CURRICULUM-2016
(Effective from Academic year 2016-2017)

.

APPLICABLE TO ALL B.TECH COURSES

S.No	Course Code	Semester	Category	Common to Branches	Course Name	L	T	P	C
1	15MA101	I	B	All branches except Bio group and B.Arch	Calculus and Solid Geometry	3	1	0	4
2	15MA103	I	B	Bio group	Matrices and Calculus	3	1	0	4
3	15MA102	II	B	All branches except Bio group	Advanced Calculus and Complex Analysis	3	1	0	4
4	15MA104	II	B	Bio group	Multiple Integrals and Differential Equations	3	1	0	4
5	15MA201	III	B	CSE, SWE, ECE, EEE, ICE, EIE, MECHT	Transforms and Boundary Value Problems	4	0	0	4
6	15MA202	III	B	AUTO, AERO, MECH, NANO, CIVIL and CHEMICAL	Fourier Series, Partial Differential Equations and Their Applications	4	0	0	4
7	15MA203	III	B	IT	Discrete Mathematics for Information Technology	4	0	0	4
8	15MA204	III	B	BME	Transform Techniques and Partial Differential Equations for Biomedical Engineering	4	0	0	4
9	15MA205B	III	B	Common To All Lateral entry students	Mathematics (LE)	4	0	0	4
10	15MA206	IV	B	AUTO, AERO, MECH, MECHT, EEE, CIVIL, CHEMICAL, EIE, BME	Numerical Methods	4	0	0	4
		V	B	NANO	Numerical Methods	4	0	0	4
11	15MA207	IV	B	IT, CSE, SWE	Probability and Queuing Theory	4	0	0	4
12	15MA209	IV	B	ECE, NANO	Probability and Random Processes	4	0	0	4
13	15MA210	IV	B	Genetics	Bio-Statistics	4	0	0	4
		VII	B	Biotech					

14	15MA301	V	B	AUTO, AERO, MECH, MECHT, CIVIL, EIE, BME	Probability and Statistics	4	0	0	4
		VI	B	EEE	Probability and Statistics	4	0	0	4
15	15MA302	V	B	CSE, SWE, EEE, ECE	Discrete Mathematics	4	0	0	4
16	15MA305	VI	B	IT	Statistics for Information Technology	4	0	0	4
17	15MA306	VI	B	MECH	Calculus of Variations and Non-linear Programming	3	0	0	3

ELECTIVES

1	15MA315E	VI/VII/VIII	E	COMMON TO ALL BRANCEHES	GRAPH THORY	3	0	0	3
2	15MA316E	VI/VII/VIII	E	COMMON TO ALL BRANCEHES	STOCHASTIC PROCESSES	3	0	0	3
3	15MA317E	VI/VII/VIII	E	COMMON TO ALL BRANCEHES	OPTIMIZATION TECHNIQUES	3	0	0	3
4	15MA318E	VI/VII/VIII	E	COMMON TO ALL BRANCEHES	FUZZY APPROACHES IN ENGINEERING MATHEMATICS	3	0	0	3
5	15MA319E	VI/VII/VIII	E	COMMON TO ALL BRANCEHES	NON LINEAR PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS	3	0	0	3
6	15MA320E	VI/VII/VIII	E	COMMON TO ALL BRANCEHES	CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS	3	0	0	3
7	15MA321E	VI/VII/VIII	E	COMMON TO ALL BRANCEHES	LINEAR ALGEBRA	2	0	0	2

15MA101	CALCULUS AND SOLID GEOMETRY	L	T	P	C
		3	1	0	4
Co-requisite:	NA				
Prerequisite:	NA				
Data Book / Codes/Standards					
Course Category	B CORE MATHEMATICS				
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To acquire analytical ability on solving Calculus and Solid Geometry problems as applied to the respective all branches of Engineering.		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	Apply advanced matrix knowledge to Engineering problems.	a	e
2.	Equip themselves familiar with functions of several variables.	a	e
3.	Familiarize with the applications of ordinary differential equations	a	e
4.	Improve their ability in solving geometrical applications of differential calculus problems.	a	e
5.	Expose to the concept of three dimensional analytical geometry.	a	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: MATRICES	**12**			
1.	Characteristic equation	1	C,I	1	1-7
2.	Eigen values and Eigen vectors of a real matrix	2	C,I	1	1-7
3.	Properties of Eigen values	2	C,I	1	1,3,4,6
4.	Cayley – Hamilton theorem orthogonal reduction of a symmetric matrix to diagonal form	2	C,I	1	1,3,4,6
5.	Orthogonal matrices	1	C,I	1	1,3,4
6.	Reduction of quadratic form to canonical form	2	C,I	1	1,3,4,6
7.	Quadratic form to canonical form by orthogonal transformations.	2	C,I	1	1,3
	UNIT II: FUNCTIONS OF SEVERAL VARIABLES	**12**			

8.	Function of two variables – Partial derivatives	2	C,I	2	1,3,4,6
9.	Total differential	2	C,I	2	1,3,4,6
10.	Taylor's expansion	2	C,I	2	1,3
11.	Maxima and Minima	2	C,I	2	1,3,4,6
12.	Constrained Maxima and Minima by Lagrangian Multiplier method	2	C,I	2	1,3,
13.	Jacobians	2	C,I	2	1-7
	UNIT III: ORDINARY DIFFERENTIAL EQUATIONS	**12**			
14.	Linear equations of second order with constant and variable coefficients	2	C,I	3	2,5,7
15.	Homogeneous equation of Euler type	2	C,I	3	2,5,7,1
16.	Homogeneous equation of Legendre's Type	2			
17.	Equations reducible to homogeneous form	2	C,I	3	2,5,7
18.	Variation of parameters	2	C,I	3	1,2
19.	Simultaneous first order with constant co-efficient.	2	C,I	3	1,2
	UNIT IV: GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	**12**			
20.	Curvature – Cartesian coordinates	2	C,I	4	7
21.	Curvature – polar coordinates	2	C,I	4	7
22.	Circle of curvature	2	C,I	4	1
23.	Centre of curvature	2	C,I	4	7
24.	Evolutes	2	C,I	4	4,5
25.	Envelopes	2	C,I	4	7
	UNIT V: THREE DIMENSIONAL ANALYTICAL GEOMETRY	**12**			
26.	Equation of a sphere – Plane section of a sphere	2	C,I	5	3,4
27.	Tangent Plane – Orthogonal spheres	2	C,I	5	3,4
28.	Equation of a cone	2	C,I	5	4
29.	Right circular cone	2	C,I	5	3,4
30.	Equation of a cylinder	2	C,I	5	2,3
31.	Right circular cylinder.	2	C,I	5	3,4
	Total contact hours	60			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Kreyszig.E, "*Advanced Engineering Mathematics*", John Wiley & Sons. Singapore, 10^{th} edition, 2012.
2.	K.Ganesan, Sundarammal Kesavan, K.S.Ganapathy Subramanian &V.Srinivasan, "*Engineering Mathematics*",Gamma publications, Revised Edition, 2013.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 42^{nd} Edition,2012.
4.	Veerajan. T, "*Engineering Mathematics I*", Tata McGraw Hill Publishing Co, New Delhi, 5th edition, 2006.
5.	Kandasamy P etal. "*Engineering Mathematics*", Vol.I (4th revised edition), S.Chand &Co., New Delhi, 2000.
6.	Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., "*Advanced Mathematics for Engineering students*", Volume I (2nd edition), S.Viswanathan Printers and Publishers, 1992.
7.	Venkataraman M.K., "*Engineering Mathematics*" – First Year (2nd edition), National Publishing Co., Chennai, 2000.

Course nature		**Theory**					
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15MA102	ADVANCED CALCULUS AND COMPLEX ANALYSIS	L	T	P	C
		3	1	0	4
Co-requisite:	NA				
Prerequisite:	15MA101				
Data Book / Codes/Standards	NA				
Course Category	B CORE MATHEMATICS				
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To acquire analytical ability on solving Advanced Calculus and Complex Analysis problems as applied to the respective branches of Engineering.	
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able to		
1.	Apply multiple integrals knowledge to Engineering problems.	a e
2.	Improve their ability in solving vector calculus problems.	a e
3.	Equip themselves familiar with Laplace Transforms.	a e
4.	Familiarize with the applications of analytic functions.	a e
5.	Expose to the concept of complex integration.	a e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: MULTIPLE INTEGRALS	**12**			
1.	Evaluation of double integration in Cartesian and plane polar coordinates	2	C,I	1	1-7
2.	Evaluation of double integral by changing of order of integration	2	C, I	1	1,3,4,6
3.	Area as a double integral (Cartesian and polar)	2	C, I	1	1,3,4,6
4.	Triple integration in Cartesian coordinates	2	C, I	1	1,3,4,6
5.	Conversion from Cartesian to polar in double integrals	2	C, I	1	1,3,4,6
6.	Volume as a Triple Integral.	2	C, I	1	1,3,4,6
	UNIT II: VECTOR CALCULUS	**12**			
7.	Review of vectors in 2,3 dimensions ,Gradient, divergence, curl – Solenoidal and irrotational fields	2	C,I	2	1,3,4,6

8.	Vector identities (without proof) – Directional derivatives	2	C, I	2	1,3
9.	Line, surface and volume integrals	2	C, I	2	1,3
10.	Green's theorem (without proof),	2	C, I	2	1,3
11.	Gauss divergence theorem (without proof), verification and applications to cubes and parallelopipeds only	2	C, I	2	1,3
12.	Stoke's theorems (without proof) – Verification and applications to cubes and parallelopipeds only.	2	C, I	2	1,3
	UNIT III: LAPLACE TRANSFORMS	**12**			
13.	Transforms of standard functions –properties – Transforms of derivatives and integrals	2	C,I	3	2,5,7
14.	Initial and final value theorems (without proof)	2	C, I	3	2,5,7,1
15.	Inverse Laplace transforms	2	C, I	3	2,5,7
16.	ILT using Convolution theorem -problems only	2	C, I	3	1,2
17.	LT of periodic functions -problems only	2	C, I	3	1,2
18.	Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficient only	2	C, I	3	1,2
	UNIT IV: ANALYTIC FUNCTIONS	**12**			3.6
19.	Definition of Analytic Function – Cauchy Riemann equations	2	C,I	4	7
20.	Properties of analytic function functions	2	C,I	4	1,2
21.	Determination of analytic function using – Milne-Thomson's method	2	C, I	4	1
22.	Conformal mappings: magnification and rotation	2	C,I	4	1,2
23.	Conformal mappings: inversion and reflection	2	C, I	4	4,5
24.	bilinear transformation	2	C, I	4	1,2
	UNIT V: COMPLEX INTEGRATION	**12**			
25.	Cauchy's integral theorem (without proof) –and its applications	2	C,I	5	3,4
26.	Cauchy's integral formulae	2	C,I	5	3,4
27.	Taylor's and Laurent's expansions with simple problems	2	C, I	5	4
28.	Singularities – Types of Poles and Residues	2	C,I	5	3,4
29.	Cauchy's residue theorem (without proof)-	2	C, I	5	2,3
30.	Contour integration: Unit circle, semicircular contour.	2	C, I	5	3,4
	Total contact hours	60			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Kreyszig.E, "*Advanced Engineering Mathematics*", John Wiley & Sons. Singapore, 10^{th} edition, 2012.
2.	K.Ganesan, Sundarammal Kesavan, K.S.Ganapathy Subramanian &V.Srinivasan, "*Engineering Mathematics*",Gamma publications, Revised Edition, 2013.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 42^{nd} Edition,2012.
4.	Veerajan. T, "*Engineering Mathematics I*", Tata McGraw Hill Publishing Co, New Delhi, 5th edition, 2006.
5.	Kandasamy P etal. "*Engineering Mathematics*", Vol.I (4th revised edition), S.Chand &Co., New Delhi, 2000.
6.	Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., "*Advanced Mathematics for Engineering students*", Volume I (2nd edition), S.Viswanathan Printers and Publishers, 1992.
7.	Venkataraman M.K., "*Engineering Mathematics*" – First Year (2nd edition), National Publishing Co., Chennai, 2000.

Course nature		**Theory**					
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15MA103	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4
Co-requisite:	NOT APPLICABLE				
Prerequisite:	NIL				
Data Book / Codes/Standards	NA				
Course Category	B PROFESSIONAL CORE	MATHEMATICS			
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- 2016				

PURPOSE	To emphasize the concepts and the problem solving techniques as applicable to the respective branches of Bio Engineering.	
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able to		
1.	To apply matrix knowledge to Engineering problems	**a** **e**
2.	To improve their ability in trigonometry	**a** **e**
3.	To equip themselves familiar with Differential calculus	**a** **e**
4.	To expose to the concepts integral calculus	**a** **e**
5.	To familiarize with the applications of differential and integral calculus	**a** **e**

Session	Description of Topic	Contact Hours	C-D-I-O	IOs	Reference
	UNIT I – MATRICES	**12**			
1.	Introduction to Matrices	1	C,I	1	1 – 7
2.	Rank of matrix	1	C,I	1	1 – 7
3.	Consistency of a system of ‘m’ linear equations in ‘n’ unknowns.	2	C,I	1	1 – 7
4.	Inconsistency of a system of ‘m’ linear equations in ‘n’ unknowns	1	C,I	1	1 – 7
5.	Introduction to Cayley- Hamilton theorem	1	C,I	1	1 – 7
6.	Cayley- Hamilton theorem applications	2	C,I	1	1 – 7
7.	To find Eigen Values for real matrices	1	C,I	1	1 – 7
8.	To find Eigen vectors for real matrices	2	C,I	1	1 – 7
9.	Properties of Eigen values and Eigen vectors.	1	C,I	1	1 – 7
	UNIT II – TRIGONOMETRY	**12**	C,I	1	1 – 7
10.	Basic Trignometric concepts	1	C,I	2	1 – 7
11.	DeMoivre’s theorem and its applications	2	C,I	2	1 – 7
12.	Expansion of $\sin n\theta$ *and* $\cos n\theta$ in terms of sinθ & cosθ	2	C,I	2	1 – 7

13.	Expansion of tannθ interms of tanθ	2	C,I	2	1 – 7
14.	Expansion of $\sin^n\theta$ in terms of sines and cosines of multiples of θ.	2	C,I	2	1 – 7
15.	Expansion of $\cos^n\theta$ in terms of sines and cosines of multiples of θ.	1	C,I	2	1 – 7
16.	Hyperbolic functions	2	C,I	2	1 – 7
	UNIT III – DIFFERENTIAL CALCULUS	**12**			
17.	Introduction to Differentiation	2	C,I	3	1 – 7
18.	Derivatives of simple functions	2	C,I	3	1 – 7
19.	Successive Differentiation-I	2	C,I	3	1 – 7
20.	Successive Differentiation-II	2	C,I	3	1 – 7
21.	Introduction to Leibnitz theorem	2	C,I	3	1 – 7
22.	Leibnitz theorem 's Applications	2	C,I	3	1 – 7
	UNIT IV –INTEGRAL CALCULUS	**12**			
23.	Introduction to integration	2	C,I	4	1 – 7
24.	Methods of integration	2	C,I	4	1 – 7
25.	Introduction to Definite integrals	2	C,I	4	1 – 7
26.	Properties of Definite integrals	2	C,I	4	1 – 7
27.	Reduction formulae for $\sin^n x, \cos^n x$ (without proof)-Problems	2	C,I	4	1 – 7
28.	Reduction formulae for $\sin^m x \cos^n x$ (without proof)-Problems	2	C,I	4	1 – 7
	UNIT V – APPLICATIONS OF DIFFERENTIAL CALCULUS & INTEGRAL CALCULUS	**12**			
29.	Differential calculus: Tangent	2	C,I	5	1 – 7
30.	Differential calculus: Normal	2	C,I	5	1 – 7
31.	Differential calculus: Radius of curvature	2	C,I	5	1 – 7
32.	Differential calculus: Velocity	2	C,I	5	1 – 7
33.	Differential calculus: Acceleration	2	C,I	5	1 – 7
34.	Integral calculus: Length & Area	2	C,I	5	1 – 7
	Total Contact Hours	**60**			

LEARNING RESOURCES:

Sl. No.	TEXT BOOKS
1.	E.Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, Singapore, 2012.
2.	K. Ganesan, Sundarammal Kesavan, K. S. Ganapathy Subramanian, V. Srinivasan, Matrices and Calculus, Gamma Publications, 7th Edition, 2015.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Grewal B. S, Higher Engineering Mathematics, Khanna Publications, 42nd Edition.2012.

