

CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)

Nationally Accredited with 'A' Grade by NAAC

ISO 9001:2015 Certified

PG AND RESEARCH DEPARTMENT OF MATHEMATICS



B.Sc., MATHEMATICS

AUTONOMOUS SYLLABUS

(2022-2023 and ONWARDS)

CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)
PG AND RESEARCH DEPARTMENT OF MATHEMATICS

VISION

To strive for excellence in the mathematical sciences in addition to encourage people to undertake opportunities in transdisciplinary domains.

MISSION

- To enhance analytical and logical problem-solving capabilities.
- To provide excellent mathematical science knowledge for a suitable career and to groom students for national prominence.
- To teach students how to use data analytics.
- To prepare students for transdisciplinary research and applications.
- Value-based education and service-oriented training programmes are used to acquire life skills.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Statements
PEO1	LEARNING ENVIRONMENT To facilitate value-based holistic and comprehensive learning by integrating innovative learning practices to match the highest quality standards and train the students to be effective leaders in their chosen fields.
PEO2	ACADEMIC EXCELLENCE To provide a conducive environment to unleash their hidden talents and to nurture the spirit of critical thinking and encourage them to achieve their goal.
PEO3	EMPLOYABILITY To equip students with the required skills in order to adapt to the changing global scenario and gain access to versatile career opportunities in multidisciplinary domains.
PEO4	PROFESSIONAL ETHICS AND SOCIAL RESPONSIBILITY To develop a sense of social responsibility by formulating ethics and equity to transform students into committed professionals with a strong attitude towards the development of the nation.
PEO5	GREEN SUSTAINABILITY To understand the impact of professional solutions in societal and environmental contexts and demonstrate the knowledge for an overall sustainable development.

PROGRAMME OUTCOMES FOR B.Sc Mathematics, B.Sc Physics,

B.Sc Chemistry PROGRAMME

After completing a B.Sc., programme, a learner will be able to

PO NO.	On completion of B.Sc Mathematics / B.Sc Physics / B.Sc Chemistry Programme, the students will be able to
PO1	DOMAIN KNOWLEDGE Analyse, design and develop solutions by applying from fundamental concepts of basic sciences and expertise in discipline.
PO2	PROBLEM SOLVING Ability to think abstractly, to evaluate and concentrates effectively on problem-solving, as well as knowledge of global challenges.
PO3	CREATIVE THINKING AND TEAM WORK Develop prudent decision-making skills and mobility to work in teams to solve multifaceted problems.
PO4	EMPLOYABILITY Self-study acclimatize them to observe effective interactive practices for practical learning enabling them to be a successful science graduate.
PO5	LIFE LONG LEARNING Assure consistent improvement in the performance and arouse interest to pursue higher studies in premium institutions.

PROGRAMME SPECIFIC OUTCOMES FOR B.Sc MATHEMATICS

PSO NO.	The Students of B.Sc Mathematics will be able to	POs Addressed
PSO1	Procure a precise understanding of the mathematical concepts.	PO1, PO3
PSO2	Excel by enhancing interpersonal skills, overcoming procedural challenges and intending career paths.	PO3, PO4
PSO3	Recognize, strengthen and analyse mathematical problems in order to acquire better conclusion.	PO4, PO5
PSO4	Manipulate numerical abilities across a variety of domains.	PO2, PO5
PSO5	Develop and desire to learn more about advanced mathematics and its applications.	PO5



CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)
PG AND RESEARCH DEPARTMENT OF MATHEMATICS
B.Sc MATHEMATICS PROGRAMME STRUCTURE

(For the candidates admitted in the year 2022-2023 and Onwards)

