ವಿಶ್ವೇಶ್ವರಯ್ಯತಾಂತ್ರಿಕವಿಶ್ವವಿದ್ಯಾಲಯ

ವಿಟಿಯುಅಧಿನಿಯಮ೧೯೯೪" ರಅಡಿಯಲ್ಲಿಕರ್ನಾಟಕಸರ್ಕಾರದಿಂದಸ್ಥಾಪಿತವಾದರಾಜ್ಯವಿಶ್ವವಿದ್ಯಾಲಯ

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

State University of Government of Karnataka Established as per the VTU Act, 1994"JnanaSangama" Belagavi-590018, Karnataka, India

Prof. B. E. Rangaswamy, Ph.D
REGISTRAR

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REF: VTU/BGM/Aca/BoS/2023/ 340

DATE: 13 APR 2023

CIRCULAR

Sub: Stream-wise Common Mathematics subjects for the 4th semester of 2021 scheme of undergraduate engineering programs regarding...

Ref: 1 Chairperson BoS in Basic Science and Humanities letter dated: 28.07.2022
2 Chairperson BoS in Electronics and Communication email dated 01.03.2023
3 Hon'ble Vice-Chancellor's approval dated10.04.2023

Concerning the subject cited above; the 4th-semester Mathematics course in Electronics and Communication Engineering has been updated by the Basic Science Board and approved by the Hon'ble Vice-Chancellor. Listed below are the titles of the 4th semester Mathematics stream-wise for stakeholder information;

Course Code	Title of the Course	For the branches of Engineering
21MATCS41	Mathematics Foundations for Computing, Probability, and Statistics	CSE/ISE and all allied branches of CSE (CS/IS/CE/AD/AI/CM/CB/CG/CO/CI/CA/CY/CD/IC/DS)
21MATME41	Complex Analysis, Probability, and Linear Programming	Mechanical Engineering and all allied branches of Mechanical Engineering (AE/AS/AG/AM/AU/IP/IM/MS/ME/MR/MM/ME/MT/RA/RI/AR/ER/SA)
21MAT41	Complex Analysis, Probability, and Statistical Methods	(BT/CH/PC/CV/CT/CC/EV/MI/EC/BM/EE/IO/EI/BM/ML/EE)

The syllabus of the above three courses is attached to this circular for stakeholders' information and reference. The syllabi of all mentioned courses are also made available at serial numbers 24, 25, and 26 of UG Scheme and Syllabus (2021 scheme) @ **https://vtu.ac.in/en/b-e-scheme-syllabus/#menu05**

All the Principals of Constituent, Affiliated Colleges under the ambit of the University are hereby informed to bring the information of this circular to the notice of all concerned. Please note: It is

important for both teachers and students to make sure that they are referring to the appropriate mathematics course in order to make sure that their claims are taken into consideration.

Sd/-

REGISTRAR

To:

1 The Principals of affiliated and Constituent Engineering Colleges under the ambit of the University

2 The Chairpersons of the PG department where 2021 scheme engineering programs are being offered

Copy to:

1 The Hon'ble Vice-Chancellor, through the secretary to VC for information

2 The Registrar (Evaluation), VTU Belgaum for information and needful

3 The Special Officer, QPDS Examination section for information and needful

4 P. Manjunath Examination Section for information and needful

5 The Director(I/c), ITI SMU, VTU, Belagavi- to upload on the VTU website

6 The coordinator IQAC VTU Belagavi for information

7 Office copy

13/04/23

REGISTRAR

Mathematics Syllabus for Computer Science & Allied branches 21MATCS41		
BoS in Computer Science & Engineering (CSE/ISE)		
1	Computer Science & Engineering	21MATCS41
2	Information Science & Engineering	
3	Artificial Intelligence and Machine Learning	
4	CSE (Artificial Intelligence & Machine Learning)	
5	Computer Engineering (2020-21)	
6	Computer & Communication Engineering (2020-21)	
7	Data Science (2020-21)	
8	CSE(Data Science) (2020-21)	
9	Artificial Intelligence & Data Science (2020-21)	
10	CSE(Artificial Intelligence) (2020-21)	
11	Computer Science & Business System	
12	CSE(IoT & Cyber Security including Block Chain Tech	
13	CSE(Cyber Security) 2021-22	
14	Computer Science & Design	
15	Computer Science & Engineering (IoT)	

B.E COMPUTER SCIENCE AND ALLIED ENGINEERING BRANCHES

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

(Effective from the academic year 2022-2023)

SEMESTER – IV

Mathematical Foundations for Computing, Probability & Statistics

Course Code	**21MATCS41**	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(21MATCS41) will enable students to:

