

**CHAUDHARY BANSILAL UNIVERSITY, BHIWANI**  
**Scheme of Examination for Undergraduate Programme (Interdisciplinary)**  
**Bachelor of Science (Actuarial Science) (Scheme- D)**  
**as per NEP-2020**

**Curriculum Framework (Multiple Entry-Exit, Internships and Choice Based Credit System LOCF)**  
**w.e.f. the session 2024-2025 (in phased manner)**  
**SEMESTER IV**

| Semester | Course Type | Course Code                                                                    | Nomenclature of the course | Credits |            |              | Contact Hours |   |       | Internal Assessment Marks |   | End Term Examination Marks |   | Total Marks | Examination hours |   |
|----------|-------------|--------------------------------------------------------------------------------|----------------------------|---------|------------|--------------|---------------|---|-------|---------------------------|---|----------------------------|---|-------------|-------------------|---|
|          |             |                                                                                |                            | Total   | Theory (L) | Tutorial (T) | L             | T | Total |                           |   |                            |   |             | Theory            |   |
| IV       | CC-10       | 24UN-ASC-                                                                      | Operations Research-II     | 4       | 3          | 1            | 3             | 1 | 4     | 30                        | - | 70                         | - | 100         | 3                 | - |
|          | CC-11       | 24UN-ASC-                                                                      | Life Contingenci           | 4       | 3          | 1            | 3             | 1 | 4     | 30                        | - | 70                         | - | 100         | 3                 | - |
|          | CC-12       | 24UN-ASC-                                                                      | Corporate Accounting-      | 4       | 3          | 1            | 3             | 1 | 4     | 30                        | - | 70                         | - | 100         | 3                 | - |
|          | CC-M4 (V)   | 24UN-ASC-                                                                      | Computational              | 4       | 3          | 1            | 3             | 1 | 4     | 30                        | - | 70                         | - | 100         | 3                 | - |
|          | AEC-4       | Select one course from the pool of Ability Enhancement Courses (AEC) 2 Credits |                            |         |            |              |               |   |       |                           |   |                            |   |             |                   |   |
|          | VAC-3       | Select one course from the pool of Value Added Courses (VAC) 2 Credits         |                            |         |            |              |               |   |       |                           |   |                            |   |             |                   |   |
|          | Total       | Credits: 24                                                                    |                            |         |            |              |               |   |       |                           |   |                            |   |             |                   |   |

Exit Option: Any student opting for exit option after second semester

**Exit Option:** Any student opting for exit option after second year will get Undergraduate Diploma in Actuarial Science provided he/she completes 96 Credits comprising 92 Credits of first four semesters and additional 4 credits of internship (100 Marks) based 4-6 weeks internship after IV semester. The internship report would be evaluated by a panel of one internal and one external expert to be nominated by Principal/Director of the institute/Chairperson of the Department from the panel of examiners approved by UGBOS of department.

CC 10

| Session:2024-25                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Part A- Introduction                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Subject/Course                       | Actuarial Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Semester                             | IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Name of the Course                   | Operations Research-II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Course Code                          | 24UN-ASC-401                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Course Type:                         | CC 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Level of the course                  | 100-199                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Pre-requisite for the course(if any) | ----                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Course Learning Outcomes(CLOs):      | <p><b>After completing this course, the learner will be able to:</b></p> <ol style="list-style-type: none"> <li>1. Apply concepts of two-person zero-sum games, saddle points, and mixed strategies to solve competitive decision-making problems.</li> <li>2. Construct and analyze PERT/CPM networks to estimate project durations, identify critical paths, and manage project scheduling.</li> <li>3. Model service systems using Markovian queuing processes and evaluate performance measures like waiting time and server utilization.</li> <li>4. Optimize inventory policies through EOQ models under varying conditions, including shortages, replenishment, and price breaks.</li> </ol> |

| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Theory                                                                                                                                                                                                      | Tutorial      | Total |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3                                                                                                                                                                                                           | 1             | 4     |
| Contact Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3                                                                                                                                                                                                           | 1             | 4     |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 30                                                                                                                                                                                                          | --            | 30    |
| End Term Examination Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 70                                                                                                                                                                                                          | --            | 70    |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 3 Hours                                                                                                                                                                                                     | 3 Hours       |       |
| Max.Marks:100                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                             |               |       |
| <b>Part B-Contents of the Course</b>                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                             |               |       |
| <p align="center"><b><u>Instructions for Paper- Setter</u></b></p> <p><b>Note:</b> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes(CLOs)into consideration. The compulsory question (Question No. 1) will contain 7 questions covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit including the compulsory question.</p> |                                                                                                                                                                                                             |               |       |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Topics                                                                                                                                                                                                      | Contact Hours |       |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Game Theory: Two person zero sum game, Game with saddle points, the rule of dominance; Algebraic, Graphical and linear programming methods for solving mixed strategy games.                                | 12            |       |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Introduction -definition of network, event, activity, Three time estimates (optimistic, pessimistic & most likely), critical path, total float and free float - difference between CPM and PERT – Problems. | 12            |       |
| III                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Queuing models: Basic components of a queuing system, Steady-state solution of Markovian queuing models with single and multiple servers (M/M/1, M/M/C, M/M/1/k, M/MC/k)                                    | 12            |       |
| IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Inventory control models: Economic order quantity(EOQ) model with uniform demand, EOQ when shortages are allowed, EOQ with uniform replenishment, Inventory control with price breaks.                      | 12            |       |

