ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR
DEPARTMENT OF MATHEMATICS
B.Sc. MATHEMATICS
CBCS - OBE PATTERN (From 2022 – 2023 onwards)

PART	Course Code	Course Title	Hrs	Cr
I SEMESTER				
I	22UTAL11/ 22UHNL11/ 22UFNL11	Tamil / Hindi / French	06	04
II	22UENA11/ 22UENB11	English through Prose & Short Story – Stream A English through Prose & Short Story – Stream B	05	04
III	22UMAC11	Core – 1 Algebra and Trigonometry	06	05
	22UMAC21	Core – 2 Mathematical Statistics – I	06	05
	22UPYB11/ 22UCHB11	Allied – 1 Allied Physics / Chemistry	03	03
	22UPYR12/ 22UCHR12	Allied Physics / Chemistry Lab	02	
	22UMAB11	Allied – 1 Allied Mathematics – I (for Phy/Che)		
IV	22UFCE11	FC - Personality Development	01	01
V	22UCSH12	Communication Skills	01	-
	22UNCC/NSS/ PHY.EDU./ YRC/ ROT/ACF/NCB12	Extension Activities NSS / NCC / Phy.Edn / YRC / ROTARACT / AICUF / Nature Club	-	-
	22UBRC11	Bridge Course		01
		TOTAL	**30**	**23**
II SEMESTER				
I	22UTAL22/ 22UHNL22/ 22UFNL22	Tamil / Hindi / French	06	04
II	22UENA22 22UENB22	English through Prose & Poetry – Stream A English through Prose & Poetry – Stream B	05	04
III	22UMAC32	Core – 3 Calculus	06	05
	22UMAC42	Core – 4 Mathematical Statistics – II	06	05
	22UPYB22/ 22UCHB22	Allied – 2 Allied Physics / Chemistry	03	03
	22UPYR12/ 22UCHR12	Allied Physics / Chemistry Lab	02	02
	22UMAB22	Allied – 2 Allied Mathematics–II (for Phy & Che)		
IV	22UFCH22	FC - Social Analysis and Human Rights	01	01
V	22UCSH12	Communication Skills	01	01
	22UNCC/NSS/ PHY.EDU./ YRC/ ROT/ACF/	Extension Activities NSS / NCC / Phy.Edn. / YRC/ ROTARACT / AICUF / Nature Club		01
		TOTAL	**30**	**26**

		III SEMESTER		
I	22UTAL33/ 22UHNL33/ 22UFNL33	Tamil / Hindi / French	06	04
II	22UENG33	English Through Literature I	06	04
III	22UMAC53	Core – 5 Sequences and Series	06	05
	22UMAA33	Allied – 3 Analytical Geometry of 3D & Vector Calculus	05	04
IV	22UMAN13	NME – 1 Mathematics for Competitive Examinations (for Arts)	03	02
	22USBE13	SBE – 1 Fundamentals of Computer, Internet and Office Automation	01	01
	22USBP13	SBE – 1 Fundamentals of Computer, Internet and Office Automation - Practical	02	01
	22UFCE33	FC – Environmental Studies	01	01
V	22UNCC/NSS/ PHY.EDU./ YRC/ ROT/ACF/NCB24	Extension Activities NSS / NCC / Phy.Edn. / YRC / ROTARACT / AICUF / Nature Club	…	
	22UARE14	ARISE	-	-
		TOTAL	**30**	**22**
		IV SEMESTER		
I	22UTAL44/ 22UHNL44/ 22UFNL44	Tamil / Hindi / French	06	04
II	22UENG44	English Through Literature II	06	04
III	22UMAC64	Core – 6 Mechanics	06	05
	22UMAA44	Allied – 4 Differential Equations and Applications	05	04
IV	22UMAN24	NME – 2 Resource Optimization Techniques (for Science)	03	02
	22USBE24	SBE – 2 Programming in C	01	01
	22USBP24	SBE – 2 Programming in C Practical	02	01
	22UFCH44	FC – Bioethics, Religions and Peace Studies Catechism of the Catholic Church	01	01
V	22UNCC/NSS/ PHY.EDU./ YRC/ ROT/ACF/NCB24	Extension Activities NSS / NCC / Phy.Edn. / YRC / ROTARACT / AICUF/ Nature Club		01
	22UARE14	ARISE		01
		TOTAL	**30**	**24**

		V SEMESTER			
III	22UMAC75	Core – 7 Modern Algebra	06	05
	22UMAC85	Core – 8 Real Analysis	06	05
	22UMAC95	Core – 9 Numerical Methods using Computer Applications	04	05
	22UMAP15	Core Lab Numerical Methods using C++ Lab		
	22UMAD05	Core – 10 Operations Research	06	05
	22UMAE15	Core Elective -1 Number Theory / Elements of Topology	04	03
V	22UINT15	Internship	-	01
	22USSI16	Soft Skills – I	02	01
		TOTAL	**30**	**25**
		VI SEMESTER			
III	22UMAD16	Core – 11 Linear Algebra	06	05
	22UMAD26	Core – 12 Complex Analysis	06	05
	22UMAD36	Core – 13 Graph Theory	06	05
	22UMAD46	Core – 14 Industrial Optimization Techniques	06	05
	22UMAE26	Core Elective – 2 Java Programming / R Programming	02	02
		Core Elective Lab Java Programming Lab / R Programming Lab	02	01
V	22USSI16	Soft Skills – II	02	01
		TOTAL	**30**	**24**

Semester	I	II	III	IV	V	VI	Total
Credits	23	26	22	24	25	24	**144**

Part I   **16** credits
Part II   **16** credits

Part III
    Core   70
    Allied   16
    Core Electives   06
    Total   **92** credits
Part IV
    Non-Major Electives   04
    Skill based Electives   04
    Foundation Courses   04
    Total   **12** credits

Part V
    Extension Activities   02
    ARISE   01
    Bridge Course   01
    Soft Skills   02

Communicative Skills	01
Internship	01
Total	**08** credits

Credits	Part I	Part II	Part III	Part IV	Part V	Total
	16	16	92	12	08	**144**

Self-Learning Courses

Semester	Course Code	Course Title	Credits
III	22UMASL3	Solar System	03
IV	22UMASL4	Stellar Universe	03
V	22UMASL5	Statistical Methods in Social Sciences	03
VI	22UMASL6	Mathematical Methods in Business	03

Value Added Courses (Certificate Course - 30 hours)

Data Analysis using R

Introduction to LaTeX

Data Analysis using Python

Introduction to Machine Learning

Career Oriented Courses

Quantitative Reasoning

Mathematics for Competitive Examinations

Resource Management Techniques

Optimization Techniques in Production

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR
DEPARTMENT OF MATHEMATICS
Algebra and Trigonometry
(For those who join from June 2022 onwards)

Class	: B.Sc. Mathematics	**Part**	: III/Core-1
Semester	: I	**Hours**	: 90
Course Code	: 22UMAC11	**Credits**	: 5

Objective:

This course will enable the students to gain profound knowledge on solving equations of higher order and apply different methods of finding the summation of trigonometric series.

Course Content:

Unit 1: Introduction to equations – Transformation of equations – standard forms to increase and decrease the roots of the equation by a given quantity – removal of terms **(18 hours)**

Unit 2: Multiple roots – working rule to find the multiple roots – nature and position of roots – Rolle's theorem – Sturm's theorem – finding Sturm's function for the given polynomial **(18 hours)**

Unit 3: Cubic equations – Cardan's method for solving a cubic equation – biquadratic equation – Ferrari's method – approximate solutions of numerical equations –Newton's method – Horner's method

(18 hours)

Unit 4: Expansion for trigonometric functions – $\sin n\theta$, $\cos n\theta$ and $\tan n\theta$ $\sin^n\theta$, $\cos^n\theta$, $\sin\theta$, $\cos\theta$, $\tan\theta$, hyperbolic functions – Properties of hyberbolic functions – inverse hyperbolic functions and its properties – relationship between hyperbolic and trigonometric functions – Logarithm of complex numbers **(18 hours)**

Unit 5: Summation of trigonometric series – methods to find the sum of the series – difference method, angles in A.P method – C + iS method – Gregory series – problem **(18 hours)**

Book for Study :

Arumugam S. et al., *Theory of Equations and Trigonometry*, New Gamma Publishing House, Palayamkottai, 2020.

Unit 1 : Chapter 5	Sections	5.5	
Unit 2 : Chapter 5	Sections	5.6 - 5.7	
Unit 3 : Chapter 5	Sections	5.8 - 5.10	
Unit 4 : Chapter 6	Sections	6.1 - 6.2	
Chapter 7	Sections	7.1 - 7.2	
Chapter 8	Section	8.1	
Unit 5 : Chapter 9	Sections	9.1 - 9.4	

Books for Reference :

1. Manickavasagam Pillai T.K., *Trigonometry for B.Sc. Mathematics Major*, S.Viswanathan (Publishers) Pvt. Ltd., Chennai, 2011.

2. Narayanan S., *Algebra Volume I and II*, Vijay Nicole Imprints Pvt, Ltd., Chennai, 2014.

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of the course, the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Up to
CO1	Transform the equations using standard forms	K3
CO2	Compute multiple roots and Sturm's function of polynomial	K3
CO3	Employ suitable method of finding the approximate solutions to the equations	K3
CO4	Illustrate the relationship between hyperbolic and trigonometric functions	K3
CO5	Find solutions to summation of series by applying suitable method.	K3

K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate, K6=Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2	2		2	2	2	2	2	22
CO2	3	3			2	2	2		2	2	2	2	2	22
CO3	3	3			2	2	2		2	2	2	2	2	22
CO4	3	3			2	2	2		2	2	2	2	2	22
CO5	3	3			2	2	2		2	2	2	2	2	22
Grand Total of Cos with POs & PSOs														110
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{110}{50}$														2.2

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.2
Observation	COs of Algebra & Trigonometry are strongly correlated with POs & PSOs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR
DEPARTMENT OF MATHEMATICS
Mathematical Statistics – I
(For those who join from June 2022 onwards)

Class	: B.Sc. Mathematics	**Part**	: III/Core-2
Semester	: I	**Hours**	: 90
Course Code	: 22UMAC21	**Credits**	: 5

Objective:

This course aims in imparting the skills of applying statistical knowledge to real world problems

Course Content:

Unit 1: Correlation – Karl Pearson's coefficient of correlation – rank correlation – regression – regression lines – regression coefficient **(18 hours)**

Unit 2: Theory of Attributes – Consistency of data – Independence and association of data – Yule's coefficient of Association **(18 hours)**

Unit 3: Random variables – discrete and continuous – mathematical expectations – moment generating function – cumulant generating function – characteristic function **(18 hours)**

Unit 4: Binomial distribution – moments of binomial distribution – recurrence relation – fitting binomial distribution Poisson distribution – moments of a Poisson distribution – fitting a Poisson distribution **(18 hours)**

Unit 5: Normal distribution – moment generating function – standard normal variate – moment generating function of standard normal variate – cumulant generating function – area property of Normal distribution – fitting of Normal distribution – area method – ordinate method **(18 hours)**

Book for Study :

Arumugam S. et al., *Statistics,* New Gamma Publishing House, Palayamkottai, 2015.

Unit 1 :	Chapter 6	Sections	6.1-6.3
Unit 2 :	Chapter 8	Sections	8.1-8.3
Unit 3 :	Chapter 12	Sections	12.0-12.6
Unit 4 :	Chapter 13	Sections	13.1-13.2
Unit 5 :	Chapter 13	Section	13.3

Books for Reference :

1. S.C. Gupta, V.K. Kapoor., *Fundamentals of Mathematical Statistics (Theory and Practice)*, Sultan Chand & Sons educational publishers , New Delhi,11th Edition, 2006

2. Sancheti D.C. and Kapoor V.K., *Statistics (Theory, Methods and Applications)*, Sultan Chand and Sons, New Delhi, 7th Edition, 2007.

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Up to
CO1	Solve the problems of finding correlation and regression coefficients by choosing suitable methods	K3
CO2	Employ the principles of attributes to find solutions to real-life problems	K3
CO3	Find solutions to the problems based on random variables	K3
CO4	Differentiate the different kinds of distributions and solve related problems	K3
CO5	Apply the concepts of normal distributions to solve real life problems.	K3

K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate, K6= Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2	2		3	2	3	2	2	24
CO2	3	3			2	2	2		3	2	3	2	2	24
CO3	3	3			2	2	2		3	2	3	2	2	24
CO4	3	3			2	2	2		3	2	3	2	2	24
CO5	3	3			2	2	2		3	2	3	2	2	24
Grand Total of Cos with POs & PSOs														120
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{120}{50}$														2.4

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.4
Observation	COs of Mathematical Statistics I are strongly correlated with POs & PSOs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Allied Mathematics – I
(For those who join from June 2022 onwards)

Class	: B.Sc. Physics & Chemistry	**Part**	: III/Allied-1
Semester	: I	**Hours**	: 75
Course Code	: 22UMAB11	**Credits**	: 4

Objectives:

This course will facilitate the learners in acquiring intense knowledge and application skills of mathematical concepts to the problems related to their disciplinary subject.

Course Content:

Unit 1: Successive differentiation – n^{th} derivative of e^{ax}, sin (ax+b), cos(ax+b), e^{ax}sinbx, log (ax +b), $(ax+b)^{-1}$ - Leibnitz's theorem– problems **(15 hours)**

Unit 2: Curvature − radius of curvature − centre of curvature- radius of curvatures in polar form – p-r form- intrinsic form- pedal equation-evolutes **(15 hours)**

Unit 3: Expansion for trigonometric functions –$\sin n\theta$, $\cos n\theta$ and $\tan n\theta$, $\sin n\theta$, $\cos n\theta$, $\sin\theta$, $\cos\theta$, $\tan\theta$- hyperbolic functions − Properties of hyberbolic functions– inverse hyperbolic functions and its properties- relationship between hyperbolic and trigonometric functions- Logarithm of complex numbers **(15 hours)**

Unit 4: Theory of equations– relation between the roots and the coefficients − sum of the powers of the roots − reciprocal equations − reciprocal equation of first type-reciprocal equation of second type- methods to solve reciprocal equations

(15 hours)

Unit 5: Numerical computation- Iteration method- Bisection method- Regula-Falsi method- Newton-Raphson method- Horner's method **(15 hours)**

Book for Study:

1. *Salai Parkunan T. et al., Allied Mathematics – I* (for Physics and Chemistry), Britto Publishing House, January 2013.
   Unit 1: Chapter 1   Sections   1.1-1.3.11
   Unit 2: Chapter 2   Sections   2.1-2.2.13
   Unit 3: Chapter 3   Sections   3.1 - 3.7.7
   Unit 4: Chapter 4   Sections   4.1- 4.5.14
2. *Numerical Methods, Second Edition,* S. Arumugam, A. Thangapandi Issac, A. Somasundram, SCITCH publications, 2009.
   Unit 5: Chapter 3   Sections   3.1-3.5

Books for Reference:

1. Veerarajan T., *Algebra and Trigonometry*, Yes Dee Publishing Pvt Ltd, Chennai, 2020.
2. Kanna M.L., *Differential Calculus,* Jai PrakashNath and Co, Meerut City, 2008.

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Compute the successive derivatives of functions and apply Leibnitz's theorem.	**K3**
CO2	Determine the curvature in various forms and comprehend its nature.	**K3**
CO3	Illustrate the relationship between hyperbolic and trigonometric functions	**K3**
CO4	Identify the type of reciprocal equations and solve by using different methods	**K3**
CO5	Find numerical solutions to a system of equations by employing various numerical methods	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2	2	2	3	3	3	3	3	23
CO2	3	3			2	2	2	2	2	2	2	2	2	24
CO3	3	3			2	2	2	2	3	3	3	3	3	24
CO4	3	3			2	2	2	2	2	2	2	2	2	23
CO5	3	3			2	2	2	2	2	2	2	2	2	24
Grand Total of Cos with POs & PSOs														130
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ Pos\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{130}{55}$														2.36

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	**0.01-1.0**	**1.01-2.0**	**2.1-3**
Quality	**Low**	**Medium**	**Strong**
Mean Value of Cos with POs & PSOs			**2.36**
Observation	**Cos of Allied mathematics I are strongly correlated with POs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Calculus
(For those who join from June 2022 onwards)

Class	: B.Sc. Mathematics	**Part**	: III/Core - 3
Semester	: II	**Hours**	: 90
Course Code	: 22UMAC32	**Credits**	: 5

Objective:

This course intends to enhance the computation skills of the learners in the fields of differentiation, integration and their related domains

Course Content:

Unit 1: Higher Derivatives – n^{th} derivatives of some standard functions $(ax+b)^m$, $\log(ax+b)$, e^{ax}, $\sin(ax+b)$, $\cos(ax+b)$, $e^{ax}\sin(bx+c)$, $e^{ax}\cos(bx+c)$ – Leibinitz's theorem and its applications **(18 hours)**

Unit 2: The pedal equations - curvature – radius of curvature – centre of curvature – radius of curvature in polar coordinates – evolutes – envelope **(18 hours)**

