19BSM804 - ADVANCED MATHEMATICAL PHYSICS										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	--	--	3	3	25	50	25	--	--	100

OBJECTIVES

1. Course consists of trending topics in geometry, coordinate transformations, generalized coordinates and their relation with Vector analysis.

2. Highlight applications of mathematical methods to physical systems which shed light on both the mathematics and the logic underpinning physical models.

SYLLABUS

Unit-I	**10**

Curvilinear Co-ordinate System: Coordinate systems, Orthogonal curvilinear co-ordinates, Condition for Orthogonality, Reciprocal sets of two triads of mutually orthogonal vectors, Gradient in terms of orthogonal curvilinear co-ordinates, Divergence in terms of orthogonal curvilinear co-ordinates, Curl in terms of curvilinear coordinates, Laplacian in terms of curvilinear co-ordinates.

UNIT II	**10**

Fourier series: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Even and odd functions and their Fourier expansions. Application. Summing of Infinite Series. Term-by-Term differentiation and integration of Fourier Series. Parseval Identity, Fast Fourier Transform (FFT)

UNIT III	**10**

General Solution of Wave Equation in 1 Dimension. Transverse Vibrations of Stretched Strings. Oscillations of Hanging Chain. Wave Equation in 2 and 3 Dimensions. Vibrations of Rectangular and Circular Membranes.

UNIT IV	**9**

Heat Flow in One, Two, and Three Dimensions. Heat Flow in Rectangular Systems of Finite Boundaries. Temperature inside Circular Plate. Laplace Equation in Cartesian, Cylindrical and Spherical Coordinate Systems. Problems of Steady Flow of Heat in Rectangular and Circular Plate

Unit V	**13**

(i) **Useful NPTEL Lectures Link:** https://nptel.ac.in/courses/108104087/8 (Rectangular coordinate and Cylindrical coordinate system)
(ii) https://nptel.ac.in/courses/122107037/24 (Fourier Series part 1)
(iii) https://nptel.ac.in/courses/122107037/25 (Fourier Series part 2)
(iv) https://nptel.ac.in/courses/122107037/26 (Convergence of Fourier series)
(v) https://nptel.ac.in/courses/111106100/54 (Temperature in a infinite rod)
(vi) https://nptel.ac.in/courses/111106100/55 (Temperature in a semi-infinite rod)
(vii) https://nptel.ac.in/courses/111106100/57 (Temperature in a finite rod)
(viii) https://nptel.ac.in/courses/111106100/58 (Temperature in a finite rod with insulated ends)
(ix) https://nptel.ac.in/courses/111106100/59 (Laplace equation in a Rectangle)

(x) https://nptel.ac.in/courses/111106100/49 (Finite length string vibrations)

(xi) https://nptel.ac.in/courses/111106100/50 (Finite length string vibrations Continued)

APPROXIMATE TOTAL	**52 Hours**

OUTCOMES

1. Solve physical and realistic problems involving complex coordinate systems other than Cartesian Coordinate system,
2. Analyse and understand the signal processing problems.
3. Study and contribute in heat-flow problems by means of diffusion equation and similarly student will develop understanding of wave equation and Laplace equation and the method of solution of these two in mathematical as well as application perspective.

TEXTS AND REFERENCES

1. Mathematical Methods in Physical Science Mary L Boas, Second Edition, John Wiley & Sons
2. Mathematical Physics, B D Gupta, Second Revised Edition, Vikas Publishing House Pvt.Ltd.
3. Vector Analysis, D Spellman, M Spiegel and S Lipschutz, Schaum Series.
4. Mathematical Methods for Physics, George B. Arfken and Hans J. Weber, Academic Press, INC(Forth Edition)