1. Understand an intense foundational introduction to fundamental concepts in discrete mathematics.
2. Interpret, identify, and solve the language associated with logical structure, sets, relations and functions, modular arithmetic.
3. To have insight into Statistical methods, Correlation and regression analysis. Fitting of curves.
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	
Fundamentals of Logic: Basic connectives and truth tables, Logical equivalence – The laws of Logic, Logical implication – Rules of Inference. Fundamentals of Logic contd.: The Use of Quantifiers, Quantifiers, Definitions, and the Proofs of Theorems. **(8 Hours)** **Self-study:** Problems on Logical equivalence. **(RBT Levels: L1, L2 and L3)**	
Pedagogy	Chalk and Board, Problem based learning
Module – 2	
Relations and Functions: Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. Function Composition, and Inverse Functions. **Relations:** Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions. **Introduction to Graph Theory:** Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits. **(8 Hours)** **Self-study:** The Pigeon-hole Principle, problems and its applications **(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 form- $y = ax + b$, $y = ax^b$ *and* $y = ax^2 + bx + c$ **(8 Hours)** **Self-study:** Angle between two regression lines, problems. Fitting of the curve $y = ab^x$ **(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. **Self-study:** exponential distribution. **(8 Hours)** **(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. Apply the concepts of logic for effective computation and relating problems in the Engineering domain.
2. Analyse the concepts of functions and relations to various fields of Engineering. Comprehend the concepts of Graph Theory for various applications of Computational sciences.
3. Apply discrete and continuous probability distributions in analysing the probability models arising in the engineering field.
4. Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.
5. Construct joint probability distributions and demonstrate the validity of testing the hypothesis.

ASSESSMENT PATTERN (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 100%. The minimum passing mark for the CIE is 40% of the maximum marks (400 marks out of 100). A student shall be deemed to have satisfied the academic requirements if the student secures not less than 40% (40 Marks out of 100)in the CIE.

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

Course Seminar suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

Or

Learning MATHS tools and solving a few problems from each module using MATHS tools (e.g. MATLAB, SciLab etc)

6. Conducting at least 05 labs sessions within the Academic Duration.

The sum of three tests, two assignments, and a seminar/Lab sessions using MATHS tools will be out of 100 marks.

The student shall secure minimum 40% of marks of course to qualify and become eligible for award of degree.

Textbooks:

1. Ralph P. Grimaldi and B V Ramana, Discrete and Combinatorial Mathematics- An Applied Introduction, Pearson Education, Asia, Fifth edition – 2007. ISBN 978-81-7758-424-0.
2. Higher Engineering Mathematics B. S. Grewal Khanna Publishers 44th Edition, 2017

References:

3. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata – McGraw Hill, Sixth Edition, Sixth reprint 2008. ISBN-(13):978-0-07-064824-1.
4. C. L. Liu and D P Mohapatra, Elementary Discrete Mathematics, Tata- McGraw Hill, Sixth Edition, ISBN:10:0-07-066913-9.
5. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata – McGraw Hill, 35TH reprint 2008. ISBN 13:978-0-07-463113-3.
6. Advanced Engineering Mathematics C. Ray Wylie, Louis C.Barrett McGraw-Hill 6th Edition 1995
7. Higher Engineering Mathematics B. V. Ramana McGraw-Hill 11th Edition,2010
8. A Text-Book of Engineering Mathematics N. P. Bali and Manish Goyal Laxmi Publications 2014
9. Advanced Engineering Mathematics Chandrika Prasad and Reena Garg Khanna Publishing, 2018

List of NPTEL videos for various topics of Discrete Mathematical Structures

https://www.youtube.com/watch?v=9AUCdsmBGmA&list=PL0862D1A947252D20&index=10

https://www.youtube.com/watch?v=oU60TuGHxe0&list=PL0862D1A947252D20&index=11

https://www.youtube.com/watch?v=_BIKq9Xo_5A&list=PL0862D1A947252D20&index=13

https://www.youtube.com/watch?v=RMLR2JHHeWo&list=PL0862D1A947252D20&index=14

https://www.youtube.com/watch?v=nf9e0_ylGdc&list=PL0862D1A947252D20&index=15

https://www.youtube.com/watch?v=7cTWea9YAJE&list=PL0862D1A947252D20&index=24

https://www.youtube.com/watch?v=695iAm935cY&list=PL0862D1A947252D20&index=25

https://www.youtube.com/watch?v=ZECJHfsf4Vs&list=PL0862D1A947252D20&index=26

https://www.youtube.com/watch?v=Dsi7x-A89Mw&list=PL0862D1A947252D20&index=28

https://www.youtube.com/watch?v=xlUFkMKSB3Y&list=PL0862D1A947252D20

https://www.youtube.com/watch?v=0uTE24o3q-o&list=PL0862D1A947252D20&index=2

https://www.youtube.com/watch?v=DmCltf8ypks&list=PL0862D1A947252D20&index=3

https://www.youtube.com/watch?v=jNeISigUCo0&list=PL0862D1A947252D20&index=4

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

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

http://academicearth.org/

VTU EDUSAT PROGRAMME - 20

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

- Quizzes
- Assignments
- Seminars

Mathematics Syllabus for Mechanical Engineering & Allied branches 21MATME41		
BoS in Aeronautical Engineering (AE)		
1	Aeronautical Engineering	21MATME41
2	Aerospace Engineering	
BoS in Automobile Engineering (AE)		
3	Automobile Engineering	21MATME41
BoS in Industrial Production & Engineering (IPE/IEM/MS)		
4	Industrial & Production Engineering	21MATME41
5	Industrial Engineering & Management	
6	Manufacturing Science & Engineering	
BoS in Mechanical Engineering (ME/PT/MIE)		
7	Mechanical Engineering	21MATME41
8	Marine Engineering	
9	Mechatronics	
10	Mechanical & Smart Manufacturing (2020-21)	
11	Robotics & Automation(2020-21)	
12	Agricultural Engineering (2021-22)	
13	Automation and Robotics (2021-22)	
14	Robotics and Artificial Intelligence (2021-22)	