### Suggested Evaluation Methods

#### Internal Assessment:

##### > Theory30

- ClassParticipation:5
- Seminar/presentation/assignment/quiz/classstestetc.:10
- Mid-TermExam:15

#### End Term Examination

:



**Theory70**  
Written  
Examination

#### Part C-Learning Resources

1. H.A. Taha,(1976) Operation Research-An introduction, Print ice Hall of India.
2. P.K. Gupta and D.S. Hira,(1999)Operations Research, S. Chand & Co.
3. S.D. Sharma,(2002) Operation Research, Kedar Nath Ram Nath Publications.2002
4. J.K. Sharma,(2007)Mathematical Model in Operation Research, Tata McGraw
5. P.C. Tulsian and Vishal Pandey;(2009) Quantitative Techniques, Person Education.

CC 11

|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Session:2024-25                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Part A- Introduction                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Subject/Course                       | Actuarial Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Semester                             | IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Name of the Course                   | Life Contingencies-II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Course Code                          | 24UN-ASC-402                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Course Type:                         | CC 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Level of the course                  | 100-199                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Pre-requisite for the course(if any) | -----                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Course Learning Outcomes(CLOs):      | <p><b>After completing this course, the learner will be able to:</b></p> <ol style="list-style-type: none"> <li>1. Apply the principle of equivalence to calculate net and gross premiums for various life insurance and annuity contracts, including with-profit policies.</li> <li>2. Evaluate prospective and retrospective reserves, apply Thiele's differential equation, and analyze mortality profit in individual and portfolio contexts.</li> <li>3. Incorporate expenses and inflation into life insurance models, defining gross future loss random variables using the equivalence principle.</li> <li>4. Analyze joint-life and last-survivor statuses, dependent lifetime models, and compute benefits for survival, contingent, and reversionary annuities.</li> </ol> |

| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Theory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Tutorial      | Total |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1             | 4     |
| Contact Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1             | 4     |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | --            | 30    |
| End Term Examination Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 70                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | --            | 70    |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3 Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 3 Hours       |       |
| Max.Marks:100                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |       |
| <b>Part B-Contents of the Course</b>                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |       |
| <p align="center"><b><u>Instructions for Paper- Setter</u></b></p> <p><b>Note:</b> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes(CLOs) into consideration. The compulsory question (Question No. 1) will contain 7 questions covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit including the compulsory question.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |       |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Contact Hours |       |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Net premiums or Benefit premiums: The random future loss under an assurance or annuity contract, state the principle of equivalence, Notations and formulae of net premium for common life insurance contracts, Fully Discrete Premiums, True m-thly payment premium, Commutation functions, increasing and decreasing Benefit premiums, Profits contract, Types of bonus, Calculating net premiums for with-profit contracts. Gross premium..                                                                                                                                                                                                                                                                                                                                                                                         | 12            |       |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Benefit Reserves: Prospective and Retrospective Reserves, Net future random loss for reserves, Conditions for equality of prospective and retrospective Reserves, Fully Continuous Benefit Reserves, other formulas for fully Continuous Benefit Reserves, Fully Discrete Benefit Reserves, Benefit Reserves on a Semi-continuous basis, Benefit Reserves based on True m-thly Benefit premiums, Net Premium Reserves, Thiele's Differential Equation, Death strain at risk(DSAR), Expected death strain(EDS), Actual death strain (ADS), Mortality profit, Mortality profit on a portfolio of policies, Calculating net Reserves for with-profit contracts. Analysis of Benefit Reserves: Benefit Reserves for General Insurances, Recursion Relations for Fully Discrete Benefit Reserves, Benefit Reserves at Fractional Durations. | 12            |       |
| III                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Insurance Models Including Expenses: List the type of expenses incurred in writing a life insurance contract, Describe the influence of inflation on the expenses, Define the gross future loss random variable for the benefits and annuities using equivalence principle.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 12            |       |
| IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Multiple Life Functions; Joint distribution of Future Lifetimes, The Joint-Life Status, The Last-Survivor Status, More Probabilities and Expectations, Dependent Lifetime Models: Common Shock, Insurance and Annuity Benefits: Survival Status, Special Two-Life                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 12            |       |

