UNIVERSITY OF MUMBAI

Bachelor Of Engineering

In

(Group A)

Computer Engineering and Information Technology

Second Year with Effect from AY 2020-21
Third Year with Effect from AY 2021-22
Final Year with Effect from AY 2022-23

(REV- 2019 ‘C’ Scheme) from Academic Year 2019 – 20

Under

FACULTY OF SCIENCE & TECHNOLOGY

(As per AICTE guidelines with effect from the academic year 2019–2020)

Program Structure for
Second Year Engineering (Semester III & IV)
Mumbai University
(With Effect from 2020-2021)
Semester III

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
XXC301	Engineering Mathematics-III	3	--	1*	3	--	1	4
XXC302	Theory Course-2	3	--	--	3	--	--	3
XXC303	Theory Course-3	3	--	--	3	--	--	3
XXC304	Theory Course-4	3	--	--	3	--	--	3
XXC305	Theory Course-5	3	--	--	3	--	--	3
XXL301	Lab Course-1	--	2	--	1	--	--	1
XXL302	Lab Course-2	--	2	--	1	--	--	1
XXL303	Lab Course-3	--	2	--	1	--	--	1
XXL304	Skill based lab course	--	4	--	2	--	--	2
XXM301	Mini project 1A	--	$4^{\$}$	--	2	--	--	2
Total		15	14	1	15	07	1	23

***Should be conducted batch wise.** $ indicates work load of Learner (Not Faculty), for Mini Project

Examination Scheme

Course Code	Course Name	Theory					Term work	Pract/ oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		Test 1	Test 2	Avg					
XXC301	Engineering Mathematics-III	20	20	20	80	3	25	--	125
XXC302	Theory Course-2	20	20	20	80	3	--	--	100
XXC303	Theory Course-3	20	20	20	80	3	--	--	100
XXC304	Theory Course-4	20	20	20	80	3	--	--	100
XXC305	Theory Course-5	20	20	20	80	3	--	--	100
XXL301	Lab Course-1	--	--	--	--	--	25	25	50
XXL302	Lab Course-2	--	--	--	--	--	25	25	50
XXL303	Lab Course-3	--	--	--	--	--	25	25	50
XXL304	Skill based lab course	--	--	--	--	--	50	--	50
XXM301	Mini project 1A	--	--	--	--	--	50	--	
Total		--	--	100	400	--	200	75	775

Semester IV

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
XXC401	Engineering Mathematics-IV	3	--	1*	3	--	1	4
XXC402	Theory Course-2	3	--	--	3	--	--	3
XXC403	Theory Course-3	3	--	--	3	--	--	3
XXC404	Theory Course-4	3	--	--	3	--	--	3
XXC405	Theory Course-5	3	--	--	3	--	--	3
XXL401	Lab Course-1	--	2	--	1	--	--	1
XXL402	Lab Course-2	--	2	--	1	--	--	1
XXL403	Lab Course-3	--	2	--	1	--	--	1
XXL404	Skill based lab course	--	4	--	2	--	--	2
XXM401	Mini project 1B	--	4$	--	2	--	--	2
Total		15	14	1	15	07	1	23

***Should be conducted batch wise.** $ indicates work load of Learner (Not Faculty), for Mini Project

Examination Scheme

Course Code	Course Name	Theory					Term work	Pract/ oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		Test 1	Test 2	Avg					
XXC401	Engineering Mathematics-IV	20	20	20	80	3	25	--	125
XXC402	Theory Course-2	20	20	20	80	3	--	--	100
XXC403	Theory Course-3	20	20	20	80	3	--	--	100
XXC404	Theory Course-4	20	20	20	80	3	--	--	100
XXC405	Theory Course-5	20	20	20	80	3	--	--	100
XXL401	Lab Course-1	--	--	--	--	--	25	25	50
XXL402	Lab Course-2	--	--	--	--	--	25	25	50
XXL403	Lab Course-3	--	--	--	--	--	25	25	50
XXL404	Skill based lab course	--	--	--	--	--	50	--	50
XXM401	Mini project 1B	--	--	--	--	--	50	--	
Total		--	--	100	400	--	200	75	775

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	TW/Pract	Tut.	Total
XXC301	**Engineering Mathematics-III**	03	-	01	03	-	01	**04**

Course Code	Course Name	Examination Scheme							
		Theory				Term Work	Pract	Oral	Total
		Internal Assessment			End Sem Exam				
		Test1	Test2	Avg of Test 1 & 2					
XXC301	**Engineering Mathematics-III**	20	20	20	80	25	-	-	**125**

Pre-requisite: Engineering Mathematics-I, Engineering Mathematics-II

Course Objectives: The course aims:

1. To learn the Laplace Transform, Inverse Laplace Transform of various functions, its applications.
2. To understand the concept of Fourier Series, its complex form and enhance the problem solving skills.
3. To understand the concept of complex variables, C-R equations with applications.
4. To understand the basic techniques of statistics like correlation, regression, and curve fitting for data analysis, Machine learning, and AI.
5. To understand some advanced topics of probability, random variables with their distributions and expectations.

