

**Vivekananda Degree College**  
Rajajinagar, Bangalore -55  
**Department of Mathematics**  
LESSON PLAN FOR THE ACADEMIC YEAR 2020-2021  
( Online classes from MAY 2020 – AUG 2021)

**Program: BSc**

**Course/Paper Name: Mathematics**


**Semester: Second Semester**

**Class: 1<sup>st</sup> Year B.Sc.**

Total Hours : 56

**THEORY**

Sl. No.	Topic covered	No. of Lect Hours	Methodology	Initials
	Algebra II - Group Theory			
1.	Introduction	1	Lecture + interaction	KRP
2.	Binary Operation	1	Blackboard + Interaction	KRP
3.	Algebraic structure – problems on finding identity and inverse	2	Blackboard + Interaction	KRP
4.	Definitions of Semigroup , Group , and Abelian group	1	Blackboard + Interaction	KRP
5.	Finite and Infinite groups - problems	2	Blackboard + Interaction	KRP
6.	Properties of Groups with proof and examples	2	Blackboard + Interaction	KRP
7.	Problems on group	1	Blackboard + Interaction	KRP
8.	A finite semigroup with both left and right cancellation laws is a group	2	Blackboard + Interaction	KRP
9.	Modular system	2	Blackboard + Interaction	KRP
10.	Permutation groups	2	Blackboard + Interaction	KRP
11.	Subgroups –Theorems(with proof) -problems	2	Blackboard + Interaction	KRP

  
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Calculus II – (2a) Differential Calculus 1				
1.	Introduction - Polar Coordinates	1	Lecture + interaction	LDN
2.	Relation between the Cartesian and the Polar coordinates	1	Blackboard + Interaction	LDN
3.	Angle of intersection of curves	1	Blackboard + Interaction	LDN
4.	Polar sub tangent and polar sub normal	1	Blackboard + Interaction	LDN
5.	Perpendicular from the pole on the tangent	1	Blackboard + Interaction	LDN
6.	Pedal equation or p-r equation of a curve	1	Blackboard + Interaction	LDN
7.	To determine the pedal equation of a curve	1	Blackboard + Interaction	LDN
8.	Derivation of an arc length	1	Blackboard + Interaction	LDN
9.	Curvature of plane curves	1	Blackboard + Interaction	LDN
10.	Radius of curvature for different forms of curves	1	Blackboard + Interaction	LDN
11.	Radius of curvature in parametric form	1	Blackboard + Interaction	LDN
12.	Radius of curvature in polar form	1	Blackboard + Interaction	LDN
13.	Centre of curvature	1	Blackboard + Interaction	LDN
14.	Coordinates of the centre of curvature in Cartesian form	1	Blackboard + Interaction	LDN
15.	Centre of curvature in parametric form	1	Blackboard + Interaction	LDN
16.	Evolutes	1	Blackboard + Interaction	LDN
17.	Singular points	1	Blackboard + Interaction	PL
18.	Double points, Multiple points	1	Blackboard + Interaction	PL
19.	Classification of double points	1	Blackboard + Interaction	PL
20.	Tangents at the origin	1	Blackboard + Interaction	PL
21.	Working rule for finding the position and nature of the double point of the curve $f(x, y) = 0$	1	Blackboard + Interaction	PL

			Interaction	
22.	Asymptotes, Determination of asymptotes parallel to the coordinate axes	1	Blackboard + Interaction	PL
23.	Oblique Asymptotes	1	Blackboard + Interaction	PL
24.	Asymptotes for polar curves	1	Blackboard + Interaction	PL
25.	Envelopes	1	Blackboard + Interaction	PL
26.	Method of finding the envelope of the family of curves $f(x, y, \alpha) = 0$	1	Blackboard + Interaction	PL
27.	Tracing of curves, Procedure for tracing Cartesian equations	1	Blackboard + Interaction	PL
28.	Polar curves	1	Blackboard + Interaction	PL
29.	Application problems	1	Blackboard + Interaction	PL
	Calculus II - (2b) Integral Calculus			
1.	Applications of integral calculus	2	Blackboard + Interaction	PL
2.	Rectification	2	Blackboard + Interaction	PL
3.	Area of plane curves	2	Blackboard + Interaction	PL
4.	Surface area of revolution	2	Blackboard + Interaction	PL
5.	Volume of revolution	2	Blackboard + Interaction	PL
6.	Application problems	1	Blackboard + Interaction	PL
	Differential Equations – I			
1.	Introduction to Differential equation of first order and first degree	1	Lecture + interaction	KRP
2.	Linear differential equations	2	Blackboard + Interaction	KRP
3.	Bernoulli's equation	2	Blackboard + Interaction	KRP
4.	Exact differential equations	1	Blackboard + Interaction	KRP
5.	Equations of first – order and higher degree	1	Blackboard +	KRP

