

REFERENCES:
1. John H Cochrane " Financial markets and the real economy ", Now Publishers, Oct 2005
2. Don K Mak " The science of financial market trading ", World Scientific, 2003
3. Keith Pilbeam "Finance and Financial Markets" 2nd Edition, Palgrave Macmillan
4. Lloyd B Thomas " Money banking and Financial Markets ", 1997, Student Gd edition, Mc Graw hill
5. Stepeh G Cecchetti "Money banking and Financial Markets ", 1st edition, 2005, Mc Graw hill.
6. Natalie Schoon "Islamic banking and Finance" Spiramus Press Ltd., Jan, 2009

COURSE OUTCOMES: On completion of the course the students will be able to

CO1: explain the basic concept of financial market.
CO2: demonstrate the concept of financial risk management.
CO3: explain the treading procedure in financial market.
CO4: explain the importance of Islamic finance.
CO5: demonstrate the knowledge of science of Market trading
CO6: understand the concept of Islamic banking and finance

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4							
CO5	M					M	
CO 6			M				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: This subject provides the basic idea about the production, investment, risk process and market treading in financial market.

MAEY 06 **ISLAMIC ASSET AND FUND**   L T P C
SDG 4 **MANAGEMENT** 3 0 0 3

COURSE OBJECTIVE:

To make the student conversant with

COB1: The Capital Market specific to Risk return principle in Islam

COB2: Islamic Stocks and Wealth Management-

COB3: Norms for Shariah screening in Islam-

COB4: Critical assessment of Islamic Screening norms

COB5: Islamic Real Estate and Project financing

COB6: Modern Islamic Banking

MODULE I   THE CAPITAL MARKET   7

The Capital Market: Functions and Objective – Risk return principle in Islam: Cost of Capital – Shariah Principles for Capital Market.

MODULE II   ISLAMIC STOCKS AND WEALTH MANAGEMENT   8

Islamic Stocks and Wealth Management- Equity shares and funds- Business and Structure of Islamic enterprise: Indebtedness- Earnings from impermissible activities.

MODULE III   SHARIAH SCREENING IN ISLAM   7

Norms for Shariah screening in Islam- Dow Jones Islamic investment criteria – Norms used in India, Pakistan and Middle East.

MODULE IV   ISLAMIC SCREENING NORMS   7

Critical assessment of Islamic Screening norms- Suitability of Market cap – Purification and Zakah.

MODULE V   REAL ESTATE AND PROJECT FINANCING   8

Islamic Real Estate and Project financing – Characteristics of Real Estate – Islamic REITS & REMFs – Islamic MODULE Trusts and Mudaraba Certificates.

MODULE VI   ISLAMIC BANKING   8

Islamic Banking – Introduction: Riba – Modern Islamic Banking – Largest Islamic banks- Principles of Islamic Banking.

L – 30; TOTAL – 30

REFERENCES:

1. Munawar Iqbal "A Guide to Islamic Finance "Risk Books ,UK, 2007.
2. Mahmoud A El-Gamal "Inslamic Finance: Law, Economics and Practice" Cambridge university Press, 2008.
3. Sohail Jaffar "Islamic Asset management" Euromoney books, London, 2006.
4. Michael Mahlknecht "Islamic capital markets and risk management" Risk Books UK 2007.
5. Aly Khorshid "Islamic Insurance" Routledge Curzon, London, 2004.
6. Sohail Jaffar "Islamic Insurance" Euromoney books, London, 2006.

COURSE OUTCOMES:

On completion of the course the students will be able to

CO1: explain the concept of capital market.

CO2: demonstrate the concept of Islamic stocks and wealth management.

CO3: explain the concept of real estate and project financing.

CO4: explain the idea of Islamic banking.

CO5: understand the concept of Islamic Real Estate and Project financing

CO6: understand the concept of Islamic banking

Board of Studies (BoS) :   **Academic Council:**

14th BOS of Mathematics & AS held on   19th AC held on 29.09.2022
30.06.2022.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4	L						
CO5						L	
CO 6			L				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: This subject provides the basic idea about the Islamic asset and fund management.

MAEY 07   **PORTFOLIO AND CREDIT RISK**   L T P C
SDG 4   **MANAGEMENT**   3 0 0 3

COURSE OBJECTIVE:

To make the student conversant with

COB1: The basic concept of valuation of derivative securities.

COB2: Binomial model

COB3: Applications of The Black-Scholes model.

COB4: The 5 – step method in discrete and continuous time.

COB5: The models for term structure of interest rates and its relationship with prices.

COB6: Various models for credit events and recovery rates to mitigate credit risks.

MODULE I   VALUATION OF DERIVATIVE SECURITIES   8

Arbitrage-European options-American options-Factors affecting option price-Pricing forward contracts-Bounds for option prices-Put-call parity.

MODULE II   THE BINOMIAL MODEL   8

The one-period model-Two-period binomial tree-n-period binomial tree-Recombining binomial trees-Calibrating binomial models-state price deflator approach.

MODULE III   BLACK-SCHOLES OPTION PRICING FORMULA   7

Assumptions of Black-Scholes model-The Black-Scholes model- Black-Scholes model for dividend-paying shares.

**MODULE IV   THE 5-STEP METHOD IN DISCRETE &   8
                        CONTINUOUS TIME**

Tradeable assets-Self-financing strategies-Replicating strategies and complete markets-Cameron-Martin-Girsanov theorem-martingale representation theorem-Diffusion models-The martingale approach (the 5-step method)- The 5-step approach with dividends.

MODULE V   THE TERM STRUCTURE OF INTEREST RATES   7

Relationships between interest rates and bond prices-The risk-neutral approach to pricing-The state price deflator approach to pricing-Models for the term structure of interest rates.

MODULE VI   CREDIT RISK   7

Credit events and recovery rates- Structural models- Reduced-form models- Intensity-based models- The Merton model- Two-state models for credit ratings- The Jarrow-Lando-Turnbull (JLT) model.

L – 45; T – 0; TOTAL – 45

REFERENCES:

1. Andrew Kimble "Credit Risk: From Transaction of Portfolio Management", Nov, 2003, Butterworth Heinemann.
2. Andrew Fight "Credit riskManagement", 2007, Elsevier India Private Limited.
3. Ludwig B chincarini "Quantitative Equity Portfolio Management ", 2006, Mc Graw Hill.
4. Greg N Gregoriou, Critisian Hoppe "The Handbook of Credit Portfoilo .Management", 2008, Mc Graw Hill.

COURSE OUTCOMES: On completion of the course the students will be able to

*   **CO1:** Demonstrate a knowledge and understanding of the properties of option prices, valuation methods and hedging techniques.
*   **CO2:** Show how to use binomial trees and lattices in valuing options and solve simple examples.
*   **CO3:** Show how to use the Black-Scholes model in valuing options and solve simple examples.
*   **CO4:** develop the theory to estimate risk neutral pricing strategy
*   **CO5:** Demonstrate a knowledge and understanding of models of the term structure of interest rates.

- **CO6:** Demonstrate a knowledge and understanding of simple models for credit risk.

Board of Studies (BoS) :
14th BOS of Mathematics & AS held on 30.06.2022.

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2			H				
CO3		H			M		
CO4							
CO5	H						
CO 6			H			H	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Statement: This subject provides the basic idea about portfolio theory and credit risk management.

****