

**B.S.ABDUR RAHMAN
UNIVERSITY**

B.S.ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)



(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

**REGULATIONS (2009), CURRICULUM AND SYLLABUS
FOR
M.Sc. (ACTUARIAL SCIENCE)
(updated upto June 2012)**

**REGULATIONS -2009 FOR
M.TECH / MCA / M. Sc DEGREE PROGRAMMES**

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires

- i) **"Programme"** means Post Graduate Degree Programme (M.Tech./ MCA / M.Sc.)
- ii) **"Course"** means a theory or practical subject that is normally studied in a semester, like Applied Mathematics, Structural Dynamics, Computer Aided Design, etc.
- iii) **"University"** means B.S.Abdur Rahman University, Chennai, 600048.
- iv) **"Institution"** unless otherwise specifically mentioned as an autonomous or off campus institution means B.S.Abdur Rahman University.
- v) **"Academic Council"** means the Academic Council of the University.
- vi) **'Dean (Academic Courses)'** means Dean (Academic Courses) of B.S.Abdur Rahman University.
- vii) **'Dean (Students)'** means Dean(Students) of B.S.Abdur Rahman University.
- viii) **"Controller of Examinations"** means the Controller of Examinations of B.S.Abdur Rahman University who is responsible for conduct of examinations and declaration of results.

2.0 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

2.1 P.G. Programmes Offered

The various P.G. Programmes and their modes of study are as follows:

Degree	Mode of study
M.Tech.	Full Time
M.Tech.	Part Time – Day / Evening
M.C.A.	Full Time
M. Sc.	Full Time

2.2 MODES OF STUDY

2.2.1 Full-time

Candidates admitted under "Full-Time" shall be available in the institution during the complete working hours for curricular, co-curricular and extra-curricular activities assigned to them.

2.2.2 A full time student, who has completed all non-project courses desiring to do the Project work in part-time mode for valid reasons, shall apply to the Head of the Institution through the Head of the Department, if the student satisfies the clause 2.3.5 of this Regulations. Permission may be granted based on merits of the case. Such conversion is not permitted in the middle of a semester.

2.2.3 Part time - Day time

In this mode of study, the candidates are required to attend classes for the courses registered along with full time students.

2.2.4 Part time - Evening

In this mode of study, the candidates are required to attend only evening classes.

2.2.5 A part time student is not permitted to convert to the full time mode of study.

2.3. ADMISSION REQUIREMENTS

2.3.1 Candidates for admission to the first semester of the Master's Degree Programme shall be required to have passed an appropriate degree examination of this University as specified in Table 1 or any other examination of any University or authority accepted by the University as equivalent thereto.

2.3.2 Notwithstanding the qualifying examination the candidate might have passed, he/she shall have a minimum level of proficiency in the appropriate programme/courses as prescribed by the institution from time to time.

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

2.3.4 All part-time candidates should satisfy other conditions regarding experience, sponsorship etc., which may be prescribed by the institution from time to time.

2.3.5 A candidate eligible for admission to M.Tech. Part Time - Day Time programme shall have his/her permanent place of work within a distance of 65km from the campus of the institution.

- 2.3.6** A candidate eligible for admission to M.B.A. Part Time - Evening programme shall have a working experience of 2 years at least at supervisory level. He/ she shall have his/her place of work within a distance of 65 km from the campus of the institution.

3.0 DURATION AND STRUCTURE OF THE P.G. PROGRAMME

- 3.1.** The minimum and maximum period for completion of the P.G. Programmes are given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
M.Tech. (Full Time)	4	8
M.Tech.(Part Time)	6	12
M.C.A. (Full Time)	6	12
M.Sc. (Full Time)	4	8

- 3.2** The P.G. programmes will consist of the following components as prescribed in the respective curriculum
- Core courses
 - Elective courses
 - Project work / thesis / dissertation
 - Laboratory Courses
 - Case studies
 - Seminars
 - Practical training
- 3.3** The curriculum and syllabi of all the P.G. programmes shall be approved by the Academic Council.
- 3.4** The number of credits to be earned for the successful completion of the programme shall be specified in the curriculum of the respective specialization of the P.G. programme.
- 3.5** Each academic semester shall normally comprise of 75 to 80 working days spread over sixteen weeks. End-semester examinations will follow immediately after these working days.

M.Sc. (Actuarial Science)**ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO P.G. PROGRAMMES**

Sl.No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
01.	Civil Engineering	M.Tech. (Structural Engineering) M.Tech. (Construction Engineering and Project Management)	B.E / B.Tech. (Civil Engineering) / (Structural Engineering) B.E. / B.Tech. (Civil Engineering) /(Structural Engineering)
02.	Mechanical Engineering	M.Tech. (CAD - CAM) M.Tech. (Manufacturing Engineering)	B.E. / B.Tech. (Mechanical / Auto /Manufacturing / Production / Industrial/Mechatronics / Metallurgy / Aerospace/Aeronautical / Material Science / Marine Engineering) B.E. / B.Tech. (Mechanical / Auto / Manufacturing / Production / Industrial/Mechatronics / Metallurgy / Aerospace/Aeronautical / Material Science / Marine Engineering)
03.	Polymer Technology	M.Tech. (Polymer Technology)	B. E. / B. Tech. degree Mech./ Production / Polymer Science or Engg or Tech/Rubber Tech/ M.Sc(Polymer Sc./Chemistry Appl. Chemistry)
04.	Electrical and Electronics Engineering	M.Tech. (Power Systems Engg) M.Tech. (Power Electronics & Drives)	B.E/B.Tech (EEE/ECE/E&I/ I&C/ Electronics / Instrumentation) B.E/B.Tech (EEE/ECE/E&I/ I&C/ Electronics/ Instrumentation)
05.	Electronics and Communication Engineering	M.Tech. (Communication Systems) M.Tech. (VLSI and Embedded Systems)	M.Tech (Power System Engg) B.E / B.Tech (EEE/ ECE / E&I / I&C / Electronics / Instrumentation) B.E/ B.Tech. in ECE / Electronics / EIE
06.	ECE Department jointly with Physics Department	M.Tech. (Optoelectronics and Laser Technology)	B.E./B.Tech. (ECE / EEE / Electronics / EIE / ICE) M.Sc (Physics / Materials Science / Electronics / Photonics)
07.	Electronics and Instrumentation Engineering	M.Tech. (Electronics and Instrumentation Engineering)	B.E./B.Tech. (EIE/ICE/Electronics/ECE/EEE)
08.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering) M.Tech. (Software Engineering)	B.E. /B.Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA) B.E. / B.Tech. (CSE / IT) MCA
09	Information Technology	M.Tech. (Information Technology)	B.E /B.Tech. (IT/CSE/ECE/EEE/EIE/ICE/ Electronics) MCA
10	Computer Applications	M.C.A. M.Tech. (Systems Engineering and Operations Research)	Any degree. Must have studied Mathematics / Statistics /Computer oriented subject. Any degree. Must have studied Mathematics / Statistics /Computer oriented subject.
11	Mathematics	M.Sc. (Actuarial Science)	B.Sc. (Mathematics) of B.Sc. (Applied Science)
12	Chemistry	M.Sc.(Chemistry)	B.Sc (Chemistry) of B.Sc. (Applied Science)

M.Sc. (Actuarial Science)

- 3.6** The curriculum of P.G. programmes shall be so designed that the minimum prescribed credits required for the award of the degree shall lie within the limits specified below:

Programme	Minimum prescribed credit range
M.Tech.	70 to 80
M.C.A	130 to 140
M.Sc	74 to 80

- 3.7** Credits will be assigned to the courses for all P.G. programmes as given below:

