THIRUVALLUVAR UNIVERSITY

SERKKADU, VELLORE–632115

B.Sc. MATHEMATICS

SYLLABUS

FROM THE ACADEMIC YEAR

2023 – 2024

Template for Curriculum Design for UG Programme in Mathematics

Credit Distribution for UG Programme in Mathematics

B.Sc Mathematics

First Year

Semester-II

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language –Tamil	3	6
Part-II	English	3	6
Part-III	Analytical Geometry	5	5
	Integral Calculus	5	5
	Elective Course 1 (Generic / Discipline Specific) EC2	3	4
	Skill Enhancement Course -SEC-2 (Discipline Specific / Generic)	2	2
	Skill Enhancement Course -SEC-3 (Discipline Specific / Generic)	2	2
		23	**30**

B.Sc Mathematics
Core Courses

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">ANALYTICAL GEOMETRY</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE 3</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
5</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice
--</td><td>Total
5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• To understand and apply the concept of homogeneous equations of second degree to represent straight lines in different forms.
• To derive polar equations for straight lines, circles, and conic sections, and analyze their geometric properties.
• To formulate general equations of planes, calculate angles between two planes, and determine perpendicular distances.
• To calculate the angle between a line and a plane, determine the length of perpendiculars, and analyze coplanar and skew lines.
• To originate equations of spheres, determine lengths of tangents, and analyze sections of spheres.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">Unit - I: Pair of Straight lines
Introduction – Homogeneous equation of second degree – Angle between the lines – Equation for the bisector of the angle between the lines – Condition for a second degree equation to represent a pair of straight lines.
(Chapter 3: Sections 3.1 - 3.5 Pages: 89 - 129).</td></tr>
<tr><td colspan="2"></td><td colspan="8">Unit - II: Polar Coordinates
Introduction – Definition of polar coordinates – Relation between Cartesian coordinates and Polar coordinates – polar equation of a straight line – circle – Polar equation of a conic.
(Chapter 9: Sections: 9.1 – 9.7.1 Pages: 480 - 500).</td></tr>
<tr><td colspan="2"></td><td colspan="8">Unit - III: Plane
Introduction – General equations of plane – Angle between two planes – Perpendicular distance – Plane passing through: Three given points, Intersection of two given planes – Condition for a second degree equation to represent a pair of planes.
(Chapter 12: Sections: 12.1 – 12.12 Pages 585 - 629).</td></tr>
<tr><td colspan="2"></td><td colspan="8">Unit - IV: Straight Lines
Introduction – Equations of straight Lines – Angle between a line and plane – Length of the perpendicular – Coplanar lines – Skew lines – Intersection of three planes.
(Chapter 13: Sections: 13.1 – 13.12 Pages: 630 – 647, 648 - 686).</td></tr>
</table>

	Unit - V: Sphere Equations of sphere – Length of the tangent – Section of a sphere – Equation of circle – Intersection of two spheres – Condition for the orthogonality – Radical planes. (Chapter 14: Sections: 14.1 – 14.11 Pages: 687 – 695, 699 - 727)**.**
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	P.R.Vittal, Analytical Geometry 2D and 3D, Pearson Publications, Chennai.
Reference Books	1. P.Duraipandian and Laxmi Duraipandian, Analytical Geometry Two dimensions, Emerald Publication. 2. Shanti Narayan and P.K.Mittal, Analytical Solid Geometry of 3D, S. Chand Publications. 3. Manicavasagam Pillay & Natarajan, Analytical Geometry of Two dimensions, S. Viswanathan (printers & publication) Pvt Ltd. 4. Manicavasagam Pillay & Natarajan, Analytical Geometry of Three dimensions, S. Viswanathan (printers & publication) Pvt Ltd.
Website and e-Learning Source	**https://mathworld.wolfram.com/ ,** **http://www.univie.ac.at/future.media/moe/galarie.html/**