4.	Veerarajan T., Engineering Mathematics, Tata McGraw Hill Publishing Co., New Delhi, 5th Edition, 2006.
5.	Kandasamy P et al. Engineering Mathematics, Vol. I (4th revised edition), S. Chand & Co., New Delhi, 2000.
6.	Narayanan S., Manicavachagom Pillay T. K., Ramanaiah G., Advanced Mathematics for Engineering students, Volume I (2nd edition), S. Viswanathan Printers and Publishers, 1992.
7.	Venkataraman M.K., Engineering Mathematics – I Year (2nd edition), National Publishing Co., Chennai, 2000.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15MA104	MULTIPLE INTEGRALS AND DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

Co-requisite:	NOT APPLICABLE		
Prerequisite:	15MA103		
Data Book / Codes/Standards	NA		
Course Category	B	PROFESSIONAL CORE	MATHEMATICS
Course designed by	Department of Mathematics		
Approval	-- Academic Council Meeting -- , 2016		

PURPOSE	To impart knowledge and skills in solving mathematical problems as applied to the respective branches of Bio Engineering.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	To understand maxima and minima and minima of functions of two and three variables.	**a**	**e**
2.	To expose to the concepts of Differential equations.	**a**	**e**
3.	To be familiar with Multiple integrals.	**a**	**e**
4.	To have an understanding of vector calculus.	**a**	**e**
5.	To expose to the concept of three dimensional analytical geometry.	**a**	**e**

Session	Description of Topic	Contact Hours	C-D-I-O	IOs	Reference
	UNIT I – FUNCTIONS OF SEVERAL VARIABLES	**12**			
1.	Functions of two variables – Partial derivatives	2	C,I	1	1 – 7
2.	Total differentiation-Euler's theorem	2	C,I	1	1 – 7
3.	Taylor's expansion	2	C,I	1	1 – 7
4.	Maxima and minima of functions of two and three variables	2	C,I	1	1 – 7
5.	Lagrange's Multiplier Method	2			
6.	Jacobians	2	C,I	1	1 – 7
	UNIT II – DIFFERENTIAL EQUATIONS	**12**			
7.	Introduction to Differential equations	1	C,I	2	1 – 7
8.	Linear equations of second order with constant coefficients –Type-1	1	C,I	2	1 – 7
9.	Linear equations of second order with constant coefficients –Type-2	1	C,I	2	1 – 7
10.	Linear equations of second order with constant coefficients –Type-3	1	C,I	2	1 – 7
11.	Linear equations of second order with constant coefficients –Type-4	2	C,I	2	1 – 7
12.	Linear equations of second order with constant coefficients –Type-5	2	C,I	2	1 – 7
13.	Homogeneous equation of second order with variable coefficients	2	C,I	2	1 – 7
14.	Method of variation of parameters	2	C,I	2	1 – 7

	UNIT III – MULTIPLE INTEGRALS:	**12**			
15.	Introduction to Double and Triple integration	2	C,I	3	1 – 7
16.	Evaluation of Double integration in Cartesian coordinates	2	C,I	3	1 – 7
17.	Evaluation of Double integration in Polar coordinates	2	C,I	3	1 – 7
18.	Change of order of integration	2	C,I	3	1 – 7
19.	Area as double integral	2	C,I	3	1 – 7
20.	Triple integration in Cartesian coordinates only.	2	C,I	3	1 – 7
	UNIT IV – VECTOR CALCULUS	**12**			
21.	Gradient, Directional derivatives	1	C,I	4	1 – 7
22.	Divergence and curl	2	C,I	4	1 – 7
23.	Solenoidal field	1	C,I	4	1 – 7
24.	Irrotational field	1	C,I	4	1 – 7
25.	Line, Surface and Volume integrals	2	C,I	4	1 – 7
26.	Green's theorem (without proof) and its applications	1	C,I	4	1 – 7
27.	Stoke's theorem (without proof) and its applications	2	C,I	4	1 – 7
28.	Gauss Divergence theorems (without proof)– Cubes and parallelopipeds only	2	C,I	4	1 – 7
	UNIT V – THREE DIMENSIONAL ANALYTICAL GEOMETRY	**12**			
29.	Direction cosines and direction ratios of a line	2	C,I	5	1 – 7
30.	Angle between two lines	1	C,I	5	1 – 7
31.	Equation of a plane	2	C,I	5	1 – 7
32.	Plane of intersection	1	C,I	5	1 – 7
33.	Equation of straight line	2	C,I	5	1 – 7
34.	Shortest distance between two skew lines	2	C,I	5	1 – 7
35.	Coplanar lines	2	C,I	5	1 – 7
	Total Contact Hours	**60**			

LEARNING RESOURCES:

Sl. No.	**TEXT BOOKS**
1.	E.Kreyszig, *Advanced Engineering Mathematics*, 10th edition, John Wiley & Sons, Singapore, 2012.
2.	K.Ganesan, Sundarammal Kesavan, K.S.Ganapathy Subramanian & V.Srinivasan, *Multiple Integrals and Differential Equations*, 7th Edition, 2015.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Grewal B. S, *Higher Engineering Mathematics*, Khanna Publications, 42nd Edition.2012.
4.	Veerarajan T., *Engineering Mathematics*, Tata McGraw Hill Publishing Co., New Delhi, 5th Edition, 2006.
5.	Kandasamy P etal. *Engineering Mathematics*, Vol. I (4th revised edition), S. Chand & Co., New Delhi, 2000.
6.	Narayanan S., Manicavachagom Pillay T. K., Ramanaiah G., *Advanced Mathematics for Engineering students*, Volume I (2nd edition), S. Viswanathan Printers and Publishers, 1992.
7.	Venkataraman M.K., Engineering Mathematics – I Year (2nd edition), National Publishing Co., Chennai, 2000.

Course nature	**Theory**

Assessment Method (Weightage 100%)

In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**

	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15MA201	**TRANSFORMS AND BOUNDARY VALUE PROBLEMS**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
Co-requisite:	NOT APPLICABLE				
Prerequisite:	15MA102(or)15MA205B				
Data Book / Codes/Standards	NOT APPLICABLE				
Course Category	B CORE MATHEMATICS				
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To acquire analytical ability in solving boundary value problems and transform techniques.		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	To know to formulate and solve partial differential equations	a	E
2.	To have thorough knowledge in Fourier series	a	E
3.	To be familiar with applications of partial differential equations	a	E
4.	To gain good knowledge in the application of Fourier transform	a	E
5.	To learn about Z- transforms and its applications	a	E

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: PARTIAL DIFFERENTIAL EQUATIONS	**14**	C,I	1	1-8
1.	Formation of partial differential equation by eliminating arbitrary constants	1	C,I	1	1-8
2.	Formation of partial differential equation by eliminating arbitrary functions	1	C,I	1	1-8
3.	Formation of partial differential equation by eliminating arbitrary functions of the form $\phi(u,v)=0$	2	C,I	1	1-8
4.	Solution of standard types of first order equations	2	C,I	1	1-8
5.	Reducible to standard type	2	C,I	1	1-8
6.	Lagrange's linear equation: Method of grouping, method of multipliers	2	C,I	1	1-8

7.	Linear Homogeneous partial differential equations of second and higher order with constant coefficients	2	C,I	1	1-8
8.	Linear Homogeneous partial differential equations of second and higher order with constant coefficients	2	C,I	1	1-8
	UNIT II: FOURIER SERIES	**14**			
9.	Introduction of Fourier series -Dirichlet's conditions for existence of Fourier Series	1	C,I	2	1-8
10.	Fourier series –related problems	2	C,I	2	1-8
11.	Fourier series –related problems	2	C,I	2	1-8
12.	Half Range sine series-related problems	2	C,I	2	1-8
13.	Half Range Cosine series-related problems	2	C,I	2	1-8
14.	Parseval's Identity(without proof)-related problems	2	C,I	2	1-8
15.	Harmonic Analysis for finding fundamental harmonic	1	C,I	2	1-8
16.	Harmonic Analysis for finding second and third harmonic	2	C,I	2	1-8
	UNIT III: ONE DIMENSIONAL WAVE & HEAT EQUATION	**12**			
17.	Classification of partial differential equations. Method of separation of variables. One dimensional Wave Equation and its possible solutions	2	C,I	3	1-8
18.	Initial and Boundary value Problems with zero velocity – related problems	2	C,I	3	1-8
19.	Initial and Boundary value Problems with Nonzero velocity- related problems	2	C,I	3	1-8
20.	One dimensional heat equation and its possible solutions	2	C,I	3	1-8
21.	Steady state conditions and zero boundary conditions- related problems	2	C,I	3	1-8
22.	Steady state conditions and Non-zero boundary conditions- related problems	2	C,I	3	1-8
	UNIT IV: FOURIER TRANSFORMS	**10**			
23.	Fourier Transforms- problems	2	C,I	4	1-8
24.	Properties of Fourier transforms-problems	2	C,I	4	1-8
25.	Fourier Sine and Cosine Transforms - problems	1	C,I	4	1-8
26.	Properties of Fourier sine & cosine Transforms-problems	2	C,I	4	1-8
27.	Convolution Theorem	1	C,I	4	1-8
28.	Parseval's Identity for Fourier transform and Fourier sine & cosine transforms	2	C,I	4	1-8
	UNIT V: Z-TRANFORMS AND DIFFERENCE EQUATIONS	**10**			
29.	Z-transform, its elementary properties	1	C,I	5	1-8
30.	Inverse Z-transform, related problems, long division method	2	C,I	5	1-8
31.	Inverse Z-transform - residue theorem method	1	C,I	5	1-8
32.	Convolution theorem (without proof)-applications	1	C,I	5	1-8

33.	Convolution theorem (without proof)-applications	2	C,I	5	1-8
34.	Solution of linear difference equations with constant coefficients using Z-transform	1	C,I	5	1-8
35.	Solution of linear difference equations with constant coefficients using Z-transform	2	C,I	5	1-8
	Total contact hours	**60**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Kreyszig.E, "*Advanced Engineering Mathematics*", 10th edition, John Wiley & Sons. Singapore,2012.
2.	Grewal B.S, "*Higher Engg Maths*", Khanna Publications, 42nd Edition, 2012.
3.	Kandasamy, P., etal., Engineering Mathematics, Vol. II & Vol. III (4th revised edition), S.Chand & Co., New Delhi, 2000
	REFERENCE BOOKS/OTHER READING MATERIAL
4.	Sivaramakrishna Das P. and Vijayakumari.C, A text book of Engineering Mathematics III, Viji's Academy,2010
5.	Narayanan. S., Manickavachagom Pillay. T . and Ramanaiah, G., *Advanced Mathematics for Engineering students*, Volume II & III (2nd edition), S,Viswanathan Printers and Publishers, 1992
6.	Venkataraman, M,K., *Engineering Mathematics* - Vol.III - A & B (13th edition), National Publishing Co., Chennai, 1998.
7.	Sankara Rao, "*Introduction to Partial Differential Equations*", 2nd Edition, PHI Learning Pvt. Ltd., 2006.
8.	Veerarajan, T., '*Engineering mathematics*', Tata McGraw-Hill (Education) India Pvt.Ltd, 2006.

Course nature		**Theory**					
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15MA202	FOURIER SERIES, PARTIAL DIFFERENTIAL EQUATIONS & THEIR APPLICATIONS	L	T	P	C
		4	0	0	4
Co-requisite:	NOT APPLICABLE				
Prerequisite:	15MA102(or)15MA205B				
Data Book / Codes/Standards	NA				
Course Category	B CORE	MATHEMATICS			
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	The purpose of this course is to develop the skills of the students in the areas of boundary value problems and transform techniques.	
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able to		
1.	To know to formulate and solve partial differential equation	**a e**
2.	To have thorough knowledge in Fourier series	**a e**
3.	To learn to solve boundary value problems	**a e**
4.	To be familiar with applications of PDE in two dimensional heat equation	**a e**
5.	To gain good knowledge in the application of Fourier transform	**a e**

Session	Description of Topic	Contact Hours	C-D-I-O	IOs	Reference
	UNIT I – - PARTIAL DIFFERENTIAL EQUATIONS	14			
1.	Formation of partial differential equation by eliminating arbitrary constants	1	C,I	1	1 – 7
2.	Formation of partial differential equation by eliminating arbitrary functions	1	C,I	1	1 – 7
3.	Formation of partial differential equation by eliminating arbitrary functions of the form $\phi(u,v)=0$	2	C,I	1	1 – 7
4.	Solution of standard types of first order equations	2	C,I	1	1 – 7
5.	Solution of standard types of first order equations	2			
6	Lagrange's linear equation of first order	2	C,I	1	1 – 7
7	Linear Homogeneous partial differential equations of second and higher order with constant coefficients.	2	C,I	1	1 – 7
8	Linear Homogeneous partial differential equations of second and higher order with constant coefficients	2	C,I	1	1 – 7
	UNIT II - FOURIER SERIES	14			
9	Introduction of Fourier series -Dirichlet's conditions for existence of Fourier Series	1	C,I	2	1 – 7