- * One credit for one lecture period per week
- * One credit for one tutorial period per week
- * One credit each for seminar/practical session of two or three periods per week
- * One credit for four weeks of practical training

- 3.8** The number of credits registered by a candidate in non-project semester and project semester should be within the range specified below:

P.G. Programme	Non-project Semester	Project semester
M.Tech. (Full Time)	15 to 23	12 to 20
M.Tech. (Part Time)	6 to 12	12 to 16
M.C.A. (Full Time)	12 to 25	12 to 20
M.Sc. (Full Time)	15 to 25	12 to 20

- 3.9** The electives from the curriculum are to be chosen with the approval of the Head of the Department.
- 3.10** A candidate may be permitted by the Head of the Department to choose electives offered from other P.G. Programmes either within a Department or from other Departments up to a maximum of three courses during the period of his/her study, provided the Heads of the Departments offering such courses also agree.
- 3.11** To help the students to take up special research areas in their project work and to enable the department to introduce courses in latest/emerging areas in the curriculum, "Special Electives" may be offered. A candidate may be

permitted to register for a "Special Elective" up to a maximum of three credits during the period of his/her study, provided the syllabus of this course is recommended by the Head of the Department and approved by the Dean (AC) before the commencement of the semester, in which the special elective course is offered. Subsequently, such course shall be ratified by the Board of Studies and Academic Council.

3.12 The medium of instruction, examination, seminar and project/thesis/dissertation reports will be English.

3.13 Practical training or industrial attachment, if specified in the curriculum shall be of not less than four weeks duration and shall be organized by the Head of the Department.

3.14 PROJECT WORK/THESIS/DISSERTATION

3.14.1 Project work / Thesis / Dissertation shall be carried out under the supervision of a qualified teacher in the concerned Department.

3.14.2 A candidate may however, in certain cases, be permitted to work on the project in an Industrial/Research Organization, on the recommendation of Head of the Department, with the approval of the Head of the Institution. In such cases, the project work shall be jointly supervised by a supervisor of the Department and an Engineer / Scientist from the organization and the student shall be instructed to meet the supervisor periodically and to attend the review committee meetings for evaluating the progress.

3.14.3 Project work / Thesis / Dissertation (Phase - II in the case of M.Tech.) shall be pursued for a minimum of 16 weeks during the final semester, following the preliminary work carried out in Phase-1 during the previous semester.

3.14.4 The Project Report/Thesis / Dissertation report / Drawings prepared according to approved guidelines and duly signed by the supervisor(s) and the Head of the Department shall be submitted to the Head of the Institution.

3.14.5 The deadline for submission of final Project Report / Thesis / Dissertation is within 30 calendar days from the last working day of the semester in which Project / Thesis / Dissertation is done.

3.14.6 If a candidate fails to submit the Project Report / Thesis / Dissertation on or before the specified deadline he / she is deemed to have not completed the Project Work / Thesis / dissertation and shall re-register the same in a subsequent semester.

3.14.7 A student who has acquired the minimum number of total credits prescribed in the Curriculum for the award of the Masters Degree will not be permitted to enroll for more courses to improve his/her cumulative grade point average (CGPA).

4.0 FACULTY ADVISER

To help the students in planning their courses of study and for getting general advice on academic programme, the concerned department will assign a certain number of students to a faculty member who will be called the Faculty Adviser.

5.0 CLASS COMMITTEE

5.1 Every class of the P.G. Programme will have a Class Committee, constituted by the Head of the Department as follows:

- i. Teachers of all courses of the programme
- ii. One senior faculty preferably not offering courses for the class, as chairperson.
- iii. One or two students of the class, nominated by the Head of the Department.
- iv. Faculty Advisers of the class - Ex-Officio Members
- v. Professor in-charge of the P.G. Programme - Ex-Officio Member.

5.2 The Class Committee shall be constituted by the respective head of the department of the students.

5.3 The basic responsibilities of the Class Committee are to review periodically the progress of the classes, to discuss problems concerning curriculum and syllabi and the conduct of the classes. The type of assessment for the course will be decided by the teacher in consultation with the Class Committee and will be announced to the students at the beginning of the semester. Each Class Committee will communicate its recommendations to the Head of the Department and the Head of the Institution. The class committee, **without the student members**, will also be responsible for finalization of the semester results.

5.4 The Class Committee is required to meet at least thrice in a semester, once at the beginning of the semester, another time after the end-semester examination to finalise the grades, and once in between.

6.0 COURSE COMMITTEE

Each common theory course offered to more than one group of students shall have a "Course Committee" comprising all the teachers teaching 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 / Head of the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several

departments. The Course Committee shall meet as often as possible and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the Course Committee may also prepare a common question paper for the test(s).

7.0 REGISTRATION AND ENROLMENT

7.1 For the first semester every student has to register and enroll for the courses he/she intends to undergo on a specified day notified to the student. The concerned Faculty Adviser will be present and guide the students in the registration/enrolment process.

7.2 For the subsequent semesters registration for the courses will be done by the student during a specified week before the end-semester examination of the previous semester. The curriculum gives details of the core and elective courses, project and seminar to be taken in different semester with the number of credits. The student should consult his/her Faculty Adviser for the choice of courses. The Registration form is filled in and signed by the student and the Faculty Adviser.

7.3 Late registration will be permitted with a prescribed fine up to two weeks from the last date specified for registration.

7.4 From the second semester onwards all students shall pay the prescribed fees and enroll on a specified day at the beginning of a semester.

A student will become eligible for enrolment only if he/she satisfies clause 9 and in addition he/she is not debarred from enrolment by a disciplinary action of the Institution. At the time of enrolment a student can drop a course registered earlier and also substitute it by another course for valid reasons with the consent of the Faculty Adviser. Late enrolment will be permitted on payment of a prescribed fine up to two weeks from the date of commencement of the semester.

7.5 Withdrawal from a course registered is permitted up to one week from the date of the completion of the first assessment test.

7.6 Change of a course within a period of 15 days from the commencement of the course, with the approval of Dean (AC), on the recommendation of the HOD, is permitted.

7.6.1 Courses withdrawn will have to be taken when they are offered next if they belong to the list of core courses.

7.7 SUMMER TERM COURSES

7.7.1 Summer term courses may be offered by a department on the recommendation by the Departmental Consultative Committee and approved by the Head of the Institution. No student should register for more than three courses during a summer term.

7.7.2 Summer term courses will be announced by the Head of the Institution at the end of the even semester before the commencement of the end semester examinations. A student will have to register within the time stipulated in the announcement. A student has to pay the fees as stipulated in the announcement.

7.7.3 Fast-track summer courses of 30 periods for 3 credit courses and 40 periods for 4 credit courses will be offered for students with I grades. They may also opt to redo such courses during regular semesters with slotted time-tables. Students with U grades will have the option either to write semester end arrears exam or to redo the courses during summer / regular semesters with slotted time-table, if they wish to improve their continuous assessment marks also.

The assessment procedure in a summer term course will also be similar to the procedure for a regular semester course.

7.7.4 Withdrawal from a summer term course is not permitted. No substitute examination will be held for the summer term courses.

8.0 TEMPORARY WITHDRAWAL FROM THE PROGRAMME

A student may be permitted by the Head of the Institution to temporarily withdraw from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. However the total duration for completion of the programme shall not exceed the prescribed number of semesters (vide clause 3.1).

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / THESIS / DISSERTATION

9.1 A candidate 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 enrol for project semester
M.Tech. (Full time)	18 (III semester)
M.Tech. (Part-time)	18 (V semester)
M.C.A. (Full time)	45 (VI semester)
M.Sc. (Full-time)	28 (IV semester)

9.2 M.Tech.: If the candidate has not earned minimum number of credits specified, he/she has to earn the required credits (at least to the extent of minimum credit specified in clause 9.1) and then register for the project semester.

