B.E (OPEN TO ALL PROGRAMMES OF ENGINEERING)

Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)

(Effective from the academic year 2022-2023)

SEMESTER – VII

Advanced Mathematical Methods

Course Code	21MAT755	CIE Marks	50
Teaching Hours/Week (L: T:P)	2:2:0	SEE Marks	50
Total Number of Contact Hours	40	Total Marks	100
Credits	03	Exam Hours	3

Course Learning Objectives: This course will enable students to:

1. To familiarize the important tools of advanced numerical methods and complex analysis, required to analyze the engineering problems.
2. To apply the knowledge of statistical techniques, stochastic process and queuing theory to offer solutions the engineering problems.

Pedagogy (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution for some exercises (post-lecture activity).

Module – 1

Numerical Methods-1: Eigen values of real symmetric matrices- Givens method and Householder's method. Roots of polynomial equations-Birge-Vieta method and Bairstow's methods. **(8 Hours)**

(RBT Levels: L1, L2 and L3)

Pedagogy	Chalk and Board, Problem based learning

Module – 2

Numerical Methods-2: Numerical solution for PDE's: Numerical solution for PDE's:- Numerical solution of Laplace and Poisson's equations . Numerical solution of heat equation by Smith and Crank-Nicolson method. Numerical solution of wave equations explicit method. **(8 Hours)**

(RBT Levels: L1, L2 and L3)

Pedagogy	Chalk and Board, Problem based learning

Module – 3	
Complex Analysis: Taylor's and Laurent series expansion of analytic functions-problems. The calculus of residues-Singularities based on Laurent's series expansion, Cauchy's residue theorem-problems. Contour integration-evaluation of real definite integrals. **(8 Hours)** **(RBT Levels: L1, L2 and L3)**	
Pedagogy	Chalk and Board, Problem based learning
Module – 4	
Descriptive Statistics: Sampling and testing the statistical hypothesis. Test of significance and confidence intervals. Estimation theory. Analysis of variance. F-distribution and F-test related to one way classification with/without interactions, problems related to ANOVA-I. **(8 Hours)** **(RBT Levels: L1, L2 and L3)**	
Pedagogy	Chalk and Board, Problem based learning
Module – 5	
Stochastic Process: Classification of stochastic process with examples. Markov chain and related problems. Queuing theory- Poisson queuing system, Little law. Discussion of M/M/1 and M/M/s queuing models. **(8 Hours)** **(RBT Levels: L1, L2 and L3)**	
Pedagogy	Chalk and Board, Problem based learning

Course Outcomes

- Demonstrate the applications of numerical methods to find the roots of polynomial equations and eigen values of real symmetric matrices.
- Apply various numerical methods for solving linear partial differential equations arising in engineering field.
- Develop expansion of functions of complex variables in terms of Laurent's series, explain ideas related to the calculus of residues and contour integration.
- Understand the facts related hypothesis testing and analyze the analysis of variance for larger samples.
- Apply the knowledge of stochastic process, queuing theory, in solving problems arising in various physical and engineering phenomena.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Marks scored out of 100 shall be reduced proportionally to 50 marks

Text Books:

1. K.F. Riley, M.P.Hobson and S.J. Bence, "Mathematical Methods for Physics and Engineering", Cambridge University Press 3rd Edition, 2017.
2. E. Kreyszig John Wiley & Sons, "Advanced Engineering Mathematics" 10thEd.,(Reprint), 2017.
3. T.Veerarajan, "Probability, Statistics and Random Process", Tata Mc-Graw Hill Co. 3rd Edition, 2016.

Reference Books:

1. G. Haribasharan, "Probability, Queuing Theory and Reliability Engineering", Laxmi Publications, New Delhi 2nd Edition, 2006 2 Higher Engineering Mathematics B.S. Grewal Khanna Publishers. 44thEdition, 2017.
2. S. S. Sastry, "Introductory Methods of Numerical Analysis", Prentice Hall of India 4th Edition, 2011.
3. M. K. Jain, S. R. K. Iyengar and R. K. Jain, "Numerical Methods for Scientific and Engineering", Computation New Age Int. Publishers 6th Edition, 2014.
4. G.R. Grimmet and D.R. Stirzaker, "Probability and Random Processes", Oxford University Press 3rd Edition, 2001.

Web links and Video Lectures (e-Resources):

http://www.class-central.com/subject/math(MOOCs)

http://academicearth.org/

http://www.bookstreet.in.

VTU EDUSAT PROGRAMME – 20

VTU e-Shikshana Program

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars