IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

Department of Mathematics

Minor Certification Courses

Scheme & Syllabus

S. No.	Semester	Subject Code	Subject Name	Contact Hours Per Week			Total Credits
				L	T	P	
1	V		Complex Analysis	4	0	0	4
2	VI		Fourier Analysis and Applications	4	0	0	4
3	VII		Basic Algebra	4	0	0	4
4	VIII		Statistics and Probability Theory	3	0	0	3
Total				**15**	**0**	**0**	**15**
Total Academic Engagement and Credits				**15**			**15**

***L: Lecture, T: Tutorial, P: Practical**

	Complex Analysis	4L:0T:0P (4 Hrs)	4 Credits

Course Objective:
The objective of this course is to understand various concepts of Complex Analysis and apply to engineering.

Module 1: **(08 Hours)**
Complex number and the point at infinity, Polar form of complex number, Triangle inequality, Limits , continuity and differentiation.

Module 2: **(08 Hours)**
Analytic functions, Zeroes of analytic functions, Cauchy-Riemann equations, Cauchy-Grousat Theorem, Cauchy's Integral theorem, Cauchy's integral formula.

Module 3: **(08 Hours)**
Singularities, Zeroes and poles, Residue, Residue theorem, Mobius Transformations, Properties of Mobius transformations.

Module 4: **(08 Hours)**
Power series, their analyticity, Rouche's Theorem, Open mapping theorem, Taylor and Laurent series

Module 5: **(08 Hours)**
Solution Integrals, Maximum Modulus Principle, Argument Principle, Conformal mappings, Contour integrals, Convergence Tests.

Course Outcome:
CO1. To describe and apply functions of complex variable in various problems appearing in engineering.
CO2. To learn about Analytic functions , their properties and uses in different engineering problems.
CO3. To understand and use the concept of Residue and Mobius Transformations in engineering problems.
CO4. To interpret and apply the concept of Power series in different problems of engineering.
CO5. To understand and use the concept of Contour integrals and Conformal mappings in engineering problems.

Textbooks/References:

- R. V. Churchill and J. W. Brown, Complex Variables and Applications, 5th Edition, McGraw-Hill, 1990.
- J. H. Mathews and R. W. Howell, Complex Analysis for Mathematics and Engineering, 3rd Edition, Narosa, 1998.
- T. Needham, Visual Complex Analysis, Oxford University Press, 1999.
- Gamelin, Complex Analysis, Springer International Edition, 2001

	Fourier Analysis & Application	4L:0T:0P (4 Hrs)	4 Credits

Course Objective:
The objective of this course is to understand various concepts of Fourier Analysis and apply to engineering.

Module 1: **(08 Hours)**
Fourier Series: Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave forms: Square wave, Half wave Rectifier, Full wave Rectifier, Sawtoothed wave, Triangular wave.

Module 2: **(08 Hours)**
Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π and $2l$, Dirichlet's conditions, Sum of Fourier series. Theorem for the convergence of Fourier Series (statement only).

Module 3: **(08 Hours)**
Fourier Series of a function with its periodic extension. Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval's identity (statement only).

Module 4: **(08 Hours)**
Fourier Transform and its Properties: Linearity, Shifting, Change of scale, Modulation. Examples. Fourier Transform of Derivatives. Examples. Convolution Theorem (statement only), Inverse of Fourier Transform.

Module 5: **(08 Hours)**
Applications of Fourier Analysis: Applications to ordinary differential equation, Applications of Fourier transform to evaluate some integrals, Applications of Fourier transform to Simple one dimensional heat transfer equations, wave equations & Laplace equations.

Course Outcome:
CO1. To learn about Fourier Series, their properties and uses in different engineering problems.
CO2. To understand and use the concept of Dirichlet's conditions in engineering problems.
CO3. To describe and apply concept of Half Range Fourier Series in various problems appearing in engineering.
CO4. To interpret and apply the concept of Fourier Transform and its Properties in different problems of engineering.
CO5. To learn about Applications of Fourier Analysis in engineering problems.

Textbooks/References:

- G. B. Folland, Fourier Analysis and its applications, Wadsworth and Brooks/Cole, California 1992.
- H. Dym and H. P. McKean: Fourier Series and Integrals, Academic Press, 1972.
- T. W. Körner: Fourier Analysis, Cambridge Univ. Press, 1988.
- E. M. Stein and R. Shakarchi: Fourier Analysis, Princeton Univ. Press, 2003.
- J. S. Walker: Fourier Analysis, Oxford Univ. Press, 1988.