Semester	Part	Course	Title	Course Code	Inst.Hrs./ week	Credits	Exam			Total
							Hrs.	Marks		
								Int.	Ext.	
I	I	Language Course – I (LC)	இக்கால இலக்கியம்	22ULT1	6	3	3	25	75	100
			Hindi Literature & Grammar – I	22ULH1						
			History of Popular Tales, Literature and Sanskrit Story	22ULS1						
			Basic French – I	22ULF1						
	II	English Language Course – I (ELC)	Functional English for Effective Communication – I	22UE1	6	3	3	25	75	100
	III	Core Course – I (CC)	Differential Calculus and Trigonometry	22UMA1CC1	5	5	3	25	75	100
		Core Course – II (CC)	Integral Calculus	22UMA1CC2	4	3	3	25	75	100
		First Allied Course – I (AC)	Mathematical Statistics I	22UMA1AC1	5	4	3	25	75	100
		First Allied Course – II (AP)	Mathematical Statistics II – Practical	22UMA1AC1P	2	2	3	40	60	100
	IV	Ability Enhancement Compulsory Course– I (AECC)	UGC Jeevan Kaushal – Universal Human Values	22UGVE	2	2	-	100	-	100
TOTAL					30	22	-	-	-	700

SEMESTER I
CORE COURSE – I (CC)
DIFFERENTIAL CALCULUS AND TRIGONOMETRY
(2022-2023 and Onwards)

Semester I	Internal Marks: 25		External Marks:75	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs /Week	CREDITS
22UMA1CC1	DIFFERENTIAL CALCULUS AND TRIGONOMETRY	CORE	5	5

Course Objective

- **Compute** mathematical quantities using differential calculus and **interpret** their meaning.
- **Explore** fundamental concepts of single variable calculus
- **Apply** calculus concepts to solve real-world problems such as optimization and related rates problems.

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
	On the successful completion of the course, students will be able to	
CO1	Remember and substitute the basic concepts of differentiation, extreme functions of two variables and Trigonometry	K1,K2
CO2	Understand the two important aspects of Modern Mathematics via Differentiation and Trigonometry	K2
CO3	Apply the concept of differentiation and trigonometry for explaining various types of functions	K3
CO4	Explore the solution of problems from a mathematical perspective	K3
CO5	Examine the conceptual understanding and fluency with trigonometric functions, techniques and manipulations necessary for success in calculus	K4

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3	3	3	2	2	1
CO2	3	2	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	3	3	2	3	3	2	2	3
CO5	3	2	3	3	2	3	3	3	3	2

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation

“-” indicates there is no correlation.

Syllabus

UNIT I

(15 HOURS)

Successive Differentiation:

The n^{th} derivative – Standard results – Method of splitting the fractional expressions into partial fractions – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula for the n^{th} derivative of a product – A complete formal proof by induction .

UNIT II

(15 HOURS)

Curvature:

Curvature – Circle, radius and centre of curvature – Cartesian formula for the radius of curvature – The coordinates of the centre of curvature – Evolute and Involute – Radius of curvature when the curve is given in polar coordinates.

UNIT III

(15 HOURS)

Expansions:

Expansions of $\cos n\theta$ and $\sin n\theta$ -Expansion of $\tan n\theta$ in powers of $\tan \theta$ –Expansion of $\tan(A + B + C + \dots)$ (omitting examples on formation of equations) – Powers of sines and cosines of θ in terms of functions of multiples of θ – Expansions of $\cos^n \theta$ when n is a positive integer – Expansions of $\sin^n \theta$ when n is a positive integer – Expansions of $\sin \theta$ and $\cos \theta$ in a series of ascending powers of θ .

UNIT IV

(15 HOURS)

Hyperbolic functions:

Hyperbolic functions – Relation between hyperbolic functions – Relations between hyperbolic functions and circular functions – Inverse hyperbolic functions.

UNIT V

(15 HOURS)

Derivatives for Graphing and Applications:

Maxima and Minima:

Maxima and Minima of functions of two variables – Working Rule – Lagrange's method of undetermined multiplier

Tracing of Curves – Tracing of curves whose equation is in Cartesian coordinates.

UNIT VI

Self-Study for Enrichment:

(Not included for End Semester Examination)

Meaning of the Derivative: Geometrical interpretation – Meaning of the sign of the differential coefficient - p - r equation: Pedal equation of a curve – The expansions of $\sin \theta$ and $\cos \theta$ to find the limits of certain expressions – Logarithms of complex quantities: Logarithms of complex quantities – To find the logarithm of $x+iy$ – General value of logarithm of $x+iy$ – Tracing of Curves : Polar Equation.

Text Books

1. Narayanan. S, .Manicavachagom Pillay. T. K. (2015). *Calculus Volume I*. S. Viswanathan (Printer & publishers) Pvt Ltd.
2. Narayanan. S, .Manicavachagom Pillay. T. K. (2013). *Trigonometry*. S. Viswanathan (Printer & publishers) Pvt Ltd.

UNIT-I Chapter III: Sections 1.1 – 1.6, 2.1, 2.2 [1]

UNIT-II Chapter X: Sections 2.1 – 2.6 [1]

UNIT-III Chapter III: Sections 1 - 4, 4.1, 5 [2]

UNIT- IV Chapter IV: Sections 1, 2, 2.1, 2.2, 2.3 [2]

UNIT- V Chapter VIII: Sections 4, 4.1,5 [1]

Chapter XIII: Sections 1.1 & 1.2 [1]

Reference Books

1. Arumugam. S and Issac. (2014). *Calculus*. New Gamma Publishing House.
2. Singaravelu. A. (2003). *Differential Calculus and Trigonometry*. A.Singaravelu and R.Ramaa 1st edition, Nagapattinam, R Publication.
3. Bali. N.P. (2010). *Differential Calculus*. Laxmi Publications (P) Ltd. New Delhi.

Web Links

1. <https://www.youtube.com/watch?v=s8hVridQ5IA>
2. <https://www.youtube.com/watch?v=KijGLjxKlsY>
3. <https://www.youtube.com/watch?v=IQJ0UiM91Z4>
4. <https://www.youtube.com/watch?v=43cMRs2pat4>
5. https://www.youtube.com/watch?v=mAC88G_cc_M
6. <https://www.youtube.com/watch?v=CioY8ElsjO4>
7. https://youtu.be/zExo4_TpOAaw

Pedagogy

Power point presentations, Group Discussions, Seminar, Quiz, Assignment.

Course Designers

1. Dr. P. Sudha

CORE COURSE – II (CC)
INTEGRAL CALCULUS
(2022-2023 and Onwards)

Semester I	Internal Marks: 25		External Marks:75	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs / Week	CREDITS
22UMA1CC2	INTEGRAL CALCULUS	CORE	4	3

Course Objective

- **Analyze** the properties of definite integral and Reduction formulae.
- **Explore** the order of Integration, Triple Integrals, Beta and Gamma functions.
- **Apply** Geometrical Applications of Integration of area under plane curve.

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
	On the successful completion of the course, students will be able to	
CO1	Recall the basic concepts of Integration.	K1
CO2	Illustrate the various concepts of Integration.	K2
CO3	Solve the definite integral by various techniques.	K3
CO4	Apply different types of integration and its properties.	K3
CO5	Examine the solution of definite and improper integral in a various field of mathematical applications.	K4

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3	3	2	2	3	2
CO2	3	2	3	3	2	2	2	3	3	3
CO3	3	3	3	3	3	2	3	2	2	2
CO4	3	2	3	3	2	3	3	3	2	2
CO5	3	3	3	3	3	2	2	2	3	3

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation

“-” indicates there is no correlation.

Syllabus

UNIT I

(12 HOURS)

Integration: Integration of rational algebraic functions: $\int \frac{dx}{ax^2 + bx + c}$ – $\int \frac{lx + m}{ax^2 + bx + c} dx$ –

Integration of Irrational functions $\int \frac{px + q}{\sqrt{ax^2 + bx + c}} dx$ – Any expression of the form

$\int \frac{dx}{(x - k)\sqrt{ax^2 + bx + c}}$ – $\int \frac{dx}{a + b \cos x}$ (Integration of these types only).

UNIT II

(12 HOURS)

Properties of Definite Integrals – Integration by parts – Reduction formulae.