10	Fourier series –related problems in $(0,2\pi)$	1	C,I	2	1 – 7
11	Fourier series –related problems in $(-\pi,\pi)$	1	C,I	2	1 – 7
12	Fourier series –related problems in $(0,2l)$	1	C,I	2	1 – 7
13	Fourier series –related problems in $(-l,l)$	1	C,I	2	1 – 7
14	Half Range Cosine series-related problems	2	C,I	2	1 – 7
15	Half Range sine series-related problems	2	C,I		1 – 7
16	Parseval's Identity(without proof)-related problems	2	C,I	2	1 – 7
17	Harmonic Analysis for finding fundamental harmonic, second and third harmonic	1	C,I	2	1 – 7
18	Harmonic Analysis for finding fundamental harmonic, second and third harmonic	2	C.I	2	1 – 7
19	**UNIT III: BOUNDARY VALUE PROBLEMS**	12			
20	Classification of partial differential equations. Method of separation of variables. One dimensional Wave Equation and its possible solutions	2	C,I	3	1 – 7
21	Initial and Boundary value Problems with zero velocity – related problems	2	C,I	3	1 – 7
22	Initial and Boundary value Problems with Nonzero velocity- related problems	2	C,I	3	1 – 7
23	One dimensional heat equation and its possible solutions	2	C,I		1 – 7
24	Steady state conditions and zero boundary conditions- related problems	2	C,I	3	1 – 7
25	Steady state conditions and Non-zero boundary conditions- related problems	2	C,I	3	1 – 7
	UNIT IV: TWO DIMENSIONAL HEAT EQUATION	10			
27	Introduction to two dimensional heat equation and its possible solutions in steady state	2	C,I	4	1 – 7
28	Laplace equation in Cartesian form- Finite plates	2	C,I	4	1 – 7
29	Laplace equation in Cartesian form- Infinite plates	2	C,I	4	1 – 7
30	Laplace equation in Polar form-semi circular, circular,	2	C,I	4	1 – 7
31	Laplace equation in Polar form- Quadrant and Annulus	2	C,I	4	1 – 7
	UNIT V: FOURIER TRANSFORMS	10			
32	Fourier Transforms- Elementary properties of Fourier transforms	2	C,I	5	1 – 7
33	Fourier Transforms and related problems- Fast Fourier Transform	2	C,I		1 – 7
34	Fourier Sine Transforms and their properties-problems	2	C,I	5	1 – 7
35	Fourier Cosine Transforms and their properties-problems	2	C,I		1 – 7
36	Convolution Theorem (without proof)-applications	1	C,I	5	1 – 7
37	Parseval's Identity(without proof)-applications	1	C,I	5	1 – 7
	Total	**60**			

LEARNING RESOURCES:	
Sl. No.	**TEXT BOOKS**
1.	Kreyszig.E, "Advanced Engineering Mathematics", 10th edition, John Wiley & Sons. Singapore,2012.
2.	Grewal B.S, "Higher Engg Maths", Khanna Publications, 42nd Edition, 2012
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Sivaramakrishna Das P. and Vijayakumari.C, A text book of Engineering Mathematics-III,Viji's Academy,2010

4.	Kandasamy, P., etal., Engineering Mathematics, Vol. II & Vol. III (4th revised edition), S.Chand & Co., New Delhi, 2000
5.	Narayanan, S., Manickavachagom Pillay, T.,. and Ramanaiah,G., Advanced Mathematics for Engineering students, Volume II & III (2nd edition), S,Viswanathan Printers Publishers, 1992
6.	Venkataraman, M,K., Engineering Mathematics - Vol.III - A & B (13th edition), National Publishing Co., Chennai, 1998.
7.	Sankara Rao, "Introduction to Partial Differential Equations", 2nd Edition, PHI Learning Pvt. Ltd., 2006.

Course nature	**Theory**

Assessment Method (Weightage 100%)

In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15MA203	DISCRETE MATHEMATICS FOR INFORMATION TECHNOLOGY	L	T	P	C
		4	0	0	4
Co-requisite:	NOT APPLICABLE				
Prerequisite:	15MA102(or)15MA205B				
Data Book / Codes/Standards	NOT APPLICABLE				
Course Category	B CORE	MATHEMATICS			
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To acquire knowledge in discrete mathematical structures as applied to Information Technology students.	
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able to		
1.	To understand mathematical logic and reasoning to count or enumerate objects in systematic way.	a e
2.	To understand set theory, relations and functions to read , understand and construct mathematical arguments.	a e
3.	To understand recurrence relation, generating functions and algebraic systems and their applications in coding theory.	a e
4.	To understand how to apply graph theory to solve real world problems like travelling salesmen problem and networks, problem.	a e
5.	To understand grammers, finite state machine and Finite State Automata.	a e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: MATHEMATICAL LOGIC	**12**			
1.	Proposition – Connectives – Truth Tables	2	C,I	1	1,2,3,4,6,7
2.	Conditional and bi conditional propositions	1	C,I	1	1,2,3,4,6,7
3.	Tautology and contradiction using truth table	1	C,I	1	1,2,3,4,6,7
4.	Tautology and contradiction without using truth table	1	C,I	1	1,2,3,4,6,7
5.	Duality Law	1	C,I	1	1,2,3,4,6,7
6.	Algebra and laws of Algebra of propositions – Tautological Implication	1	C,I	1	1,2,3,4,6,7
7.	Theory of Inference – Direct method of proof	1	C,I	1	1,2,3,4,6,7

8.	Proof using CP Rule	1	C,I	1	1,2,3,4,6,7
9.	Rules of Inference – Inconsistency of premises.	2	C,I	1	1,2,3,4,6,7
10.	Indirect method of proof	1	C,I	1	1,2,3,4,6,7
	UNIT II: COMBINATORICS	**12**			
11.	Pigeonhole Principle – Generalized Pigeon hole principle	2	C,I	2	1,2,3,4,6
12.	Mathematical induction	2	C,I	2	1,2,3,4,6
13.	Generalized Mathematical induction	1	C,I	2	1,2,3,4,6
14.	Recurrence relation – Formation of Recurrence Relation	2	C,I	2	1,2,3,4,6
15.	Solving Homogeneous Recurrence Relation	1	C,I	2	1,2,3,4,6
16.	Non Homogeneous Recurrence Relation	2	C,I	2	1,2,3,4,6
17.	Generating Function Method to solve Recurrence relation	2	C,I	2	1,2,3,4,6
	UNIT III: GROUP THEORY AND CODING THEORY	**12**			
18.	Group – Definition, examples	1	C,I	3	1,2,3,6
19.	Properties of Groups	1	C,I	3	1,2,3,6
20.	Subgroups – Cyclic groups – Properties	2	C,I	3	1,2,3,6
21.	Group Homomorphism – Cosets	1	C,I	3	1,2,3,6
22.	Normal subgroups and properties	2	C,I	3	1,2,3,6
23.	Lagrange's Theorem	1	C,I	3	1,2,3,6
24.	Encoders and Decoders – Group code	2	C,I	3	1,2,3,6
25.	Hamming codes – Error correction - Decoding Group codes	2	C,I	3	1,2,3,6
	UNIT IV: GRAPH THEORY	**12**			
26.	Basic Definitions – Special Graphs	1	C,I	4	1,2,3,4
27.	Matrix Representation of Graphs	1	C,I	4	1,2,3,4
28.	Properties of graphs using Matrix representation	1	C,I	4	1,2,3,4
29.	Paths, Circuits - Shortest path: Definition & Examples	1	C,I	4	1,2,3,4
30.	Shortest path algorithm: Warshall's Algorithm	2	C,I	4	1,2,3,4
31.	Eulerian and Hamiltonian Graphs	1	C,I	4	1,2,3,4
32.	Tree	1	C,I	4	1,2,3,4
33.	Properties of trees	2	C,I	4	1,2,3,4
34.	Spanning Trees	1	C,I	4	1,2,3,4
35.	Minimum Spanning Tree - Krushkal's Algorithm	1	C,I	4	1,2,3,4

	UNIT V: FORMAL LANGUAGES AND AUTOMATA THEORY	**12**			
36.	Phrase structure Grammar – Types of Grammar	2	C,I	5	1,2,3,4,6
37.	Backus-Naur Form-Finite state machine-Input and output string for FSM	2	C,I	5	1,2,3,4,6
38.	Finite state Automata – Definition-Language Accepted by FSA	2	C,I	5	1,2,3,4,6
39.	Deterministic FSA	2	C,I	5	1,2,3,4,6
40.	Non deterministic FSA	1	C,I	5	1,2,3,4,6
41.	Language Accepted NFA	2	C,I	5	1,2,3,4,6
42.	Conversion of an NFA to an equivalent DFA.	1	C,I	5	1,2,3,4,6
	Total contact hours	60			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	J.P. Tremblay, R.Manohar, "Discrete Mathematical Structures with applications to Computer Science" Tata McGraw-Hill Publishing company pvt.Ltd.,New Delhi,35th edition,2008
2.	Veerajan T., Discrete Mathematics with Graph Theory and Combinatorics", 10th edition,Tata McGraw Hill Companies,2010
	REFERENCE BOOKS/OTHER READING MATERIAL
1.	Dr.M.K.Venkataraman, Dr.N.Sridharan N.Chandrasekaran, "Discrete Mathematics", The National Publishing company,2003
2.	Kenneth H.Rosen, "Discrete Mathematics and its Application", Fifth edition, Tata McGraw-Hill Publishing company pvt.Ltd., New Delhi,2003
3.	Narsing Deo, "Graph Theory with applications to Engineering and Computer science", Prentice-Hall of India pvt. Ltd.,New Delhi, 2004
4.	Bernard Kolman, Robert C. Busby, Sharon Culter Ross, Nadeen-ur-Rehman "Discrete Mathematical Structures ", Pearson Education,5th edition,2004
5.	Alan Doerr and Kenneth Levasseur, "Applied Discrete Structures for Computer Science", Galgotia Publications (P) Ltd, 1992.

Course nature		**Theory**					
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15MA204	TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS FOR BIOMEDICAL ENGINEERING	L	T	P	C
		4	0	0	4
Co-requisite:	NOT APPLICABLE				
Prerequisite:	15MA104				
Data Book / Codes/Standards	NA				
Course Category	B CORE	MATHEMATICS			
Course designed by	Department of Mathematics				
Approval	Academic Council Meeting -- 2016				

PURPOSE	To acquire analytical ability in solving mathematical problems as applied to the respective branches of Biomedical Engineering.		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1	They will be able to simulate mathematical models using partial differential equations	~~a~~	**e**
2	Students will be able to have good knowledge in Fourier series	~~a~~	**e**
3	Students will be able to be familiar with one dimensional wave equation and heat equation	~~a~~	**e**
4	Students will be able to gain good knowledge in the application of Fourier transforms	~~a~~	**e**
5	Students will be able to solve using graph theory techniques in real world problems like shortest path and matrix representation of graphs	~~a~~	**e**

Session	Description of Topic	Contact Hours	C-D-I-O	IOs	Reference
	UNIT I – - PARTIAL DIFFERENTIAL EQUATIONS	12			
1.	Introduction to partial differential equations, formation of PDE by elimination of arbitrary constants - problems	1	C,I	1	1 – 3
2.	Formation of partial differential equation by eliminating arbitrary functions - problems	1	C,I	1	1 – 3
3.	Methods to solve the first order PDEs – Type-1, Type-2	1	C,I	1	1 – 3
4.	Methods to solve the first order PDEs – Type-3, Type-4	1	C,I	1	1 – 3
5.	Reduction to standard types	1	C,I	1	1 – 3
6.	Lagrange's linear equations – Method of grouping	1	C,I	1	1 – 3
7.	Lagrange's linear equations – Method of multipliers	2	C,I	1	1 – 3
8.	Linear Homogeneous partial differential equations of second and higher order with constant coefficients: Type-1, Type-2	1	C,I	1	1 – 3
9.	Linear Homogeneous partial differential equations of second and higher order with constant coefficients: Type-3	1	C,I	1	1 – 3
10.	Linear Homogeneous partial differential equations of second and higher order with constant coefficients: Type-4	1	C,I	1	1 – 3

11.	Classification of second order linear PDE – Variable separable method	1	C,I	1	1 – 3
	UNIT II - FOURIER SERIES	12			
12.	Introduction of Fourier series - Dirichlet's conditions	1	C,I	2	1 – 4
13.	General Fourier series $(0,2l)$ interval	2	C,I	2	1 – 4
14.	Problems under $(0,2\pi)$ interval	1	C,I	2	1 – 4
15.	Fourier series of odd and even functions in $(-l,l),(-\pi,\pi)$	2	C,I	2	1 – 4
16.	Half range sine and cosine series $(0,\pi)$	1	C,I	2	1 – 4
17.	Half range sine and cosine series $(0,l)$	1	C,I	2	1 – 4
18.	RMS value - Parseval's Theorem / Identity	2	C,I	3	1 – 4
19.	Harmonic Analysis – Full range problems	1	C,I	3	1 – 4
20.	Harmonic Analysis – Half range problems	1	C,I	3	1 – 4
	UNIT III: ONE DIMENSIONAL WAVE AND HEAT EQUATIONS	12			
21.	Introduction to one dimensional wave equation	2	C,I	3	1 – 5
22.	One dimensional wave equation – Boundary and initial value problems with zero velocity	2	C,I	3	1 – 5
23.	Boundary and initial value problems with non zero velocity	2	C,I	3	1 – 5
24.	One dimensional heat equation – Problems with zero boundary values	2	C,I	3	1 – 5
25.	Steady state conditions and non zero boundary conditions	2	C,I	3	1 – 5
26.	Steady and transient states - problems	2	C,I	3	1 – 5
	UNIT V: FOURIER TRANSFORMS	12			
27.	Introduction to Fourier Transforms - Statement of Fourier integral theorem	1	C,I	4	1 – 5
28.	Complex Fourier Transforms pair – problems	1	C,I	4	1 – 5
29.	Fourier sine transforms – problems	1	C,I	4	1 – 5
30.	Fourier cosine transforms – problems	1	C,I	4	1 – 5
31.	Properties Complex Fourier Transforms	1	C,I	4	1 – 5
32.	Properties Fourier sine and cosine Transforms	2	C,I	4	1 – 5
33.	Properties of simple functions – problems	1	C,I	4	1 – 5
34.	Convolution theorem and its applications	1	C,I	4	1 – 5
35.	Problems based on Parseval's Identity	2	C,I	4	1 – 5
36.	Solution of integral equations using FT	1	C,I	4	1 – 5
	UNIT V: GRAPH THEORY	12			
37.	Basic definitions	1	C,I	5	5,6
38.	Some special simple graphs: Complex, Regular, Bipartite, Sub and Isomorphic Graphs	2	C,I	5	5,6
39.	Matrix representation of graphs	2	C,I	5	5,6
40.	Isomorphism and adjacency matrices – examples	1	C,I	5	5,6
41.	Paths, cycles and connectivity	1	C,I	5	5,6
42.	Shortest path algorithms: Dijkstra's algorithm	2	C,I	5	5,6