Unit 3: Maximum value of a function – minimum value of a function – necessary condition for extreme values – sufficient condition for extreme value – second order derivatives – application to problems **(18 hours)**

Unit 4: Evaluation of definite integral – Reduction formulae: reduction formula of some standard forms – double and triple integrals – Change of variables

(18 hours)

Unit 5: Beta and Gamma functions – Properties and results involving Beta and Gamma functions-Duplication formula-Fourier series: Cosine series –sine series. Half range Fourier sine series- half range Fourier cosine series

(18 hours)

Books for Study:

1. Arumugam S. and Thangapandi Issac, *Calculus*, New Gamma Publishing House, Palayamkottai, 2011.

Unit 1	Chapter 2	Sections	2.11, 2.12	(part-1)
Unit 2	Chapter 3	Sections	3.3- 3.6	(part-1)
Unit 4	Chapter 2	Sections	2.6, 2.8	(part-2)
	Chapter 3	Sections	3.1-3.4	(part-2)
Unit 5	Chapter 4	Section	4.1	(part 2)
	Chapter 5	Sections	5.1, 5.2	(part 2)

2. Shanti Narayan and Dr.P.K.Mittal, Differential Calculus, S.Chand & Company LTI, New Delhi, 2011

Unit 3	Chapter 9	Sections	9.1-9.5

Books for Reference:

1. Manickavasgan Pillai T.K. and Narayanan S., *Calculus*, Volume I and II, S.Viswanathan (Publishers) Pvt.Ltd., Chennai, 2017.

2. Kanna M.L., *Calculus – Differential and Integral*, Jai Prakash Nath and Company, Meerut City, 2009.

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level
CO1	Compute the higher derivatives of functions and solve the problems using Leibnitz's theorem.	K3
CO2	Illustrate, determine and analyze the curvature and radius of curvature of various curves.	K3
CO3	Calculate maxima and minima of a functions and use second derivatives in solving problems	K3
CO4	Compute the definite integrals of various kinds by employing reduction formulae.	K3
CO5	Apply Beta and Gamma functions to evaluate integrals and express the given function as Fourier series	K3

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2	2		3	2	2	2	2	23
CO2	3	3			2	2	2		3	2	3	2	2	24
CO3	3	3			2	2	2		3	2	3	2	2	24
CO4	3	3			2	2	2		3	2	2	2	2	23
CO5	3	3			2	2	2		3	2	3	2	2	24
Grand Total of Cos with POs & PSOs														118
Mean Value of COs with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{118}{50}$														2.4

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.4
Observation	COs of Calculus are strongly correlated with POs & PSOs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR
DEPARTMENT OF MATHEMATICS
Mathematical Statistics – II
(For those who join from June 2022 onwards)

Class	: B.Sc. Mathematics	**Part**	: III/Core-4
Semester	: II	**Hours**	: 90
Course Code	: 22UMAC42	**Credits**	: 5

Objective:

This course aims in igniting the minds of the learners with profound knowledge and applications of inferential statistics

Course Content:

Unit-I

Introduction - types of sampling - tests of significance - procedure for testing of hypothesis - test of significance for large samples - sampling of attributes - sampling of variables

(18 hours)

Unit II

Derivation of the chi-square distribution - MGF of chi-square distribution – test based on chi-square distribution – population variance – goodness of fit- independence of attributes

(18 hours)

Unit III

Student's t - distribution –test for means – test the significance of an observed sample correlation - F-distribution – test for equality of two population variance

(18 hours)

Unit-IV

Characteristics of estimators -Methods of Estimation – Method of Maximum Likelihood Estimation –Method of Minimum Variance - Method of Moments - Method of least squares

(18 hours)

Unit V

Introduction – analysis of variance - one-way classification - two-way classification - Latin square **(18 hours)**

Books for Study

1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th thoroughly revised edition, Sultan Chand and Sons, 2006.

Unit 1 :   Chapter 14   Sections   14.1-14.8
Unit 2:   Chapter 15   Sections   15.1- 15.3, 15.6.1 – 15.6.3
Unit 3 :   Chapter 16   Sections   16.1-16.3, 16.5-16.6.1
Unit 4:   Chapter 17   Sections   17.1, 17.2, 17.6

2. Statistics**,** S. Arumugam and A. Thangapandi Issac, New Gamma Publishing house, 2011.

Unit 5: Chapter17   Sections   17.0-17.3

Books for Reference:

1. Gupta B.N., *Statistics (Theory and Practice)*, Sahitya Bhavan, Agra, 4th Edition, 2004.

2. Sancheti D.C. and Kapoor V.K., *Statistics (Theory, Methods and Applications)*, Sultan Chand and Sons, New Delhi, 7th Edition, 2007.

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Differentiate between the types of sampling and apply the tests of significance	K3
CO2	Make use of $\chi 2$ distribution and determine the results to draw conclusions.	K3
CO3	Employ suitable tests of significance to small samples.	K3
CO4	Explain the significance of estimation and compute solutions to the real life problems.	K3
CO5	Apply analysis of variance and Latin square to solve problems and analyze the results	K3

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2	2		3	2	3	2	2	24
CO2	3	3			2	2	2		3	2	3	2	2	24
CO3	3	3			2	2	2		3	2	3	2	2	24
CO4	3	3			2	2	2		3	2	3	2	2	24
CO5	3	3			2	2	2		3	2	3	2	2	24
Grand Total of Cos with POs & PSOs														120
Mean Value of COs with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{120}{50}$														2.4

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.4
Observation	COs of Mathematical Statistics II are strongly correlated with POs & PSOs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Allied Mathematics – II
(For those who join from June 2022 onwards)

Class	: B.Sc. Physics & Chemistry	**Part**	: III/Allied-2
Semester	: II	**Hours**	: 75
Course Code	: 22UMAB22	**Credits**	: 4

Objectives:

This course will facilitate the learners in acquiring intense knowledge and application skills of mathematical concepts to the problems related to their disciplinary subject.