			Interaction	
6.	Equations solvable for p	1	Blackboard + Interaction	KRP
7.	Equations solvable for x	1	Blackboard + Interaction	KRP
8.	Equations solvable for y	1	Blackboard + Interaction	KRP
9.	Clairaut's equation	2	Blackboard + Interaction	KRP
10.	Orthogonal trajectories	2	Blackboard + Interaction	KRP
11.	Orthogonal trajectories in polar form	2	Blackboard + Interaction	KRP
12.	Application problems	1	Blackboard + Interaction	KRP
ASSIGNMENTS – Solving question bank and model question papers				

KRP : PROF PUSHPA K R = 35 HOURS

PL : PROF PUSHPALATHA A = 25 HOURS

LDN : DR. LATHA D N = 16 HOURS

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## PRACTICALS

**Total Hours ; 33**

Sl. No.	Topic covered	No. of Lecture Hours	Methodology
1.	i) Verifying whether given operator is binary or not. ii) To find identity element of a group. iii) To find inverse element of a group.	3	Blackboard + Lecture + Hands on key
2.	Finding all possible subgroups of a finite group.	3	Blackboard + Lecture + Hands on key
3.	Plotting of standard Cartesian curves using Scilab/Maxima.	3	Blackboard + Lecture + Hands on key
4.	Plotting of standard Polar curves using Scilab/Maxima.	3	Blackboard + Lecture + Hands on key
5.	Plotting of standard parametric curves using Scilab/Maxima.	3	Blackboard + Lecture + Hands on key
6.	Scilab/Maxima programs for area and volume.	3	Blackboard + Lecture + Hands on key
7.	Solution of Differential equation using Scilab/Maxima and plotting the solution-I.	3	Blackboard + Lecture + Hands on key
8.	Solution of Differential equation using Scilab/Maxima and plotting the solution-II.	3	Blackboard + Lecture + Hands on key
9.	Solution of Differential equation using Scilab/Maxima and plotting the solution-III.	3	Blackboard + Lecture + Hands on key
10.	Solution of Differential equation using Scilab/Maxima and plotting the solution-IV.	3	Blackboard + Lecture + Hands on key
11.	REPETATION	3	Hands on key

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**Department of Mathematics**  
LESSON PLAN FOR THE ACADEMIC YEAR 2020-2021

**Program: BSc**

**Course/Paper Name: Mathematics**

**Semester: Fourth Semester**

**Class: 2<sup>nd</sup> Year B.Sc.**

Total Hours : 56

**THEORY**

Sl. No.	Topic covered	No. of Lecture Hours	Methodology	Initials
Algebra IV - Group theory (Normal Sub Groups)				
1.	Introduction to groups	1	Lecture + interaction	KRP
2.	Theorems on Normal subgroups	2	Blackboard + Interaction	KRP
3.	Some results on Normal subgroups	1	Blackboard + Interaction	KRP
4.	Centre of a group , Definitions and theorems	1	Blackboard + Interaction	KRP
5.	Quotient Group (Factor group) and theorems	1	Blackboard + Interaction	KRP
6.	Homomorphism of groups	1	Blackboard + Interaction	KRP
7.	Properties of Homomorphism of groups	1	Blackboard + Interaction	KRP
8.	Kernel of a homomorphism and theorems	1	Blackboard + Interaction	KRP
9.	Isomorphism of groups , Fundamental theorem of homomorphism	1	Blackboard + Interaction	KRP
10.	Properties related to Isomorphism	2	Blackboard + Interaction	KRP
11.	Permutation group	2	Blackboard + Interaction	KRP
12.	Cayley's theorem	2	Blackboard + Interaction	KRP