UNIT III

(12 HOURS)

Multiple Integrals: Definition of the double integrals – Evaluation of the double Integrals – Triple Integrals.

UNIT IV

(12 HOURS)

Improper Integrals: Beta and Gamma functions: Definition – convergence of $\Gamma(n)$ – Recurrence formula for gamma functions – Properties of Beta functions – Relation between Beta and Gamma functions – Definite integrals using Gamma functions.

UNIT V

(12 HOURS)

Geometrical Applications of Integration – Areas under plane curves: Cartesian Co-ordinates – Area of a closed curve – Examples – Area in polar co-ordinates.

UNIT VI

Self-Study for Enrichment:

(Not included for End Semester Examination)

$\int \frac{dx}{a \cos x + b \sin x}$ – Bernoulli's formula – Applications of Multiple Integrals – Applications of

Gamma functions to multiple integrals – Approximate Integration.

Text Books

1. Narayanan, S. & Manicavachagom Pillay, T.K. (2015). *Calculus, Volume II*. S. Viswanathan (Printers & publishers) Pvt Ltd.

UNIT – I Chapter 1: Sections 7.3 (Type I & II) 8 - Case II and case V, 9

UNIT – II Chapter 1: Sections 11, 12, 1.3(13.1 – 13.9)

UNIT –III Chapter 5: Sections 2.1, 2.2 & 4

UNIT – IV Chapter 7: Sections: 2.1 – 2.3, 3 – 5

UNIT –V Chapter 2: Sections 1.1 – 1.4

Reference Books

1. Shanti Narayan, (2002). *Integral Calculus*. S. Chand & Company Ltd.
2. Shanti Narayan & Mittal, P. K (2008). *Integral Calculus*. S. Chand & Company Ltd.
3. Singh, U. P. Srivastava, R. J & Siddiqui, N. H. (2011). *Integral Calculus*, Wistom Press.

Web Links

1. <https://youtu.be/w-T90XSM90s>
2. <https://youtu.be/VXSn6EY9klg>
3. <https://youtu.be/2l-SV8cwsW>
4. <https://youtu.be/bLhxQldbWW8>
5. <https://youtu.be/4KDenLHggDM>
6. https://youtu.be/db7d_a0wiUg
7. <https://youtu.be/zFy-OpajEtA>
8. <https://youtu.be/j6A44yOrGfU>
9. <https://youtu.be/scKJXbQpePM>
10. <https://youtu.be/FsC3do74Ulo>

Pedagogy

Power point presentations, Group Discussions, Seminar, Quiz, Assignment.

Course Designers

1. Dr. P. Shalini

FIRST ALLIED COURSE –I (AC)
MATHEMATICAL STATISTICS I
(2022-2023 and Onwards)

Semester I	Internal Marks: 25		External Marks:75	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs / Week	CREDITS
22UMA1AC1	MATHEMATICAL STATISTICS I	ALLIED	5	4

Course Objective

- **Enable** the students to acquire the knowledge of statistics.
- **Analyze** the properties of various statistical functions.
- **Explore** the concepts of some statistical distributions.

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
	On the successful completion of the course, students will be able to	
CO1	Define the basic concepts in random variables, generating functions, correlation and exact sampling distributions.	K1
CO2	Explain various statistical methods and techniques in solving problems	K2
CO3	Solve problems in random variables, generating functions, correlation and exact sampling distributions.	K3
CO4	Examine the given data and interpret the results.	K4
CO5	Analyze various statistical functions and the tests of hypothesis in the case of small samples to arrive at solid conclusion about the values of the population parameter.	K4

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3	3	3	2	2	1
CO2	3	2	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	3	3	2	3	3	2	2	3
CO5	3	2	3	3	2	3	3	3	3	2

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation

“-” indicates there is no correlation.

