B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

Regulations 2019
Curriculum and Syllabi

(Amendments updated upto June 2020)

M.Sc.
(Actuarial Science)

B.S. Abdur Rahman Crescent Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2019
CURRICULUM AND SYLLABI
(Amendments updated upto June 2020)

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:

- To provide opportunities of higher studies in the professional area of Actuarial Science.
- To impart knowledge on various theoretical and practical aspects of Actuarial Science.
- To enable the students to apply their newly gained knowledge and skills in their workplace.
- To develop independent learning skills and transferable skills among the students.
- To help the students extend and develop their career plan and pursue their own professional development.
- To provide the students with a structured programme of study covering all Core Actuarial Science subject contents.
- 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

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

- 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.

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

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

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

- 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,

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

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY, CHENNAI – 600 048.

REGULATIONS - 2019 FOR

M.Tech. / MCA / M.Sc. DEGREE PROGRAMMES

(Under Choice Based Credit System)

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires **"Programme"** means Post Graduate Degree Programme (M.Tech. / MCA / M.Sc.)

"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.,

"Institution" means B.S. Abdur Rahman Crescent Institute of Science & Technology.

"Academic Council" means the Academic Council, which is the apex body on all academic matters of B.S. Abdur Rahman Crescent Institute of Science & Technology.

"Dean (Academic Affairs)" means Dean (Academic Affairs) of B.S. Abdur Rahman Crescent Institute of Science & Technology who administers the academic matters.

"Dean (Student Affairs)" means Dean (Student Affairs) of B.S. Abdur Rahman Crescent Institute of Science & Technology, who looks after the welfare and discipline of the students.

"Controller of Examinations" means the Controller of Examinations of B.S. Abdur Rahman Crescent Institute of Science & Technology who is responsible for the conduct of examinations and declaration of results.

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.	

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 of this Institution as specified in the clause 3.2 [Eligible entry qualifications for admission to P.G. programmes] or any other degree examination of any University or authority accepted by this Institution as equivalent thereto.

2.2.2 Eligibility 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 (3 years)	6	12
MCA (Lateral Entry)	4	8
MCA (2 years)	4	8
M.Sc.	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	Qualifications for admission
1.	Aeronautical Engineering	M. Tech. (Avionics)	B.E. / B. Tech. (Aeronautical Engineering)
2.	Civil Engineering	M. Tech. (Structural Engineering)	B.E. / B. Tech. (Civil Engineering) / (Structural Engineering)

		M. Tech. (Construction Engineering and Project Management)	B.E. / B. Tech. (Civil Engineering) / (Structural Engineering) / B. Arch.
3.	Mechanical Engineering	M.Tech. (Manufacturing Engineering)	B.E. / B.Tech. (Mechanical / Automobile / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering)
		M.Tech. (CAD/CAM)	
4.	Electrical and Electronics Engineering	M.Tech. (Power Systems Engg.)	B.E. / B. Tech. (EEE/ECE/E&I/I&C / Electronics / Instrumentation)
		M.Tech. (Power Electronics and Drives)	
5.	Electronics and Communication Engineering	M.Tech. (Communication Systems)	B.E. / B. Tech. (EEE/ ECE / E&I / CSE IT / I&C / Electronics / Instrumentation)
		M.Tech. (VLSI and Embedded Systems)	B.E. / B. Tech. (ECE / E&I / I&C / EEE / CSE / IT)
6.	Electronics and Instrumentation Engineering	M.Tech. (Electronics and Instrumentation Engineering)	B.E. / B. Tech. (EIE/ICE/Electronics/ECE/EEE)
7.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering)	B.E. / B. Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
8.	Information Technology	M.Tech. (Information Technology)	B.E. / B. Tech. (IT/CSE/ECE/EEE/EIE/ICE/ Electronics / MCA)

9.	Computer Applications	MCA (3 years)	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level
		MCA – (Lateral Entry)	B.Sc. Computer Science / B.Sc. Information Technology / BCA
		MCA (2 years)	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level or B.Sc. Computer Science / B.Sc. Information Technology / BCA
10.	Mathematics	M.Sc. (Actuarial Science)	Any Degree with Mathematics / Statistics as one of the subjects of study
11.	Physics	M.Sc.(Physics)	B.Sc. (Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation)
12.	Chemistry	M.Sc.(Chemistry)	B.Sc. (Chemistry / Applied Science)
13.	Life Sciences	M.Sc. Molecular Biology & Biochemistry	B.Sc. in any branch of Life Sciences
		M.Sc. Biotechnology	B.Sc. in any branch of Life Sciences
		M.Sc. Microbiology	B.Sc. in any branch of Life Sciences
		M.Tech. Biotechnology	B.Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences

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 oriented core courses
iv. Project work / thesis / dissertation
v. Laboratory Courses
vi. Seminars
vii. Mini Project
viii. Industrial Internship
ix. Value Added Courses
x. MOOC Courses (NPTEL, SWAYAM, etc.,)

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.	74 - 80
MCA (3 years)	118 - 126
MCA (Lateral Entry)	80 - 85
MCA (2 years)	85 - 90
M.Sc.	77- 82

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 four weeks of industrial internship or 160 hours per semester.

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 28	18 to 26
MCA	12 to 33	12 to 26
M.Sc.	9 to 32	10 to 26

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, during the entire period of study, with the approval of the 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 20% of credits of courses in a semester excluding project semester 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 ratified by the respective Board of Studies 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 faculty member.

3.5 PROJECT WORK / DISSERTATION

3.5.1 Project work / Dissertation 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 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 / Dissertation 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 / dissertation 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 whole class. He/she is responsible for maintaining the academic, curricular and co-curricular records of all students throughout their period of study.

4.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling on the academic programme, the Head of the Department / Dean of School of the students shall attach a certain number of 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 offer advice to the students on academic and personal matters, and guide the students in taking up courses for registration and enrolment in every semester.

5.0 CLASS COMMITTEE

5.1 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:

5.2 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

5.3 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.

5.4 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 syllabus.

5.5 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.

6.0 COURSE COMMITTEE

6.1 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.

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.

7.2 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.

7.3 A student can withdraw from an enrolled course at any time before the first 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 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.

8.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

8.1 A student may be permitted by the Dean (Academic Affairs) to avail temporary break of study from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. A student can avail the break of study before the start of first assessment test of the ongoing semester. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1). If any student is debarred for want of attendance or suspended due to any act of indiscipline, it will not be considered as break of study. A student who has availed break of study has to rejoin in the same semester only in the subsequent year. The student availing break of study is permitted to write arrear examinations by paying the prescribed fees.

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / DISSERTATION

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 (3 years)	45
MCA (Lateral Entry)	22
MCA (2 years)	22
M.Sc.	18

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

10.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds, representing for the institution in approved events, etc.) 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. The courses in which the student is awarded "I" grade, shall register and redo the course when it is offered next.

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 that course to the Class Advisor. The Class Advisor will consolidate and furnish the list of students who have earned less that 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department / Dean of School. Thereupon, the Dean (Academic Affairs) shall announce the names of such students prevented from writing the semester end examination in each course.

10.3 A student who has obtained 'I' grade in all the courses in a semester is not permitted to move to next higher semester. Such student shall redo 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.

10.4 A student shall register to redo a core course wherein "I" or "W" grade is awarded. If the student is awarded, "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be chosen with the approval of Head of the Department / Dean of School.

11.0 REDO COURSES

11.1 A student can register for a maximum of two redo courses per semester in the evening after regular working hours, if such courses are offered by the

concerned department. Students may also opt to redo the courses offered during regular semesters, without affecting the regular academic schedule and not exceeding prescribed maximum credits.

11.2 The Head of the Department with the approval of Dean (Academic Affairs) may arrange for the conduct of a few courses in the evening after regular working hours, depending on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

11.3 The number of contact hours and the assessment procedure for any redo course will be the same as those during regular semesters except that there is no provision for any substitute examination and withdrawal from an evening redo course.

12.0 ASSESSMENTS AND EXAMINATIONS

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 Appearing for semester end theory examination for each course is mandatory and a student should secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

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

12.3 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 component shall have a total of three assessments with two continuous assessments having 25% weightage each and semester end examination having 50% weightage. The student shall secure a separate minimum of 40%

in the semester end theory examination for the award of pass grade. The evaluation of practical component shall be through continuous assessment.

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

12.5 In the case of Industrial training, 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 organisation. The weightage for Industry internship report shall be 60% and 40% for viva voce examination.

12.6 In the case of project work, a committee of faculty members constituted by the Head of the Department will carry out three periodic reviews. Based on the project report submitted by the student, an oral examination (viva voce) shall be conducted as semester end examination by an external examiner approved by 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.

12.7 For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be considered for grading along with the marks scored in the semester end arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination to award grades and the internal assessment marks secured during the course of study shall not be considered.

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 arrear examination for theory component. There shall be no arrear or improvement examination for lab component.

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 semester.

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 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
W	0

I	0
AB	0

"W" denotes withdrawal from the course.

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

"U" denotes unsuccessful performance in the course.

"AB" denotes absence for the semester end examination.

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 fee 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 i^{th} course and GP_i is the Grade

Point in the i^{th} course

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

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” and "W" grades are excluded for calculating GPA.

"U", “I”, "AB" and **"W"** 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

However, to be eligible for First Class with Distinction, a student should not have obtained ‘U’ or ‘I’ grade in any course during his/her period of study and should have completed the P.G. programme within a minimum period (except break of study). To be eligible for First Class, a student should have passed the examination in all the courses within the specified minimum number of semesters reckoned from his/her commencement of study plus two semesters. For this purpose, the authorized break of study is not considered. The students who do not satisfy the above two conditions shall be classified as second class. For the purpose of classification, the CGPA shall be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

16.0 DISCIPLINE

16.1 Every student is expected to observe disciplined and decorous behaviour 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 MASTERS DEGREE

17.1 A student shall be declared to be eligible for the award of the Masters 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

Not withstanding all that have been stated above, the Academic Council has the right to modify any of the above regulations from time to time.

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

M.SC. (ACTUARIAL SCIENCE)

CURRICULUM & SYLLABUS, REGULATIONS 2019

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C
1	MAD 6101	Fundamentals of Financial Mathematics	3	1	0	4
2	MAD 6102	Probability Distributions	3	1	0	4
3	MAD 6103	Business Economics	3	1	0	4
4	MAD 6104	Financial reporting and Accounting	3	1	0	4
5	MAD 6105	Principles of Insurance	2	0	0	2
6	MAD 6106	Actuarial Computational Laboratory (MS-EXCEL)	0	0	4	2
		Total				**20**

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C
1	MAD 6201	Applications of Financial Mathematics	3	1	0	4
2	MAD 6202	Fundamentals of Life Contingencies	3	1	0	4
3	MAD 6203	Descriptive Statistical Methods in Actuarial Science	3	1	0	4
4	MAD 6204	Stochastic Models	2	1	0	3
5	MAD 6205	Mathematical Statistics	3	1	0	4
6	END 6281	Communication Skills	1	0	2	2
7	MAD 6206	R Programming	0	0	4	2
		Value added course				
		Total				**23**

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C
1	MAD 7101	Applications of Life Contingencies	3	1	0	4
2	MAD 7102	Financial Economics	3	1	0	4
3	MAD 7103	Applied Statistical Methods in Actuarial Science	3	1	0	4
4	MAD 7104	Survival Models	3	1	0	4
5	MAD 7105	Actuarial Computational Laboratory (SPSS)	0	0	4	2
6		Elective – I	3	0	0	3
7		Elective- II	3	0	0	3
8	MAD 7201	Project Phase-I	0	0	8	4*
		MOOC Course				
		Total				**24**

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C
1	MAD 7201	Project Phase –II	0	0	24	8*
		Total				**12**

* Credits for Project Work Phase I to be accounted along with Project Work Phase II in IV Semester

Total Credits (20+23+24+12) = 79

LIST OF ELECTIVES

Elective I

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MADY01	Financial Management of Life Office	3	0	0	3
2.	MADY02	Islamic Investments	3	0	0	3
3.	MADY03	Corporate Finance	3	0	0	3