Analysis II - Fourier Series				
1.	Introduction to Periodic functions, Trigonometric Fourier series	1	Lecture + interaction	PL
2.	Derivation of Euler's formulae	2	Blackboard + Interaction	PL
3.	Even and odd functions and illustrative examples	2	Blackboard + Interaction	PL
4.	Even and odd nature of $f(x)$ defined in $(0, 2\pi)$	2	Blackboard + Interaction	PL
5.	Fourier series of arbitrary period	2	Blackboard + Interaction	PL
6.	Half Range Fourier Expansion, Cosine series and Sine series	3	Blackboard + Interaction	PL
Calculus IV - Differential Calculus				
1.	Introduction to Limits, Continuity of $f(x, y)$	1	Lecture + interaction	PL
2.	Partial Differentiability	1	Blackboard + Interaction	PL
3.	Taylor's Theorem for a function of two variables	3	Blackboard + Interaction	PL
4.	Maclaurin's Expansion for $f(x, y)$ and problems	2	Blackboard + Interaction	PL
5.	Maxima and Minima of functions of two variables	3	Blackboard + Interaction	PL
6.	Lagrange's Method of undetermined multipliers	2	Blackboard + Interaction	PL
Mathematical methods - I : Laplace Transforms				
1.	Introduction to Definition and basic properties	3	Lecture + interaction	PL
2.	Laplace transform of derivatives	2	Blackboard + Interaction	PL
3.	Laplace transform of Integrals	2	Blackboard + Interaction	PL
4.	Laplace transforms of periodic functions	2	Blackboard + Interaction	PL
5.	Laplace Transform of the Heaviside function( or unit step function)	1	Blackboard + Interaction	PL
6.	Convolution theorem	2	Blackboard + Interaction	PL
7.	The Inverse Laplace Transform	3	Blackboard + Interaction	PL

8.	Evaluation of $L^{-1}\left\{\frac{F(s)}{s}\right\}; L^{-1}\{F^n(s)\}$	2	Blackboard + Interaction	PL
9.	Evaluation of Inverse Laplace transform by using the convolution theorem	2	Blackboard + Interaction	PL
Differential Equations - II				
1.	Introduction to Second and higher order linear differential equations with constant coefficients – complimentary function – particular integrals	1	Lecture + interaction	LDN
2.	Homogeneous equations of second order with constant coefficients	2	Blackboard + Interaction	LDN
3.	Method of finding the complimentary function	1	Blackboard + Interaction	LDN
4.	Linear non- homogeneous equations of second order with constant coefficients	1	Blackboard + Interaction	LDN
5.	Specific forms of Particular integrals	3	Blackboard + Interaction	LDN
6.	Cauchy – Euler homogeneous linear equation	2	Blackboard + Interaction	LDN
7.	Simultaneous linear differential equations with constant coefficients	2	Blackboard + Interaction	LDN
8.	Solution when a part of the complimentary function is known	1	Blackboard + Interaction	LDN
9.	Solution by Changing the independent variable	1	Blackboard + Interaction	LDN
10.	Solution by Changing the dependent variable	1	Blackboard + Interaction	LDN
11.	Method of Variation of parameters	1	Blackboard + Interaction	LDN
12.	Solution when the equation is exact	1	Blackboard + Interaction	LDN
ASSIGNMENTS – Solving question bank and model question papers				