	Basic Algebra	4L:0T:0P (4 Hrs)	4 Credits

Course Objective:
The objective of this course is to provide fundamental knowledge of Basic Algebra and apply to engineering.

Module 1: **(8 Hours)**
Sets, Relations, Functions, Partial orders, Equivalence relations, Partitions, Division algorithm for integers, Primes, Unique factorization, Euler ϕ-function and Lattices.

Module 2: **(8 Hours)**
Vector space, Subspace, Quotient spaces, Linear dependence and independence, Basis, Basis Extension Theorem, Linear transformations.

Module 3: **(8 Hours)**
Monoids, Groups. Subgroups and factor groups, Lagrange`s Theorem, Homeomorphisms, Normal subgroups. Quotients of groups, Symmetric groups, Matrix groups, Cyclic groups, Simple groups and solvable groups, Nilpotent groups.

Module 4: **(8 Hours)**
Boolean Algebra, Definition, Fundamental Theorems of Boolean Algebra, The Existence and the Oneness of the Boolean Functions, Representing Logical Functions and Arithmetic Operations by Logical Gates.

Module 5: **(8 Hours)**
Connectivity, Matching, Coloring, Counting, Recurrence Relations, Generating functions.

Course Outcome:
CO1. To describe and apply concept of Sets, Relations and Functions in various problems appearing in engineering.
CO2. To understand and use the concept of Vector space in engineering problems.
CO3. To learn about Group theory, their properties and uses in different engineering problems.
CO4. To interpret and apply the concept of Boolean Algebra and its Properties in different problems of engineering.
CO5. To understand and use the concept of Recurrence Relations in engineering problems.

Textbooks/References:

1. M. Artin, Algebra, Prentice Hall of India, 1994.
2. D. S. Dummit and R. M. Foote, Abstract Algebra, 2nd Edition, John Wiley, 2002.
3. J. A. Gallian, Contemporary Abstract Algebra, 4th Edition, Narosa, 1999
4. K. D. Joshi, Foundations of Discrete Mathematics, Wiley Eastern, 1989.
5. T. T. Moh, Algebra, World Scientific, 1992.
6. S. Lang, Undergraduate Algebra, 2nd Edition, Springer, 2001.
7. S. Lang, Algebra, 3rd Edition, Springer (India), 2004.
8. J. Stillwell, Elements of Algebra, Springer, 1994.

	Probability and Statistics:	**3L:0T:0P (4 Hrs)**	**3 Credits**

Course Objective:
The objective of this course is to understand various concepts of Probability and Statistics and apply to engineering.

Module 1: **(08 Hours)**
Review of basic probability, Sample spaces, events, the axioms of probability, addition rule ,conditional probability, multiplication rule, total probability, independence, Baye's Theorem.

Module 2: **(08 Hours)**
Random variables, Probability Distribution, Mathematical Expectation and Variance of Probability distribution, Standard discrete distributions: Binomial, Poisson and Geometric distributions.

Module 3: **(08 Hours)**
Probability density function, Cumulative distribution function, Standard continuous distributions – Uniform, Normal, Exponential, Gumbel distribution.

Module 4: **(08 Hours)**
Covariance, Correlation and linear regression, Transformation of random variables , Central limit theorem for independent and identically distributed random variables.

Module 5: **(08 Hours)**
Sampling distributions, Estimation of parameters, Statistical hypothesis, Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean and variance .

Course Outcome:
CO1. To describe and apply concept of basic probability in various problems appearing in engineering.
CO2. To understand and use the concept of Random variables and Probability Distribution in engineering problems.
CO3. To learn about Probability density function, their properties and uses in different engineering problems.
CO4. To interpret and apply the concept of Correlation and linear regression in different problems of engineering.
CO5. To understand and use the concept of Sampling distributions in engineering problems.

Textbooks/References:

- E. Walpole, R. H. Mayers, S. L. Mayers and K. Ye, (2007), Probability and Statistics for Engineers and Scientists,8th Edition, Pearson Education, ISBN: 978-8-131-71552-9.
- Sheldon M. Ross, (2011), Introduction to Probability and Statistics for Engineers and Scientists, 4th Edition, Academic Foundation, ISBN: 978-8-190-93568-5.

- Douglas C. Montgomery, (2012), Applied Statistics and Probability for Engineers, 5th Edition, , Wiley India, ISBN: 978-8-126-53719-8.
- Spiegel, M. R., Schiller, J. and Srinivasan, R. A., (2010), Probability & Statistics, 3rdEdition, TataMcGraw Hill, ISBN : 978-0-070-15154-3.