43.	Trees, properties of trees	1	C,I	5	5,6
44.	Binary trees and their properties	2	C,I	5	5,6
	TOTAL HOURS	60			

LEARNING RESOURCES:	
Sl. No.	**TEXT BOOKS**
1.	Kreyszig.E, "*Advanced Engineering Mathematics"*, 10th edition, John Wiley & Sons. Singapore,2012.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	Grewal B.S, *"Higher Engg Maths",* Khanna Publications, 42nd Edition, 2012
3.	Kandasamy, P., etal., Engineering Mathematics, Vol. II & Vol. III (4th revised edition), S.Chand & Co., New Delhi, 2000
4.	Narayanan, S., Manickavachagom Pillay, T.,. and Ramanaiah,G., Advanced Mathematics for Engineering students, Volume II & III (2nd edition), S,Viswanathan Printers Publishers, 1992
5.	Venkataraman, M,K., Sridharan, N., Chandrasekaran, N., Discrete Mathematics, The National Publishing Company, Reprint, 2012, Chennai.
6.	T.Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw Hill, 2009.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15MA205B	MATHEMATICS (LE)	L	T	P	C
		4	0	0	4
Co-requisite:	NA				
Prerequisite:	NA				
Data Book / Codes/Standards	NIL				
Course Category	B CORE	MATHEMATICS			
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To acquire analytical ability on solving mathematical problems as applied to Lateral Entry student's for the respective branches of Engineering.	
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able to		
1.	Apply advanced matrix knowledge to Engineering problems.	a e
2.	Improve their ability in solving geometrical applications of differential calculus problems.	a e
3.	Equip themselves familiar with functions of several variables.	a e
4.	Expose to the concept of three dimensional analytical geometry.	a e
5.	Familiarize with the applications of multiple integrals.	a e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: MATRICES	**12**			
1.	Characteristic equation	2	C,I	1	1-7
2.	Eigen values and Eigen vectors of a real matrix	2	C,I	1	1-7
3.	Properties of Eigen values	2	C,I	1	1,3,4,6
4.	Cayley – Hamilton theorem orthogonal reduction of a symmetric matrix to diagonal form	2	C,I	1	1,3,4,6
5.	Orthogonal matrices	2	C,I	1	1-7
6.	Reduction of quadratic form to canonical form by orthogonal transformations.	2	C,I	1	1,3,4,6
	UNIT II: GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	**12**			
7.	Curvature – Cartesian coordinates	2	C,I	2	1,3,4,6
8.	Curvature – polar coordinates	2	C,I	2	1,3,4,6

9.	Circle of curvature	2	C,I	2	1,3
10.	Centre of curvature	2	C,I	2	1,3,4,6
11.	Evolutes	2	C,I	2	1,3
12.	Envelopes	2	C,I	2	1,3,4,6
	UNIT III: FUNCTIONS OF SEVERAL VARIABLES	**12**			
13.	Function of two variables – Partial derivatives	2	C,I	3	1-7
14.	Total differential	2	C,I	3	1-7
15.	Taylor's expansion	2	C,I	3	2,5,7
16.	Maxima and Minima	2	C,I	3	1-7
17.	Constrained Maxima and Minima by Lagrangian Multiplier method	2	C,I	3	2,5,7,1
18.	Jacobians	2	C,I	3	2,5,7
	UNIT IV: THREE DIMENSIONAL ANALYTICAL GEOMETRY	**12**			
19.	Equation of a sphere – Plane section of a sphere –	2	C,I	4	1,2
20.	Tangent Plane – Orthogonal Sphere	2	C,I	4	1,2
21.	Equation of a cone	2	C,I	4	3.6
22.	Right circular cone	2	C,I	4	1,2
23.	Equation of a cylinder	2	C,I	4	7
24.	Right circular cylinder	2	C,I	4	1,2
	UNIT V: MULTIPLE INTEGRALS	**12**			
25.	Double integration in Cartesian and polar coordinates	2	C,I	5	1-7
26.	Change of order of integration	2	C,I	5	3,4
27.	Area as a double integral	2	C,I	5	4
28.	Triple integration in Cartesian coordinates	2	C,I	5	2,3
29.	Conversion from Cartesian to polar	2	C,I	5	2,3
30.	Volume as a Triple Integral.	2	C,I	5	2,3
	Total contact hours	60			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Kreyszig.E, "*Advanced Engineering Mathematics*", John Wiley & Sons. Singapore, 10^{th} edition, 2012.
2.	K.Ganesan, Sundarammal Kesavan, K.S.Ganapathy Subramanian &V.Srinivasan, "*Engineering Mathematics*",Gamma

	publications, Revised Edition, 2013.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Grewal B.S, Higher Engineering Mathematics, Khanna Publications, 42nd Edition,2012.
4.	Veerajan. T, "*Engineering Mathematics I*", Tata McGraw Hill Publishing Co, New Delhi, 5th edition, 2006.
5.	Kandasamy P etal. "*Engineering Mathematics*", Vol.I (4th revised edition), S.Chand &Co., New Delhi, 2000.
6.	Narayanan S., Manicavachagom Pillay T.K., Ramanaiah G., "*Advanced Mathematics for Engineering students*", Volume I (2nd edition), S.Viswanathan Printers and Publishers, 1992.
7.	Venkataraman M.K., "*Engineering Mathematics*" – First Year (2nd edition), National Publishing Co., Chennai, 2000.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15MA206	NUMERICAL METHODS	L	T	P	C
		4	0	0	4

Co-requisite:	NOT APPLICABLE		
Prerequisite:	15 MA102 (or) 15MA104 (or) 15MA205B		
Data Book / Codes/Standards	NA		
Course Category	B	CORE	MATHEMATICS
Course designed by	Department of Mathematics		
Approval	-- Academic Council Meeting -- 2016		

PURPOSE	To acquire analytical ability in solving mathematical problems numerically as applied to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	To familiarise with numerical solution of equations	**a**	**e**
2.	To get exposed to finite differences and interpolation	**a**	**e**
3.	To be thorough with the numerical Differentiation and integration	**a**	**e**
4.	To find numerical solutions of ordinary differential equations	**a**	**e**
5.	To find numerical solutions of partial differential equations	**a**	**e**

Session	Description of Topic	Contact Hours	C-D-I-O	IOs	Reference
	UNIT I – CURVE FITTING AND NUMERICAL SOLUTION OF EQUATIONS	**14**			
1.	Introduction – Method of Least Squares – Curve fitting.	2	C,I	1	1 – 7
2.	Fitting a straight line –Calculation of the sum of the squares of the residuals.	1	C,I	1	1 – 7
3.	Fitting a parabola – Calculation of the sum of the squares of the residuals.	2	C,I	1	1 – 7
4.	Solution of Algebraic and Transcendental equations Newton-Raphson method.	1	C,I	1	1 – 7
5.	Bisection method and its applications.	1	C,I	1	1 – 7
6.	Problems using Method of false position.	1	C,I	1	1 – 7
7.	Solution of system of equations Direct Method - Gauss Elimination method.	1	C,I	1	1 – 7
8.	Iterative Methods - Gauss Jacobi method, Gauss Seidel method.	2	C,I	1	1 – 7
9.	Finding the Eigen values by Power method.	2	C,I	1	1 – 7
10.	More Problems in Power method.	1	C,I	1	1 – 7

	UNIT II – FINITE DIFFERENCES AND INTERPOLATION	**12**			
11.	Introduction – First and Higher order differences – Forward differences and backward differences (only definitions without proof).	2	C	2	1 – 7
12.	Central Differences – Shifting operator E – Relations between the operators (only definitions without proof).	2	C	2	1 – 7
13.	Interpolation – Newton-Gregory Forward and Backward Interpolation formulae.	2	C,I	2	1 – 7
14.	Additional problems using Newton-Gregory Forward and Backward Interpolation formulae.	2	C,I	2	1 – 7
15.	Divided differences – Newton's Divided difference formula.	2	C,I	2	1 – 7
16.	Lagrange's Interpolation formula – Inverse interpolation.	2	C,I	2	1 – 7
	UNIT III – NUMERICAL DIFFERENTIATION AND INTEGRATION	**10**			
17.	Introduction to Numerical Differentiation.	1	C	3	1 – 7
18.	Numerical Differentiation - Newton's forward and backward differences formulae to compute first and higher order derivatives.	2	C,I	3	1 – 7
19.	Applications of Newton's forward and backward differences formulae to compute first and higher order derivatives.	2	C,I	3	1 – 7
20.	Introduction - Numerical Integration	1	C,I	3	1 – 7
21.	Trapezoidal rule – Simpson's one third rule and Simpson's three eighth rules.	2	C,I	3	1 – 7
22.	More problems using Trapezoidal rule – Simpson's one third rule and Simpson's three eighth rules.	2	C,I	3	1 – 7
	UNIT IV – NUMERICAL SOLUTIONS OF FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS	**12**			
23.	Introduction, Solution by Taylor's series method.	2	C,I	4	1 – 7
24.	Solutions of I order simultaneous differential equations by Taylor's series method.	1	C,I	4	1 – 7
25.	Euler's method and its applications.	1	C,I	4	1 – 7
26.	Problems in Improved and modified Euler methods.	2	C,I	4	1 – 7
27.	Solution by Runge-Kutta method of fourth order (No proof).	2	C,I	4	1 – 7
28.	Additional problems using Runge-Kutta method of fourth order.	1	C,I	4	1 – 7
29.	Predictor-Corrector Methods - Milne-Thomson Method.	2	C,I	4	1 – 7
30.	Predictor-Corrector Methods - Adam's Bashforth method.	1	C,I	4	1 – 7
	UNIT V – NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS	**12**			
31.	Introduction - Solutions of Elliptic Equations.	1	C,I	5	1 – 7
32.	Solutions of Laplace Equations by Leibmann's Iterative process.	2	C,I	5	1 – 7
33.	Solutions of Poisson Equations.	1	C,I	5	1 – 7
34.	Solutions of Parabolic equations by Bendre-Smidth formula.	2	C,I	5	1 – 7
35.	Solutions of Parabolic equations by Crank-Nicolson formula.	2	C,I	5	1 – 7
36.	Solutions of Hyperbolic equations by Explicit formula.	2	C,I	5	1 – 7
37.	More problems in Hyperbolic equations using Explicit formula.	2	C,I	5	1 – 7

	Total Contact Hours	**60**

LEARNING RESOURCES:	
Sl. No.	**TEXT BOOKS**
1.	B.S. Grewal, Numerical Methods in engineering and science, Khanna Publishers, 42nd edition, 2012.
2.	Dr. M.K. Venkataraman, Numerical Methods in Science and Engineering, National Publishing Co., 2005.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	S.S. Sastry, Introductory Methods of Numerical Analysis, 4th edition, 2005.
4.	E. Balagurusamy, Computer Oriented Statistical and Numerical Methods – Tata McGraw Hill., 2000.
5.	M.K.Jain, SRK Iyengar and R.L.Jain, Numerical Methods for Scientific and Engineering Computation, Wiley Eastern Ltd., 4th edition, 2003.
6.	M.K.Jain, Numerical Solution of Differential Equations, 2nd edition (Reprint), 2002.
7.	P.Kandasamy etal., Numerical Methods, S.Chand & Co., New Delhi, 2003.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15MA207	PROBABILITY AND QUEUEING THEORY	L	T	P	C
		4	0	0	4
Co-requisite:	NOT APPLICABALE				
Prerequisite:	15 MA102 (or) 15MA205B				
Data Book / Codes/Standards	STATISTICAL TABLES				
Course Category	B CORE	MATHEMATICS			
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To acquire analytical ability in solving mathematical problems as applied to the respective branches of engineering	
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able to		
1.	Be through with probability concepts	a e
2.	To acquire knowledge on Probability Distributions	a e
3.	Get exposed to the testing of hypothesis using distributions	a e
4.	Gain strong knowledge inn principles of Queueing theory	a e
5.	Get exposed to Discrete time Markov chain	a e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: RANDOM VARIABLES	**14**			
1.	Review of probability concepts, Types of Events, Axioms, Conditional probability, Multiplication theorem, Applications.	2	C,I	1	1-5
2.	Discrete and continuous Random Variables – Discrete case, Probability Mass function, Cumulative distribution function, Applications	2	C,I	1	1-5
3.	Characteristics of random variables – Continuous case, Probability density function, Cumulative distribution function, Applications	2	C,I	1	1-5
4.	Expectation, Variance.	2	C,I	1	1-5
5.	Higher Order Moments	2	C,I	1	1-5
6.	Moment Generating Function, Functions of Random Variable (One dimensional only)	2	C,I	1	1-5
7.	Chebychev's Inequality – (Statement only). Applications of Chebychev's Inequality	2	C,I	1	1-5

	UNIT II: THEORETICAL DISTRIBUTIONS	**12**			
8.	Discrete Probability distribution: Binomial distribution – MGF, Mean, Variance, Applications of Binomial distribution, Fitting a Binomial distribution	2	C,I	2	1-5
9.	Poisson distribution – MGF, Mean, Variance, Applications of Poisson distribution, Fitting a Poisson distribution	2	C,I	2	1-5
10.	Geometric distribution – MGF, Mean, Variance, Memoryless Property , Applications of Geometric distribution	2	C,I	2	1-5
11.	Continuous Probability Distributions: Uniform distribution – MGF, Mean, Variance & Applications	1	C,I	2	1-5
12.	Exponential Distribution - MGF, Mean, Variance, Memoryless Property Applications of Exponential distribution	2	C,I	2	1-5
13.	Normal distribution – Mean, Variance	1	C,I	2	1-5
14.	Standard Normal distribution and Applications of Normal distribution	2	C,I	2	1-5
	UNIT-III - TESTING OF HYPOTHESIS	**14**			
15.	Introduction to Sampling Distributions, Population and Sample, Null Hypothesis and Alternative Hypothesis, Single and Two Tailed Test.	2	C,I	3	1-5
16.	Testing of Hypothesis, Level of Significance, Critical Region, Procedure for Testing of Hypothesis	1	C,I	3	1-5
17.	Large Sample Test- Test For Single Proportion, Two Sample Proportions	2	C,I	3	1-5
18.	Large Sample Test- Test For Single Mean, Two Sample Means	2	C,I	3	1-5
19.	Small Sample Tests – ‘t’ Test For a Single Mean	1	C,I	3	1-5
20.	‘t’ Test For The Difference Of Means, Paired ‘t’ Test	2	C,I	3	1-5
21.	F Test – Test of Significance of The Difference Between Two Population Variances	2	C,I	3	1-5
22.	Chi Square Test For Goodness of Fit, Independence of Attributes	2	C,I	3	1-5
	UNIT-IV : QUEUEING THEORY	**10**			
23.	Introduction to Markovian queueing models	2	C,I	4	1-5
24.	Single Server Model with Infinite system capacity, Characteristics of the Model (M/M/1) : (∞/FIFO)	2	C,I	4	1-5
25.	Problems on Model (M/M/1) : (∞/FIFO)	2	C,I	4	1-5
26.	Single Server Model with Finite System Capacity, Characteristics of the Model (M/M/1) : (K/FIFO)	2	C,I	4	1-5
27.	Problems on Model (M/M/1) : (K/FIFO)	2	C,I	4	1-5
	UNIT-V : MARKOV CHAINS	**10**			
28.	Introduction to Stochastic process, Markov process, Markov chain one step & n-step Transition Probability.	2	C,I	5	1-5

29.	TPM and Applications	1	C,I	5	1-5
30.	Chapman Kolmogorov theorem (Statement only), Applications on Chapman Kolmogorov theorem	1	C,I	5	1-5
31.	Transition probability	2	C,I	5	1-5
32.	Transition probability - Applications	1	C,I	5	1-5
33.	Classification of states of a Markov chain	2	C,I	5	1-5
34.	Classification of states of a Markov chain – Applications	1	C,I	5	1-5
	Total contact hours	60			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Veerarajan T., Probability, Statistics and Random Processes, Tata McGraw Hill,1st Reprint 2004.
2.	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 9th extensively revised edition, Sultan Chand & Sons, 1999.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Trivedi K S, " Probability and Statistics with reliability, Queueing and Computer Science Applications", Prentice Hall of India, New Delhi, 1984
4.	Gross.D and Harris.C.M. "Fundamentals of Queuing theory", John Wiley and Sons, 1985.
5.	Allen.A.O., "Probability Statistics and Queuing theory", Academic Press, 1981.