9.3 M.C.A.: If the candidate has not earned the required 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 work in subsequent semesters.

10.0 DISCIPLINE

10.1 Every candidate is required to observe discipline and decorous behaviour both inside and outside the campus and not to indulge in any activity, which will tend to bring down the prestige of the institution.

10.2 Any act of indiscipline of a candidate reported to the Head of the Institution will be referred to a Discipline and Welfare Committee for taking appropriate action.

10.3 Every candidate should have been certified by the HOD that his / her conduct and discipline have been satisfactory.

11.0 ATTENDANCE

11.1 Attendance rules for all Full Time Programme and Part time - day Time Programmes are given in the following sub-clauses.

11.2 A student **shall earn 100% attendance** in the contact periods of every course, subject to a **a maximum relaxation of 25%** for genuine reasons like on medical grounds , representing the University in approved events etc., to become eligible to appear for the end-semester examination in that course, failing which the student shall be awarded "I" grade in that course. If the course is a core course, the candidate should register for and repeat the course when it is offered next.

12.0 ASSESSMENTS AND EXAMINATIONS

12.1 The following rule shall apply to the full-time and part-time P.G. programmes (M.Tech./ M.C.A. / M.Sc.)

For lecture-based courses, normally a minimum of two assessments will be made during the semester. The assessments may be combination of tests and assignments. The assessment procedure as decided at the Class Committee will be announced to the students right at the beginning of the semester by the teacher and informed to Dean(AC)

- 12.2** There shall be one **examination** of three hours duration, at the end of the semester, in each lecture based course.
- 12.3** The evaluation of the Project work will be based on the project report and a Viva-Voce Examination by a team consisting of the supervisor concerned, an Internal Examiner and External Examiner to be appointed by the Controller of Examinations.
- 12.4** At the end of practical training or industrial attachment, the candidate shall submit a certificate from the organization where he/she has undergone training and also a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a Departmental Committee constituted by the Head of the Department.

13.0 WEIGHTAGES

- 13.1** The following shall be the weightages for different courses:

i) Lecture based course

Two sessional assessments	-	50%
End-semester examination	-	50%

ii) Laboratory based courses

Laboratory work assessment	-	75%
End-semester examination	-	25%

iii) Project work

Periodic reviews	-	50%
Evaluation of Project Report by External Examiner	-	20%
Viva-Voce Examination	-	30%

- 13.2** The markings for all tests, tutorial assignments (if any), laboratory work and examinations will be on absolute basis. The final percentage of marks is calculated in each course as per weightages given in clause 13.1.

14.0 SUBSTITUTE EXAMINATION

- 14.1** A student who has missed for genuine reasons any one of the three assessments including end-semester examination of a course may be permitted to write a substitute examination. However, permissions to take up a substitute examination will be given under exceptional circumstances, such as accident or admissions to a hospital due to illness, etc.,

14.2 A student who misses any assessment in a course shall apply in a prescribed form to the Dean(AC) through the Head of the department within a week from the date of missed assessment. However the substitute tests and examination for a course will be conducted within two weeks after the last day of the end-semester examinations.

15.0 COURSEWISE GRADING OF STUDENTS AND LETTER GRADES:

15.1 Based on the semester performance, each student is awarded a final letter grade at the end of the semester in each course. The letter grades and the corresponding grade points are as follows, but grading has to be relative grading

Letter grade	Grade points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
I	-
W	-

Flexible range grading system will be adopted

"W" denotes withdrawal from the course.

"I" denotes inadequate attendance and hence prevention from End Semester examination.

"U" denotes unsuccessful performance in a course.

15.2 A student is considered to have completed a course successfully and earned the credits if he / she secure five grade points or higher. A letter grade U in any course implies unsuccessful performance in that course. A course successfully completed cannot be repeated for any reason.

16.0 METHOD OF AWARDING LETTER GRADE:

- 16.1** A final meeting of the Class Committee without the student member(s) will be convened within ten days after the last day of the semester end examination. The letter grades to be awarded to the students for different courses will be finalized at the meeting.
- 16.2** Three copies of the results sheets for each course, containing the final grade and three copies with the absolute marks and the final grade should be submitted by the teacher to the concerned Class Committee Chairman. After finalisation of the grades at the class committee meeting the Chairman will forward two copies of each to the Controller of Examinations and the other copies to the Head of the Department in which course is offered.

17.0 DECLARATION OF RESULTS:

- 17.1** After finalisation by the Class Committee as per clause 16.1 the Letter Grades awarded to the students in the each course shall be announced on the departmental notice board after duly approved by the Controller of Examinations. In case any student feels aggrieved, he/she can apply for revaluation after paying the prescribed fee for the purpose, within two weeks from the commencement of the semester immediately following the announcement of results. A committee will be constituted by the Controller of Examinations comprising the Chairperson of the concerned Class Committee (Convener), the teacher concerned and another teacher of the department who is knowledgeable in the concerned course. If the Committee finds that the case is genuine, it may jointly revalue the answer script and forward the revised mark to the Controller of Examinations with full justification for the revision if any.
- 17.2** The “U” grade once awarded stays in the grade sheet of the students and is not deleted when he/she completes the course successfully later. The grade acquired by the student later will be indicated in the grade sheet of the appropriate semester.

18.0 COURSE REPETITION AND ARREARS EXAMINATION

- 18.1** A student should register to re-do 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 taken.
- 18.2** A student who is awarded “U” grade in a course shall write the end-semester examination as arrear examination, at the end of the next semester, along with the regular examinations of next semester courses. **The marks earned earlier in the continuous assessment tests for the course, will be**

used for grading along with the marks earned in the end-semester arrear examination for the course.

19.0 GRADE SHEET

19.1 The grade sheet issued at the end of the semester to each student will contain the following:

- (i) the credits for each course registered for that semester.
- (ii) the performance in each course by the letter grade obtained.
- (iii) the total credits earned in that semester.
- (iv) the Grade Point Average (GPA) of all the courses registered for that semester and the Cumulative Grade Point Average (CGPA) of all the courses taken up to that semester.

19.2 The GPA will be calculated according to the formula

$$GPA = \frac{\sum_i (C_i)(GP_i)}{\sum_i C_i}$$

where C_i is the number of credits assigned for i^{th} course

GP_i - Grade point obtained in the i^{th} course

For the cumulative grade point average (CGPA) a similar formula is used except that the sum is over all the courses taken in all the semesters completed up to the point in time.

I and W grades will be excluded for GPA calculations.

U, I and W grades will be excluded for CGPA calculations.

19.3 Classification of the award of degree will be as follows:

CGPA	Classification
8.50 and above, having completed in first appearance in all courses	First class with Distinction
6.50 and above, having completed within a period of 2 semesters beyond the programme period.	First Class
All others	Second Class

However, to be eligible for First Class with Distinction, a candidate should not have obtained U or I grade in any course during his/her study and should have completed the P.G. Programme within a minimum period covered by the minimum duration (clause 3.1) plus authorized break of study, if any (clause

8). To be eligible for First Class, a candidate should have passed the examination in all 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 will not be counted. The candidates who do not satisfy the above two conditions will be classified as second class. For the purpose of classification, the CGPA will be rounded to first decimal place. For the purpose of comparison of performance of candidates and ranking, CGPA will be considered up to three decimal places.

