**EASTERN MEDITERRANEAN UNIVERSITY**

**DEPARTMENT OF INDUSTRIAL ENGINEERING**

**IENG514 Stochastic Processes**

**Course Outline**

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| **COURSE CODE** |  IENG514 | **SEMESTER / ACADEMIC YEAR** |  Fall 2024-25 |
| **COURSE TITLE** |  Stochastic Processes and its Applications |
| **CREDIT VALUE** |  (3, 0, 0) 3 |
| **LECTURER(S)** |  Assoc. Prof. Dr. Sahand DANESHVAR |  sahand.daneshvar@emu.edu.tr  | IE-C109 |  +90 392 630 2773 |
| **COURSE TYPE** | Core Course |
| **PRE-REQUISITE(S)** | Consent of the instructor |
| **DURATION OFCOURSE** | 14 Weeks |
| **COURSE SCHEDULE** | Monday 09:30-12:20 IE-E201 |
| **COURSE WEB LINK** | https://staff.emu.edu.tr/sahanddaneshvar |
| **COURSE DESCRIPTION**Review of conditional probability and conditional expectation. Basic definitions. Homogenous and non-homogenous Poisson processes, generation of random numbers from Poisson processes, compound Poisson processes, birth-death processes. Markov chains and pure jump processes. Renewal theory and applications. Markov-renewal processes. Applications to queuing, replacement, and inventory problems. Selected topics from stationary processes, rth order Markov chains, time series as stochastic processes. |
| **AIMS & OBJECTIVES**The basic purpose of presenting the materials of this course is to:* Review and developed basic ideas of probability theory in order to prepare the background for understanding stochastic process.
* Present various stochastic processes with applications to Industrial problems and other areas.

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| **GENERAL LEARNING OUTCOMES (COMPETENCES)**On successful completion of this course, all students will have developed **knowledge** and **understanding** of:* Modelling random phenomenon as a stochastic process,
* Poisson process as a powerful tool and several variations of Poisson processes,
* Markov and Renewal processes to model Industrial and Production processes and also to model failure and repair processes,
* To model time series analysis as a stochastic process,
* Solving stochastic problems using SPSS,
* Some estimation procedures of model parameters.

On successful completion of this course, all students will have developed **their skills in**:* Analyzing stochastic processes,
* Finding the type of the under evaluation stochastic process,
* Explore the special properties of the stochastic process,
* Solving the problems using the properties of the stochastic process numerically.

On successful completion of this course, all students will have developed their appreciation of and respect for **values and attitudes** regarding the issues of: * To the concept and application of stochastic processes,
* Construction of algorithms for the problems which can consider as the stochastic processes,
* Interpretation of the results of the mentioned problems.
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| **GRADING CRITERIA****Exams:** All examinations and assignments will be based on the lectures and tutorials. Assignments will be to hone the problem skills of the students. Students will be encouraged to go through their answer scripts and clarify their omissions and mistakes, if any. Descriptions of the examinations are as follows:*Midterm Exam:* There will be one such examination covering all the teaching material up to the 8th week. This exam held on 28 October *2024 (09:30-11:20)* which is not flexible.*Final Exam:* The final examination will cover all the material studied throughout the semester, and has the same structure as the midterm examination. It will also be used to determine letter grades. Final exam held on *13* January *2025 (09:30-11:20)*. *Quizzes:* There will be two quizzes that will held on28 October *2024 (09:30-10:20)* and 16 December *2024 (09:30-10:20),* respectively which are not flexible.*Assignments:* Six Homeworks in the form of assignments will be given to assess students’ problem-solving ability. The dead line for submission each of them is **one week** after it is presented on course web link. Late submissions will not be valued.Note: The voluntary paper presentation has (5%) bonus. Topics will be given by the instructor. |
| **LEARNING / TEACHING METHOD**Teaching will enable the students to understand the application of various stochastic processes methods. The function of teaching is to enable students to learn. Therefore, students are required to read the chapters of the textbook before coming to class and solve the related homework questions after each lecture. The instructor will lecture in class by writing on the board and some lectures will be given as a MS power point presentation. Also, the lectures will be supplemented by tutorial sessions. |
| **READING ASSIGNMENTS**Besides the textbook material, there will be some reading assignments, which will support the lectures. For any type of examination, students are also responsible from studying all assigned readings, even if they might not be discussed in class. |
| **METHOD OF ASSESSMENT**Although the student’s overall grade will be based on the general assessment of the instructor, the following percentages may give an idea about the relative importance of various assessment tools. Quizzes 18 % Homework 18 % Mid-term Exam 28 % Final Exam 36 % TOTAL 100 pointsNote that the instructor reserves the right to modify these percentages in case he finds it necessary. Letter grade equivalents of numerical performances will be announced by the Registrar’s Office after the last day for the submission of letter grades. |
| **ATTENDANCE**1. Attendance is mandatory. Any student who has poor attendance and/or misses an examination without providing a valid excuse will be given **NG** grade.
2. Students missing just on Midterm Exam should provide a valid excuse within three working days following the examination they missed. One make-up examination will be given at the end of the semester after the final examination period.
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| **TEXTBOOK/S**Students must refer the following textbooks:**Text Book**s: * *J. Medhi, Stochastic Processes, Second Edition, WILEY EASTERN LIMITED,1994*

 Reference Books: * *Stochastic Process. S M.Ross, John Wiley, 1996, 2nd edition.*
* *The Theory of Stochastic process, DR Cox and HD Miller, Chapman and Hall, London, 1965*
* *Stochastic Models, HC Tijms, Wiley, England , 1994,*
* *Introduction to Stochastic process, E.Cinlar, Prentice Hall, Englewood cliffs, NJ, 1975*

**CONTENT & SCHEDULE**The lecture topics within the semester are as in the following schedule although minor changes are possible:

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| **WEEK** | **TOPICS** |
| 1 | Review of probability |
| 2 | Introduction of Stochastic Processes |
| 3 | Stationary Processes |
| 4 | Markov Chain |
| 5 | Chapman Kolmogorov Equations |
| 6 | Classification of States |
| 7 | Poisson Process  |
| 8 | Properties of Poisson Process |
| 9 | **Midterm Exam** |
| 10 | Cluster Poisson Process Renewal Processes |
| 11 | Birth and Death Processes  |
| 12 |  Renewal Processes  |
| 13 |  Renewal Theorem |
| 14 | Elements of Markov Renewal Process  |
| 15 |  Applications to Queuing, Time Series as Stochastic Processes |
| 16 |  **Final Exam** |

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| **ACADEMIC HONESTY, PLAGIARISM & CHEATING**This is intentionally failing to give credit to sources used in writing regardless of whether they are published or unpublished. Plagiarism (which also includes any kind of cheating in exams) is a disciplinary offence and will be dealt with accordingly. According to university by laws cheating and plagiarism are serious offences punishable with disciplinary action ranging from simple failure from the exam or project/report, to more serious action (suspension from the university for up to one semester). Disciplinary action is written in student records and may appear in student transcripts. Any act not suitable for a university student will not be tolerated and may lead to formal disciplinary action. Example of this are: getting someone else to take the examinations for you, misrepresentation of your own answer sheet as another’s work, cheating, knowingly assisting other students to cheat, abusing the tolerance or breaking the discipline of the class. |

**PLEASE KEEP THIS COURSE OUTLINE FOR FUTURE REFERENCE AS IT CONTAINS IMPORTANT INFORMATION!!!**