Elective II

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MADY04	Financial Markets	3	0	0	3
2.	MADY05	Islamic Asset and Fund Management	3	0	0	3
3.	MADY06	Portfolio and Credit Risk Management	3	0	0	3

SEMESTER I

MAD 6101	FUNDAMENTALS OF FINANCIAL MATHEMATICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aim of this course is to

- Provide basic grounding in basic financial mathematics like simple interest, compound interest and their simple applications to calculate accumulate value, present value and loan calculation.

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 Hours –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. lrwin, 1991.

OUTCOMES:

On completion of the course the students will be able to

- Describe how to use a generalised cash-flow model to describe financial transactions
- Describe how to take into account the time value of money using the concepts of compound interest and discounting.
- Show how interest rates or discount rates may be expressed in terms of different time periods.
- Demonstrate a knowledge and understanding of real and money interest rates.

MAD 6102 PROBABILITY DISTRIBUTIONS

L	T	P	C
3	1	0	4

OBJECTIVES:

The aim of this subject is to

- Provide grounding in the aspects of Basic probability, Random variables, probability distributions, joint distribution that are of relevance to actuarial work.

MODULE I BASIC PROBABILITY 9+3

Types of data- Frequency distributions-Bar chart- Histogram- Stem and leaf diagram- Dotplot /Lineplot- Cumulative frequency curves- Boxplot- Location-Spread. Set theory, Venn diagrams, Basics of probability- The addition and multiplication rule – Conditional Probability- and Total probability – Baye's Theorem

MODULE II RANDOM VARIABLES 6+2

Random Variables and Expectation of a random variable – Moment inequalities (Tchebyshev, Markov, Jensen)-Continuous random variables Functions of a random variable.

MODULE III DISCRETE AND CONTINUOUS PROBABILITY DISTRIBUTIONS 9+3

Discrete distributions- Uniform, Bernoulli, Binomial, Geometric, Negative binomial, Hypergeometric and Poisson distribution. 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 ANDLAW OF LARGE NUMBERS **8+3**

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.

OUTCOMES :

On completion of the course the students will be able to

- summarize the main features of a data set (exploratory data analysis).
- explain the concepts of probability.
- 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.
- 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.
- 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.
- state the central limit theorem, and apply it.

MAD 6103 BUSINESS ECONOMICS L T P C
3 1 0 4

OBJECTIVES:

The aim of the subject is to

- Provide 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.

MODULE I ECONOMIC CONCEPTS, SUPPLY AND DEMAND 8+3

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+3

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.

OUTCOMES :

On completion of the course the students will be able to

- 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.
- 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.
- 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.

- 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.
- Discuss the role of exchange rates and international trade in the economy and the meaning of the term balance of payments.
- 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.

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

OBJECTIVES:

The aim of this subject is to

- Provide a basic understanding of corporate finance including knowledge of the instruments used by companies to raise finance and manage financial risk.
- Provide the ability to interpret the accounts and financial statements of companies and financial institutions.

MODULE I THE KEY PRINCIPLES OF FINANCE 8+3

The key principles of finance- Finance and the real resources of an organisation- 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+3

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 8+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 GROUPAND INSURANCE COMPANY ACCOUNTS 7+2

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

Associated companies.

MODULE VI INTERPRETATION AND LIMITATION OF ACCOUNTS 8+3

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.

OUTCOMES :

On completion of the course the students will be able to

- demonstrate a knowledge and understanding of the principal terms which is used in investment and asset management.
- Demonstrate an awareness of the key principles of finance and basic principles of personal and corporate taxation.
- Describe the structure of a joint stock company and the different methods by which it may be financed.
- 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.

- Describe the basic construction of accounts of different types and the role and principal features of the accounts of a company.
- 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.

MAD 6105 PRINCIPLES OF INSURANCE

L	T	P	C
2	0	0	2

OBJECTIVES:

The objective of the paper Principles of Insurance is

- to give introduction about the various types of insurable risk, principle of insurance, insurance products and markets with a brief history of 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 INSURANCE 5

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; T – 0; 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.