Course nature			**Theory**				
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15MA209	PROBABILITY AND RANDOM PROCESSES	L	T	P	C
		4	0	0	4

Co-requisite:	NOT APPLICABLE		
Prerequisite:	15MA201 (or) 15MA202		
Data Book / Codes/Standards	Statistical Tables		
Course Category	B	CORE	ENIGINEERING MATHEMATICS
Course designed by	Department of Mathematics		
Approval	-- Academic Council Meeting -- 2016		

PURPOSE	To introduce the students to random variables, distribution and random process which forms the base for the study of signals and systems and papers like radar communication.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	Acquire knowledge about Probability and Random variables, distribution.	a	e
2.	Gain knowledge on 2-D Random variables	a	e
3.	Expose to the concepts of Random variables.	a	e
4.	Gain knowledge about the correlation functions	a	e
5.	Learn about the applications of Fourier Transforms like spectral density.	a	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: PROBABILITY DISTRIBUTIONS	**14**			
1.	Types of random variables introduction and examples.	1	C,I	1	2-4
2.	Problems based on probability mass function, CDF, mean and variance of a discrete random variable.	1	C,I	1	2-4
3.	Problems based on probability density function, CDF, mean and variance of a continuous random variable.	1	C,I	1	2-4
4.	Problems using the properties of expectation	1	C,I	1	2-4
5.	Moments.	1	C,I	1	2,3,4.
6.	Moment generating function.	2	C,I	1	2,3,4
7.	Binomial distribution.	1	C,I	1	1,2,3,4
8.	Poisson distribution.	1	C,I	1	1,2,3,4

9.	Geometric distribution.	1	C,I	1	1,2,3,4
10.	Exponential distribution.	1	C,I	1	1,2,3,4
11.	Normal distribution.	2	C,I	1	1,2,3,4
12.	Functions of Random variables.	1	C,I	1	2,3,4
	UNIT II: TWO DIMENSIONAL RANDOM VARIABLES	**12**			
13.	Two dimensional random variables introduction.	1	C,I	2	2,3,4
14.	Problems based on two dimensional discrete random variables and on two dimensional continuous random variables	1	C,I	2	2,3,4
15.	Problems based - joint probability density function.	1	C,I	2	2,3,4
16.	Problems on marginal probability density function, marginal distribution functions.	1	C,I	2	2,3,4
17.	Problems on conditional probability density functions,	1	C,I	2	2,3,4
18.	Independent continuous random variables, cumulative distribution function of (X, Y).	2	C,I	2	2,3,4
19.	Transformation of Random Variables.	1	C,I	2	2,3,4
20.	Transformation of Random Variables.	2	C,I	2	2,3,4
21.	Central Limit Theorem (Theorem without proof) - Lindeberg Levy's form and Liapounoff's form.	1	C,I	2	2,3
22.	Problems based on central limit theorem.	1	C,I	2	2,3
	UNIT III: RANDOM PROCESSES	**12**			
23.	Classification of Random processes.	1	C,I	3	2,3
24.	Stationary processes- definitions.	1	C,I	3	2,3
25.	Problems based on Stationary processes - WSS and SSS processes.	2	C,I	3	2,3
26.	Poisson Random Process definition and problems.	2	C,I	3	2,3
27.	Renewal Process.	1	C,I	3	1,2,3
28.	Markov Chain and transition probabilities - definitions.	2	C,I	3	1,2,3
29.	Problems based on framing the transition probability matrix and on Markov chains.	2	C,I	3	1,2,3
30.	Problems based on the classification of state of a Markov chain.	1	C,I	3	1,2,3
	UNIT IV: CORRELATION FUNCTIONS	**10**			
31.	Autocorrelation function and its properties with proof.	1	C,I	4	2,3
32.	Problems based on Autocorrelation function.	2	C,I	4	2,3
33.	Cross correlation function and its properties with proof.	2	C,I	4	2,3
34.	Problems based on Cross correlation and jointly WSS	1	C,I	4	2,3

35.	Linear system with random inputs.	2	C,I	4	2,3
36.	Ergodicity.	2	C,I	4	2,3
	UNIT V: SPECTRAL DENSITY	**12**			
37.	Power spectral Density Function – properties	1	C,I	5	2,3
38.	Problems based on Power density spectrum.	2	C,I	5	2,3
39.	Representation of system in the form of convolution.	2	C,I	5	2,3
40.	Unit Impulse Response of the System.	2	C,I	5	2,3
41.	Einstein – Weiner - Khinchine Relationship- statement and problems.	2	C,I	5	2,3
42.	Cross Power Density Spectrum- definition and properties.	1	C,I	5	2,3
43.	Problems based on Cross Power Density Spectrum.	2	C,I	5	2,3
	Total contact hours	60			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Trivedi K S, "Probability and Statistics with reliability, Queuing and Computer Science Applications",Prentice Hall of India, New Delhi, 2nd Edition, 2002.
2.	Veerarajan T., "Probability statistics and Random Processes", 3rd Edition, Tata McGraw-Hill, New Delhi,2008.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Sivaramakrishna Das P. and Vijayakumari.C, "A text book of Probability and Random Processes", Viji's Academy, 2010.
4.	Papoulis, "Probability, Random Variables and Stochastic Processes", 4th Edition, Tata McGraw-Hill, New Delhi, 2002.

Course nature		**Theory**					
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15MA210	BIO STATISTICS	L	T	P	C
		4	0	0	4
Co-requisite:	NOT APPLICABLE				
Prerequisite:	15 MA104				
Data Book / Codes/Standards	NA				
Course Category	B CORE MATHEMATICS				
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To develop an understanding of the methods of probability and statistics which are used in the field of bio engineering problems.	
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able to		
1.	To gain knowledge in measures of central tendency, dispersion, moments, correlation and regression lines.	**a** **e**
2.	To appropriately choose, define and/or derive probability distributions such as the Binomial, Poisson and normal distribution to solve engineering problems.	**a** **e**
3.	To learn how to formulate and test the hypotheses about means, proportions and standard deviation to draw conclusions based on the results of statistical tests in large sample.	**a** **e**
4.	To learn how to formulate and test the hypotheses about means, variances for small samples using t and F test for small sample and have knowledge on ANOVA.	**a** **e**
5.	To understand the fundamentals of quality control and the methods used to control systems and processes.	**a** **e**

Session	Description of Topic	Contact Hours	C-D-I-O	IOs	Reference
	UNIT I – INTRODUCTION TO BIO-STATISTICS (numerical problems only)	**14 +**			
1.	Introduction – Ungrouped, Discrete and Continuous types of Statistical Data.	1	C	1	1,2,3,8
2.	Measures of central tendency Arithmetic Mean, Median, Mode.	2	C,I	1	1,2,3,8
3.	Measures of central tendency Geometric Mean, and Harmonic Mean.	2	C,I	1	1,2,3,8
4.	Measures of dispersion Range, Quartile Deviation, Mean Deviation, and Standard Deviation.	2	C,I	1	1,2,3,8
5.	Coefficients of dispersion - Coefficient of Variation.	1	C,I	1	1,2,3,8
6.	Moments - Central moments and Moments about the point.	1	C,I	1	1,2,3,8
7.	Skewness - Measures of Skewness & Kurtosis.	1	C,I	1	1,2,3,8

8.	Karl Pearson's coefficient of Correlation.	1	C,I	1	1,2,3,8
9.	Spearman's Rank correlation coefficient.	1	C,I	1	1,2,3,8
10.	Regression lines and its applications.	2	C,I	1	1,2,3,8
	UNIT II: PROBABILITY & THEORETICAL DISTRIBUTIONS (Problems only)	**14**			
11.	**PROBABILITY** Introduction – Probability concepts - Random experiment, Trial, Sample space, Sample size, Events, (Only definitions, properties without proof and simple problems).	1	C,I	2	1 – 10
12.	**PROBABILITY** Types of Events: Impossible, Simple, Mutually Exclusive, Mutually exhaustive and Independent Events. (Only definitions, properties without proof and simple problems).	1	C,I	2	1 – 10
13.	**Conditional Probability** – Problems based on Addition and Multiplication Theorems.	1	C,I	2	1 – 10
14.	Baye's Theorem (without proof) and its applications.	2	C,I	2	1 – 10
15.	Introduction – One dimensional random variables.	1	C	2	1 – 10
16.	Discrete Random Variable – Probability mass function - Cumulative function – properties (without proof) – applications.	1	C,I	2	1 – 10
17.	Continuous Random Variable – Probability density function - Distribution function – properties (without proof) – applications.	1	C,I	2	1 – 10
18.	Mathematical Expectation – Mean and Variance – Properties (without proof) – applications.	2	C,I	2	1 – 10
19.	THEORETICAL DISTRIBUTIONS Discrete Type - Binomial (Bernoulli) Distribution.	1	C,I	2	1 – 10
20.	THEORETICAL DISTRIBUTIONS Discrete Type - Poisson Distribution.	1	C,I	2	1 – 10
21.	Continuous Type - Normal (Gaussian) Distribution.	2	C,I	2	1 – 10
	UNIT III: TESTING OF HYPOTHESIS	**12**			
22.	Sampling Theory – Basic concepts Population, Sample, Sampling, Sample size, Sampling Distribution, Population Parameters and Sample Statistics, Standard Error.	1	C,I	3	1 – 10
23.	Testing of Hypothesis, Null and Alternative Hypothesis, Single tailed and Two tailed tests, Type I and Type II errors, Acceptance and Rejection Regions, Level of Significance, degrees of freedom and Confidence (Fiducial) limits.	2	C,I	3	1 – 10
24.	Large sample tests based on normal distribution(Z-test) Z - Test for single proportion and difference of proportions.	2	C,I	3	1 – 10
25.	Z - Test for single mean and difference of means.	2	C,I	3	1 – 10
26.	Z - Test for single standard deviation and difference of standard deviations.	2	C,I	3	1 – 10
27.	Chi-square test for goodness of fit.	1	C,I	3	1 – 10
28.	Chi-square test for Independence of attributes using contingency table.	2	C,I	3	1 – 10
	UNIT IV: ANALYSIS OF VARIANCE	**10**			
29.	Small sample tests based on t-distribution t - Test for single mean.	1	C,I	4	1 – 10

30.	Small sample tests based on t-distribution t - Test for difference of means.	2	C,I	4	1 – 10
31.	Paired t - Test.	1	C,I	4	1 – 10
32.	F – test for equality of variances.	2	C,I	4	1 – 10
33.	ANOVA - One-way classification – applications.	2	C,I	4	1 – 10
34.	ANOVA - Two-way classification – applications.	2	C,I	4	1 – 10
	UNIT V: STATISTICAL QUALITY CONTROL	**10**			
35.	Introduction – Quality , Chance variation, Assignable variation, Statistical Quality Control, Process control , Product control - Control charts (Variable and Attribute types),	2	C	5	2, 4
36.	Control charts for Variables Sample Mean ($\overline{X}$)and Sample Range (R) chart	2	C,I	5	2, 4
37.	Control charts for Variables Sample Mean ($\overline{X}$)and Sample SD (s) chart	2	C,I	5	2, 4
38.	Control charts for Variables Number of defectives $\left(n\overline{p}\right)$ chart Proportion of defectives $\left(\overline{p}\right)$ chart.	2	C,I	5	2, 4
39.	Control charts for Variables Number of defects in a unit $\left(\overline{c}\right)$ chart.	2	C,I	5	2, 4
	Total Contact Hours	**60**			

LEARNING RESOURCES:

Sl. No.	TEXT BOOKS
1.	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th extensively revised edition, Sultan Chand & Sons, 2007.
2.	S.C.Gupta and V.K.Kapoor, "Fundamentals of Applied Statistics", Sultan Chand and Sons, New Delhi, 2003.
3.	V.K.Kapoor, "Statistic – Problems and Solutions", 5th edition, Sultan Chand & Sons, 2007.
4.	T.Veerarajan, "Probability, Statistics and Random Processes", Tata McGraw-Hill Publishing Company Limited, New Delhi, Revised 7th Edition, 2013.
	REFERENCE BOOKS/OTHER READING MATERIAL
5.	Trivedi K S, "Probability and Statistics with reliability, Queueing and Computer Science Applications", Prentice Hall of India, New Delhi, 2nd revised edition, 2002
6.	Allen.A.O., "Probability Statistics and Queuing theory with Computer science applications", Academic Press, 2nd edition, 1990.
7.	Papoulis, Probability, Random variables and stochastic processes, 4th edition, Tata McGraw Hill Company, 2002.
8.	R.S.N.Pillai, & V.Bagavathi, "Statistics – Theory and Practice", Sultan Chand & Sons, 2009.
9.	P.Kandasamy, "Probability and Queuing Theory", Sultan Chand & Sons, 2009.
10.	Sivaramakrishna Das P. and Vijayakumari.C,A Textbook of Probability and Random Processes, PEARSON Academy, 6th Edition, 2013.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15MA301	**PROBABILITY AND STATISTICS**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**
Co-requisite:	NOT APPLICABALE				
Prerequisite:	15 MA102 (or) 15MA104 (or) 15MA205B				
Data Book / Codes/Standards	STATISTICAL TABLES				
Course Category	B CORE MATHEMATICS				
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To impart analytical ability in solving mathematical problems as applied to the respective branches of engineering	
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able to		
1.	To apply the basic rules and theorems of probability theory such as Baye's Theorem, to determine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution.	a e
2.	To appropriately choose, define and/or derive probability distributions such as the Binomial, Poisson and Normal etc to model and solve engineering problems.	a e
3.	To learn how to formulate and test hypotheses about means, variances and proportions and to draw conclusions based on the results of statistical tests.	a e
4.	To understand how regression analysis can be used to develop an equation that estimates how two variables are related and how the analysis of variance procedure can be used to determine if means of more than two populations are equal.	a e
5.	To understand the fundamentals of quality control and the methods used to control systems and processes.	a e

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: PROBABILITY & RANDOM VARIABLES	**12**			
1.	Introduction to probability concepts, Types of Events, axioms, theorems,	1	C,1	1	1-5
2.	Conditional probability, Multiplication theorem, Applications.	1	C,1	1	1-5
3.	Characteristics of random variables – Discrete case, Probability Mass function, Cumulative distribution function, Applications	2	C,1	1	1-5
4.	Characteristics of random variables – Continuous case, , Probability density function, Cumulative distribution function, Applications	2	C,1	1	1-5
5.	Central and Raw Moments	2	C,1	1	1-5
6.	Expectation, variance, Applications	2	C,1	1	1-5

