Course Code	Course Name	Credits
MTC401	**Applied Mathematics-IV**	**04**

Pre-requisite:

Engineering Mathematics-I, Engineering Mathematics-II, Engineering Mathematics-III,

Objectives:

1) To study the concept of Vector calculus & its applications in engineering.
2) To study Line and Contour integrals and expansion of complex valued function in a power series.
3) To familiarize with the concepts of statistics for data analysis.
4) To acquaint with the concepts of probability, random variables with their distributions and expectations.
5) To familiarize with the concepts of probability distributions and sampling theory with its applications.

Outcomes: Learner will be able to….

1) Apply the concept of Vector calculus to evaluate line integrals, surface integrals using Green's theorem, Stoke's theorem & Gauss Divergence theorem.
2) Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
3) Apply the concept of Correlation, Regression and curve fitting to the engineering problems in data science.
4) Illustrate understanding of the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.
5) Apply the concept of probability distribution to engineering problems & Testing hypothesis of small samples using sampling theory
6) Apply the concepts of parametric and nonparametric tests for analyzing practical problems.

Module	Detailed Contents	Hrs.
01	**Module : Vector Calculus** Solenoidal and irrotational (conservative) vector fields. Line integrals – definition and problems. Green's theorem (without proof) in a plane, Stokes' theorem (without Proof), Gauss' Divergence theorem (without proof) and problems (only evaluation). **SelfLearningTopics**: Identities connecting Gradient, Divergence and Curl, Angle between surfaces. Verifications of Green's theorem, Stoke's theorem & Gauss-Divergence theorem, related identities & deductions.	**06**
02	**Module: Complex Integration** Line Integral, Cauchy's Integral theorem for simple connected and multiply connected regions (without proof), Cauchy's Integral formula (without proof). Taylor's and Laurent's series (without proof). 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.	**06**

03	**Module: Statistical Techniques** Karl Pearson's Coefficient of correlation (r) and related concepts with problems Spearman's Rank correlation coefficient (R) (Repeated& non repeated ranks problems), Lines of regression, Fitting of first and second degree curves. **Self-learning Topics:** Covariance, fitting of exponential curve.	**06**
04	**Module: Probability Theory:** Conditional probability, Total Probability and Baye's Theorem. Discrete and Continuous random variables, Probability mass and density function, Probability distribution for random variables, Expectation, Variance, Co-variance, moments, Moment generating functions, (Four moments about the origin &about the mean). **Self- learning Topics:** Properties variance and covariance,	**06**
05	**Module: Probability Distribution and Sampling Theory-I** Probability Distribution: Poisson and Normal distribution, Sampling distribution, Test of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Degree of freedom. Students't-distribution (Small sample). Test the significance of single sample mean and two independent sample means and paired t-test) **Self -learning Topics: Test** of significance of large samples, Proportion test, Survey based project.	**06**
06	**Module: Sampling theory-II** 6.1 Chi-square test: Test of goodness of fit and independence of attributes (Contingency table) including Yate's Correction. 6.2 Analysis of variance: F-test (significant difference between variances of two samples) **Self- learning Topics:** ANOVA**:** One way classification, Two-way classification (short-cut method).	**06**

Assessment:

Term Work:

General Instructions:

1) Batch wise tutorials are to be conducted. The number of students per batch should be as per University pattern for practical.
2) Students must be encouraged to write at least 6 class tutorials on 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 should be considered as mini project in Engineering mathematics. This project should be graded for 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

Internal Assessment for 20 marks: Consisting Two Compulsory Class Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour.

End Semester Examination: Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total six questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four questions need to be solved.

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. Vector Analysis, Murray R. Spiegel, Schaum Series
4. Complex Variables and Applications, Brown and Churchill, McGrawHillEducation
5. Probability, Statistics and Random Processes, T. Veerarajan, Mc. GrawHillEducation.