OUTCOMES :

Students to complete this course will be able to

- describe the basic principle of insurance.
- identify different kind of insurable risk.
- demonstrate the insurance terminology.
- describe the history of insurance.
- plan new products based market need

MAD 6106	ACTUARIAL COMPUTATIONAL LABORATORY (MS-EXCEL)	L	T	P	C
		0	0	4	2

OBJECTIVES:

- The objective of this laboratory is to provide grounding in Microsoft Excel so that they can perform the actuarial calculation in an effective way.

Review: 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-Pivot Table-V Lookup-H Lookup.

PROBLEMS FROM THE FOLLOWING TOPICS

- Presenting data in tables and charts
- Numerical descriptive measures
- Basic probability
- Some important discrete probability distributions
- The normal distribution and other continuous distributions
- Sampling and sampling distributions
- Confidence interval estimation
- Fundamentals of hypothesis testing
- Simple linear regression
- Introduction to multiple regression

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.

OUTCOMES :

On completion of the course the students will be able to

- Entering data.
- Calculating a set of data.
- Displaying the data in a meaningful way.
- Sharing data so that other can understand.
- Formatting cells for the need.
- Using functions and formulae

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

OBJECTIVES:

The aim of this course is

- to provide 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.

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-Measurement of investment performance-Money-weighted rate of return-Time-weighted rate of return-Linked internal rate of return.

MODULE II INVESTMENTS 7+2

Investments-Fixed interest borrowings- government bonds-Government bills-Characteristics of corporate debt-Debentures-Unsecured loan stocks-Eurobonds-Certificates of deposit-Shares and other equity-type borrowing-Property-Derivatives-Futures-Options-Swaps.

MODULE III ELEMENTARY COMPOUND INTEREST PROBLEMS 8+3

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

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.

OUTCOMES :

On completion of the course the students will be able to

- show how discounted cash flow techniques can be used in investment project appraisal.
- describe the investment and risk characteristics of the following types of asset available for investment purposes.
- calculate the delivery price and the value of a forward contract using arbitrage free pricing methods.
- show an understanding of the term structure of interest rates.
- show an understanding of simple stochastic interest models for investment returns.

MAD 6202	FUNDAMENTALS OF LIFE CONTINGENCIES	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aim of the Life Contingencies subject is

- to provide 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.

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.

OUTCOMES :

On completion of the course the students will be able to

- 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.
- Describe practical methods of evaluating expected values and variances of

the simple contracts defined in objective.

- Describe and calculate, using ultimate or select mortality, net premiums and net premium reserves of simple insurance contracts.
- Describe the calculation, using ultimate or select mortality, of net premiums and net premium reserves for increasing and decreasing benefits and annuities.
- Describe the calculation of gross premiums and reserves of assurance and annuity contracts.

MAD 6203 DESCRIPTIVE STATISTICAL METHODS IN ACTUARIAL SCIENCE

L	T	P	C
3	1	0	4

OBJECTIVES:

- The objective of this subject is to provide grounding in Decision theory, Bayesian statistics, Loss distributions, Reinsurance, and Credibility theory which have particular relevance to General Insurance.

MODULE I DECISION THEORY 6+2

Decision theory-Zero-sum two-player games-Domination- the Minimax criterion-Randomised Strategies-Statistical games-Decision criteria-The Bayes criterion.

MODULE II 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 III 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 IV 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 V 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.Empirical Bayes credibility theory -EBCT Model to estimate risk premium - EBCT Model to estimate claim frequency.

MODULE VI RISK MODELS 9+3

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

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.

OUTCOMES :

On completion of the course the students will be able to

- explain the concepts of decision theory and apply them.
- calculate probabilities and moments of loss distributions both with and without limits and risk-sharing arrangements.
- 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.
- explain the fundamental concepts of bayesian statistics and use these concepts to calculate bayesian estimators.
- describe the fundamental concepts of rating and apply them to simple experience rating systems.
- 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.