20 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

20.1 A student shall be declared to be eligible for the award of the Masters Degree, if he/she has:

- i) registered for and undergone all the core courses and completed the Project Work,
- ii) successfully acquired the required credits as specified in the Curriculum corresponding to his/her programme within the stipulated time,
- iii) successfully completed the field visit/industrial training, if any, as prescribed in the curriculum.
- iv) has no dues to the Institution, Hostels and Library.
- v) no disciplinary action is pending against him/her

20.2 The award of the degree must be approved by the University.

21.0 POWER TO MODIFY:

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

M.SC. (ACTUARIAL SCIENCE)
CURRICULUM AND SYLLABI

The curriculum has been designed to provide a multidisciplinary profile and a flexible approach to disseminate knowledge in the frontier areas of Actuarial science.

Semester I

Course Code	Course Title	L	T	P	C
MA511	Financial Mathematics	3	1	0	4
MA512	Probability and Mathematical Statistics	3	1	0	4
MA513	Micro Economics	3	1	0	4
MA514	Regression and Time series Analysis	3	0	0	3
MA515	Principles of Insurance	3	0	0	3
MA516	SPSS LAB	0	0	6	2
Total		15	3	6	20

Semester II

Course Code	Course Title	L	T	P	C
MA521	Risk Neutral Valuation: Pricing and Hedging Derivatives	3	0	0	3
MA522	Life Contingencies	3	1	0	4
MA523	Financial reporting and Accounting	3	1	0	4
MA524	Stochastic Models	3	1	0	4
MA525	Macro Economics	3	1	0	4
MA526	MINITAB LAB	0	0	6	2
Total		15	4	6	21

Semester III

Course Code	Course Title	L	T	P	C
MA531	Joint Life and Pension Techniques	3	0	0	3
MA532	Financial Investment	3	1	0	4
MA533	Statistical Methods in Actuarial Science	3	1	0	4
MA534	Survival Models	3	1	0	4
	Elective - I	3	0	0	3
MA536	Project Phase -I	0	0	8	*
Total		15	3	8	18

* 4 credits of phase I is added with 12 credits of phase II

Semester IV

Course Code	Course Title	L	T	P	C
	Elective- II	3	0	0	3
	Project Phase -II	0	0	24	16*
Total		3	1	24	19

* Project phase I and II will be based on training in Insurance organizations

List of Electives

Elective - I

Course Code	Course Title	L	T	P	C
MAY011	Financial Management of Life Office	3	0	0	3
MAY012	Islamic Investments	3	0	0	3
MAY013	Corporate Finance	3	0	0	3

Elective - II

Course Code	Course Title	L	T	P	C
MAY014	Financial Markets	3	0	0	3
MAY015	Islamic Asset and Fund Management	3	0	0	3
MAY016	Portfolio and Credit Risk Management	3	0	0	3

PROGRAMME OBJECTIVE

The programme is set up to produce skilled actuarial executives for various departments in an insurance company such as the actuarial department, underwriting, policy servicing, corporate planning and so on. In addition, the programme is also intended to provide basic and adequate knowledge for our students to appear for the early professional examinations. Emphasis is given such that our graduates could also significantly contribute towards other financial sectors and not limited to insurance sector.

An 'actuary' is a business professional who manages financial risks related to insurance products design, pension and other financial corporate planning. By applying the knowledge in probability, statistics, risk theory and financial principles, an actuary is able to quantify future risk with respect to insurance, annuity and pension programs. To achieve all this, an actuary must initially collect and analyze data to formulate mathematical models. Models on the probability of sickness, death, accident and so on together with unemployment, marriage and other demographic tables are constructed. After all probabilities and company's expenses are calculated, an actuary is able to determine the value of periodical or single premium needed to pay for expected insurance benefits to be paid in the future.

An 'actuary' is also known as a financial architect and a social mathematician due to his unique combination of quantitative analysis and business expertise to solve the ever increasing financial and social problems. The calculations and planning of an actuary is the backbone of the insurance industry and financial securities. Even though an actuarial career involved a lot of mathematics, an actuary must always observe current issues and trends in business, social science, legal environment and the economy.

An Actuary should have the following qualities:

- An outstanding student in mathematics.
- Ability to do research and to learn and solve complicated problems.
- Knowledge of explicit strategic games like chess and computer games.
- Ability to write and communicate with other people.
- Interested in history, social, legal and political issues.
- Self motivation and good leadership qualities.

COURSE OBJECTIVE:

The aim of the Financial Mathematics course is to provide grounding in financial mathematics and their simple applications.

UNIT-I

(9 + 3)

Cash flow model: Cash flow process, outflows-Cash flow model for a zero coupon bond – Time value of money – Compound interest and discount – Single investment- Present value-Commercial discount- Interest rate or discount rates- Relationship between rate of interest and discount –Nominal and effective rate of interest.

UNIT-II

(9 + 3)

Rate of inflation: Equal and unequal payments- Real and money interest rates –Variation of interest and discount – Differed/not differed period of time-Compound interest functions including annuities.

UNIT-III

(9 + 3)

Equation of value: Payment or receipt, uncertain receipt, exact solution – Repayment of loans: flat rates, annual effective rates, capital outstanding- Cash flow technique: accumulated profit – Receipts and payment from investment-payback period – Money waited rate of return.

UNIT-IV

(9 + 3)

Investment and risk characteristics: fixed interest for government borrowings/ other bodies –Shares and other equity types- Derivatives – Calculation of running yield, redemption yield, effect of inflationary growth- Delivery price and arbitrage free pricing- Hedging.

UNIT-V

(9 + 3)

Structure of interest rates: influencing factors- Part and maturity yields- Relationship between discrete /continuous spot rates and forward spot rates- Convexity of cash flow sequence – Stochastic models for investment returns.

Total (45+15=60)

REFERENCES:

- Mark S. Joshi “ The concepts and practice of Mathematical Finance”, Cambridge university press, 2nd Edition (2008)
- Mc Cutcheon and Scott “ Introduction to the Mathematics of Finance”, - Heinemann Professional publishing, 1989
- Paul Wilmott, Sam Howison, and Jeff Dewynne “ The Mathematics of Financial derivatives” Cambridge university press, 1995
- S.M. Ross “ An Introduction to Mathematical finance” Cambridge University Press,

COURSE OUTCOME:

On completion of the course the trainee actuary 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.
- Calculate the present value and the accumulated value of a stream of equal or unequal payments using specified rates of interest and the net present value at a real rate of interest, assuming a constant rate of inflation.
- Define and use the most important compound interest functions, including annuities certain.
- Describe how a loan may be repaid by regular installments of interest and capital.
- 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.

MA512	PROBABILITY & MATHEMATICAL STATISTICS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

The aim of the Probability and Mathematical Statistics subject is to provide grounding in the aspects of statistics and in particular statistical modeling that is of relevance to actuarial work.

UNIT-I **(9 + 3)**

Probability concepts: Baye's theorem-random variable-probability density function, distribution function –expected value-moments, Moment generating function- cumulant generating function-characteristics function.

UNIT-II **(9 + 3)**

Discrete distribution: Binomial, Poisson, Negative Binomial, Geometric, Hyper Geometric-Continuous distribution: normal, exponential, gamma, Weibul and chi square distribution-central limit theorem.

UNIT-III **(9 + 3)**

Testing of hypothesis: sampling distributions –testing of hypothesis for mean, variance, proportions and differences using normal, t, chi square and F distributions- tests for independence of attributes and goodness of fit.

UNIT-IV **(9 + 3)**

Design of experiments: Analysis of variance- One way classification-CRD- Two way classification-RBD-Latin square design- factorial experiments - 2² design, 2ⁿ factorial experiment.

UNIT-V **(9 + 3)**

Theory of estimation: characteristics, consistence, unbiasedness - methods of estimation- maximum likely hood estimation, minimum variance, moments, and least squares.

Total (45+15=60)

References:

- S.C Gupta,V.K Kapoor, "Fundamentals of mathematical statistics ", Sultan chand and sons , New Delhi.