Syllabus

UNIT I

(18 HOURS)

Random Variables and Distribution Functions

Random Variable – Distribution Functions – Properties of Distribution Function – Discrete Random Variable – Probability Mass Function – Discrete Distribution Function – Continuous Random Variable – Probability Density Function – Various Measures of Central Tendency, Dispersion, Skewness and Kurtosis for Continuous Probability Distribution – Continuous Distribution Function – Joint Probability Mass Function and Marginal and Conditional Probability Function – Joint Probability Distribution Function – Joint Density Function, Marginal Density Function - The Conditional Distribution Function and Conditional Probability Density Function.

UNIT II

(15 HOURS)

Mathematical Expectation

Mathematical Expectation – Addition Theorem of Expectation – Multiplication Theorem of Expectation – Co-variance – Expectation of a Linear Combination of Random Variables – Variance of a Linear Combination of Random Variables – Expectation of a Continuous random variable – Conditional Expectation & Conditional Variance.

UNIT III

(14 HOURS)

Generating Functions

Moment Generating Function – Theorems on moment Generating Functions– Cumulants– Additive Property of Cumulants – Effect of Change of Origin and Scale on Cumulants – Characteristic Function – Properties of Characteristic Function.

UNIT IV

(13 HOURS)

Correlation and Linear Regression

Introduction – Meaning of Correlation – Scatter Diagram – Karl Pearson's Co-efficient of Correlation : Limits for Correlation Co-efficient – Assumptions Underlying Karl Pearson's Correlation Co-efficient – Rank Correlation : Spearman's Rank Correlation Co- efficient – Tied or Repeated Ranks – Repeated Ranks (continued) - Introduction – Linear Regression : Regression Co-efficient - Properties of Regression Co-efficient – Angle between two lines of Regression.

UNIT V

(15 HOURS)

Exact Sampling Distributions

Chi-Square Distribution: Introduction – Derivation of the Chi-Square Distribution(χ^2) – M.G.F. of Chi-Square Distribution : Cumulant Generating Function of χ^2 -Distribution – Limiting Form of χ^2 -Distribution for–Characteristic Function of χ^2 -Distribution – Mode and Skewness of χ^2 -Distribution – Additive Property of χ^2 Variates – Chi- Square Probability Curve – Students 't' Distribution : Derivation of the Students 't' Distribution – Fisher's 't' – Distribution of Fisher's 't' –

Constants of t-distribution – Limiting Form of t-distribution – F- Distribution : Derivation of Snedecor's F- Distribution – Constants of F- Distribution – Mode and Points of Inflexion of F- Distribution.

UNIT VI

Self-Study for Enrichment:

(Not included for End Semester Examination)

Independent Random Variables – Uniqueness Theorem of Characteristic Function – Limits for the Rank Correlation Coefficient – Graph of t-distribution – Critical Values of t .

Text Books

1. Gupta, S.C. & Kapoor, V.K. (2004). *Elements Of Mathematical Statistics*. Sultan Chand & Sons, New Delhi.
2. Gupta, S.C. & Kapoor, V.K. (2015). *Fundamentals Of Mathematical Statistics*. Sultan Chand & Sons, New Delhi.

UNIT-I Chapter 5: Sections 5.1 to 5.5.3, 5.5.5 [1]

UNIT-II Chapter 6: Sections 6.1 to 6.8 [1]

UNIT-III Chapter 6: Sections 6.9 to 6.11.1 [1]

UNIT- IV Chapter 10: Sections 10.1 to 10.4.2 & 10.7, 10.7.1 to 10.7.3 [2]

Chapter 11: Sections 11.1 to 11.2.3 [2]

UNIT- V Chapter 15: Sections 15.1 to 15.3.6 [2]

Chapter 16: Sections 16.2 to 16.2.5, 16.5, 16.5.1 to 16.5.3 [2]

Reference Books

1. Pillai, R.S.N. Pillai & Bhagavathi. (2008). *Statistics, Theory and Practice*. S.Chand & Sons.
2. Bhishma Rao, G.S.S. (2011). *Probability and Statistics*. Scitech Publications (India) Pvt Ltd.
3. Veerarajan, T. (2010). *Probability, Statistics and Random Processes*. Tata McGraw Hill Education Private Limited.

