



JAI HIND COLLEGE
BASANTSING INSTITUTE OF SCIENCE
&
J.T.LALVANI COLLEGE OF COMMERCE
(AUTONOMOUS)

"A" Road, Churchgate, Mumbai - 400 020, India.

Affiliated to
University of Mumbai

Program : B.Sc.

Proposed Course : Mathematics

Credit Based Semester and Grading System (CBCS) with effect from the
academic year 2019-20

S.Y.B.Sc. / B.A Mathematics Syllabus

Academic year 2019-2020

Semester III			
Course Code	Course Title	Credits	Lectures /Week
SMAT 301	CALCULUS AND DIFFERENTIAL EQUATION III	03	03
SMAT 302 / AMAT 301	LINEAR ALGEBRA II	03	03
SMAT 303 / AMAT 302	DATA ANALYTICS	03	04
SMAT PR 1	PRACTICAL BASED ON SMAT 301	2.5	01
SMAT PR 2 / AMAT PR 3	PRACTICAL BASED ON SMAT 302/AMAT 401 AND SMAT 303/402	2.5	03



Semester III – Theory

PAPER I: Calculus and Differential Equations-III		No. of credits: 3
COURSE CODE: SMAT301		
	<p>Objectives: To increase the understanding of differentiation in higher dimension</p> <p>Outcomes: Students will learn to deal with modern engineering problems.</p>	
Unit I	Infinite Series	15 L
	<p>a. Infinite series in \mathbb{R}, Convergence of series, Absolute convergence</p> <p>b. Test of Convergence: nth term test, Comparison test, Root test, Ratio test.</p> <p>c. Test for Conditional convergence: Partial summation formula, Dirichlet's test, Leibnitz's test.</p>	
Unit II	Functions of Several Variables	15 L
	<p>a. Euclidean inner space and Euclidean norm function on \mathbb{R}^n, distance between two points, sequences in \mathbb{R}^n, convergence of sequences (these concepts should be specifically discussed for \mathbb{R}^2 and \mathbb{R}^3).</p> <p>b. Limits and continuity of functions from \mathbb{R}^2 or \mathbb{R}^3 to \mathbb{R}, basic results on limits and continuity and composition of composite functions.</p> <p>c. Partial derivatives and directional derivatives.</p> <p>d. Bivariate mean value theorem and bivariate mean value Inequality.</p>	
Unit III	Second order Differential Equations	15 L
	<p>Homogeneous and non-homogeneous equations, Particular and general solution.</p> <p>Solving second order linear differential equations:</p> <p>a. Second order linear Differential Equations with constant coefficients, equations which can be reduced to an equation with constant coefficient.</p> <p>b. By method of Undetermined coefficients</p> <p>c. By method of variation of parameters for solving the non-homogeneous equation $y'' + P(x)y' + Q(x)y = R(x)$, from the general solution of the associated homogeneous equation</p> <p>d. Using a known solution to find general solution.</p>	
	References:	

<ol style="list-style-type: none"> 1. G.F. Simmons and S. Krantz, Differential Equations with Applications and Historical notes, Tata Mc-Graw Hill. 2. Sudhir R. Ghorpade, Balmohan V. Limaye, A Course in Calculus and Real Analysis, Springer. 3. Sudhir R. Ghorpade, Balmohan V. Limaye, A Course in Multivariable Calculus and Analysis, Springer. <p>Additional References:</p> <ol style="list-style-type: none"> 1. R. R. Goldberg, Methods of real analysis, Oxford & I. B. H. Publications, 1970 2. T. Apostol. Calculus, Vol. 2 (Second Edition), John Wiley. 3. Robert, G. Bartle, Donald Sherbert - Introduction to real analysis, Third edition, John Wiley and Sons 4. G.B. Thomas and R. L. Finney, Calculus and Analytic Geometry, Ninth Edition, Addison-Wesley, 1998 5. Ajit Kumar and S.Kumaresan, A Basic Course in Real Analysis, CRC Press, Second Indian Reprint 2015 6. Howard Anton, Calculus - A new Horizon, Sixth Edition, John Wiley and Sons Inc, 1999 		
PAPER II: LINEAR ALGEBRA COURSE CODE: SMAT302/AMAT302 No. of Credits: 3		
Unit I	Vector spaces	15L
	System of linear equations (overview), definition and examples of vector spaces, vector subspaces, linearly dependent and linearly independent set of vectors, basis and dimension of a vector space.	
Unit II	Linear Transformations	15L
	Definition and examples, kernel and image of a linear transformation, rank-nullity theorem, representation of linear transformation by matrices, linear isomorphism, cosets and quotient spaces.	
Unit III	Matrices and determinants	15L
	Elementary matrices, rank of a matrix, introduction to determinants and their properties, Laplace expansion, adjoint of a matrix, Cramer's rule.	
PAPER II: MATHEMATICS-III - DATA ANALYTICS COURSE CODE: SMAT303/AMAT302 No. of Credits: 3		