Unit 1: Reduction formulae – Beta and Gamma functions – Properties and result involving beta and gamma functions – the relation between Beta and Gamma function—duplication formula-Fourier series: the cosine and sine series -half range Fourier series **(15 hours)**

Unit 2: Vector calculus – differentiation of vectors – directional derivatives – gradient, divergence and curl and their properties – directional derivatives – solenoidal and irrotational fields **(15 hours)**

Unit 3: Vector integration – line, surface and volume integrals – Green's, Stoke's and Gauss theorems (Statements only) and their applications **(15 hours)**

Unit 4: Exact differential equations – equations of first order but of higher degree – solvable for p, y and x – Clairaut's equations – problems **(15 hours)**

Unit 5: Laplace transforms –Inverse Laplace transforms-properties-problems- applications of Laplace transforms – solving second order and simultaneousdifferential equations **(15 hours)**

Book for Study:

Allied Mathematics – II (for Physics and Chemistry), prepared by Department of Mathematics, Arul Anandar College (Autonomous), Madurai, Britto Publishing House, January 2013.

Unit 1: Chapter 1   Sections   1.1 -1.3
Unit 2: Chapter 2   Sections   2.1- 2.5
Unit 3: Chapter 3   Sections   3.1- 3.3
Unit 4: Chapter 4   Sections   4.1-4.5
Unit 5: Chapter 5   Sections   5.1-5.4

Books for Reference:

1. Manickavasgan Pillai T.K. and Narayanan S., *Calculus*, Volume I and II, S.Viswanathan (Publishers) Pvt. Ltd., Chennai, 2017.

2. Sankara Narayanan, *Differential Equations and Applications*, Suja Publishers, Palayamkottai,2011.

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level upto
CO1	Apply Beta and Gamma functions to evaluate integrals and express the given function as Fourier series	K3
CO2	Explain and find the derivatives of vector valued functions.	K3
CO3	Use the results of the theorems on vector integration in evaluating theintegrals.	K3
CO4	Apply the suitable method and solve differential equations.	K3
CO5	Employ the Laplace and inverse Laplace transforms to solve differential equations	K3

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with POs and PSOs

	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3			2	2	2		3	3	3	3	3
CO2	3	3			2	2	2		2	2	2	2	2
CO3	3	3			2	2	2		3	3	3	3	3
CO4	3	3			2	2	2		2	2	2	2	2
CO5	3	3			2	2	2		2	2	2	2	2

Strong – 3, Medium – 2, Low-1

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514

DEPARTMENT OF MATHEMATICS

QUESTION PAPER PATTERN (UG)
(Core, Core Elective and Non-Major Elective)
(For those who join from 2022 onwards)

INTERNAL (40 MARKS)

SECTION – A (4 x 1 = 4 marks)

FOUR multiple choice questions. Each question carries one mark. (K1, K2)

SECTION – B (2 x 4 = 8 marks)

TWO questions with internal choice. Each question carries four marks. (K3, K4)

SECTION – C (4 x 7 = 28 marks)
FOUR questions with internal choice. Each question carries seven marks. (K3, K4, K5)

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514

DEPARTMENT OF MATHEMATICS

SCHEME OF EVALUATION (UG)

1. Continuous Internal Assessment

	Marks
Test – 1	40
Test – 2	40
Assignment / Seminar	20

Total	100
	------

2. Semester Examination   100 Marks

3. Total Marks = 50% C.I.A + 50% Semester Examinations

A candidate must score a minimum of 20 marks out of 50 in the semester examination and an overall aggregate minimum of 40 marks out of 100 for a pass.

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATUR – 625 514
DEPARTMENT OF MATHEMATICS
Sequences and Series
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	**: II B.Sc. Mathematics**	**Part**	**: III/Core-5**
Semester	**: III**	**Hours**	**: 90**
Course Code	**: 22UMAC53**	**Credits**	**: 5**

Objective:

This course will enable the students to gain profound knowledge on the various characteristics of sequences and series.

Course Content:

Unit 1: **Sequences :** Bounded sequences – monotonic sequences – convergent sequences – divergent and oscillating sequences – algebra of limits – behavior of monotonic sequences **(18 hours)**

Unit 2: **Theorems on limits :** Cauchy's limit theorems - subsequences – limit points – Cauchy sequences – Cauchy's general principle of convergence for sequences – upper and lower limits of a sequence **(18 hours)**

Unit 3: **Series of positive terms :** Infinite series – convergence, divergence and oscillation of series – Cauchy's general principle of convergence for series – comparison test **(18 hours)**

Unit 4: **Tests of Convergence :** Kummer's test – D'Alembert's ratio test – Raabe's test – Gauss's test – Cauchy's root test and condensation test – Cauchy's integral test **(18 hours)**

Unit 5: **Series of arbitrary terms :** Alternating series – Leibnitz's test – absolute convergence – conditional convergence – tests for convergence of series of arbitrary terms – Dirichlet's test – Abel's test **(18 hours)**

Book for Study:

Arumugam S., Thangapandi Issac A., "Sequences and Series", New Gamma Publishing House, Palayamkottai, 2019.

Unit 1 : Chapter 3 sections 3.1 to 3.7
Unit 2 : Chapter 3 sections 3.8 to 3.12
Unit 3 : Chapter 4 sections 4.1 to 4.2
Unit 4 : Chapter 4 sections 4.3 to 4.5
Unit 5 : Chapter 5 sections 5.1 to 5.3

Books for Reference:

1. SC Malik, Savita Arora, Mathematical Analysis, New Age International Private Limited, Publications, 5th multicolour edition, New Delhi 2016, Reprint.
2. Richard R. Goldberg, Methods of Real Analysis, Oxford and IBH Publishing Co., 2017.