Course Outcomes: On successful completion, of course, learner/student will be able to:

1. Understand the concept of Laplace transform and its application to solve the real integrals in engineering problems.
2. Understand the concept of inverse Laplace transform of various functions and its applications in engineering problems.
3. Expand the periodic function by using the Fourier series for real-life problems and complex engineering problems.
4. Understand complex variable theory, application of harmonic conjugate to get orthogonal trajectories and analytic functions.
5. Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning, and AI.
6. Understand the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.

Module	Detailed Contents	Hours
01	**Module: Laplace Transform** 1.1 Definition of Laplace transform, Condition of Existence of Laplace transform. 1.2 Laplace Transform (L) of standard functions like e^{at}, $sin(at)$, $cos(at)$, $sinh(at)$, $cosh(at)$ and $t^n, n \geq 0$. 1.3 Properties of Laplace Transform: Linearity, First Shifting Theorem, Second Shifting Theorem, Change of Scale, Multiplication by *t*, Division by *t*, Laplace Transform of derivatives and integrals (Properties without proof). 1.4 Evaluation of real improper integrals by using Laplace Transformation. **Self-learning Topics:** Laplace Transform: Periodic functions, Heaviside's Unit Step function, Dirac Delta Function , Special functions (Error and Bessel)	6
02	**Module: Inverse Laplace Transform** 2.1 Definition of Inverse Laplace Transform, Linearity property, Inverse Laplace Transform of standard functions, Inverse Laplace transform using derivatives. 2.2 Partial fractions method to find Inverse Laplace transform. 2.3 Inverse Laplace transform using Convolution theorem (without proof) **Self-learning Topics:** Applications to solve initial and boundary value problems involving ordinary differential equations.	6
03	**Module: Fourier Series:** 3.1 Dirichlet's conditions, Definition of Fourier series and Parseval's Identity (without proof). 3.2 Fourier series of periodic function with period 2π and $2l$. 3.3 Fourier series of even and odd functions. 3.4 Half range Sine and Cosine Series. **Self-learning Topics:** Orthogonal and orthonormal set of functions, Complex form of Fourier Series, Fourier Transforms.	6
04	**Module: Complex Variables:** 4.1 Function *f(z)* of complex variable, Limit, Continuity and Differentiability of *f(z)*, Analytic function: Necessary and sufficient conditions for *f(z)* to be analytic (without proof). 4.2 Cauchy-Riemann equations in Cartesian coordinates (without proof). 4.3 Milne-Thomson method: Determine analytic function *f(z)* when real part (u), imaginary part (v) or its combination (u+v / u-v) is given. 4.4 Harmonic function, Harmonic conjugate and Orthogonal trajectories. **Self-learning Topics:** Conformal mapping, Linear and Bilinear mappings, cross ratio, fixed points and standard transformations.	6

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Module	Detailed Contents	Hours
05	**Module: Statistical Techniques** 5.1 Karl Pearson's coefficient of correlation (r) 5.2 Spearman's Rank correlation coefficient (R) (with repeated and non-repeated ranks) 5.3 Lines of regression 5.4 Fitting of first and second degree curves. **Self-learning Topics:** Covariance, fitting of exponential curve.	6
06	**Module: Probability** 6.1 Definition and basics of probability, conditional probability. 6.2 Total Probability theorem and Bayes' theorem. 6.3 Discrete and continuous random variable with probability distribution and probability density function. 6.4 Expectation, Variance, Moment generating function, Raw and central moments up to 4^{th} order. **Self-learning Topics:** Skewness and Kurtosis of distribution (data).	6

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Term Work:

General Instructions:

1. Batch wise tutorials have to be conducted. The number of students per batch will be as per University pattern for practicals.
2. Students must be encouraged to write at least 6 class tutorials on the entire syllabus.
3. A group of 4-6 students should be assigned a self-learning topic. Students should prepare a presentation/problem solving of 10-15 minutes. This will be considered as a mini project in Engineering Mathematics. This project will be graded out of 10 marks depending on the performance of the students.

The distribution of Term Work marks will be as follows –

1.	Attendance (Theory and Tutorial)	05 marks
2.	Class Tutorials on entire syllabus	10 marks
3.	Mini project	10 marks

Assessment:

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Internal Assessment Test:

The assessment consists of two class tests of 20 marks each. The 1st class test (Internal Assessment I) has to be conducted when approximately 40% of the syllabus is completed. The 2nd class test has to be conducted (Internal Assessment II) when an additional 35% syllabus is completed. The duration of each test will be for one hour.

End Semester Theory Examination:

1. The question paper will comprise a total of 6 questions, each carrying 20 marks.
2. Out of the 6 questions, 4 questions have to be attempted.
3. Question 1, based on the entire syllabus, will have 4 sub-questions of 5 marks each and is compulsory.
4. Question 2 to Question 6 will have 3 sub-questions, each of 6, 6, and 8 marks, respectively.
5. Each sub-question in (4) will be from different modules of the syllabus.
6. Weightage of each module will be proportional to the number of lecture hours, as mentioned in the syllabus.