Course Learning Outcome (for Mapping with POs and PSOs)

CO Number	CO Statement	Knowledge Level
CO1	Understand and apply the concept of homogeneous equations of second degree to represent straight lines in different forms.	K1,K2
CO2	Derive polar equations for straight lines, circles, and conic sections, and analyze their geometric properties.	K4, K5
CO3	Formulate general equations of planes, calculate angles between two planes, and determine perpendicular distances.	K5,K6
CO4	Calculate the angle between a line and a plane, determine the length of perpendiculars, and analyze coplanar and skew lines.	K5,K6
CO5	Formulate equations of spheres, determine lengths of tangents, and analyze sections of spheres.	K4,K5,K6

Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	3	3	2	3	3	3	3	2	2.8
2	3	3	3	3	2	3	3	3	3	2	2.8
3	3	3	3	3	2	3	3	3	3	1	2.7
4	3	3	3	3	1	3	3	3	3	1	2.6
5	3	3	3	3	1	3	3	2	3	1	2.5

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">INTEGRAL CALCULUS</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">CORE 4</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">5</td><td colspan="2"></td><td colspan="2">--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• Knowledge on integration and its geometrical applications, double, triple integrals and improper integrals.
• Knowledge about Beta and Gamma functions and their applications.
• Skills to Determine Fourier series expansions.</td></tr>
<tr><td colspan="2" rowspan="5">Course Outline</td><td colspan="8">UNIT-I: Reduction formulae -Types, integration of product of powers of algebraic and trigonometric functions, integration of product of powers of algebraic and logarithmic functions - Bernoulli’s formula, Feyman’s technique of integration.</td></tr>
<tr><td colspan="8">UNIT-II: Multiple Integrals - definition of double integrals - evaluation of double integrals – double integrals in polar coordinates - Change of order of integration.</td></tr>
<tr><td colspan="8">UNIT-III: Triple integrals –applications of multiple integrals - volumes of solids of revolution - areas of curved surfaces–change of variables - Jacobian.</td></tr>
<tr><td colspan="8">UNIT-IV: Beta and Gamma functions – infinite integral - definitions–recurrence formula of Gamma functions – properties of Beta and Gamma functions- relation between Beta and Gamma functions - Applications.</td></tr>
<tr><td colspan="8">UNIT-V: Geometric and Physical Applications of Integral calculus.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved
(To be discussed during the Tutorial hour)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="8">Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill</td></tr>
</table>

Recommended Text	1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002. 2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007. 3. D. Chatterjee, Integral Calculus and Differential Equations, Tata-McGraw Hill Publishing Company Ltd. 4. P. Dyke, An Introduction to Laplace Transforms and Fourier Series, Springer Undergraduate Mathematics Series, 2001 (second edition).
Website and e-Learning Source	https://nptel.ac.in

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO 1: Determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae

CLO 2: Evaluate double and triple integrals and problems using change of order of integration

CLO 3: Solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution

CLO 4: Explain beta and gamma functions and to use them in solving problems of integration

CLO 5: Explain Geometric and Physical applications of integral calculus

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	-	-	-	3	2	1
CLO2	3	1	3	-	-	-	3	2	1
CLO3	3	1	3	-	-	-	3	2	1
CLO4	3	1	3	-	-	-	3	2	1
CLO5	3	1	3	-	2	1	3	2	1

Generic Elective Courses (Allied Courses)