Teaching Learning Methods:

- Lecture Method, ICT, Assignment, Quiz, Group Discussion

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level
CO1	Explain the definitions of the fundamental concepts of sequences with examples	K2
CO2	Find the limit of sequences and illustrate the nature of Cauchy sequences	K2
CO3	Analyze the nature of series by applying various tests.	K4
CO4	Apply different kinds of test of convergence for series	K3
CO5	Use the tests of convergence of series of arbitrary terms	K3

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze K5 = Evaluate K6 Create

Mapping Course outcome with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2			3	2		2	2	19
CO2	3	3			2	2			3	2		2	2	19
CO3	3	3			2	3			3	3		2	2	21
CO4	3	3			2	2			3	2		2	2	19
CO5	3	3			2	2			3	2		2	2	19
Grand Total of Cos with POs & PSOs														97
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{97}{40}$														2.4

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.4
Observation	COs of Sequences & Series are strongly correlated with POs & PSOs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Analytical Geometry of 3D and Vector Calculus
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	: II B.Sc. Mathematics	**Part**	: III/ Allied - 3
Semester	: III	**Hours**	: 75
Course Code	: 22UMAA33	**Credits**	: 4

Objective:

This course will make the learners acquire intense knowledge on solving problems associated with three dimensional objects, vector differentiation and vector integration and also gain hands on experience in solving problems using Geogebra software.

Course Content:

Unit 1: **Planes :** Equation of a plane – angle between two planes – angle bisectors of two planes – hands on training on solving problems based on planes using Geogebra
(15 hours)

Unit 2: **Straight lines** : Equation of a straight line – non-symmetric form – symmetric form – two points form – plane and a line – skew lines –equation of two skew lines in a simple form – intersection of three planes – hands on training on solving problems based on straight lines using Geogebra **(15 hours)**

Unit 3: **The Sphere**: Equation of a sphere – centre radius form – general form of a sphere – diameter form – tangent line and tangent plane – angle of intersection of two spheres – section of a sphere– hands on training on solving problems based on sphere using Geogebra **(15 hours)**

Unit 4: **Vector Differentiation**: Vector algebra – differentiation of vectors –gradient – geometrical interpretation – equation of the tangent plane – equation of the normal line – divergence and curl– harmonic vector. **(15 hours)**

Unit 5: **Line and Surface Integrals**: Line integrals – work done by a force – surface integrals – theorems of Green, Gauss and Stokes **(15 hours)**

Book for Study:

S.Arumugam and A.Thangapandi Isaac, Analytical Geometry 3D and Vector Calculus, New Gamma Publishing House,2018.

Unit 1	:	Chapter 2	Section 2.1-2.21
Unit 2	:	Chapter 3	Section 3.1-3.44
Unit 3	:	Chapter 4	Section 4.1-4.21
Unit 4	:	Chapter 5	Section 5.1-5.28
Unit 5	:	Chapter 7	Section7.1-7.29

Books for Reference:

1. K.Manicavachagom Pillay and T.Natarajan, S.Viswanathan, Analytical Geometry Part II – Three Dimensions by Printers & Publishers Pvt. Ltd. 2017.
2. S.Narayanan and T.K.Manicavachagom Pillay, S.Viswanathan, Vector Calculus by Printers & Publishers Pvt. Ltd. 2017.

Teaching Learning Methods:

- Lecture Method, Assignment, Quiz, Group Discussion

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Up to
CO1	Find the equation of plane and compute the angle between the planes	K3
CO2	Classify skew lines and coplanar lines; compute the shortest distance between lines	K3
CO3	Construct the equation of the sphere of various forms and its section.	K3
CO4	Employ vector differentiation to calculate the gradient of functions and categorize vectors	K3
CO5	Apply the fundamental theorems of calculus to find the relationship between different types of integrals	K3

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze K5 = Evaluate K6 Create

Mapping Course outcome with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2			3	2	3	2	2	22
CO2	3	3			2	2			3	2	3	2	2	22
CO3	3	3			2	2			3	2	3	2	2	22
CO4	3	3			2	2			3	2	3	2	2	22
CO5	3	3			2	2			3	2	3	2	2	22
Grand Total of Cos with POs & PSOs														110
Mean Value of COs with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{110}{45}$														2.4

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.4
Observation	**COs of Analytical Geometry of 3D & Vector Calculus are strongly correlated with POs & PSOs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATUR – 625 514
DEPARTMENT OF MATHEMATICS
Mathematics for Competitive Examinations
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	: II B.A. (Arts)	**Part**	: IV/NME-1
Semester	: III	**Hours**	: 45
Course Code	: 22UMAN13	**Credits**	: 2

Objective:

This course intends to make the learners gain competency of solving problems in competitive examinations.

Course Content:

Unit 1: Highest common factor – factorized method – division method - least common multiple – factorized method – shortcut method **(9 hours)**

Unit 2: Simplification - various algebraic formulas and their applications – simplify the rule of BODMAS – square roots– cube roots **(9 hours)**

Unit 3: Percentage- results on population – result on depreciation – reduction percentage **(9 hours)**

Unit 4: Chain rule –Ratio - Proportion - Direct proportion – Indirect proportion **(9 hours)**

Unit 5: Calendar-odd days-leap Year-ordinary Year-counting of odd days-day of the week related to odd days. **(9 hours)**

Book for Study

R.S. Aggarwal, "Quantitative Aptitude", revised edition, S.Chand & Company Ltd, New Delhi, 2017.

       Unit 1 :   Chapter 2
       Unit 2 :   Chapters 4 & 5
       Unit 3 :   Chapter 11
       Unit 4 :   Chapter 14
       Unit 5 :   Chapter 27

Books for Reference:

01. Ashish Aggarwal, "Quick Arithmetic", First Edition, S.Chand & Company Ltd., New Delhi, 2014.

02. Dinesh Khattar, "The Pearson Guide to Quantitative Aptitude", Third Edition, Dorling Kindersley Private Limited, New Delhi, 2010.