Unit I	Summary Statistics	15 L
	<ul style="list-style-type: none"> • Types of characteristics: <ul style="list-style-type: none"> (a) Attributes: Nominal scale, ordinal scale, (b) Variables: Interval scale, ratio scale, discrete and continuous variables, difference between linear scale and circular scale • Types of data: <ul style="list-style-type: none"> (a) Primary data, Secondary data (b) Cross-sectional data, time series data, directional data. • Classification:Raw data and its classification, ungrouped frequency distribution, Sturges' rule, grouped frequency distribution, cumulative frequency distribution, inclusive and exclusive methods of classification, Open end classes, and relative frequency distribution. (No question on this topic) • Measures of Central Tendency: Concept of central tendency of statistical data, Statistical averages, characteristics of a good statistical average. Arithmetic mean, combined mean of a number of groups, Mode and Median. • Measures of Dispersion:Concept of dispersion, characteristics of good measure of dispersion. Range, Quartile deviation ,Mean deviation, minimality property (without proof),Variance and standard deviation, combined variance for n groups(derivation for two groups). Measures of dispersion for comparison:Coefficient of range, coefficient of quartile deviation and coefficient of mean deviation, coefficient of variation. 	
Unit II	Discrete Probability distribution	15L
	<ul style="list-style-type: none"> • Definition and simple examples of probability and conditional probability (No question on this topic) • Probability Distributions <ul style="list-style-type: none"> (a) Concept and definition of a discrete random variable (b) Probability mass function and Cumulative distribution function (d.f.) of discrete random variable. 	

	<p>(c) Mathematical Expectation and Variance of a random variable. Theorem on Expectation & Variance</p> <ul style="list-style-type: none"> • Discrete Probability Distributions <p>(a) Discrete Uniform Distribution – Definition, derivation of their mean and variance.</p> <p>(b) Bernoulli Distribution, Binomial distribution – Definition and properties, derivation of their mean and variance .</p> <p>(c) Poisson distribution – Definition and properties, derivation of their mean and variance.</p>	
Unit III	Continuous Probability Distributions	15 L
	<ul style="list-style-type: none"> • Continuous random variables <p>(a) Probability density function and cumulative distribution function</p> <p>(b) Expectation of a continuous random variable and its properties</p> <ul style="list-style-type: none"> • Continuous Probability distribution <p>(a) Exponential distribution – Definition, derivation of their mean and variance</p> <p>(b) Normal distribution – Properties of Normal distribution (without proof)</p> <p>(c) Normal approximation to Binomial and Poisson distribution (Statement only)</p> <p>(d) Central Limit theorem (statement only)</p> <p>(e) Sampling distribution of sample mean and sample proportion. (For large sample only)</p> <p>(f) Standard errors of sample mean and sample proportion.</p> <p>(g) Point and Interval estimate (Confidence interval) of single mean, single proportion from sample of large size</p>	
	<p>References:</p> <ol style="list-style-type: none"> 1. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi 2. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta 3. Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi <p>Additional References:</p> <ol style="list-style-type: none"> 1. Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, New Delhi 2. Freund, J. E. (1977). Modern Elementary Statistics. Fourth Edition, Prentice Hall of India Private Limited, New Delhi 3. Hoel P. G. (1971). Introduction to Mathematical Statistics, John Wiley and 	

	<p>Sons, New York</p> <p>4. Hogg, R. V. and Craig R. G. (1989). Introduction to Mathematical Statistics, Ed. 4. MacMillan Publishing Co., New York</p> <p>5. Mayer, P. (1972). Introductory Probability and Statistical Applications, Addison Wesley Publishing Co., London</p> <p>6. Mood, A. M. and Graybill, F. A. and Boes D.C. (1974). Introduction to the Theory of Statistics, Ed. 3, McGraw Hill Book Company</p> <p>7. Ross S. (2002). A First Course in Probability, Sixth Edition, Pearson Education, Inc. & Dorling Kindersley Publishing, Inc</p>
	Semester III – Practicals
	PRACTICAL-I
	COURSE CODE: SMAT301PR/AMAT301PR No. of Credits: 3
(A)	<p>Title of Practicals on SMAT301</p> <p>(a) Examples on Convergent series in \mathbb{R}. Cauchy's criterion. Problems based on test of Convergence of a series in \mathbb{R}</p> <p>(b) Examples on Alternating series, Leibnitz's test, Absolute convergence.</p> <p>(c) Sequences, Limit and Continuity in \mathbb{R} and \mathbb{C}</p> <p>(d) Computing directional derivatives, partial derivatives</p> <p>(e) Finding general solution of homogeneous and non-homogeneous equations, use of known solutions to find the general solution of homogeneous equations.</p> <p>(f) Solving equations using method of undetermined coefficients and method of variation of parameters.</p>
(B)	<p>Title of Practicals on SMAT302/AMAT301</p> <ol style="list-style-type: none"> 1. Vector spaces and subspaces 2. Linearly dependent and independent vectors 3. Basis and dimension of a vector space 4. Linear transformations and the matrix associated with the linear transformation 5. Rank-nullity theorem 6. Quotient spaces

	<ol style="list-style-type: none"> 7. Elementary matrices and rank of a matrix 8. Finding determinants and inverse of a square matrix 9. Cramer's rule 	
PRACTICAL-II COURSE CODE:SMAT302PR/AMAT301PR No. of Credits: 3		
	<ol style="list-style-type: none"> 1. Diagrammatic representation of statistical data: simple and subdivided bar diagrams, multiple bar diagram, percentage bar diagram, pie diagram 2. Graphical representation of statistical data: histogram, frequency curve and ogive curves. Determination of mode and median graphically 3. Computation of measures of central tendency and dispersion (grouped data) 4. Fitting of binomial distribution and computation of expected frequencies 5. Fitting of binomial distribution and computation of expected frequencies 6. Fitting of Poisson distribution and computation of expected frequencies. 7. Fitting of normal and exponential distributions, plot of observed and expected frequencies 	