KRP : PROF PUSHPA K R = 16 HOURS

PL : PROF PUSHPALATHA A = 43 HOURS

LDN : DR. LATHA D N = 17 HOURS

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## PRACTICALS

**Total Hours : 39**

Sl. No.	Topic covered	No. of Lecture Hours	Methodology
1.	Illustrating homomorphism and isomorphism of groups.	3	Blackboard + Lecture + Hands on key
2.	Verification of Normality of a given subgroup.	3	Blackboard + Lecture + Hands on key
3.	Verifying Cayley's theorem and isomorphism theorems.	3	Blackboard + Lecture + Hands on key
4.	To plot periodic functions with period $2\pi$ and $2L$ .	3	Blackboard + Lecture + Hands on key
5.	To find full range trigonometric Fourier series of some simple functions with period $2\pi$ and $2L$ .	3	Blackboard + Lecture + Hands on key
6.	Plotting of functions in half-range and including their even and odd extensions.	3	Blackboard + Lecture + Hands on key
7.	To find the half-range sine and cosine series of simple functions.	3	Blackboard + Lecture + Hands on key
8.	Finding maxima/minima of functions of two variables.	3	Blackboard + Lecture + Hands on key
9.	Finding the Laplace transforms of some standard functions.	3	Blackboard + Lecture + Hands on key
10.	Finding the inverse Laplace transform of simple functions.	3	Blackboard + Lecture + Hands on key
11.	Implementing Laplace transform method of solving ordinary linear differential equations of first and second order with constant coefficient.	3	Blackboard + Lecture + Hands on key
12.	Finding complementary function and particular integral of constant coefficient second and higher order ordinary differential equations.	3	Blackboard + Lecture + Hands on key
13.	REPETATION	3	Hands on key

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**Department of Mathematics**  
LESSON PLAN FOR THE ACADEMIC YEAR 2020-2021

**Program: BSc**

**Course/Paper Name: Mathematics**

**Semester: Sixth Semester**

**Class: 3<sup>rd</sup> Year B.Sc.**

**Paper VII**

**THEORY**

Total Hours : 42

Sl. No.	Topic covered	No. of Lecture Hours	Methodology	Initials
	Algebra V – Linear Algebra			
1.	Introduction to vector spaces , Examples on vector spaces	2	Lecture + interaction	KRP
2.	Properties of vector spaces	1	Blackboard + Interaction	KRP
3.	Vector subspaces	2	Blackboard + Interaction	KRP
4.	Linear combination of vectors : Linear span of a set	1	Blackboard + Interaction	KRP
5.	Linear span : Definition	1	Blackboard + Interaction	KRP
6.	Linear dependence and linear independence of vectors	2	Blackboard + Interaction	KRP
7.	Basis and Dimension	2	Blackboard + Interaction	KRP
8.	Finite dimensional	1	Blackboard + Interaction	KRP
9.	Linear transformations	1	Blackboard + Interaction	KRP
10.	Properties of linear transformation	1	Blackboard + Interaction	KRP
11.	Matrix of a linear transformation	2	Blackboard + Interaction	KRP
12.	Change of a basis	1	Blackboard + Interaction	KRP
13.	Range and Kernel of a linear transformation	1	Blackboard + Interaction	KRP
14.	Definition : Rank of linear transformation	1	Blackboard + Interaction	KRP

15.	Rank – Nullity theorem	1	Blackboard + Interaction	KRP
16.	Non-singular linear transformations	1	Blackboard + Interaction	KRP
Differential Equations III – 2(a) Orthogonal curvilinear coordinates				
1.	Introduction to Relation between base vectors and normal vectors	2	Lecture + interaction	LDN
2.	Elementary arc length , Spherical curvilinear system , Cartesian, Cylindrical	2	Blackboard + Interaction	LDN
3.	Cylindrical polar coordinates	2	Blackboard + Interaction	LDN
4.	Spherical polar coordinates	2	Blackboard + Interaction	LDN
2(b) Total , Simultaneous and Partial Differential Equations				
1.	Introduction to Total differential equations	1	Lecture + interaction	KRP
2.	A necessary and sufficient condition for the total differential equation	1	Blackboard + Interaction	KRP
3.	Geometric interpretation of $Pdx + Qdy + Rdz = 0$	1	Blackboard + Interaction	KRP
4.	Methods of solving $Pdx + Qdy + Rdz = 0$	1	Blackboard + Interaction	KRP
5.	Simultaneous equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$	2	Blackboard + Interaction	KRP
6.	Partial Differential equations : Introduction to Kinds of Partial differential equations	1	Blackboard + Interaction	KRP
7.	Formation of Partial differential equations : Method of elimination of arbitrary constants	2	Blackboard + Interaction	KRP
8.	Method of elimination of arbitrary functions	1	Blackboard + Interaction	KRP
9.	Linear Partial differential equation of first order	2	Blackboard + Interaction	KRP
10.	Standard types of first order non – linear partial differential equations: Type I : Equations of the type $f(p, q) = 0$	1	Blackboard + Interaction	KRP
11.	Type II : Clariaut’s equation	1	Blackboard + Interaction	KRP
12.	Type III : Equation of the type $f(p, q, z) = 0$	1	Blackboard + Interaction	KRP
13.	Type IV : Equation of the type $f_1(x, p) = f_2(y, q)$	1	Blackboard + Interaction	KRP