M.Sc. (Actuarial Science)

- S.C Gupta,V.K Kapoor, "Fundamentals of Applied statistics ", Sultan chand and sons , New Delhi.
- Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. "A Modern Introduction to Probability and Statistics" Springer text seires, 2nd Edition
- Chin Long chiang " Statistical Methods of Analysis " World Scientific Books, 2003

COURSE OUTCOME:

On completion of the subject the trainee actuary will be able to:

- Summarise 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
- Define basic discrete and continuous distributions, apply them and simulate them in simple cases.
- 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.
- 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 & apply them.
- Construct confidence intervals for unknown parameters.
- Test hypotheses.
- Investigate linear relationships between variables using correlation analysis and regression analysis.
- Explain the concepts of analysis of variance and use them.

COURSE OBJECTIVE:

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

UNIT-I

(9 + 3)

Scope of economics-Supply and demand-equilibrium market-mixed economics-complimentary and substitute goods-elasticity of demand and supply- numerical estimation of elasticity –application utility theory – characteristics of utility functions-financial impact simple insurance problems in utility theory

UNIT-II

(9 + 3)

Short and long run production-opportunity, marginal cost- normal and super normal profit-economy and diseconomy –sort of competition- perfect market, competition, monopoly, oligopoly-Micro economic principles: The ramification of strategic decisions, Prisoner's dilemma, breakdown cartels, surplus economics

UNIT – III

(9 + 3)

Public sector finances: Direct and indirect taxes, Progressive and regressive systems, public sector net cash, debt and national debt – Gross domestic Product (GDP), Gross National Income (GNP): Country's economy- national income, expenditure- basic costs, market prices –Propensity: marginal – equilibrium level-multiplier and accelerator –IS and LM curves.

UNIT-IV

(9 + 3)

Fiscal impact –fiscal policies- measures of money supply –monetary aggregates –credits through banking system-role of exchange rates and international trades- absolute, comparative advantage balance payments-level of exchange rates- purchasing power parity theory- fixed and floating exchange rates.

UNIT-V

(9 + 3)

Factors affecting inflation- principal economics statistics types of unemployment-causes-cost push and demand-pull inflation-Philips curve – control inflation –Monetarist and Keynesian approach.

Total (45+15=60)

References:

- John Robert Stinespring “Mathematics for Micro economics “ Academic Press, 1st Edition, 2002
- Robert Pindyck “Micro economics” , 5th Edition ,Pearson education
- Frederik Mishkin “Economics of Money, banking and Financial Markets “, Printice Hall, July , 2009

COURSE OUTCOME:

On completion of the subject the trainee actuary 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 and discuss the application of utility theory to economic and financial problems.
- Describe how profit maximising 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.
- Use knowledge of the following microeconomic principles to increase their understanding of the markets in which we operate, the regulatory issues and the ramification of strategic decisions
- 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.

M.Sc. (Actuarial Science)

- 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 industrialised country.

MA514	REGRESSION AND TIME SERIES ANALYSIS	L T P C
		3 0 0 3

COURSE OBJECTIVE:

The aim of the Regression and Time series analysis subject is to provide grounding in the aspects of statistics and in particular Time series to predict the future that is of relevance to actuarial work.

UNIT-I (9)

Principal of least square: fitting a straight line, second-degree parabola, and polynomial of nth degree- Two-dimensional random variable: Joint probability loss, Marginal and conditional distribution- Covariance-Transformation of random variables.

UNIT-II (9)

Correlation and Regression: Scatter diagram –coefficient of correlation-limitations- rank correlation –lines of regression –regression coefficient-properties – multiple and partial correlation.

UNIT-III (9)

Time series analysis: Components of time series –measurement of trends-seasonal fluctuations-cyclic moments- Auto regression series- Auto correlation and Correlogram

UNIT-IV (9)

Vital statistics: population measurements- mortality measurements- rates and ratio of vital events- mortality / life table- abridged life table- fertility-measurement of population growth.

UNIT-V (9)

Statistical quality control: tools for SQC –control charts for attributes- control charts for number of defects-natural tolerance limits and specification limits.

Total (45)

References:

- S.C Gupta, V.K Kapoor,"Fundamentals of applied statistics ", Sultan chand and sons, New Delhi.

M.Sc. (Actuarial Science)

- E Basset “ Statistics Problems and Solutions” World Scientific, (2002)
- C Montgomery “ Statistical Quality Control” .John Wiley and sons, 4th Edition (2000)
- Donald j Wheeler, David S Chambers “ Understanding the statistical Process control”, SPC Press, 2nd Edition , 1992

COURSE OUTCOME:

On completion of the subject the trainee actuary will be able to:

- 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.
- Investigate linear relationships between variables using correlation analysis and regression analysis.
- 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.

MA 515	PRINCIPLES OF INSURANCE	L T P C
		3 0 0 3

COURSE OBJECTIVE:

The objective of the paper is to give introduction about the various types of insurance products and markets.

UNIT – I (9)

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

UNIT-II (9)

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

UNIT-III (9)

General insurance –main types- type of reinsurance –business environment- professional-Guidance- Principal Terms used in life insurance-Main types of life insurance –Methods of distributing profits-Asserts

UNIT-IV (9)

Unit linked life insurance-cost of guaranties and options-benefits on early termination or alteration –pricing and valuing life insurance-supervisory results –principal of investment –monitoring actual experience.

UNIT-V (9)

Insurance and reinsurance-managing risks –Principle modeling techniques- appropriate to health care insurance-assumption of crucial to pricing and valuation- Methodology of valuation and reserving supervisory reporting – supervisory reporting-investment under pinning-health insurance operations to refocus business planning

Total (45)

References:

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

COURSE OUTCOME:

On completion of the course students will get to know about the insurance markets which will help them to plan new products.

COURSE OBJECTIVE:

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

COURSE OUTCOME:

- The students will have the thorough knowledge and idea about all the above

MA 521	RISK NEUTRAL VALUATION: PRICING AND HEDGING DERIVATIVES	L T P C
		3 0 0 3

COURSE OBJECTIVE:

The aim of the paper is to give further ideas into the financial markets and make students able to understand the performance of certain products and model them.

UNIT-I (9)

Financial Markets and Instruments: derivative instruments – underlying securities-markets- types of trades - Arbitrage and arbitrage relationships – Single period market models – Probabilistic approach

UNIT-II (9)

Mathematical finance in discrete time: Existence of equivalence martingale measures –Uniqueness of EMMs – Fundamental theorem of asset pricing: Risk Neutral valuation – Cox_Ross_Rubinstein Model – Binomial approximations – Contingent claim valuation – Multi factor models

UNIT – III (9)

Mathematical finance in continuous time: Financial market models for continuous time- Risk Neutral Pricing – Pricing and hedging contingent claims (Black Scholes model)-Volatility- Discrete Vs Continuous time market model-futures markets- currency markets

UNIT – IV (9)

Incomplete markets: Pricing- Escher Measure –Hedging contingent claim-Mean variance hedging and the minimal ELMM – Quadratic principles in Insurance - Martingale measures

UNIT – V (9)

Bond Pricing – Term structure equation – Forward risk martingale measures-Pricing and hedging contingent claims –LIBOR measure and swap markets – Pricing kernels and potentials .

Total (45)

References:

- Bingham N H and Rudiger Keisel “Risk Neutral Valuation : Pricing And Hedging Derivatives” Springer-verlag, 2004

COURSE OUTCOME:

On completion of this course students get basic ideas of different models in financial markets.

- Describe the mathematical models of asset returns
- Demonstrate the knowledge and understanding of stochastic models of the behavior of the security prices.
- Define and apply the main concepts of Brownian motion.
- Demonstrate the knowledge and understanding of hedging, bond pricing, swaping etc....