B. E. (Mechanical Engineering & Allied branches)
Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)
SEMESTER - IV

Complex Analysis, Probability and Linear Programming

Course Code	**21MATME41**	CIE Marks	50
Teaching Hours/Week (L: T:P)	(2:2:0)	SEE Marks	50
Credits	03	Exam Hours	03

Course Learning Objectives:

- To provide an insight into applications of complex variables and conformal mapping arising in potential theory, quantum mechanics, heat conduction and field theory.
- To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, design engineering and microwave engineering.
- Analyze and solve linear programming models of real-life situations and learn about the applications to transportation and assignment problems.

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.

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

Calculus of complex functions: Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences. Applications to flow problems

Construction of analytic functions: Milne-Thomson method-Problems. **(8 hours)**

Self-Study: Review of a function of a complex variable, limits, continuity, and differentiability.

(RBT Levels: L1, L2 and L3)

Pedagogy: Chalk and talk method and Powerpoint Presentations

Module-2
Conformal transformations: Introduction. Discussion of transformations $w = z^2$, $w = e^z$, $w = z + \frac{1}{z}, (z \neq 0)$. Bilinear transformations- Problems. **Complex integration:** Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems. **(8 hours)** **Self-Study:** Residues, Residue theorem – problems **(RBT Levels: L1, L2 and L3)**
Pedagogy: Chalk and talk method and Powerpoint Presentations
Module-3
Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Mean-Variance and Standard Deviations of a random variable. Binomial, Poisson, exponential and normal distributions- problems. **(8 hours)** **Self-Study:** Two-dimensional random variables, marginals pdf's, Independent random variables **(RBT Levels: L1, L2 and L3)**
Pedagogy: Chalk and talk method and Powerpoint Presentations
Module-4
Linear Programming Problems (L.P.P): General Linear programming Problem, Canonical and standard forms of L.P.P. Basic solution, Basic feasible solution, Optimal solution, Simplex Method-Problems. Artificial variables, Big-M method, Two-Phase method-Problems. **(8 hours)** **Self-Study:** Formulation of an L.P.P and optimal solution by Graphical Method. **(RBT Levels: L1, L2 and L3)**
Pedagogy: Chalk and talk method and Powerpoint Presentations
Module-5
Transportation and Assignment Problems: Formulation of transportation problems, Methods of finding initial basic feasible solutions by North-West corner method, Least cost method, Vogel approximation method. Optimal solutions-Problems. Formulation of assignment problems, Hungarian method-Problems. **(8 hours)** **Self-Study**: Degeneracy in Transportation problem. **(RBT Levels: L1, L2 and L3)**
Pedagogy: Chalk and talk method and Powerpoint Presentations
Course outcomes: At the end of the course the student will be able to: • Use the concepts of an analytic function and complex potentials to solve the problems arising in fluid flow. • Utilize conformal transformation and complex integral arising in aerofoil theory, fluid flow visualization and image processing. • Apply discrete and continuous probability distributions in analyzing the probability models arising in the engineering field. • Analyze and solve linear programming models of real-life situations and solve LPP by the simplex method • Learn techniques to solve Transportation and Assignment problems.

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.

Suggested Learning Resources:

Text Books:

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons,10th Ed. (Reprint),2016.
3. S.D. Sharma: "Operations Research" Kedarnath Publishers Ed. 2012

Reference Books

1. V. Ramana: "*Higher Engineering Mathematics*" McGraw-Hill Education,11th Ed.
2. Mokhtar S.Bazaraa, John J.Jarvis & Hanif D.Sherali(2010*), Linear Programming and Network Flows(* 4th E*dition), John Wiley & sons.*
3. G.Hadley (2002) *Linear Programming, Narosa Publishing House*
4. F.S. Hillier. G.J. Lieberman: Introduction to Operations Research- Concepts and Cases, 9th Edition, Tata Mc-Graw Hill, 2010.
5. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press,3rdReprint, 2016.
6. N.P Bali and Manish Goyal: "A textbook of Engineering Mathematics" Laxmi Publications, Latest edition.
7. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw – Hill Book

Co. New York, Latest ed.

8. H.K. Dass and Er. RajnishVerma:"Higher EngineeringMathematics"S.ChandPublication(2014).

Web links and Video Lectures (e-Resources):

- http://.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- https://www.coursera.org/learn/operations-research-modeling
- https://www.careers360.com/university/indian-institute-of-technology-madras/introduction-operations-research-certification-course
- http://people.whitman.edu/~hundledr/courses/M339.html
- VTU e-Shikshana Program
- VTU EDUSAT Program

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

- Quizzes
- Assignments
- Seminars

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