14.	General method of solving Partial differential equations of non – linear type with two independent variables	2	Blackboard + Interaction	LDN
15.	Second order linear partial differential equations in two variables with constant coefficients	3	Blackboard + Interaction	LDN
16.	Rules for finding the Particular Integral	1	Blackboard + Interaction	LDN
17.	Non-Homogeneous linear equations with constant coefficients	2	Blackboard + Interaction	LDN
18.	Solutions of one – dimensional heat equation using Fourier series	2	Blackboard + Interaction	LDN
19.	Solutions of one – dimensional wave equation using Fourier series	2	Blackboard + Interaction	LDN
ASSIGNMENTS – Solving question bank and model question papers				

KRP : PROF PUSHPA K R = 27 HOURS

LDN : DR. LATHA D N = 20 HOURS

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## PRACTICALS

**Total Hours : 30**

Sl. No.	Topic covered	No. of Lecture Hours	Methodology
1.	i) Vector space, subspace – illustrative examples. ii) Expressing a vector as a linear combination of given set of vectors. iii) Examples on linear dependence and independence of vectors.	3	Blackboard + Lecture + Hands on key
2.	i) Basis and Dimension – illustrative examples. ii) Verifying whether a given transformation is linear.	3	Blackboard + Lecture + Hands on key
3.	i) Finding matrix of a linear transformation. ii) Problems on rank and nullity.	3	Blackboard + Lecture + Hands on key
4.	Solutions to the problems on total and simultaneous differential equations.	3	Blackboard + Lecture + Hands on key
5.	Solutions to the problems on different types of Partial differential equations.	3	Blackboard + Lecture + Hands on key
6.	Solving second order linear partial differential equations in two variables with constant coefficient.	3	Blackboard + Lecture + Hands on key
7.	Solving some more second order linear partial differential equations in two variables with constant coefficient.	3	Blackboard + Lecture + Hands on key
8.	Solution of one dimensional heat equation using Fourier series with Dirichlet condition.	3	Blackboard + Lecture + Hands on key
9.	Solution of one dimensional wave equation using Fourier series with Dirichlet condition.	3	Blackboard + Lecture + Hands on key
10.	REPETATION	3	Hands on key

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**Paper VIII**  
**THEORY**

Total Hours : 42

Sl. No.	Topic covered	No. of Lecture Hours	Methodology	Initials
Analysis III – Complex analysis				
1.	Introduction – Definition, Modulus – Argument form or Polar standard form or Trigonometric form of a complex number	1	Lecture + interaction	PL
2.	Equation of a straight line , Basic definitions, Limit of a function	1	Blackboard+ Interaction	PL
3.	Continuity of a function of a complex variable, Differentiability of a function of a complex variable	2	Blackboard+ Interaction	PL
4.	Introduction to Analytic functions , The necessary and sufficient conditions for $f(z)$ to be analytic and problems	3	Blackboard+ Interaction	PL
5.	Polar form of Cauchy-Riemann equations and problems	2	Blackboard+ Interaction	PL
6.	Orthogonal system	1	Blackboard+ Interaction	PL
7.	Harmonic functions	1	Blackboard+ Interaction	PL
8.	Construction of analytic functions by Milne-Thomson method	3	Blackboard+ Interaction	PL
9.	Complex integration	1	Blackboard+ Interaction	PL
10.	Complex line integral	2	Blackboard+ Interaction	PL
11.	Cauchy's integral theorem	1	Blackboard+ Interaction	PL
12.	Consequence of Cauchy's integral theorem	1	Blackboard+ Interaction	PL
13.	Cauchy's integral formula	1	Blackboard+ Interaction	PL
14.	Generalized Cauchy's integral formula	3	Blackboard+ Interaction	PL
15.	Cauchy's inequality, Liouville's theorem, Fundamental theorem of Algebra	2	Blackboard+ Interaction	PL
16.	Transformations - Conformal mapping (or transformations)	1	Blackboard+ Interaction	PL
17.	Some standard elementary transformations	2	Blackboard+ Interaction	PL