COURSE OBJECTIVE:

The aim of the Life Contingencies subject is to provide a grounding in the mathematical techniques which can be used to model and value cashflows dependent on death, survival, or other uncertain risks.

UNIT-I (9+3)

Simple assurance and annuity contracts- curtate random future lifetime – benefit payments of each contracts-extension of annuity factors-annuities payable in advance and in arrear- expected accumulation of benefit- life table probabilities –mean, variance and expected accumulation –practical alternatives to the life table.

UNIT-II (9+3)

Ultimate or selected mortality, net premiums and reserves - Future loss under an insurance contract – setup reserves: prospective and retrospective reserves-recursive relation between net premium results –Thiele's differential equations- Single policy and portfolio of policies- Net premiums and reserves for increasing and decreasing benefit and annuities.

UNIT-III (9+3)

Gross premium and reserves of assurance and annuity contracts: types of expenses –influence of inflations- Gross future loss random variable-prospective and retrospective reserves of gross premium-recursive relation between successive and annual reserves- Straight forward functions involving two lives.

UNIT-IV (9+3)

Cash flow contingencies: multi state Markov model- Kolmogorov equations- Transition intensities-emerging costs: Pricing, reserving and assessing-UNIT link contract: cash flows for whole life, endowment and term assurance, annuity-profit vector and profit signature, single and multiple decrements tables.

UNIT-V (9+3)

Principal forms of heterogeneity: principal factors which contribute to variations in mortality and morbidity –main forms of selections- types of life insurance

contracts- mortality tables-risk classification in life insurance-genetic information on risk classification- advantages and disadvantages of actual experiences.

Total (45+15=60)

References:

- B H Smith “ Contingencies of Value “ Harvard university Press, 1988
- Alistair Neil “ Life Contingencies”, Butterworth-Heinemann Ltd; illustrated edition (1977)
- Griffith Davis “ Table of Life Contingencies” , Longman &Co, 1825: University of California Library
- Micheal M Parmenter, “theory of Interest and Life contingencies with Pension”, 3rd edition.

COURSE OUTCOME:

On completion of the subject the trainee actuary 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.
- Define and use straightforward functions involving two lives.
- Describe methods which can be used to model cashflows 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.

MA 523	FINANCIAL REPORTING AND ACCOUNTING	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

The aim of the Financial Reporting and Accounting 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 and to provide the ability to interpret the accounts and financial statements of companies and financial institutions.

UNIT- I **(9+3)**

Investment and knowledge management- principles of finance – finance and real resources- capital markets- agency theory – shareholder's wealth – methods of finance- business entities – types of loan and share capital.

UNIT- II **(9+3)**

Share capital – limited company – private and public company – medium term and short term companies – Personal and corporate taxation – Principal forms of financial instruments: Characteristics of issuers and non financial company – types of new issues –role of underwriting

UNIT – III **(9+3)**

Capital structure and dividend policy : market valuation of a company – effect of taxation – setting dividend policy – profits and buybacks –Cost of capital interacts: weighted average cost – project evaluation – risky investment

UNIT – IV **(9+3)**

Principal features of Accounts: Annual reports , fundamental accounting concepts – balance sheet, income statement , cash flow statement – Structure of accounts – consolidated accounts – share capital and other reserves

UNIT- V **(9+3)**

Accounts of a Group of company: Priority percentage, gearing- income and asset cover- price earning ratio, dividend – accounting ratio – limitations – false impression – financial techniques in capital investment: viability, discount rate – different risk covers – distribution of financial out comes.

Total (45 +15=60)

References:

- Anne Britton, Chris waterston “ Financial Accounting”, Pearson Education, 2009
- Barry Elliott, Jamie Elliott “ Financial Accounting and reporting”, Trans-Atlantic publications, 2005
- Lawrence Revsine “Financial Reporting and Analysis”, Mc Graw Hill, 2008.

COURSE OUTCOME:

On completion of this subject the candidate will be able to:

- Demonstrate a knowledge and understanding of the principal terms in use 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.
- Discuss the factors to be considered by a company when deciding on its capital structure and dividend policy.
- Define what is meant by a company's cost of capital and discuss how its cost of capital interacts with the nature of the investment projects it undertakes.
- 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.

COURSE OBJECTIVE:

The aim of the Stochastic Models subject is to provide grounding in stochastic processes and their application.

UNIT – I (9+3)

Principles of Actuarial models: use, benefits, limitations- Difference between Stochastic and deterministic model, short-run and long –run properties- sensitivity testing

UNIT- II (9+3)

Stochastic Process: Classification- Particular counting process- Continuous/ discrete time/state pace- Applications of mixed processes- Markov property

UNIT- III (9+3)

Markov chain: features- Chapman –Kolmogorov equations- Stationary distribution- ratings in terms of Markov chain- Time in-homogeneous Markov model- Tools for modeling & simulation

UNIT – IV (9+3)

Markov Process: features, Poisson Process- Kolmogorov equation – Survival model, sickness model, marriage model in terms of Markov Process – Transition intensities depend on age/time/ duration of stay in one or more states

UNIT – V (9+3)

Sickness, Marriage models in terms of duration dependent Markov process and other simple applications - Markov Jump process.

Total (45 +15 =60)

References:

- Vladimir I Rotar “ Actuarial Models” Chapman & Hall, 2006
- Elke Korn, Ralf Korn “ Monte Carlo Simulation of financial and Actuarial model” Chapman & Hall, (Feb 2010)

M.Sc. (Actuarial Science)

- Elke Korn, Ralf Korn “ Monte Carlo Methods in finance and Insurance “ Chapman & Hall, (Feb 2010)
- Dick London “ Survival models and their estimation “ ACTEX Publication. 1998
- A.C. Davison “ Statistical models “ Cambridge University Press, 2008
- Regina C Elandt Johnson “ Survival models and data Analysis”, Wiley, Inter science, 1999

COURSE OUTCOME:

On completion of the subject the trainee actuary will be able to:

- Describe the principles of actuarial modelling.
- Describe the general principles of stochastic processes, and their classification into different types.
- Define and apply Markov chain.
- Define and apply Markov process.

COURSE OBJECTIVE:

The aim of the Macro Economics subject is to develop the necessary skills to construct asset liability models and to value financial derivatives. These skills are also required to communicate with other financial professionals and to critically evaluate modern financial theories.

UNIT-I (9+3)

Different measure of investment risk –advantages and disadvantages-distribution of returns and thickness—Mean-variance portfolio theory – optimum portfolio- expected return and risk –diversification

UNIT – II (9+3)

Single and multi factor models: Models in asset returns – diversifiable and non diversifiable risk –Asset pricing models-assumption and limitations – Sharpe-Lintner-Mossin Capital Asset Pricing model (CAPM)-Ross Arbitrage Pricing theory model (APT)

UNIT-III (9+3)

Efficient markets: hypothesis, consequence-stochastic models of security prices-parameters of Asset pricing models- Brownian Motion (or) Weiner process –Ito integral, diffusion and mean-reverting process-geometric Brownian motion-Ornstein-Uhlenbeck process.

UNIT-IV (9+3)

Option prices, hedging technique-arbitrage and complete market-model dependent-Binomial trees and lattices-risk neutral pricing measure –state price deflator-Black-Scholes-derivative pricing model –first, second partial derivatives of option price.

UNIT-V (9+3)

Term structure of interest rate-characteristics-computational tools -Vasicek-Cox-Ingersoll-Rossand Hull-white models-credit risk models: credit event, recovery rate, structural models reduced form models, intensity based model, Merton model, two state model Jarrow- Lando- Turnbull model -stochastic transition intensity.