7.	Moment generating function of discrete and continuous random variable	2	C,1	1	1-5
	UNIT II: Theoretical Distributions	**12**			
8.	Discrete distribution: Binomial distribution – MGF, Mean, Variance, Applications of Binomial distribution, Fitting a binomial distribution	2	C,1	2	1-5
9.	Poisson distribution – MGF, Mean, Variance, Applications of Poisson distribution, Fitting a poisson distribution	2	C,1	2	1-5
10.	Geometric distribution – MGF, Mean, Variance, Memoryless Property , Applications of Geometric distribution	1	C,1	2	1-5
11.	Continuous distribution: Uniform distribution – MGF, Mean, Variance & applications	2	C,1	2	1-5
12.	Exponential distribution - MGF, Mean, Variance, Memoryless Property Applications of Exponential distribution	2	C,1	2	1-5
13.	Normal distribution – MGF, Mean, Variance	2	C,1	2	1-5
14.	Applications of Normal distribution and Problems	1	C,1	2	1-5
	UNIT-III Testing of Hypothesis	**12**			
15.	Introduction to sampling distributions, population and sample, null hypothesis and alternative hypothesis, Testing of hypothesis, level of significance, critical region, Procedure for testing of hypothesis	1	C,1	3	1-5
16.	Large sample test- test for single proportion, two proportions	2	C,1	3	1-5
17.	Large sample test- test for single mean, two means	2	C,1	3	1-5
18.	Small sample tests – ‘t’ test for a single mean	1	C,1	3	1-5
19.	‘t’ test for the difference of means, ‘t’ test for the paired observations	2	C,1	3	1-5
20.	F test – Test of significance of the difference between population variances	2	C,1	3	1-5
21.	Chi square test for goodness of fit, independence of Attributes	2	C,1	3	1-5
	UNIT IV:CORRELATION, REGRESSION AND ANALYSIS OF VARIANCE	**12**			
22.	Correlation and Properties, Karl pearsons correlation coefficient	2	C,1	4	1-5
23.	Rank correlation coefficient	2	C,1	4	1-5
24.	Linear Regression lines and Properties, regression coefficient, Problems	2	C,1	4	1-5
25.	Analysis of Variance – One way Classification	2	C,1	4	1-5
26.	Two way Classification	2	C,1	4	1-5
27.	Introduction to Non parametric Test – Wilcoxon signed rank test(one sample test) – Wilcoxon Mann-Whitney rank test (Two sample test)	2	C,1	4	1-5
	UNIT V: STATISTICAL QUALITY CONTROL	**12**			
28.	Introduction and Process Control	2	C,1	5	1-5

29.	Control Charts for X and R,	2	C,1	5	1-5
30.	Control Charts for X and S.	2	C,1	5	1-5
31.	p chart	2	C,1	5	1-5
32.	np chart	2	C,1	5	1-5
33.	c chart	2	C,1	5	1-5
	Total contact hours	60			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Veerarajan T., Probability, Statistics and Random Processes, Tata McGraw Hill,1st Reprint 2004.
2.	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 9th extensively revised edition, Sultan Chand & Sons, 1999.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	Ross. S., "A first Course in Probability", Fifth Edition, Pearsons Education, Delhi 2002.
4.	Johnson. R. A., "Miller & Freund's Probability and Statistics for Engineers"' Sixth Edition, Pearson Education, DSelhi, 2000.
5.	Walpole, R. W., Myers, R. H. Myers R. S. L. and Ye. K, "Probability; and Statistics for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi, 2002.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15MA302	DISCRETE MATHEMATICS	L	T	P	C
		4	0	0	4

Co-requisite:	NOT APPLICABLE		
Prerequisite:	15 MA102 (or) 15MA205B		
Data Book / Codes/Standards	NA		
Course Category	B	CORE	MATHEMATICS
Course designed by	Department of Mathematics		
Approval	-- Academic Council Meeting -- , 2016		

PURPOSE	To acquire knowledge in discrete mathematical structures as applied to the respective branches of Engineering		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	To understand logic and mathematical reasoning to count or enumerate objects in systematic way.	**a**	**e**
2.	To understand set theory, relations and functions to read , understand and construct mathematical arguments.	**a**	**e**
3.	To understand recurrence relation, generating functions and algebraic systems.	**a**	**e**
4.	To understand how to apply the knowledge of graph theory to solve real world problems like minimum spanning tree - traversal of binary tree.	**a**	**e**
5.	To understand the concept of lattices and Boolean algebra.	**a**	**e**

Session	Description of Topic	Contact Hours	C-D-I-O	IOs	Reference
	UNIT I – MATHEMATICAL LOGIC:	**12**			
1.	Propositions and Logical operators - Truth tables and propositions generated by a set	1	C,I	1	1,2,9
2.	Equivalence and Implications of statements	2	C,I	1	1,2,9
3.	Tautologies of statements	1	C,I	1	1,2,9
4.	Direct proofs - Conditional conclusions	2	C,I	1	1,2,9
5.	Indirect proofs	1	C,I	1	1,2,9
6.	Problems bases on Mathematical Induction	1	C,I	1	1,2,9
7.	The existential and universal quantifiers	2	C,I	1	1,2,9
8.	Predicate calculus including theory of inference	2	C,I	1	1,2,9
	UNIT II – SET THEORY:	**12**			
9.	Laws of Set theory	1	C	2	1 ,2
10.	Partition of a set	1	C,I	2	1 ,2
11.	The duality principle	1	C,I	2	1 ,2

12.	Relations – Properties - Equivalence relation and partial order relation	2	C,I	2	1 ,2
13.	Poset - Graphs of relations - Hasse diagram	1	C,I	2	1 ,2
14.	Matrices of relations	2	C,I	2	1 ,2
15.	Closure operations on relations - Warshall's algorithm	2	C,I	2	1 ,2
16.	Functions, Combinatorics - Pigeonhole Principle – Generalized Pigeon hole principle	2	C,I	2	1 ,2
	UNIT III – RECURRENCE RELATION & ALGEBRAIC SYSTEMS:	**12**			
17.	Recurrence relations - Solving a recurrence relation – Homogeneous and Non-homogeneous Recurrence relations	2	C,I	3	1,2,9
18.	Formation of Recurrence relations obtained from solutions	1	C,I	3	1,2,9
19.	Generating functions, Solution of a recurrence relation using generating functions	1	C,I	3	1,2,9
20.	Groups – Axioms of groups	2	C,I	3	1,2,9
21.	Cyclic groups and their axioms	2	C,I	3	1,2,9
22.	subgroups and their axioms	1	C,I	3	1,2,9
23.	Cosets – Lagrange's Theorem	2	C,I	3	1,2,9
24.	Normal subgroup, group homomorphism	1	C,I	3	1,2,9
	UNIT IV – GRAPH THEORY:	**12**			
25.	Basic concepts - Basic Definitions – Some Special Graphs	2	C,I	4	1,2,7
26.	Matrix Representation of Graphs	1	C,I	4	1,2,7
27.	Paths and circuits	2	C,I	4	1,2,7
28.	Eulerian and Hamiltonian Graphs	1	C,I	4	1,2,7
29.	Connected graphs	2	C,I	4	1,2,7
30.	Trees - Spanning Trees - Rooted trees	2	C,I	4	1,2,7
31.	Binary Trees, Kruskal's algorithm - Traversals of Binary trees	2	C,I	4	1,2,7
	UNIT V – LATTICES AND BOOLEAN ALGEBRA:	**12**			
32.	Lattices, properties of lattices	2	C,I	5	1,2,7
33.	Lattices as algebraic system	1	C,I	5	1,2,7
34.	Sub-lattices	1	C,I	5	1,2,7
35.	Lattices –Properties of Lattices	2	C,I	5	1,2,7
36.	Some special lattices	2	C,I	5	1,2,7
37.	Boolean algebra : Definition and Examples, Basic laws of Boolean Algebra	2	C,I	5	1,2,7
38.	Expression of Boolean function by algebraic method	2	C,I	5	1,2,7
	Total Contact Hours	**60**			

LEARNING RESOURCES:	
Sl. No.	**TEXT BOOKS**
1.	Alan Doerr and Kenneth Levasseur, "Applied Discrete Structures for Computer Science", Galgotia Publications (P) Ltd, 1992.
2.	Tremblay J. P. and Manohar R., Discrete Mathematical Structures with applications to Computer Science, Tata Mc Graw Hill Publishing Co., 35th edition,2008.
	REFERENCE BOOKS/OTHER READING MATERIAL
3.	V. Sundaresan, K.S. Ganapathy Subramanian and K. Ganesan, Discrete Mathematics, New Revised Edition, A. R. Publications, 2001
4.	Kolman and Busby, Discrete Mathematical Structures for Computer Science, Prentice Hall, 3rd edition,1997.
5.	Kenneth H.Rosen, Discrete Mathematics and its Application, Fifth edition, Tata McGraw-Hill Publishing company PVT .Ltd., New Delhi, 2003
6.	Lipschutz Seymour, Marc Lars Lipson, Discrete Mathematics, Mc Graw Hill Inc., 1992
7.	Narsing Deo, Graph Theory with applications to Engineering and Computer science, Prentice-Hall of India pvt. Ltd., New Delhi, 1987.
8.	C.L. Liu, Elements of Discrete Mathematics, 2nd Edition, McGraw Hill Publications, 1985.
9.	T.Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata McGraw Hill, 2009.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15MA305	STATISTICS FOR INFORMATION TECHNOLOGY	L	T	P	C
		4	0	0	4

Co-requisite:	NA		
Prerequisite:	15 MA102 (or) 15MA205B		
Data Book / Codes/Standards	Statistical Tables and control chart constant values to be provided.		
Course Category	B	CORE	MATHEMATICS
Course designed by	DEPARTMENT OF MATHEMATICS		
Approval	-- Academic Council Meeting -- 2016		

PURPOSE	The purpose of this course is to make the students learn about the applications of statistical tools and techniques in different field.

INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able			
1.	To gain knowledge in measures of central tendency and dispersion	a	e
2.	To learn about methods of studying correlation and regression.	a	e
3.	To have knowledge about analysis of time series	a	e
4.	To gain knowledge about ANOVA	a	e
5.	To understand the fundamentals of quality control and the methods used to control systems and processes	a	e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: INTRODUCTION TO STATISTICS (numerical problems only)	**12**			
1.	Introduction to uni-variate data	1	C, I	1	1-7
2.	Measures of central tendency: Arithmetic mean, Median, Definition,Problems Median: Definition, Problems	2	C,I	1	1-7
3.	Mode, Geometric Mean and Harmonic Mean: Definition, Problems	2	C,I	1	1-7
4.	Measures of dispersion: Range, Quartile deviation, Mean deviation, Definition, Problems	2	C,I	1	1-7
5.	Standard deviation and Co-efficient of variation: Definition, Problems	2	C,I	1	1-7
6.	Skewness, Definition, Problems	1	C,I	1	1-7
7.	Kurtosis and Moments, Definition, Problems	2	C,I	1	1-7
	UNIT II: CORRELATION AND REGRESSION ANALYSIS	**11**			
8.	Introduction to Correlation analysis, Types of correlation	1	C,I	2	1-7

9.	Methods of studying correlation - Karl Pearson's coefficient of correlation	2	C,I	2	1-7
10.	Rank correlation method	2	C,I	2	1-7
11.	Partial and Multiple Correlation	2	C,I	2	1-7
12.	Introduction to Regression analysis – Regression lines	1	C,I	2	1-7
13.	Properties of Regression coefficients, Problems	2	C,I	2	1-7
14.	Angle between two regression lines.	1	C,I	2	1-7
	UNIT III: ANALYSIS OF TIME SERIES	**12**			
15.	Components of time series – Problems of classifications – Methods of measuring trends	1	C,I	3	1,3,4
16.	Freehand graphing method, semi average method	2	C,I	3	1,3,4
17.	moving average method	2	C,I	3	1,3,4
18.	method of least squares	2	C,I	3	1,3,4
19.	Introduction to Measurement of seasonal variation	1	C,I	3	1,3,4
20.	Method of simple averages (weekly, monthly and quarterly)	2	C,I	3	1,3,4
21.	Ratio to trend method	2	C,I	3	1,3,4
	UNIT IV: ANALYSIS OF VARIANCE	**13**			
22.	Introduction to Small sample tests based on t and F distribution	1	C,I	4	1-4
23.	Test for single mean, difference between means,	2	C,I	4	1-4
24.	Paired t-test, Test for equality of variances,	2	C,I	4	1-4
25.	ANOVA- one -way classification	2	C,I	4	1-4
26.	Two-way classification.	2	C,I	4	1-4
27.	Non-Parametric Test: The Mann Whitney test,	2	C,I	4	1,3,6
28.	The Kruskal-Wallis single-factor analysis of variance by ranks, Procedure and problems	2	C,I	4	1,3,6
	UNIT V: STATISTICAL QUALITY CONTROL	**12**			
29.	Introduction - Process control	1	C,I	5	1,3,4
30.	control charts for variables - Mean and Range chart (X Bar and R)	2	C,I	5	1,3,4
31.	control charts for variables - Mean and Standard deviation chart (X Bar and s)	2	C,I	5	1,3,4
32.	Introduction to Attributes Control charts	1	C,I	5	1,3,4
33.	Control chart for the number of defectives (np-chart)	2	C,I	5	1,3,4
34.	Control chart for the fraction of defectives (p-chart)	2	C,I	5	1,3,4
35.	Control chart for the number of defects (c-chart)	2	C,I	5	1,3,4
	Total contact hours	60			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	C.Chatfield, "Statistics for Technology- A course in Applied Statistics", Chapman and Hall, 2010.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, New Delhi, 11th edition,2007.
3.	S.P.Gupta,"Elements of business Statistics", Sultan Chand and Sons, New Delhi, 1993.
4.	S.C.Gupta and V.K.Kapoor, "Fundamentals of Applied Statistics", Sultan Chand and Sons, New Delhi, 2003.
5.	R.S.N.Pillai, & V.Bagavathi, "Statistics – Theory and Practice", Sultan Chand & Sons, 2009.
6.	John E. Freund's: Mathematical statistics with Application, Miller and Miller, Pearson Education, 2012.
7.	V.K.Kapoor, "Statistic – Problems and Solutions", 5th edition, Sultan Chand & Sons, 2007.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage	**50%**

15MA306	CALCULUS OF VARIATIONS AND NON-LINEAR PROGRAMMING	L	T	P	C
		3	0	0	3
Co-requisite:	NOT APPLICABLE				
Prerequisite:	15 MA102 (or) 15MA205B				
Data Book / Codes/Standards	NA				
Course Category	B	CORE	MATHEMATICS		
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To acquire analytical ability on solving calculus of variations and Non- Linear mathematical problems as applied to the respective branches of Engineering.		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1	Fully understand the concept of functionls and Euler's Equations	a	e
2	Be familiar with constrained variational problems	a	e
3	Be familiar with isoperimetric problems	a	e
4	Be thorough with methods for solving classical minimization problems	a	e
5	Get exposed to Non- Linear programming methods and applications to quadratic programming	a	e