Teaching Learning Methods:

● Lecture Method, ICT, Assignment, Quiz, Group Discussion

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Up to
CO1	Employ various methods to find H.C.F and L.C.M.	**K3**
CO2	Apply various algebraic formulae in computing solutions to the problems	**K3**
CO3	Solve real life problems using the notion of percentage	**K3**

CO4	Use the aspects of chain rula to compute solutions to the problems.	**K3**
CO5	Compute solutions to the problems based on calendar	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze K5 = Evaluate K6 Create

Mapping Course outcome with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2			2	2			3	3	3	3	3	23
CO2	3	2			2	2			2	2	2	2	2	24
CO3	3	2			2	2			3	3	3	3	3	24
CO4	3	2			2	2			2	2	2	2	2	23
CO5	3	2			2	2			2	2	2	2	2	24
Grand Total of Cos with POs & PSOs														105
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{118}{45}$														2.33

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.33
Observation	**Cos of Mathematics for Competitive examinations are strongly correlated with POs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Solar system
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	**: II UG**	**Part**	**: SLC**
Semester	**: III**	**Credits**	**: 3**
Course Code	**: 22UMASL3**		

Objective:

This course enables the learners to gain more insights on solar structure and elements of solar system

Course outline:

Unit 1: Introduction – planetesimal hypothesis – surface structure of the sun – solar constant

Unit 2: Surface structure of mercury - Venus and Mars

Unit 3: Discovery of the minor planets – Asteroids – surface structure of Jupiter and Saturn.

Unit 4: Discoveries of Uranus, Neptune and Pluto

Unit 5: Meteors – zodiacal light – difference between the planets and comets

Book for Study:

Kumaravelu, Susheela Kumaravelu, "Astronomy", Reprinted, Sri Vishnu Arts, 2004.

Unit 1: Chapter 14   sections 321, 322

Unit 2: Chapter 14   sections 323 - 325

Unit 3: Chapter 14   sections 326 - 328

Unit 4: Chapter 14   sections 329 - 331

Unit 5: Chapter 14   sections 332 – 334

Teaching Learning Methods:

● Lecture Method, ICT, Assignment, Quiz, Group Discussion

On completion of this course the student will be able to

Course Outcome No.	Course Outcome	Knowledge Level
CO1	Retrieve the fundamentals of solar structure	**K1**
CO2	Summarize the features of planets	**K2**
CO3	Explain the structure of minor planets	**K2**
CO4	Explicate the composition of outer most planets	**K2**
CO5	Describe the differences between planets , meteors and comets	**K2**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze K5 = Evaluate K6 Create

Mapping Course outcome with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2		2		2			2		2		2	15
CO2	3	2		2		2			2		2		2	15
CO3	3	2		2		2			2		2		2	15
CO4	3	2		2		2			2		2		2	15
CO5	3	2		2		2			2		2		2	15
Grand Total of Cos with POs & PSOs														75
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{75}{35}$														2.14

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.14
Observation	Cos of Solar system are strongly correlated with POs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATUR – 625 514
DEPARTMENT OF MATHEMATICS
MECHANICS
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	: II B.Sc. Mathematics	**Part**	: III/Core-6
Semester	: IV	**Hours**	: 90
Course Code	: 22UMAC64	**Credits**	: 5

Objective:
This course aims in making the students acquire profound knowledge and applications of the changes in physical systems both under rest and motion.

Course Content:

Unit 1: **Forces acting at a point**: Resultant and components – simple cases of finding the resultant – parallelogram of forces – analytical expression for the resultant of two forces acting at a point– Triangle of forces – perpendicular Triangle of forces – converse of the Triangle of forces – polygon of forces – Lami's theorem – extended form of parallelogram law of forces –resolution of a force –component of a force along two given directions –theorem on resolved parts –resultant of any number of forces acting at a point –resultant of coplanar forces – conditions of equilibrium of any number **(18 hours)**

Unit 2: **Parallel forces and Moments** : Resultant of two like parallel forces acting on a rigid body – resultant of two unlike and unequal parallel forces acting on a rigid body – resultant of a number of parallel forces acting on a rigid body – condition of equilibrium of three coplanar parallel forces – centre of two parallel forces – moment of a force– physical significance of the moment of a force – sign of the moment – unit of moments – Varignon's theorem of moments –generalized theorem of moments **(18 hours)**

Unit 3: **Stability of Equilibrium:** Stable, unstable and neutral equilibrium- nature of equilibrium of a rigid body supported at one fixed point- conditions of stability for a body with one degree of freedom-stability of rocking stones – important particular cases **(18 hours)**

Unit 4: **Projectiles** : Two fundamental principles – path of a projectile is a parabola – characteristics of the motion of projectile – particle projected horizontally from a certain height – maximum horizontal range of the projectile with velocity and magnitude of projection – two possible directions of projections with initial velocity – velocity and magnitude of the projectile at the end of time –velocity of the projectile for a freely falling body –two directions of projection **(18 hours)**

Unit 5: **Collision of Elastic Bodies**: Fundamental law of Impacts – Newton's experimental law – motion of two smooth bodies perpendicular to the line of impact – Principle of conservative momentum –impact of a smooth spheres on a fixed smooth plane – Direct impact of two smooth spheres- loss of kinetic energy due to impact of two smooth spheres – **(18 hours)**

Books for study:
01. Venkatraman, M.K., "Statics, Eighteenth Edition", Agasthiar Publications, Trichy, 2016.
         Unit 1 :   Chapter 2   Sections 1 – 16
         Unit 2 :   Chapter 3   Sections 1 – 13
         Unit 3 :   Chapter 10   Sections 1 – 4
02. Venkatraman, M.K., "Dynamics, Eighteenth Edition", Agasthiar Publications, Trichy, 2016.
         Unit 4 :   Chapter 6   Sections 6.1 – 6.11
         Unit 5 :   Chapter 8   Sections 8.1 – 8.6