Total (45 +15 =60)

References:

- Micheal Parkin “ Macro Economics”, Additon- Wiley, 4th Editon, 1997
- Christian Kleiber “ Statistical size distributions in economic and Actuarial science “Wiley Interscience, 1st edition (2003)
- Todd A Knoop “ Modern Macro Economics: Panics, Crashes, and Crises” Wiley Black Well (2008)

COURSE OUTCOME:

On completion of the course the trainee actuary will be able to:

- 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.
- Discuss the various forms of the Efficient Markets Hypothesis and discuss the evidence for and against the hypothesis.
- Demonstrate a knowledge and understanding of stochastic models of the behaviour of security prices.
- Define and apply the main concepts of Brownian motion (or Wiener processes).
- Demonstrate a knowledge and understanding of the properties of option prices, valuation methods and hedging techniques.
- 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.

COURSE OBJECTIVE:

The aim of the MINITAB lab is to provide the practical knowledge of the various Actuarial aspects

MINITAB

- Categorical data Analysis
- Bayesian Analysis
- Survival Analysis
- Forecasting and time series Analysis
- 5 Financial Analyses
- Cross sell and Up Sell
- Customer segmentation
- Solvency and Risk Management

COURSE OUTCOME:

- The students will have the thorough knowledge and idea about all the above.

MA 531	JOINT LIFE AND PENSION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

The aim of the paper is to give the basic knowledge of different types of group insurance schemes, including two or more lives.

UNIT –I (9)

Provision of pensions and other benefits – alternative systems of social security – Mandatory individual accounts- Occupational pension scheme- personal pensions-Needs of parties- implications for the parties

UNIT- II (9)

Financing the benefits – time contribution- characteristics of investment – payment dues – Sponsor covenant – Suitable design for benefits and contribution- risks and uncertainties

UNIT –III (9)

Process of population projection – Socio-economic factors - Actuarial models for decision making purposes in non state pensions - Actuarial methods to financial management of social security scheme – Assumptions for valuing future benefits – determination of discontinuance

UNIT – IV (9)

Value of assets, future benefits and contributions – application of actuarial methods to contribution of pension schemes : Viability, robustness– conversion of individual accounts – retirement income planning and pension grantees – future operating expenses

UNIT-V (9)

Asset-liability matching for pensions and related benefits – re-insurance, risk and uncertainties of pensions –Sources of surplus/deficit for a benefit provider- Actuarial control cycle.

Total (45)

References:

- Jeery S Rosenbloom "The Handbook of Employee benefits" 6th edition ,Mc Graw Hill
- Richard M Stienberg " Pension and other employee benefits" 4th Edition,1992, Wiley and sons

COURSE OUTCOME:

On completion of the subject the trainee actuary 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

COURSE OBJECTIVE:

The aim of the Financial Investment subject is to provide a further grounding in investments of particular relevance to financial work.

UNIT-I (9+3)

Risk free rate of return –typical ways of investment and effect of taxation-features of financial statement –influence over the commercial and economic environment –principles of fundamental share.

UNIT-II (9+3)

Method for valuation of individual investments-monitoring and controlling institution from various types of risk context of mean- variance portfolio theory-principles of legislative and regulatory frame work application of the principles

UNIT-III (9+3)

Theory of finance- characteristic of financial instruments-types of derivative and payoff-actuarial technique- investment strategy- limitations-investment indices –role of custodian

UNIT-IV (9+3)

Derivative markets- characteristics- forward and future prices-future prices by no arbitrage-future in hedging –traded derivatives – interest rate of derivatives.

UNIT-V (9+3)

Exotic equity and foreign exchange derivatives –option prices-simple chock-pricing and hedging of derivatives instrument- Binomial model-Black Scholes.- Pricing American option- Binomial, Trinomial, Tres-Monte Carlo simulation for long staff –Schwartz.

Total (45+15=60)

Reference:

- Dr. John White “ Investing Stocks and Shares”, June 2009, How to books Ltd
- Keith Pilbeam “Finance and Financial Markets” 2nd Revised edition, Palgrave Macmillan
- Elliot Goodman “, Finance and Investment Handbook” 6th Edition, Barron’s Educational Series
- Philip Jenks “ Book of Investing Rules “ Financial times- Prentice hall press, 2002

COURSE OUTCOME:

On completion of the subject the trainee actuary will be able to:

- Understanding the method for valuation of individual investments
- Explain about the Foreign exchange, Options, Swaps.

MA533	STATISTICAL METHODS IN ACTUARIAL SCIENCE	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

The aim of the Statistical Methods subject is to provide a further grounding in mathematical and statistical techniques of particular relevance to financial work.

UNIT –I **(9+3)**

Decision theory : Optimum strategies – decision and risk functions- Loss distributions: Individual and aggregate loss- Gamma, exponential , Pareto, generalized Pareto, log normal, normal, weibull and burr distributions- excess and retention limits- loss reinsurance

UNIT- II **(9+3)**

Risk models in frequency and severity distributions: Models appropriate for short term contracts. Claims- ruin of risk models: cash flow process for a risk – Probabilities of ruin in infinite/finite and continuous/discrete time and state.

UNIT- III **(9+3)**

Bayesian statistics: Concepts, uses- Prior, posterior distribution-loss function- Bayesian estimates- credibility premium formula- Rating: insurance business, banking- simple experience rating system on claim frequency.

UNIT-IV **(9+3)**

Analyzing delay (or run off) triangle: development factor-Basic chain ladder model – alternatives for development factors- outstanding claim amounts- Bornhuetter-Ferguson method- underpin run-off triangle- Generalized Linear Model (GLM) – Exponential family of distributions- link function and canonical form- linear predictor- parameters of GLM-Pearson and deviance residuals- Pearson's' chi-square test.

UNIT- V **(9+3)**

Analysis of time series models: Univariate time series- stationary random series- backwards shift, difference operators- Autoregressive moving average, autoregressive integrated moving averages- Multivariate time series- co integrated time series- residuals- Monte Carlo simulation using a series of pseudo-random numbers.

Total (45+15=60)

References:

- Critian P Robert “ Monte Carlo Statistical Methods”, 2nd Edition, Springer-Verlag
- George W Snedecor “ Statistical Methods”, 8th Edition, Iowa State University Press,
- G.S. Maddala C.R Rao“ Statistical methods in Finance”, Jan 1996, Elsevier Science and technology
- Philip J Boland “Statistical and Probabilistic Methods in Actuary Science” , Chapman & Hall Press, 2007.

COURSE OUTCOME:

On completion of the subject the trainee actuary 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 concept of ruin for a risk model.
- 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.
- 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.

COURSE OBJECTIVE:

The aim of the Survival Models subject is to provide grounding in survival models and their application.

UNIT- I (9+3)

Survival models: Models of life time or failure time- consistency- condition between random variables- densities and distribution of future life time, survival function, force of mortality

UNIT – II (9+3)

Gompertz and Makeham laws- Curtate future life time model- Expected value and variance of the complete and curtate future life time- Define ex and exo – Two state model of a single decrement

UNIT – III (9+3)

Life time distributions: Methods of censoring- Kaplan-Meier estimate – Nelson Aalen estimate of cumulative hazard – Cox Regression model

UNIT- IV (9+3)

Likelihood function and likelihood estimators for transition intensities- Poisson approximation estimator – Binomial model mortality – maximum likelihood estimator for binomial models

UNIT – V (9+3)

Census approximation: Importance of homogeneous classes- central exposed to risk – census approximation of waiting time – concepts of rate of interval – Crude estimates: Statistical tests of crude estimates-graduating, smoothness of crude estimates- advantages and disadvantages – comparison of crude and graduated set – standard table.