Session	Description of Topic	Contact Hours	C-D-I-O	IOs	Reference
	UNIT I VARIATIONAL PROBLEMS	**9**			
1.	Introduction	1	C,I	1	1-7
2.	Functionals	2	C,I	1	1-7
3.	Euler's equation	2	C,I	1	1-7
4.	Different forms of Euler's equations	2	C,I	1	1-7
5.	Solutions of Euler's equation – Geometrical problems	2	C,I	1	1-7
	UNIT II CONSTRAINED VARIATIONAL PROBLEMS	**9**			
6.	Geodesics	1	C,I	2	1-7
7.	Variational problems involving several unknown functions	2	C,I	2	1-7
8.	Functionals dependent on Higher order derivatives	2	C,I	2	1-7
9.	Variational problems involving several independent variables	2	C,I	2	1-7
10.	Constraints and Lagrange's multipliers	2	C,I	2	1-7
	UNIT III ISOPERIMETRIC PROBLEMS	**9**			
11.	Introduction	1	C,I	3	1-7
12.	Isoperimetric problems	2	C,I	3	1-7
13.	The general variation of a functional	2	C,I	3	1-7

14.	Functionals involving higher order derivatives	2	C,I	3	1-7
15.	Approximate solution of boundary value problems – Rayleigh-Ritz method	2	C,I	3	1-7
	UNIT IV CLASSICAL MINIMIZATION METHODS	**9**			
16.	Introduction	1	C,I	4	1-7
17.	single variable functions – condition for Local Minima and Maxima	2	C,I	4	1-7
18.	Multi Variable functions	2	C,I	4	1-7
19.	constrained Multi Variable function with Equality constraints: Direct search method – Lagranges Multipliers methods	2	C,I	4	1-7
20.	Constrained Multi Variable with Inequality constraints: Kuhn-Tucker Necessary and sufficient Conditions.	2	C,I	4	1-7
	UNIT V NON-LINEAR PROGRAMMING METHODS	9			
21.	Introduction	1	C,I	5	1-7
22.	The general Non-Linear programming problem	2	C,I	5	1-7
23.	Graphical Solution Method	2	C,I	5	1-7
24.	Quadratic Programming: Kuhn-Tucker conditions	2	C,I	5	1-7
25.	Quadratic Programming: Wolfe's Modified simplex methods – Beale's Method.	2	C,I	5	1-7

LEARNING RESOURCES:

Sl. No.	**TEXT BOOKS**
1.	Dr. M. K. Venkatraman, Higher Engineering Mathematics, National Publishing Company, 2012.
2.	J K SHARMA, Operations Research Theory and Applications, second edition, Mac Millan India Ltd., 2003.
	REFERENCE BOOKS/OTHER READING MATERIAL
1.	Elsgolts, Differential Equations and the Calculus of Variations, University Press of the Pacific, 2003**.**
2.	B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Delhi, 40th Edition, 2007.
3.	S. Gupta, Calculus of Variations with Applications, Prentice-Hall Of India Pvt. Limited, 2004.
4.	Hamdy A Taha, Operations Research: An Introduction, Ninth edition, Pearson Publisher, 2012.
5.	D. Sharma, Himanshu Sharma, Operations Research: Theory, Methods and Applications, 15th edition, Kedar Nath Ram Nath, 1972.

Course nature			**Theory**			
Assessment Method (Weightage 100%)						
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15MA315E	GRAPH THEORY	L	T	P	C
		3	0	0	3
Co-requisite:	NOT APPLICABALE				
Prerequisite:	15MA102(or)15MA104 (or) 15MA205B				
Data Book / Codes/Standards					
Course Category	E — Elective — MATHEMATICS				
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	The purpose of this course is to understand the basic concepts of graph theory and the coloring of graphs which has wide range of applications in all fields of engineering.	
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able to		
1.	Be through with Graph theoretical concepts	a e
2.	To acquire knowledge on Theoretical concepts	a e
3.	Get exposed to solve the Problems in theoretical view	a e
4.	Gain strong knowledge about Eulerian and Hamiltonian graphs	a e
5.	Get Solution in terms of Mathematical modeling	a e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: GRAPHS AND SUBGRAPHS	**9**			
1.	Introduction to Graph theory: Graphs, Subgraphs	2	C,I	1	1-5
2.	Degree of a Vertex	2	C,I	1	1-5
3.	Isomorphism of Graphs	1	C,I	1	1-5
4.	Independent Sets and Coverings	2	C,I	1	1-5
5.	Intersection Graphs	2	C,I	1	1-5
	UNIT II: DEGREE SEQUENCES	**9**			
6.	Adjacency and Incidence Matrices	1	C,I	2	1-5
7.	Operation on Graphs	2	C,I	2	1-5

8.	Degree Sequences	1	C,I	2	1-5
9.	Graphic Sequences	2	C,I	2	1-5
10.	Walks, Trails	1	C,I	2	1-5
11.	Paths, Problems	2	C,I	2	1-5
	UNIT-III - CONNCECTEDNESS	**9**			
12.	Connectedness and Components	1	C,I	3	1-5
13.	Connectedness and Components, Problems	2	C,I	3	1-5
14.	Cut Point	1	C,I	3	1-5
15.	Bridge	2	C,I	3	1-5
16.	Block	1	C,I	3	1-5
17.	Connectivity theorems, Simple Problems	2	C,I	3	1-5
	UNIT-IV : EULERIAN AND HAMILTONIAN GRAPHS	**8**			
18.	Eulerian graphs	2	C,I	4	1-5
19.	Hamiltonian graphs	2	C,I	4	1-5
20.	Hamiltonian graphs, Simple Problems	2	C,I	4	1-5
21.	Trees, Theorems and Simple Problems	2	C,I	4	1-5
	UNIT-V : PLANARITY, COLOURABILITY	**10**			
22.	Planarity: Definition	2	C,I	5	1-5
23.	Properties of Planarity	2			
24.	Characterization of Planar Graphs	2	C,I	5	1-5
25.	Colourability, Chromatic Number	2	C,I	5	1-5
26.	Chromatic Index	2	C,I	5	1-5
	Total contact hours	45			

LEARNING RESOURCES

Sl. No.	**TEXT BOOKS**
1.	S. Arumugam and S.Ramachandran, "Invitation to Graph Theory", SITECH Publications India Pvt.Ltd, Chennai – 17, 2006.
	REFERENCE BOOKS/OTHER READING MATERIAL
2.	S.Kumaravelu, Susheela Kumaravelu, Graph Theory, SKV Publishers, Sivakasi, 1999.
3.	S.A.Choudam, A First Course in Graph Theory, Macmillan India Ltd, 2000.
4.	Robin J.Wilson, Introduction to Graph Theory, Prentice Hall, 2012.
5.	J.A.Bondy and U.S.R. Murthy, Graph Theory with Applications, Macmillon, London, 2008.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15MA316E	**STOCHASTIC PROCESSES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	NIL				
Prerequisite:	15MA207 (or) 15MA209 (or) 15MA301				
Data Book / Codes/Standards	NIL				
Course Category	E ELECTIVE MATHEMATICS				
Course designed by	DEPARTMENT OF MATHEMATICS				
Approval	-- Academic Council Meeting -- 2016				

PURPOSE	The students will be able to use the tools of probability and stochastic processes to develop models to improve decision-making in an uncertain environment.	
INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**	
At the end of the course, student will be able to		
1. Define and characterize a stochastic process	a	e
2. Identify, Define and Apply stochastic models particularly, Markov chains (discrete and continuous)	a	e
3. Identify, Define and Apply stochastic models particularly, Markov chains (discrete and continuous)	a	e
4. Be exposed to renewal and branching processes	a	e
5. Be exposed to renewal and branching processes	a	e

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I:	**09**			
1.	Basic concepts: definition and examples of stochastic process	2	C,I	1	1-6
2.	classification of general stochastic processes into Discrete state spaces	2	C,I	1	1-6
3.	classification of general stochastic processes into continuous state spaces	2	C,I	1	1-6
4.	type of stochastic processes	2	C,I	1	1-6
5.	Elementary problems.	1	C,I	1	1-6
	UNIT II:	**09**			
6.	Introduction to Markov chains discrete in time, examples	2	C,I	2	1-6, 7

7.	Classification of States of a Markov chain	2	C,I	2	1-6, 7
8.	Recurrence – Basic limit theorem of Markov chains	2	C,I	2	1-6, 7
9.	Absorption probabilities – Criteria for recurrence.	2	C,I	2	1-6, 7
10.	Problems based on Morkov chain	1	C,I	2	1-6, 7
	UNIT III:	**09**			
11.	Continuous time Markov chain	2	C,I	3	1-6, 7
12.	Pure birth process and Poisson process	2	C,I	3	1-6, 7
13.	birth and death process	2	C,I	3	1-6, 7
14.	Problems based on Continuous time Markov chain	2	C,I	3	1-6, 7
15.	Problems based on Continuous time Markov chain	1	C,I	3	1-6, 7
	UNIT IV:	**09**			
16.	Renewal process – definition and examples	2	C,I	4	1-6
17.	Renewal process Problems	2	C,I	4	1-6
18.	elementary renewal theorem	2	C,I	4	1-6
19.	Martingales – Examples.	2	C,I	4	1-6
20.	Problems	2	C,I	4	1-6
	UNIT V:	**09**			
21.	Introduction to Branching process	1	C,I	5	1-6
22.	Definition and examples of discrete time branching process	2	C,I	5	1-6
23.	probability generating function mean and variance	2	C,I	5	1-6
24.	Probability of extinction, problems.	2	C,I	5	1-6
25.	Problems.	2	C,I	5	1-6
	Total contact hours	45			

LEARNING RESOURCES

Sl. No.	TEXT BOOKS
1.	Samuel Karlin and Howard M.Taylor, "A Second Course in Stochastic Processes", Academic Press, 1981.Unit I: Chapter 1: 2, 3
2.	Medhi J., "Stochastic Processes", New Age International, 2012. Unit I: Chapter 1: 1.5 -1.5.1; Unit II: Chapter 2: 2.1.1, 2.1.2, 2.4 – 2.4.3, 2.4.4; unit III: Chapter 3: 3.1 – 3.2, 3.3 – 3.3.3, 3.4 – 3.4.1; Unit IV: Chapter 6: 6.1 - 6.1.1, 6.1.2, 6.1.3, 6.1.4, 6.1.5, 6.5 – 6.5.1, 6.5.2, Chapter 5: 5.1, 5.2, 5.3 (only statements), 5.3.2 (with proof); Unit V: Chapter 9: 9.1, 9.2, 9.3
	REFERENCE BOOKS/OTHER READING MATERIAL
1.	Ross S.M., "Stochastic Processes", John Wiley & Sons, 3rd Edition, 2010.
2.	Cox D R and Miller H D "The theory of Stochastic Process" Methuen, London, 1965.
3.	Narayan Bhat U and Gregory K Miller "Elements of applied stochastic processes" Wiley - Inter science, 3rd edition, 2002.
4.	Basu, A.K., "Elements of Stochastic Processes", Narosa Publications, 2002.
5.	T.Veerarajan, "Probability, Statistics and Random Processes", Tata McGraw Hill Publishing Company Ltd., 2003.

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15MA317E	**OPTIMIZATION TECHNIQUES**			**L**	**T**	**P**	**C**
				3	**0**	**0**	**3**
Co-requisite:	NA						
Prerequisite:	15MA102 (or) 15MA104 (or) 15MA205B						
Data Book / Codes/Standards	Yes						
Course Category	E	ELECTIVE	MATHEMATICS				
Course designed by	Department of Mathematics						
Approval	-- Academic Council Meeting -- , 2016						

PURPOSE	To understand and apply optimization techniques to industrial operations		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	Identify the optimization of resources and apply techniques to industrial problems.	a	e
2.	Predict the life time of replacement items	a	e
3.	Ascertain the optimal sequence to do the jobs through the machinesand CPM- PERT Network models.	a	e
4.	To know the goal of inventory control	a	e
5.	Employ the concept of Transportation and Assignment problems.	a	e

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: LINEAR PROGRAMMING PROBLEM	**9**			
1.	Formulation of an LPP model	1	C, I	1	1-7
2.	Graphical Method of LPP	2	C, I	1	1,3,4,6
3.	Simplex algorithm- Maximization case	2	C, I	1	1,3,4,6
4.	Simplex algorithm- Minimization case	2	C, I	1	1,3,4,6

5.	Artificial variable techniques	2	C, I	1	1,3,4,6
	UNIT II: REPLACEMENT AND GAME THEORY	**9**			
6.	Replacement of items that deteriorate with time and value of money remains constant	2	C, I	2	1,3,4,6
7.	Replacement of items which do not deteriorate with time and equipment that fails suddenly	2	C, I	2	1,3
8.	Two person zero sum games	1	C, I	2	1,3
9.	Saddle point, pure strategies, mixed strategies and dominance property	2	C, I	2	1,3,4,6
10.	Graphical method for 2 x n and m x 2 games	2	C, I	2	1,5,6
	UNIT III: RESOURCE SCHEDULING AND NETWORK ANALYSIS	**9**			
11.	Sequencing problem :Models with n jobs through two machines	2	C, I	3	2,5,7
12.	Sequencing problem :Models with n jobs through three machines	2	C,I	3	2,5,7,1
13.	Sequencing problem :Models with n jobs through m machines	1	C,I	3	2,5,7
14.	Critical Path Method (CPM)	2	C,I	3	1,2
15.	PERT in network	2	C,I	3	1,2
	UNIT IV: INVENTORY CONTROL	**9**			3.6
16.	Inventory models – Introduction, Economic ordering quantity, Reorder level.	2	C,I	4	7
17.	Deterministic models – Purchasing model with no shortages	2	C,I	4	1,5,6
18.	Deterministic models –Manufacturing model with no shortages	1			
19.	Deterministic models – Purchasing model with shortages	2	C,I	4	4,5
20.	Deterministic models – Manufacturing model with shortages	1			
21.	Optimum cost	1	C,I	4	1,2
	UNIT V: ADVANCED LINEAR PROGRAMMING	**9**			
22.	Initial basic solution of transportation problem by Vogel's Approximation Method	2	C,I	5	3,4
23.	Optimality test- MODI method	2	C,I	5	3, 4
24.	Unbalanced transportation problem	2	C,I	5	3,4
25.	Degenerate solution	1	C,I	5	3,4
26.	Assignment problem- Hungarian method	1	C,I	5	3, 4
27.	Travelling salesman problem	1	C,I	5	3, 4
	Total contact hours	**45**			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	KantiSwarup, Gupta P. K., and Man Mohan, *Operations Research*, Sultan Chand & Sons, 1994.
	REFERENCE BOOKS/OTHER READING MATERIAL
1.	Gupta, P.K., and Hira, D.S., *Operations Research*S.Chand& Sons., 2000.
2.	Sundaresan.V, Ganapathy Subramanian. K.S. and Ganesan.K, *Resource Management Techniques*, A.R. Publications, 2002
3.	Sharma S.D., *Operations Research*, KedarnthRamnath& Co., Meerut 1994
4.	Taha, H.A, *Operations Research - An Introduction*, 7th edition, Prentice Hall of India, New Delhi.
5.	Gupta P. K., and Manmohan, *Operations Research and Quantitative Analysis* – S. Chand &Co. New Delhi.
6.	Billy B. Gillet., *Introduction to Operations Research*, TMH Publishing and Co.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15MA318E	**FUZZY APPROACHES IN ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Co-requisite:	NA				
Prerequisite:	15MA102 (or) 15MA104 (or) 15MA205B				
Data Book / Codes/Standards	NA				
Course Category	E ELECTIVE	MATHEMATICS			
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To acquire unique capabilities of fuzzy approaches as greatest advantage to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES	**STUDENT OUTCOMES**						
At the end of the course, student will be able to							