MAD 6204 STOCHASTIC MODELS L T P C
2 1 0 3

OBJECTIVES:

- The objective of this subject is to provide grounding in actuarial modeling, stochastic processes, Markov chains and its application in framing NCD, HSD models.

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 PROCESSES 5+3

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 PROCESSES 5+3

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.

OUTCOMES :

On completion of the course the students will be able to

- Describe the principles of actuarial modeling.
- Describe the general principles of stochastic processes, and their classification into different types.
- Define and apply markov chain.
- Define and apply markov process.
- Solve insurance related problem based on markov chain.

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

3 1 0 4

OBJECTIVES:

The aim of the Mathematical Statistics subject is

- To provide grounding in Advance Probability and in particular sampling, Hypothesis testing, correlation-regression and Analysis of variance that are of relevance to actuarial work.

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.

MODULE V CORRELATION AND REGRESSION 8+3

Correlation and regression- Scatter plots- Correlation- linear correlation- Regression- Regression line- deriving the least squares estimates- Bivariate data- Correlation analysis- Regression analysis- The multiple linear regression model-

MODULE VI ANALYSIS OF VARIANCE 7+2

Analysis of variance- One-way analysis of variances- Estimation of the parameters- Partitioning the variability-Examining the treatment means- Confidence intervals for a single treatment mean and pair of treatment means.

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.

OUTCOMES :

On completion of the course the students will be able to

- Explain the concepts of random sampling, statistical inference and sampling distribution, and state and use basic sampling distributions.
- Describe the main methods of estimation and the main properties of estimators, and apply them.
- Construct confidence intervals for unknown parameters and Test hypotheses.
- Investigate linear relationships between variables using correlation analysis and regression analysis.
- Explain the concepts of analysis of variance and use them.

END 6281 COMMUNICATION SKILLS L T P C
1 0 2 2

OBJECTIVES:

- To orient students in communication skills.
- To train students making effective presentations and discussion various topics.
- To develop active listening skills among students.
- To encourage them to read important documents by using the sub – skills of reading.
- To train them to write project reports with confidence.

MODULE I INTRODUCTION TO LANGUAGE SKILLS 2

Orientation to communication skills - Introduction to business vocabulary - Integration of grammatical elements in business English.

MODULE II SPEAKING IN FORMAL AND INFORMAL SCENARIO 2

Orientation to presentation skills – Introducing one-self - Presentation skills -Talking on a familiar topic.(JAM) - Making presentations - Getting into conversations- Role play.

MODULE III ACTIVE LISTENING 2

Listening to basic conversations - Listening for specific information - Note-taking and developing points.

MODULE IV READING COMPREHENSION 2

Introduction to reading skills & sub – skills - Developing comprehension skills - Reading circulars and important notices - Reading advertisement and responding.

MODULE V WRITING SKILLS 2

Implications of communication skills in work life - Discussion on current topics-newspaper items, current issues - Reading a newspaper article - Report writing - Project proposal and report.

MODULE VI INTEGRATION OF SKILLS 2

Implications of communication skills in work life - Discussion on current topics-

newspaper items, current issues - Reading a newspaper article - Report writing - Project proposal and report.

L – 12; P – 18; TOTAL – 30

REFERENCES:

1. Byrne, D “Teaching Oral Skill”, London: Longman. (1975).
2. Byrne, D. Teaching Writing,, London: Longman. (1975).
3. Grellet, F “Developing Reading Skills”, Cambridge University Skills.UK. (1981).
4. Ur,P. “Teaching Listening Comprehension”, Cambridge University Press.UK. (1984).
5. Anderson, K., Maclean, J. & Lynch, T “Study speaking”, A Course in Spoken English for Academic Purposes. Cambridge University Press, UK. (2004).
6. Withrow, J., Brookes, G.& Cummings, M.C. “Inspired to write. Reading and Tasks to Develop Writing Skills”, Cambridge University Press, U.K (2004).

OUTCOMES :

On completion of the course the students will be able to

- Communicate effectively.
- Present their ideas with confidence.
- Listen and respond effectively.
- Read all types of documents effectively.
- Write project reports.