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">ALLIED MATHEMATICS – II</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="8">ELECTIVE COURSE II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I OR II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II OR IV</td></tr>
<tr><td colspan="2">Instructional Hours per week</td><td colspan="2">Lecture
4</td><td colspan="2">Tutorial
-</td><td colspan="2">Lab Practice
--</td><td>Total
4</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="8">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="8">• To discuss and analyze the concept of gradient, divergence and curl and its properties.
• To be familiar with Green's, Gauss and Stoke's theorem in vector integrals.
• To find the solution of first order linear partial differential equations.
• To solve the ordinary differential equations by using Laplace and Inverse Laplace Transform.</td></tr>
<tr><td colspan="2">Course Outline</td><td colspan="8">Unit – I: Differentiation of Vectors
Differentiation of vectors – Differential operators – Solenoidal – Irrotational – Directional derivative – Gradient –Divergence and curl – Formula involving operator ∇.
(Chapter 8: Pages: 329 - 363)
Unit – II: Integration of Vectors
Line integrals – Surface integrals – Volume integrals – Statements of Gauss divergence, Green's, Stoke's theorems and its applications – verifications.
(Chapter 8: Pages: 364 - 390, 395 - 418 excluding Green's theorem in space- problems)
Unit – III: Partial Differential Equations
Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions – Solutions of standard types of first order equations: $f(p,q)=0, f(x,p)=g(y,q), f(x,p,q)=0, f(y,p,q)=0, f(z,p,q)=0: z=px+qy+f(p,q)$
(Chapter 6: Pages: 252 - 269)
Unit – IV: Laplace Transforms
Definition – Laplace transforms of e^{at}, cos at, sin at, cosh at, sinh at, t^n, $e^{at}f(t)$, $t^nf(t)$, $f'(t)$, $f''(t)$.
(Chapter 7: Pages: 289 - 298)</td></tr>
</table>

	UNIT-V: Inverse Laplace transforms – Solving differential equations of second order with constant coefficients using Laplace transform. (Chapter 7: Pages: 299 - 317 excluding simultaneous equations - problems)
Extended Professional Component is apart of internal component only, Not to be includedinthe External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Text	S. Narayanan, P. Kandhasamy, R. Hanumantha Rao and T.K. Manickavasagam Pillai, Ancillary Mathematics, Volume II, S. Viswanathan Printers, Chennai 2010.
Reference Books	1. P. Balasubramaniyam, K. G. Subramanian, Ancillary Mathematics, Volume – I, Tata McGraw – Hill publishing company limited, New Delhi, 1996. 2. P. Durai Pandian, S. Udaya Baskaran, Allied Mathematics, Volume – I, Muhil publishers, 1st Edition, Chennai, 1997. 3. P. Kandsamy and K. Thilagavathy, Allied Mathematics volume – I, Volume – II, S. Chand & Company, New Delhi, 2004. 4. Shanti Narayan, P.K. Mittal, Differential Calculus, S. Chand & Co, New Delhi, 2005. 5. A. Singaravelu, Allied Mathematics, Meenakshi Agency, Chennai, 2001. 6. P.R. Vittal, Allied Mathematics, Margham Publications, Chennai, 1999.

Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	discuss and analyze the concept of gradient, divergence and curl and its properties.	K2, K4
CO2	recognize the importance of Green's, Gauss and Stoke's theorem in vector integrals.	K1
CO3	find solution of first order linear partial differential	K5

	equations using Lagrange's method.	
CO4	solve the ordinary differential equations by using Laplace Transform.	K3
CO5	develop Fourier series of the periodic functions.	K6

Mapping of CO with PO and PSO												
Programme Outcomes (PO)							**Programme Specific Outcomes (PSO)**					**Mean Scores of COs**
PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
2	2	1	3	2	2	1	3	3	3	2	2	2.17
2	3	2	2	3	2	3	2	3	2	3	2	2.42
3	3	2	2	3	3	3	2	3	2	3	2	2.58
3	3	2	2	3	1	3	3	2	3	2	1	2.33
3	2	1	2	1	2	2	2	2	2	1	3	1.92