18.	Special transformations	1	Blackboard+ Interaction	PL
19.	The Bilinear transformation (or Mobius transformation) - Properties of Bilinear transformation	4	Blackboard+ Interaction	PL
Numerical methods – II				
1.	Introduction - Initial approximations	1	Lecture + interaction	LDN
2.	Method of successive bisection	2	Blackboard+ Interaction	LDN
3.	Method of False position (or Regula-Falsi method)	2	Blackboard+ Interaction	LDN
4.	Newton-Raphson method	2	Blackboard+ Interaction	LDN
5.	Numerical solutions of non-homogeneous systems of linear algebraic equations in 3 variables	1	Blackboard+ Interaction	LDN
6.	Jacobi Iteration method: (also known as Gauss-Jacobi's method)	2	Blackboard+ Interaction	LDN
7.	Gauss-Seidel method	2	Blackboard+ Interaction	LDN
8.	Computation of largest Eigen value of a square matrix by power method	2	Blackboard+ Interaction	LDN
9.	Numerical solution of ordinary differential equations	1	Blackboard+ Interaction	LDN
10.	Taylor's series method	1	Blackboard+ Interaction	LDN
11.	Euler's method	1	Blackboard+ Interaction	LDN
12.	Modified Euler's method	2	Blackboard+ Interaction	LDN
13.	Runge - Kutta method of fourth order	2	Blackboard+ Interaction	LDN
ASSIGNMENTS – Solving question bank and model question papers				

PL : PROF PUSHPALATHA A = 33 HOURS

LDN : DR. LATHA D N = 21 HOURS

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## PRACTICALS

Total Hours : 39

Sl. No.	Topic covered	No. of Lecture Hours	Methodology
1.	Some problems on Cauchy-Riemann equations (polar form).	3	Blackboard + Lecture + Hands on key
2.	Implementation of Milne-Thomson method of constructing analytic functions (simple examples).	3	Blackboard + Lecture + Hands on key
3.	Illustrating orthogonality of the surfaces obtained from the real and imaginary parts of an analytic function.	3	Blackboard + Lecture + Hands on key
4.	Verifying real and imaginary parts of an analytic function being harmonic (in polar coordinates).	3	Blackboard + Lecture + Hands on key
5.	Illustrating that circles are transformed to circles by a bilinear transformation.	3	Blackboard + Lecture + Hands on key
6.	Examples connected with Cauchy's integral theorem.	3	Blackboard + Lecture + Hands on key
7.	Solving algebraic equation (Bisection method).	3	Blackboard + Lecture + Hands on key
8.	Solving algebraic equation (Regula-Falsi and Newton-Raphson methods).	3	Blackboard + Lecture + Hands on key
9.	Solving system of equations (Jacobi and Gauss-Seidel methods).	3	Blackboard + Lecture + Hands on key
10.	Solving for largest eigenvalue by Power method.	3	Blackboard + Lecture + Hands on key
11.	Solving ordinary differential equation by modified Euler's method.	3	Blackboard + Lecture + Hands on key
12.	Solving ordinary differential equation by Runge-Kutta method of 4 <sup>th</sup> order.	3	Blackboard + Lecture + Hands on key
13.	REPETATION	3	Hands on key

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