References:

1. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited.
3. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa Publication.
4. Complex Variables and Applications, Brown and Churchill, McGraw-Hill Education.
5. Probability, Statistics and Random Processes, T. Veerarajan, McGraw-Hill Education.
6. Theory and Problems of Fourier Analysis with applications to BVP, Murray Spiegel, Schaum's Outline Series.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	TW/Pract	Tut.	Total
XXC401	**Engineering Mathematics-IV**	03	-	01	03	-	01	**04**

Course Code	Course Name	Examination Scheme							
		Theory				Term Work	Pract	Oral	Total
		Internal Assessment			End Sem Exam				
		Test1	Test2	Avg of Test 1 & 2					
XXC401	**Engineering Mathematics-IV**	20	20	20	80	25	-	-	**125**

Pre-requisite: Engineering Mathematics-I, Engineering Mathematics-II, Engineering Mathematics-III, Binomial Distribution.

Course Objectives: The course aims to learn:

1. Matrix algebra to understand engineering problems.
2. Line and Contour integrals and expansion of a complex valued function in a power series.
3. Z-Transforms and Inverse Z-Transforms with its properties.
4. The concepts of probability distributions and sampling theory for small samples.
5. Linear and Non-linear programming problems of optimization.

Course Outcomes: On successful completion, of course, learner/student will be able to:

1. Apply the concepts of eigenvalues and eigenvectors in engineering problems.
2. Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
3. Apply the concept of Z- transformation and inverse in engineering problems.
4. Use the concept of probability distribution and sampling theory to engineering problems.
5. Apply the concept of Linear Programming Problems to optimization.
6. Solve Non-Linear Programming Problems for optimization of engineering problems.

Module	Detailed Contents	Hours
01	**Module: Linear Algebra (Theory of Matrices)** 1.1 Characteristic Equation, Eigenvalues and Eigenvectors, and properties (without proof) 1.2 Cayley-Hamilton Theorem (without proof), verification and reduction of higher degree polynomials 1.3 Similarity of matrices, diagonalizable and non-diagonalizable matrices **Self-learning Topics:** Derogatory and non-derogatory matrices, Functions of Square Matrix, Linear Transformations, Quadratic forms.	6
02	**Module: Complex Integration** 2.1 Line Integral, Cauchy's Integral theorem for simple connected and multiply connected regions (without proof), Cauchy's Integral formula (without proof). 2.2 Taylor's and Laurent's series (without proof). 2.3 Definition of Singularity, Zeroes, poles of $f(z)$, Residues, Cauchy's Residue Theorem (without proof) **Self-learning Topics:** Application of Residue Theorem to evaluate real integrations.	7

Module	Detailed Contents	Hours
03	**Module: Z Transform** 3.1 Definition and Region of Convergence, Transform of Standard Functions: $\{k^n a^k\}$, $\{a^{\lvert k \rvert}\}$, $\{{}^{k+n}_{n}C.\, a^k\}$, $\{c^k \sin(\alpha k+\beta)\}$, $\{c^k \sinh \alpha k\}$, $\{c^k \cosh \alpha k\}$. 3.2 Properties of Z Transform: Change of Scale, Shifting Property, Multiplication, and Division by k, Convolution theorem. 3.3 Inverse Z transform: Partial Fraction Method, Convolution Method. **Self-learning Topics:** Initial value theorem, Final value theorem, Inverse of Z Transform by Binomial Expansion	5
04	**Module: Probability Distribution and Sampling Theory** 4.1 Probability Distribution: Poisson and Normal distribution 4.2 Sampling distribution, Test of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Degree of freedom. 4.3 Students' t-distribution (Small sample). Test the significance of mean and Difference between the means of two samples. Chi-Square Test: Test of goodness of fit and independence of attributes, Contingency table. **Self-learning Topics:** Test significance for Large samples, Estimate parameters of a population, Yate's Correction.	6
05	**Module: Linear Programming Problems** 5.1 Types of solutions, Standard and Canonical of LPP, Basic and Feasible solutions, slack variables, surplus variables, Simplex method. 5.2 Artificial variables, Big-M method (Method of penalty) 5.3 Duality, Dual of LPP and Dual Simplex Method **Self-learning Topics:** Sensitivity Analysis, Two-Phase Simplex Method, Revised Simplex Method.	6
06	**Module: Nonlinear Programming Problems** 6.1 NLPP with one equality constraint (two or three variables) using the method of Lagrange's multipliers 6.2 NLPP with two equality constraints 6.3 NLPP with inequality constraint: Kuhn-Tucker conditions **Self-learning Topics:** Problems with two inequality constraints, Unconstrained optimization: One-dimensional search method (Golden Search method, Newton's method). Gradient Search method	6

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5. Operations Research: An Introduction, Hamdy A Taha, Pearson.
6. Engineering Optimization: Theory and Practice, S.S Rao, Wiley-Blackwell.
7. Operations Research, Hira and Gupta, S. Chand Publication.