1.	To apply knowledge of Fuzzy mathematics, science, and engineering	a	e					
2.	To apply the basic concepts of fuzzification of classical set	a	e					
3.	To get familiar with fuzzy arithmetic and fuzzy logic	a	e					
4.	To model natural language to fuzzy sets and knowledge about rule based system	a	e					
5.	Expose to the concept of fuzzy logic controller	a	e					

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: INTRODUCTION TO FUZZY SETS	**9**			
1.	Introduction to crisp sets and fuzzy sets	2	C,I	1	1-5
2.	Operations and properties of fuzzy sets	2	C,I	1	1,3,4
3.	Introduction to fuzzy relation and its properties	2	C,I	1	1,3,4
4.	Fuzzy equivalence relation	2	C,I	1	1,3,4
5.	Value assignment problems	1	C,I	1	1,3,4
	UNIT II: FUZZY-CRISP CONVERSIONS	**9**			
6.	Features of membership function	1	C,I	2	1,3,4
7.	Properties of membership function	2	C,I	2	1,3,4
8.	Fuzzification of classical set	2	C,I	2	1,3
9.	Intuition, Inference and rank ordering	2	C,I	2	1,3
10.	Fuzzy to crisp conversion	2	C,I	2	1,3
	UNIT III: OPERATIONS ON FUZZY SETS AND FUZZY LOGIC	**9**			
11.	Introduction to Fuzzy numbers	1	C,I	3	1
12.	Fuzzy arithmetic	2	C,I	3	1
13.	Interval arithmetic	1	C,I	3	1
14.	Basic concept of fuzzy logic	2	C,I	3	1
15.	Max-min composition	2	C,I	3	1
16.	Max Product composition	1	C,I	3	1
	UNIT IV: FUZZY RULE BASED SYSTEM	**9**			
17.	Introduction to natural language	2	C,I	4	1
18.	Introduction to Linguistic hedges	2	C,I	4	1
19.	Introduction to Ruled based system	2	C,I	4	1

20.	Fuzzy rule based system	1	C,I	4	1
21.	Aggregation of fuzzy rules	2	C,I	4	1
	UNIT V: FUZZY CONTROL SYSTEM	**9**			
22.	Simple Fuzzy logic controller	2	C,I	5	3,4
23.	General Fuzzy logic controller	2	C,I	5	3,4
24.	Introduction to Fuzzy control system design	2	C,I	5	3,4
25.	Examples of fuzzy control system design	1	C,I	5	4
26.	Application of fuzzy logic in industry	2	C,I	5	2,3
	Total contact hours	45			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	Timothy J.Ross,"Fuzzy logic with Engineering applications, MCGraw Hill, 2010
	REFERENCE BOOKS/OTHER READING MATERIAL
1.	Li-Xin Wang, " A course in fuzzy systems and control, Prentice Hall,1997.
2.	R.K.Yager, D.P.Filev, "Essentias of fuzzy modeling and control, John Wiley and Sons Inc, Newyourk, 1994
3.	Klir.G.J and B.O.Yuan, "Fuzzy sets and Fuzzy logic:Theory and Applications, PHI, India, 1997.
4.	Dimiter Driakov etal, " An introduction to Fuzzy control", Narosa Publication House, 1993.

Course nature		**Theory**					
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**

15MA319E	NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3
Co-requisite:	NA				
Prerequisite:	15MA201 (or) 15MA202 (or) 15MA204				
Data Book / Codes/Standards	NA				
Course Category	E	Elective	MATHEMATICS		
Course designed by	Department of Mathematics				
Approval	-- Academic Council Meeting -- , 2016				

PURPOSE	To acquire analytical ability on solving nonlinear partial differential equations as applied to elective students for the respective branches of Engineering.	
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**
At the end of the course, student will be able to		
1.	Be familiar with formulation and solution of first order nonlinear PDE	a e
2.	Study in detail the weak solutions to hyperbolic equations	a e
3.	Get exposed to diffusion processes	a e
4.	To study the applications of reaction- diffusion processes	a e
5.	Be thorough with equilibrium models.	a e

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: FIRST-ORDER DIFFERENTIAL EQUATIONS AND CHARACTERISTICS	**9**			
1.	Nonlinear Equations- Quasilinear Equations	2	C,D	1	1-7
2.	The General Solution-Propagation of Singularities-Complete Integral	2	C,D	1	1,3,4,6
3.	A uniqueness Result-Age Structure-Structured Predator-Prey Model	2	C,D	1	1,3,4,6
4.	Chemotherapy-mass Structure-Size	2	C,D	1	1,3,4,6
5.	Dependent Predation	1	C,D	1	1,3,4,6
	UNIT II: WEAK SOLUTIONS TO HYPERBOLIC EQUATIONS	**9**			

6.	Discontinuous Solutions-Jump Conditions-Shock Formation	2	C,D	2	1,3,4,6
7.	Applications-Weak Solutions-Asymptotic Behavior of Shocks	2	C,D	2	1,3
8.	Equal-Area Principle	2	D,I	2	1,3
9.	Shock Fitting	2	C,D	2	2,4
10.	Asymptotic Behavior	1	C,D	2	2,4
	UNIT III: DIFFUSION PROCESSES	**9**			
11.	Diffusion and Random Motion--Nonlinear Diffusion models	2	C,D	3	2,5,7
12.	Diffusion: Fisher's Equation-Traveling wave Solutions-Perturbation Solution	2	C,D	3	2,5,7,1
13.	Diffusion: Burgers' Equation-Traveling wave Solution-Initial Value Problem	2	C,D	3	2,5,7
14.	Asymptotic Solution to Burgers' Equation	2	C,D	3	1,2
15.	Evolution of a Point Source	1	C,D	3	1,2
	UNIT IV: REACTION-DIFFUSION SYSTEMS	**9**			
16.	Predator-Prey Model-Combustion-Chemotaxis	2	C,D	4	2
17.	Fixed-Point Iteration	2	C,D	4	1,2
18.	Energy Estimates	2	C,D	4	2,4,5
19.	Semilinear Equations-maximum Principles	2	C,D	4	1,2
20.	Asymptotic Behavior	1	C,D	4	2,4,5
	UNIT V: EQUILIBRIUM MODELS	**9**			
21.	Elliptic models- Maximum Principle- Existence Theorem	2	C,D	5	2,3,4
22.	Eigenvalue Problems	2	C,D	5	2,4
23.	Nonlinear Eigenvalue Problems	2	C,D	5	2,3
24.	Linear Eigenvalue Problems	2	C,D	5	2,3
25.	Stability and Bifurcation	1	C,D	5	2,3
	Total contact hours	45			

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	K.Sankara Rao, Introduction to Partial Differential Equations, Prentice-Hall of India, 3rd Edition, 2010.
2.	J. D. Logan, An Introduction to nonlinear Partial Differential Equations, Wiley.2nd edition, 2008.

	REFERENCE BOOKS/OTHER READING MATERIALS
1.	Donald Greenspan, Introduction to Partial Differential Equations, Courier Dover Publications, 2000.
2.	J.N.Sharma & Kehar Singh, Partial Differential Equations for Engineers and Scientists, Narosha Publishing House, Reprint, 2011.
3.	Ian. N. Snedden, Elements of Partial Differential Equations, Dover Publications, 2006.
4.	TynMyint.U and Lokenath Debnath, Linear Partial Differential Equations for Scientists and Engineers, North Holland, New York, 2007.
5.	Robert C. Mc Owen, Partial Differential Equations Methods and Applications, Pearson Education, 2004.

Course nature	**Theory**

Assessment Method (Weightage 100%)

	Assessment tool	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
In-semester	**Weightage**	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15MA320E	**CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Co-requisite:	NOT APPLICABLE		
Prerequisite:	15MA102 (or) 15MA104 (or) 15MA205B		
Data Book / Codes/Standards	NA		
Course Category	E	ELECTIVE	MATHEMATICS
Course designed by	Department of Mathematics		
Approval	-- Academic Council Meeting -- , 2016		

PURPOSE	To impart analytical ability in solving variational problems and Integral equation.		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1	Fully understand the properties of geometrical problems	a	e
2	Be familiar with variational problems	a	e
3	Be familiar isoperimetric problems	a	e
4	Be thorough with different types of integral equations	a	e
5	Be exposed to the decomposition method	a	e

Session	Description of Topic	Contact Hours	C-D-I-O	IOs	Reference
	UNIT I	**9**			
1.	Introduction – Functionals	1	C,I	1	1-4
2.	Euler's equation – Different forms of Euler's equations	2	C,I	1	1-4
3.	Euler's equation – Different forms of Euler's equations	2	C,I	1	1-4
4.	Solutions of Euler's equation – Geometrical problems	2	C,I	1	1-4
5.	Solutions of Euler's equation – Geometrical problems	2	C,I	1	1-4
	UNIT II	**9**			
6.	Geodesics	1	C,I	2	1-4
7.	Variational problems involving several unknown functions	2	C,I	2	1-4
8.	Functionals dependent on Higher order derivatives	**2**	C,I	2	1-4
9.	Variational problems involving several independent variables	2	C,I	2	1-4
10.	Constraints and Lagrange's multipliers	2	C,I	2	1-4
	UNIT III	**9**			
11.	Isoperimetric problems	2	C,I	3	1-4
12.	The general variation of a functional - Functionals involving higher order derivatives	2	C,I	3	1-4
13.	Functionals involving higher order derivatives	1	C,I	3	1-4
14.	Approximate solution of boundary value problems – Rayleigh-Ritz method	2	C,I	3	1-4
15.	Rayleigh-Ritz method	2	C,I	3	1-4
	UNIT IV	**9**			
16.	Definition-Classification of integral equations	1	C,I	4	1-4
17.	Solution of an integral equation	2	C,I	4	1-4
18.	Converting Volterrato equation to ODE	2	C,I	4	1-4
19.	Converting IVP to Volterra equation	2	C,I	4	1-4
20.	Converting BVP to Fredholm equation.	2	C,I	4	1-4
	UNIT V	**9**			
21	Fredholm integral equation - The Decomposition method	2	C,I	5	1-4
22	The Modified Decomposition method	2	C,I	5	1-4
23	The Direct computation method	1	C,I	5	1-4
24	The successive approximations method	2	C,I	5	1-4
25	The method of successive substitutions	2	C,I	5	1-4

LEARNING RESOURCES:

Sl. No.	TEXT BOOKS
1.	Dr. M. K. Venkatraman, Higher Engineering Mathematics, National Publishing Company, 2012.**Unit I**:Chapter 9: Sec 1 – 9; **Unit II**:Chapter 9: Sec 10 – 14; **Unit III**: Chapter 9: 15 – 21
2.	Abdul Majid Wazwaz, "A first course in integral equations", World Scientific Publishing Company Pvt. Ltd., 1997 **Unit IV**: Chapter 1.1 – 1.6; **Unit V**: Chapter 2.1 – 2.7
3.	F.G. Tricomi, "Integral equations", Courier Dover Publications, 1985

	REFERENCE BOOKS/OTHER READING MATERIAL
1.	L. Elsgolts, Differential Equations and the Calculus of Variations, University Press of the Pacific, 2003**.**

Course nature			**Theory**				
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
						End semester examination Weightage :	**50%**

15MA321E	**LINEAR ALGEBRA**			**L**	**T**	**P**	**C**
				2	**0**	**0**	**2**
Co-requisite:	NA						
Prerequisite:	15MA102 (or) 15MA104 (or) 15MA205B						
Data Book / Codes/Standards							
Course Category	E	ELECTIVE	MATHEMATICS				
Course designed by	Department of Mathematics						
Approval	-- Academic Council Meeting -- , 2016						

PURPOSE	To acquire theoretical background necessary for application in signal processing.		
INSTRUCTIONAL OBJECTIVES		**STUDENT OUTCOMES**	
At the end of the course, student will be able to			
1.	Apply vector space knowledge to Engineering problems.	a	e
2.	Improve their ability to apply inner product space theory to engineering system like signal processing.	a	e

Session	**Description of Topic**	**Contact hours**	**C-D-I-O**	**IOs**	**Reference**
	UNIT I: VECTOR SPACE AND LINEAR TRANSFORMATION	**12**			
1.	Vector space-Definition, examples. Simple Properties.	1	C,I	1	1
2.	Subspaces-Definition, examples	1	C,I	1	1

3.	Linear combination of vectors- examples. Span of a set-Simple problems.	1	C,I	1	1
4.	Theorems without proof on subspaces and span. Span of a set is a subspace-Problems.	1	C,I	1	1
5.	Linear independence and dependence of vectors- problems.	1	C,I	1	1
6.	Basis of a vector space-examples	1	C,I	1	1
7.	Dimension of a vector space -problems	1	C,I	1	1
8.	Linear transformation-examples and properties.	1	C,I	1	1
9.	Matrix representation of a linear transformation-Problems	1	C,I	1	1
10.	Linear transformation corresponding to a matrix-problems	1	C,I	1	1
11.	Algebra of linear transformation-finding sum, difference and composition of linear transformation.	1	C,I	1	1
12.	Theorems without proof on matrix representation-Matrix of sum and composition of linear transformation problems.	1	C,I	1	1
	UNIT II: INNER PRODUCT SPACE	12			
1.	Inner product space-Definition and examples.	1	C,I	2	1
2.	Simple properties of inner product space, norm of a vector- properties.	2	C,I	2	1
3.	Schwarz and triangular inequalities without proof and simple problems.	1	C,I	2	1
4.	Orthogonal vectors, orthonormal vectors-problems	2	C,I	2	1
5.	Orthonormal basis-Problems	1	C,I	2	1
6.	Gram-Schmidt process for constructing orthonormal basis-problems	2	C,I	2	1
7.	Construction of orthonormal basis -problems	2	C,I	2	1
8.	Orthogonal complement of a set-problems	1	C,I	2	1

LEARNING RESOURCES	
Sl. No.	**TEXT BOOKS**
1.	K.S.Narayanan and T.K.Manicavachagam Pillai, S.Viswanathan "Modern Algebra. Vo II"(Printers & Publisher)1983.

Course nature				**Theory**			
Assessment Method (Weightage 100%)							
In-semester	**Assessment tool**	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	**Total**
	Weightage	**10%**	**15%**	**15%**	**5%**	**5%**	**50%**
					End semester examination Weightage :		**50%**