21 Scheme 4th Semester Mathematics Syllabus for different branches		
Common Scheme 21MAT 41		
BoS in Bio-Technology (BT)		Subject Code
1	Biotechnology	21MAT41
BoS in Chemical Engineering (CH/Polymer) ✓		
2	Chemical Engineering	21MAT41
3	Petrochem Engineering	
BoS in Civil / Transportation Engineering (CV/TR/EV/CC) ✓		
4	Civil engineering	21MAT41
5	Construction Technology & Management	
6	Environmental Engineering	
7	Ceramics and Cement Technology	
8	Mining Engineering	
BoS in Electronics and Communication Engineering (ECE/TCE)		
9	Electronics & Communication Engg	21MAT41
10	Electronics & Telecommunication Engg	
11	Industrial IoT	
BoS in Electronics & Instrumentation Engineering (IT/BM/ML) ✓		
12	Electronics & Instrumentation Engineering	21MAT41
13	Biomedical Engineering	
14	Medical Electronics Engineering	
BoS in Electrical & Electronics Engineering (EEE) ✓		
15	Electrical & Electronics Engineering	21MAT41
BoS in Nano Technology ✓		
16	Nano Technology	21MAT41

B.E MATHS SYLLABUS (Except CS, ME and allied branches)

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

(Effective from the academic year 2022-2023)

SEMESTER – IV

COMPLEX ANALYSIS, PROBABILITY AND STATISTICAL METHODS			
Course Code	21MAT41	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 Objectives: This course(21MAT41) will enable students to:

1. Provide insight into applications of complex variables, conformal mapping arising in potential theory, quantum mechanics, heat conduction and field theory.
2. Special functions familiarize the Power series solution required to analyse the Engineering Problems.
3. To have insight into Statistical methods, Correlation and regression analysis.
4. To develop probability distribution of discrete and continuous random variables, Joint probability distribution occurs in digital signal processing, design engineering and microwave engineering.

Teaching-Learning Process (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

Complex Analysis: Review of a function of a complex variable, limits, continuity and differentiability. Analytic functions: Cauchy-Riemann equations in cartesian and polar forms and consequences. Construction of analytic functions by Milne-Thomson method, Problems.

Complex integration: Line integral of a complex function, Cauchy's theorem and Cauchy's integral formula and problems. **(8 Hours)**

Self-Study: Conformal transformations: Discussion of transformations: $w = z^2$, $w = e^z$, $w = z + 1/z$ $(z \neq 0)$. Bilinear transformations- Problems.

(RBT Levels: L1, L2 and L3)	
Pedagogy	Chalk and Board, Problem based learning
Module – 2	
Special functions: Series solution of Bessel's differential equation leading to $J_n(x)$ Bessel's function of the first kind, Properties, Orthogonality of Bessel's functions. Series solution of Legendre's differential equation leading to $P_n(x)$-Legendre polynomials. Rodrigue's formula (without proof), problems. **(8 Hours)** **Self Study:** Recurrence Relations. **(RBT Levels: L1, L2 and L3)**	
Pedagogy	Chalk and Board, Problem based learning
Module – 3	
Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation, problems. Regression analysis, lines of regression, problems. **Curve Fitting:** Curve fitting by the method of least squares, fitting the curves of the forms $y = ax + b$, $y = ax^b$ *and* $y = ax^2 + bx + c$. **(8 Hours)** **Self-study:** Angle between two regression lines, problems. **(RBT Levels: L1, L2 and L3)**	
Pedagogy	Chalk and Board, Problem based learning
Module – 4	
Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions- problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples. **(8 Hours)** **Self-study:** Exponential distribution. **(RBT Levels: L1, L2 and L3)**	
Pedagogy	Chalk and Board, Problem based learning
Module – 5	
Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation. **Sampling Theory**: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit. **(8 Hours)** **Self-Study:** Point estimation and interval estimation. **(RBT Levels: L1, L2 and L3)**	
Pedagogy	Chalk and Board, Problem based learning
Course Outcomes	

Course Outcomes: At the end of the courses, the students will be able to:

1. Use the concepts of an analytic function and complex potentials to solve the problems arising in electromagnetic field theory. Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing.
2. Obtain Series Solutions of Ordinary Differential Equation.
3. Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
4. Apply discrete and continuous probability distributions in analysing the probability models arising in the engineering field.
5. Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

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.

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal Khanna Publishers 44th Edition, 2017.
2. Advanced Engineering Mathematics, E. Kreyszig: John Wiley & Sons, 10th Ed. (Reprint), 2016.

References:

1. Advanced Engineering Mathematics C. Ray Wylie, Louis C.Barrett McGraw-Hill 6th Edition 1995.
2. Higher Engineering Mathematics B. V. Ramana McGraw-Hill 11th Edition,2010.
3. A Text-Book of Engineering Mathematics N. P. Bali and Manish Goyal Laxmi Publications 2014.
4. Advanced Engineering Mathematics Chandrika Prasad and Reena Garg Khanna Publishing, 2018.

Web links and Video Lectures (e-Resources):

http://nptel.ac.in/courses.php?disciplineID=111

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