|                                                                 |  |
|-----------------------------------------------------------------|--|
| Annuities, Reversionary Annuities, Simple Contingent Functions. |  |
|-----------------------------------------------------------------|--|

|                                     |
|-------------------------------------|
| <b>Suggested Evaluation Methods</b> |
|-------------------------------------|

|                                                                                                                                                                                                                        |                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| <b>Internal Assessment:</b><br>> <b>Theory30</b> <ul style="list-style-type: none"> <li>• ClassParticipation:5</li> <li>• Seminar/presentation/assignment/quiz/classstestetc.:10</li> <li>• Mid-TermExam:15</li> </ul> | <b>End Term Examination</b><br>:<br><input type="checkbox"/> <b>Theory70</b><br>Written Examination |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|

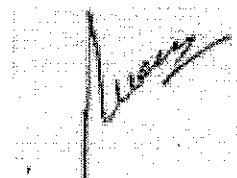
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Part C-Learning Resources</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <ol style="list-style-type: none"> <li>1. Bowers, N. L., Gerber, H.U., Hickman, J.C., Jones, D.A., Nesbitt, C.L.(1986), Actuarial Mathematics, The society of actuaries.</li> <li>2. David, C. M., Dickson, Mary R. Hardy and Howard, R. Waters.(2009). Actuarial Mathematics for Life Contingent Risks. Cambridge University Press.</li> <li>3. Deshmukh, S.R. (2009). Actuarial Statistics, Universities Press India. Principles of Macroeconomics.</li> <li>4. Robin Cunningham, Thomas N. Herzog, Richard L.(2011) Models for Quantifying Risk, 4th Edition, ACTEX Publications.</li> </ol> |



CC 12

Session:2024-25

| Part A- Introduction                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Subject/Course                       | Actuarial Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Semester                             | IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Name of the Course                   | Corporate Accounting-II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Course Code                          | 24UN-ASC-403                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Course Type:                         | CC 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Level of the course                  | 100-199                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Pre-requisite for the course(if any) | -----                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Course Learning Outcomes(CLOs):      | <p><b>After completing this course, the learner will be able to:</b></p> <ol style="list-style-type: none"> <li>1. Apply accounting procedures for internal and external reconstruction, including mergers and purchases.</li> <li>2. Prepare accounts for company liquidation and understand financial reporting requirements for financial institutions.</li> <li>3. Construct and interpret final accounts of banking companies in compliance with regulatory standards.</li> <li>4. Prepare consolidated accounts of holding companies and their subsidiaries, applying relevant accounting principles.</li> </ol> |





| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Theory                                                                                 | Tutorial      | Total |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|---------------|-------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                                                                                      | 1             | 4     |
| Contact Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3                                                                                      | 1             | 4     |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                | 30                                                                                     | --            | 30    |
| End Term Examination Marks                                                                                                                                                                                                                                                                                                                                                                                                                                               | 70                                                                                     | --            | 70    |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3 Hours                                                                                | 3 Hours       |       |
| Max.Marks:100                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                        |               |       |
| <b>Part B-Contents of the Course</b>                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                        |               |       |
| <p align="center"><b><u>Instructions for Paper- Setter</u></b></p> <p>Note: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes(CLOs)into consideration. The compulsory question (Question No. 1) will contain 7 questions covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit including the compulsory question.</p> |                                                                                        |               |       |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Topics                                                                                 | Contact Hours |       |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Internal Reconstruction; External Reconstruction in the nature of merger and purchase. | 12            |       |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Liquidation of a company ; Financial reporting for financial institutions..            | 12            |       |
| III                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Final Accounts of Banking Companies.                                                   | 12            |       |
| IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Accounts of Holding Companies.                                                         | 12            |       |

### Suggested Evaluation Methods

**Internal Assessment:****> Theory30**

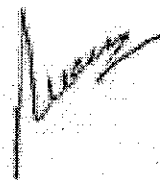
- ClassParticipation:5
- Seminar/presentation/assignment/quiz/classstestetc.:10
- Mid-TermExam:15

**End Term  
Examination**

:

**Theory70**  
Written  
Examination**Part C-Learning Resources**

1. Shukla M.C, Grewal T.S and Gupta S.C.(2016) Advance Accounts: S.Chand& comp., New Delhi.
2. Gupta R.L & Radha Swami M. (2021)Company Account: Sultan Chand, New Delhi.
3. Monga J.R ,.Ahuja Girish and Sehgal Ashok,(2012) Financial Accounting: Mayur Paper Backs, Noida
4. Goel, D.K.(2018), Corporate Accounting. Arya Publications, New Delhi



**CC -M4(V)**

**Session:2024-25**

**Part A- Introduction**

|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Subject/Course                       | Actuarial Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Semester                             | IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Name of the Course                   | Computational Techniques                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Course Code                          | 24UN-ASC-404                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Course Type:                         | CC -M(V4)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Level of the course                  | 100-199                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Pre-requisite for the course(if any) | -----                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Course Learning Outcomes(CLOs):      | <p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Apply iterative techniques (Bisection, Regula-Falsi, Secant, Newton-Raphson) to solve algebraic and transcendental equations, and analyze their convergence.</li> <li>2. Use finite and central difference operators for interpolation, and apply binomial, Poisson, and normal distributions to model random variables.</li> <li>3. Compute derivatives and integrals using interpolation-based formulas, quadrature rules, and Newton-Cote methods.</li> <li>4. Solve ordinary differential equations using single-step (Euler, Runge-Kutta, Taylor, Picard) and multi-step (Predictor-Corrector, Milne-Simpson) numerical methods.</li> </ol> |

| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Theory                                                                                                                                                                                                                                                                                                                                                                                                                          | Tutorial      | Total |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3                                                                                                                                                                                                                                                                                                                                                                                                                               | 1             | 4     |
| Contact Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 3                                                                                                                                                                                                                                                                                                                                                                                                                               | 1             | 4     |
| Internal Assessment Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 30                                                                                                                                                                                                                                                                                                                                                                                                                              | --            | 30    |
| End Term Examination Marks                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 70                                                                                                                                                                                                                                                                                                                                                                                                                              | --            | 70    |
| Examination Time                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3 Hours                                                                                                                                                                                                                                                                                                                                                                                                                         | 3 Hours       |       |
| Max.Marks:100                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |       |
| <b>Part B-Contents of the Course</b>                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |       |
| <p align="center"><b><u>Instructions for Paper- Setter</u></b></p> <p><b>Note:</b> The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will contain 7 questions covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit including the compulsory question.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |       |
| Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Topics                                                                                                                                                                                                                                                                                                                                                                                                                          | Contact Hours |       |
| I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Solution of Algebraic and Transcendental equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson's method. Newton's iterative method for finding pth root of a number, Order of convergence of above methods. Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method.                                                                                                   | 12            |       |
| II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Finite Differences operators and their relations. Finding the missing terms and effect of error in a difference tabular values, Interpolation with equal intervals: Newton's forward and Newton's backward interpolation formulae. Interpolation with unequal intervals: Newton's divided difference, Lagrange's Interpolation formulae, Hermite Formula.                                                                       | 12            |       |
| III                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Central Differences: Gauss forward and Gauss's backward interpolation formulae, Sterling, Bessel Formula. Numerical Differentiation: Derivative of a function using interpolation formulae. Probability distribution of random variables, Binomial distribution, Poisson's distribution, Normal distribution: Mean, Variance and Fitting.                                                                                       | 14            |       |
| IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Numerical Integration: Newton-Cote's Quadrature formula, Trapezoidal rule, Simpson's one third and three-eighth rule, Chebychev formula, Gauss Quadrature formula. Numerical solution of ordinary differential equations: Single step methods-Picard's method. Taylor's series method, Euler's method, Runge-Kutta Methods. Multiple step methods; Predictor-corrector method, Modified Euler's method, Milne-Simpson's method. | 12            |       |

### Suggested Evaluation Methods

|                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| <b>Internal Assessment:</b><br><b>&gt; Theory30</b> <ul style="list-style-type: none"> <li>• ClassParticipation:5</li> <li>• Seminar/presentation/assignment/quiz/classstestetc.:10</li> <li>• Mid-TermExam:15</li> </ul>                                                                                                                                       | <b>End Term Examination</b><br>:<br><input type="checkbox"/> <b>Theory70</b><br>Written Examination |
| <b>Part C-Learning Resources</b>                                                                                                                                                                                                                                                                                                                                |                                                                                                     |
| 1. M.K. Jain, S.R.K.Iyengar, R.K. Jain(1996) Numerical Method, Problems and Solutions, New Age International (P) Ltd.<br>2.S.S.Sastry (2012) Introductory Methods Of Numerical Analysis, Prentice Hall India Learning Private Limited.<br>3.B.S.Grewal (2013), Numerical Methods in Engineering & Science with Programs in C, C++ and MATLAB, Khanna Publisher. |                                                                                                     |