MAD 6206	R PROGRAMMING	L	T	P	C
	R: A Language and Environment for Statistical Computing	0	0	4	2

OBJECTIVES:

The objective of the R-Programming is

- To give the basic knowledge of a system for statistical computation and graphics.

PROBLEMS FROM THE FOLLOWING TOPICS

1. Introduction and preliminaries
2. Simple manipulations; numbers and vectors
3. Objects, their modes and attributes
4. Ordered and unordered factors
5. Arrays and matrices
6. Lists and data frames
7. Reading data from files
8. Probability distributions
9. Grouping, loops and conditional execution
10. Writing own functions
11. Statistical models in R

OUTCOMES :

On completion of the course the students will be able touse the statistical procedures. Among these are:

- Linear and generalized linear models.
- Nonlinear regression models.
- Time series analysis.
- Classical parametric and nonparametric tests.
- Clustering and smoothing.

MAD 7101	APPLICATIONS OF LIFE CONTINGENCIES	L	T	P	C
		3	1	0	4

OBJECTIVES:

The objective of the subject is to

- Give the basic knowledge of different types of insurance contract involving two life's, Idea of Pension Scheme and ULIP policies.

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

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.

OUTCOMES :

On completion of the course the students will be able to

- Define and use straightforward functions involving two lives.
- Describe methods which can be used to model cash flows contingent upon competing risks.
- Describe the technique of discounted emerging costs, for use in pricing, reserving, and assessing profitability.
- Describe the principal forms of heterogeneity within a population and the ways in which selection can occur.

MAD 7102 FINANCIAL ECONOMICS L T P C
3 1 0 4

OBJECTIVES:

- The objective of the 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.

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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

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

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.

OUTCOMES :

On completion of the course the students will be able to

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

MAD 7103	APPLIED STATISTICAL METHODS IN ACTUARIAL SCIENCE	L	T	P	C
		3	1	0	4

OBJECTIVES:

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

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 GENERALISED LINEAR MODELS 7+2

Generalised 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.

MODULE III 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 IV 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 V 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.

MODULE VI MONTE CARLO SIMULATION 7+2

Monte Carlo simulation-Generation of pseudo-random numbers using a computer-Inverse transform method-Inverse transform method for discrete variates-Acceptance-rejection method-Generating normal variates-Numerical evaluation of derivatives-Comparative simulations, performance evaluation.

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.

OUTCOMES :

On completion of the course the students will be able to

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

MAD 7104 SURVIVAL MODELS L T P C
3 1 0 4

OBJECTIVES:

The objective of the 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.

MODULE I SURVIVAL MODELS AND THE LIFE TABLE 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_xInitial 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 FUNCTION 7+2

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 BINOMIAL-TYPE MODELS 7+3

Binomial-type models-The actuarial estimate-Central exposed to risk-Strengths and weakness of the binomial model-Poisson models- Estimating the underlying force of mortality- Comparison of multiple-state, binomial and Poisson models-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 and statistical tests-The need for graduation-Reasons for graduation-

Desirable features of a graduation-Testing the smoothness of a graduation-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.

MODULE VI METHODS OF GRADUATION AND MORTALITY PROJECTION 9+3

Methods of graduation-Graduation by parametric formula-Graduation by reference to a standard table-Graphical graduation-Comparison of different methods- Statistical tests of a graduation- The effect of duplicate policies-Mortality projection- Methods based on expectation, extrapolation and explanation-the Lee-Carter model, the age-period-cohort model, Sources of error in mortality forecasts.

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.

OUTCOMES :

On completion of the course the students will be able to

- explain the concept of survival models and estimation for lifetime distributions.
- derive maximum likelihood estimators for the transition intensities in models of transfers between states with piecewise constant transition intensities.
- describe the binomial model of mortality, derive a maximum likelihood estimator for the probability of death and compare the binomial model with the multiple state models.
- describe how to estimate transition intensities depending on age, exactly or using the census approximation and test crude estimates for consistency with a standard table or a set of graduated estimates, and describe the process of graduation.