Total (45+15=60)

References:

- Vlamidir I Rotar “ Actuarial Models” Chapman & Hall, 2006
- Elke Korn, Ralf Korn “ Monte Carlo Simulation of financial and Actuarial model” Chapman & Hall, (Feb 2010)

M.Sc. (Actuarial Science)

- Dick London “ Survival models and their estimation “ ACTEX Publication. 1998
- A.C. Davison “ Statistical models “ Cambridge University Press, 2008
- Regina C Elandt Johnson “ Survival models and data Analysis”, Wiley, Inter science, 1999

COURSE OUTCOME:

On completion of the subject the trainee actuary 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.

MAY011	FINANCIAL MANAGEMENT OF LIFE OFFICE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

The aim of the following elective is to provide the basic idea about Financial Markets and Management, Islamic investments and Fund management

UNIT- I (9)

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.

UNIT –II (9)

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

UNIT – III (9)

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

UNIT – IV (9)

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

UNIT – V (9)

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

Total (45)

References:

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

COURSE OUTCOME:

On completion of the subject the trainee actuary will be able to:

- Use their knowledge of investments, tax laws, insurance and real estate to recommend financial options to individuals based on their short-term and long-term goals.

COURSE OBJECTIVE:

The aim of the following elective is to provide the basic idea Islamic investments that are a unique form of socially responsible investments because Islam makes no division between the spiritual and the secular aspects.

UNIT- I (9)

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

UNIT – II (9)

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

UNIT-III (9)

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

UNIT-IV (9)

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

UNIT- V (9)

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

Total (45)

References:

- Munawar Iqbal “ A Guide to Islamic Finance “ Risk Books ,UK, 2007
- Mahmoud A El-Gamal “ Inslamic Finance : Law, Economics and Practice” Cambridge university Press, 2008
- Sohail Jaffar “ Islamic Asset management” Euromoney books, London, 2006

M.Sc. (Actuarial Science)

- Michael Mahlkecht “ Islamic capital markets and risk management” Risk Books UK, 2007
- Aly Khorshid “ Islamic Insurance “ Routledge Curzon, London, 2004
- Sohail Jaffar “ Islamic Insurance ” Euromoney books, London, 2006

COURSE OUTCOME:

On completion of the subject the trainee actuary will be able to:

- explore and capitalize on new markets, distribution channels, new product development and investment and asset management opportunities in the Islamic sector

COURSE OBJECTIVE:

The aim of the following elective is to instill in successful candidates the ability to apply knowledge of the financial environment and the principles of actuarial practice to the financial management of clients' affairs.

UNIT – I (9)

Introduction to corporate Finance - Financial Statements and Cash Flow – Analysis and Long term planning - Valuation and Capital Budgetting

UNIT – II (9)

Risk and Return – Capital Structure and dividend policy- Long term Financing

UNIT – III (9)

Short term Finance – Uption, futures and corporate Finance – Mergers and Acquisition – Financial Distress

UNIT – IV (9)

Principles of Lending – Documentatin law – International credit rating Agencies and rating criteria – Global Capital Market-

UNIT – V (9)

International Bond Market – regulatory Issues – Syndicate loans - Corporate trasurey Management

Total (45)

References :

- S A Ross, Wester Field , Jaffe “ Corporate Finance” 8th Edition , Mc Graw Hill , 2008
- S. R Vishwanath “ Corporate Finance Theory and Practice”, Sage Publications(ca), 2007
- IIBF “International Corporate Finance”, Macmillan (I) Publishing , Delhi,2007

COURSE OUTCOME:

On completion of the subject the trainee actuary will be able to:

- Show how actuarial techniques may be used to identify and measure financial and non-financial risk.
- Apply the concept of economic capital and describe methodologies for allocating capital within a financial organization.

COURSE OBJECTIVE:

The aim of the following elective is to provide the basic idea about the primary purpose of financial markets

UNIT – I (9)

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

UNIT – II (9)

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

UNIT – III (9)

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

UNIT – IV (9)

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

UNIT –V (9)

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

Total (45)

References:

- John H Cochrane “Financial markets and the real economy”, Now Publishers, Oct 2005
- Don K Mak “The science of financial market trading”, World Scientific, 2003
- Keith Pilbeam “Finance and Financial Markets” 2nd Edition, Palgrave Macmillan
- Lloyd B Thomas “Money, banking and Financial Markets”, 1997, Student Gd edition, Mc Graw hill

M.Sc. (Actuarial Science)

- Stepeh G Cecchetti "Money , banking and Financial Markets", 1st edition, 2005, Mc Graw hill
- Natalie Schoon "Islamic banking and Finance" Spiramus Press Ltd., Jan , 2009.

COURSE OUTCOME:

On completion of the subject the trainee actuary will be able to:

- List some of the major financial markets.
- Give two reasons that savers use financial intermediaries
- Explain how instability can arise in financial markets.
- Define what is meant by an "efficient market." 2009.

MAY 015	ISLAMIC ASSET AND FUND MANAGEMENT	L T P C
		3 0 0 3

COURSE OBJECTIVE:

The aim of the following elective is to provide the basic idea of global Islamic banking and finance franchise. It also gives some insider knowledge of complement of Shariah-compliant financial solutions, operating in parallel with the Group's universal banking franchise etc.

UNIT-I (9)

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

UNIT-II (9)

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

UNIT-III (9)

Norms for Shariah screening in Islam- Dow Jones Islamic investment criteria – Norms used in India, Pakistan and Middle East – Critical assessment of Islamic Screening norms- Suitability of Market cap – Purification and Zakah

UNIT-IV (9)

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

UNIT- V (9)

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

TOTAL (45)

COURSE OUTCOME:

On completion of the subject the trainee actuary will be able to:

- Explain in detail about Islamic banking franchise, incorporating products and services in compliance with Shariah principles
- Represent its leading investment banking services, asset management and private banking franchise.

MAY 016	PORTFOLIO AND CREDIT RISK MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

The aim of the following elective is to provide the basic idea about portfolio theory, how to choose an efficient portfolio, and different types of risk and risk mitigation.

UNIT – I (9)

Portfolio theory – single and multi period model of asset return – equilibrium models – efficient markets hypothesis – Investment portfolio – limitation – principal techniques in portfolio of risk control – role of custodian

UNIT – II (9)

Portfolio construction – Measurement, comparison and attribution of risk- Portfolio of derivatives – role of futures in risk management – scenario analysis – Portfolio selection and management

UNIT – III (9)

Classical measure of portfolio performance – conditional performance evaluation- Stochastic discount factor (SDF) approach – Bond and hedge fund performance – Managed portfolio performance and market efficiency.

UNIT – IV (9)

Introduction to credit risk – credit –risky instruments – defaults- ratings- Merton's model for default firm – Common Industry models(KMV, Credit Metrics, Credit risk +) – dependence of models

UNIT – V (9)

Latent variable or threshold models of default- Mixture models – Portfolio of credit loss- Behavior of portfolio loss distribution – Calibration and inference for credit risk models

Total (45)

References:

- Andrew Kimble “ Credit Risk : From Transaction of Portfolio Management”, Nov, 2003, Butterworth Heinemann
- Andrew Fight “ Credit riskManagement”,2007, Elsevier India Private Limited
- Ludwig B chincarini “ Quantitative Equity Portfolio Management “, 2006, Mc Graw Hill
- Greg N Gregoriou, Critisian Hoppe “ The Handbook of Credit Portfolio Management”,2008, Mc Graw Hill

COURSE OUTCOME:

On completion of the subject the trainee actuary will be able to:

- Calculate the expected return and risk of a portfolio of many risky assets, given the expected return, variance and covariance of returns of the individual assets, using mean-variance portfolio theory.
- Describe and discuss the properties of single and multifactor models of asset returns.
- Discuss the conditions under which application of mean-variance portfolio theory leads to the selection of an optimum portfolio.