Web Links

1. <https://www.youtube.com/watch?v=YXLVjCKVP7U>
2. <https://www.youtube.com/watch?v=xTpHD5WLuoA>
3. <https://www.youtube.com/watch?v=wjwLTNYOuI4>
4. <https://www.youtube.com/watch?v=zmyh7nCjmsg>
5. <https://www.youtube.com/watch?v=ux8zQvWWLk>

Pedagogy

Power point Presentations, Group Discussions, Seminar, Quiz, Assignment and Smart Classroom.

Course Designers

1. Ms. V. ManiMozhi

FIRST ALLIED COURSE – II (AC)
MATHEMATICAL STATISTICS II – PRACTICAL
(2022-2023 and Onwards)

Semester I	Internal Marks: 40		External Marks:60	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs / Week	CREDITS
22UMA1AC1P	MATHEMATICAL STATISTICS II – PRACTICAL	ALLIED	2	2

Course Objective

- **Understands** the basic concepts in quantitative data analysis.
- **Apply** the technical knowledge to **interpret** and **solve** the problems.
- **Explore** the ideas of Excel in Statistics.

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
	On the successful completion of the course, students will be able to	
CO1	Apply various Statistical concepts in Excel.	K3
CO2	Analyze the concepts and use the necessary to the real-life problems.	K4
CO3	Make use of formulas, including the built-in functions.	K3

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	2	2	3	2	2	2
CO2	3	2	3	2	2	2	3	2	2	2
CO3	3	2	3	2	2	2	3	2	2	2

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation

“-” indicates there is no correlation.

LIST OF PROGRAMS

- 1) Arithmetic Mean, Geometric Mean and Harmonic Mean.
- 2) Median and Mode.
- 3) Quartile Deviation and Mean Deviation.
- 4) Standard Deviation and Co-efficient of Variation.
- 5) Karl Pearson’s Co-efficient of Skewness.
- 6) Bowley’s Co-efficient of Skewness.
- 7) Moments and Kurtosis.

- 8) Karl Pearson's Co-efficient of correlation.
- 9) Rank Correlation.
- 10) Fit the regression line.
- 11) Test the hypothesis for the difference between two sample means.
- 12) Test the hypothesis for single proportion.
- 13) Test the significance of hypothesis using 't' test.
- 14) Test the significance of hypothesis using 'F' test.
- 15) Test the significance of hypothesis using chi-square test.

Text Books

1. Asha Chawla. & Seema Malik. (2017). *Statistical Analysis with MS Excel*. Avichal Publishing Company.

Reference Books

1. Web Tech Sol. (2010). *Mastering Microsoft Excel Functions and Formulas*. Khanna Book Publishing Company.
2. Neil J. Salkind. (2015). *Excel Statistics a Quick Guide*. SAGE Publications, Inc.
3. Charles Zaiontz. (2015). *Statistics using Excel Succinctly*. E-Book.

Web links

1. <https://www.youtube.com/watch?v=2rEhWFhSgnI>
2. <https://www.youtube.com/watch?v=L9TiYC6tQmU>
3. <https://www.youtube.com/watch?v=v5kYz3ADPBI>
4. <https://www.youtube.com/watch?v=9cXluqvGe8c>
5. <https://www.youtube.com/watch?v=egAvfCZTpz8>
6. <https://www.youtube.com/watch?v=7Y1g340tcbU>
7. <https://www.youtube.com/watch?v=QnsH74zXhA>
8. https://www.youtube.com/watch?v=BIS11D2VL_U
9. <https://www.youtube.com/watch?v=WNUfgZipww>
10. <https://www.youtube.com/watch?v=j966OJol0iA>
11. <https://www.youtube.com/watch?v=mUycvaTRrCw>
12. <https://www.youtube.com/watch?v=ckcUt3EvD-Q>

Pedagogy

Power point presentations, Live Demo, Hands on training.

Course Designers

1. Dr. P. Saranya
2. Dr. C. Saranya