MAD 7105	ACTUARIAL COMPUTATIONAL LABORATORY (SPSS)	L	T	P	C
		0	0	4	2

OBJECTIVES:

The aim of the SPSS lab is

- To provide the practical knowledge of the various Actuarial aspects

[S P S S (STATISTICAL PACKAGE FOR SOCIAL SCIENCES)]

- Data Analysis
- Basic Data Analysis and graphs
- Regression Analysis
- Sampling (Normal, F, Students- t, chi-square distributions)
- Analysis of Variance (One way, Two Way, Latin square, factorial Methods)
- Contingency tables
- Risk Analysis Using Monte-Carlo Method
- Insurance Claims Severity and frequency

References:

1. George A. Morgan, Nancy L. Leech, Gene W. Gloeckner, Karen C. Barrett: SPSS *for Introductory Statistics:Use and Interpretation,* (Second Edition), Lawrence Erlbaum Associates Publishers, New Jersey, 2004.

OUTCOMES:

- Will have the thorough knowledge SPSS and they can use this idea to calculate premium and reserve using similar software which is widely used in actuarial evaluation process in industries.

ELECTIVES

		L	T	P	C
MADY 01	**FINANCIAL MANAGEMENT OF LIFE OFFICE**	**3**	**0**	**0**	**3**

OBJECTIVES:

- The objective of the subject is to provide the basic idea about the financial management of companies in particular 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.

OUTCOMES :

On completion of the course the students will be able to

- explain the role of actuary and their work.
- explain what are the asset and liabilities of an insurance companies.
- differentiate the different type of bonuses.
- explain why insurance companies need to keep reserve.

MADY02	ISLAMIC INVESTMENTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of the subject is

- To provide the basic idea about Islamic investment in insurance sector and how it differs from other investment.

MODULE I ISLAMIC INVESTMENT AND GLOBAL TRENDS 8

Innovation, globalization and diversification- strengths and resilience of the Islamic banking sector- Growth and development of Islamic capital market.

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.

OUTCOMES :

On completion of the course the students will be able to

- describe the fundamental concept of islamic law
- use islamic derivatives to reduce the risk in investment
- demonstrate the concept of islamic asset management

MADY 03	CORPORATE FINANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of the subject is

- To provide the basic idea about corporate finance and Capital project appraisal.

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 – 45; T – 0; TOTAL – 45

REFERENCES:

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

OUTCOMES :

On completion of the course the students will be able to

- Explain the basic concepts of corporate finance.
- Explain the various financial institutions and its purpose.
- Identify the components and factors of capital structure.
- Identify the factors and important of didivent policies.
- 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.

MADY 04 FINANCIAL MARKETS L T P C

3 0 0 3

OBJECTIVES:

The objective of the subject is

- To provide the basic idea about the production, investment, risk process and market treading in financial market.

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 EQUILIBRIUM 8

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; T – 0; 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.

OUTCOMES :

On completion of the course the students will be able to

- Explain the basic concept of financial market.
- Demonstrate the concept of financial risk management.
- Explain the treading procedure in financial market.
- Explain the importance of Islamic finance.

MADY 05 ISLAMIC ASSET AND FUND MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- The objective of the subject is to provide the basic idea about the Islamic asset and fund management.

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 – 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.

OUTCOMES :

On completion of the course the students will be able to

- explain the concept of capital market.
- demonstrate the concept of Islamic stocks and wealth management.
- explain the concept of real estate and project financing.
- explain the idea of Islamic banking .

MADY 06	PORTFOLIO AND CREDIT RISK MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of the subject of the subject is

- To provide the basic idea about portfolio theory and credit risk management.

MODULE I VALUATION OFDERIVATIVE 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 & CONTINUOUS TIME 8

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.

OUTCOMES :

On completion of the course the students will be able to

- Demonstrate a knowledge and understanding of the properties of option prices, valuation methods and hedging techniques.
- Show how to use binomial trees and lattices in valuing options and solve simple examples.
- Show how to use the Black-Scholes model in valuing options and solve simple examples.
- Demonstrate a knowledge and understanding of models of the term structure of interest rates.
- Demonstrate a knowledge and understanding of simple models for credit risk.