<table>
<tr><td>Title of the Course</td><td colspan="6">NUMERICAL METHODS with Applications - II</td></tr>
<tr><td>Paper Number</td><td colspan="6">ELECTIVE - II</td></tr>
<tr><td>Category Core</td><td colspan="6">Year I OR II | Credits 3 | Course Code
Semester II OR IV</td></tr>
<tr><td>Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td></td><td>4</td><td>--</td><td>--</td><td>4</td></tr>
<tr><td>Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td>Objectives of the Course</td><td colspan="6">➢ To evaluate derivatives using Newton’s forward and backward differences formulae.
➢ To acquire the knowledge about evaluation of numerical integration.
➢ To evaluate the solution of linear homogeneous difference equations with constant coefficients.
➢ To obtain numerical solutions to the ordinary differential equations.</td></tr>
<tr><td>Course Outline</td><td colspan="6">Unit I: Numerical Differentiation: Derivatives using Newton’s Forward and Backward Difference Formulae Derivatives using Stirling’s Formula- Derivatives using Divided Difference Formula- Maxima and Minima using the above Formulae.
Chapter 7 :Section 7.1 to 7.4 & 7.6</td></tr>
<tr><td></td><td colspan="6">Unit II: Numerical Integration: Trapezoidal Rule-Simpson’s One-Third Rule - Simpson’s Three-Eighth Rule- Weddle’s Rule.
Chapter 7 :Section 7.9 & 7.13 to 7.15</td></tr>
<tr><td></td><td colspan="6">Unit III: Difference Equations: Linear Homogenous and Non Homogenous Difference Equation with constant coefficients- particular integrals for $a^x, x^m, \sin kx, \cos kx, a^x F(x)$.
Chapter 8 :Section 8.1 to 8.4 & 8.6</td></tr>
<tr><td></td><td colspan="6">Unit IV: Numerical solution of Ordinary Differential Equations
(I order only): Taylor’s series method- Picard’s method.
Chapter 9: Section 9.5 ,9.6</td></tr>
<tr><td></td><td colspan="6">Unit V: Numerical solution of Ordinary Differential Equations
(I order only): Euler’s Method- Modified Euler’s Method-Runge-Kutta Method (Fourth Order only).
Chapter 9 : Section 9.7,9.9 to 9.11</td></tr>
</table>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, problem solving, analytical ability, professional competency, professional communication and transferable skill.
Recommended Text	P.Kandasamy, K.Thilagavathy (2003) Calculus of Finite differences & Numerical Analysis, S. Chand & Company Ltd., New Delhi-55.
Reference Books	1.B.D. Gupta.(2001) *Numerical Analysis.*Konark Pub. Ltd., Delhi 2. M.K. Venkataraman. (1992) *Numerical methods for Science and Engineering* National Publishing Company, Chennai. 3. S. Arumugam. (2003) *Numerical Methods*, New Gamma Publishing, Palayamkottai. 4. H.C. Saxena. (1991) *Finite differences and Numerical analysis* S.Chand & Co., Delhi
Website and e-Learning Source	https://ocw.mit.edu/courses/22-15-essential-numerical-methods-fall-2014/pages/syllabus/ https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2004/

Course Learning Outcome (for Mapping with POs and PSOs)

Students will be able to

CLO1: After studied unit -1, the student will be able to evaluate derivatives by applying Newton's forward and backward differences formulae.

CLO2: After studied unit -2, the student will be able to evaluate integrations by applying the trapezoidal rule, Simpson‟s rules, and Weddle‟s rule.

CLO3: After studied unit -3, the student will be able to find a complete solution to linear difference equations.

CLO4: After studied unit -4, the student will be able to estimate approximate numerical solutions of ordinary differential equations by Euler, Picard and Taylor.

CLO5: After studied unit -5, the student will be able to estimate approximate numerical solutions of ordinary differential equations by Runge-Kutta methods.

	POs						PSOs		
	1	2	3	4	5	6	1	2	3
CLO1	3	1	3	2	4	-	3	2	1
CLO2	2	1	3	1	4	-	3	2	1
CLO3	3	1	3	1	2	-	3	2	1
CLO4	3	1	3	2	4	-	3	2	1
CLO5	3	1	3	2	4	-	3	2	1