Books for Reference:

01. Duraipandian, P., Laxmi Duraipandian and Muthamizh Jayapragasm, "Mechanics", S.Chand and Company, 2003.

02. Narayanan, S., "Dynamics", S.Chand and Company, 16th Edition, New Delhi, 1986.

Teaching Learning Methods:

● Lecture Method, ICT, Assignment, Quiz, Group Discussion

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level
CO1	Explain various laws of forces and solve problems by applying the same	**K3**
CO2	Compare like and unlike parallel forces and employ Varignon's theorem in solving problems	**K3**
CO3	Use the concepts of stability of equilibrium in solving problems	**K3**
CO4	Explicate projectile and apply its properties to solve problems	**K3**
CO5	Apply the concept of impulsive forces in finding solutions to the problems	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze K5 = Evaluate K6 Create

Mapping Course outcome with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2			3		3		2	18
CO2	3	3			2	2			3		3		2	18
CO3	3	3			2	2			3		3		2	18
CO4	3	3			2	2			3		3		2	18
CO5	3	3			2	2			3		3		2	18
Grand Total of Cos with POs & PSOs														90
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{90}{35}$														2.6

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.6
Observation	**Cos of Mechanics are strongly correlated with POs & PSOs**		

DEPARTMENT OF MATHEMATICS
Differential Equations and Applications
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	: II B.Sc. Mathematics	**Part**	: III/Allied-4
Semester	: IV	**Hours**	: 75
Course Code	: 22UMAA44	**Credits**	: 4

Objective:

This course will make the learners to gain knowledge in applying different methods of solving differential equations.

Course Content:

Unit 1: **Equation of first order & higher degree:** Bernoulli's Equation-Exact differential equations – Practical rule for solving an exact differential equation-equations of first order but of higher degree – equations solvable for x,y and p – Clairauts' equation- Equations that do not contain x explicitly **(15 hours)**

Unit 2: **Linear equation with constant coefficients:** – The operator D- complementary function of a linear equation with constant coefficients-particular integral-general method for finding P.I-special methods for finding P.I- linear equations with variable coefficients – equations with reducible to the linear equations **(15 hours)**

Unit 3: **Simultaneous differential equations**: simultaneous equations of first order and first degree- solutions of Lagrange's equations -Methods for solving Lagrange's equations- simultaneous linear differential equations- simultaneous equation with variable coefficients. **(15 hours)**

Unit 4: **The Laplace transforms:** sufficiently conditions for the existence of the Laplace transform-Laplace transform of periodic functions- The inverse transform – solution of differential equations using Laplace transforms. **(15 hours)**

Unit 5: **Applications of first order equations:** Growth, Decay and Chemical Reactions – Flow of water from an orifice-simple electric circuits **(15 hours)**

Book for Study:

S.Narayanan, T.K.Manickavachagam Pillay," Differential Equations and its Applications", S.Viswanathan (Printers & Publishers), PVT., LTD.2018

Unit 1 :	Chapter 2	sections 5, 6	
	Chapter 4	sections 1, 2, 3	
Unit 2 :	Chapter 5	sections 1-6	
Unit 3 :	Chapter 6	sections 1-7	
Unit 4 :	Chapter 9	sections 1-7	
Unit 5 :	Chapter 3	sections 1, 2 & 6	

Books for Reference:

1. Arumugam and Issac, "Differential Equations and Applications", New Gamma Publishing House, Palayamkottai, 2014.
2. M.L Khanna, "Differential Equations", Jai Prakashnath & Co, Meerut, 1999.

Teaching Learning Methods:

- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level
CO1	Compute solutions to differential equations of many kinds by applying various methods	**K3**
CO2	Apply the method of variation of parameters to solve linear differential equations.	**K3**
CO3	Employ the properties of Laplace transforms to solve differential equations	**K3**
CO4	Use Lagrange's and Charpit's methods to solve the partial differential equations	**K3**
CO5	Formulate and solve the differential equation representing the real life problems	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze K5 = Evaluate K6 Create

Mapping Course outcome with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3		2	2				3	2	2	2	2	21
CO2	3	3		2	2				3	2	2	2	2	21
CO3	3	3		2	2				3	2	2	2	2	21
CO4	3	3		2	2				3	2	2	2	2	21
CO5	3	3	2	2	2				3	2	2	2	2	23
Grand Total of Cos with POs & PSOs														107
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{107}{46}$														2.3

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.3
Observation	COs of Differential Equations and Applications are strongly correlated with POs & PSOs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATUR – 625 514
DEPARTMENT OF MATHEMATICS
Resource Optimization Techniques
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	: II B.Sc. (Other Sciences)	Part	: IV/NME-2
Semester	: IV	Hours	: 45
Course Code	: 22UMAN24	Credits	: 2

Objective:
This course enables the learners acquire intense knowledge and apply different optimization techniques to real life problems.

Course Content:

Unit 1: **Linear programming problem:** Introduction – Linear Programming Problem - Mathematical formulation of Problem - Graphical solution method.
(9 hours)

Unit 2: **Transportation problem:** Introduction – LP formulation of transportation problem- Solution of a transportation problem – Finding an initial basic feasible solution.
(9 hours)

Unit 3: **Assignment problem:** Introduction – mathematical formulation of assignment problem – solution to an assignment problem – Travelling salesman problem.
(9 hours)

Unit 4: **Sequencing problem:** Introduction - Problem of sequencing – Basic Terms used in sequencing – Processing n jobs through two machine – Processing n jobs through k machines. **(9 hours)**

Unit 5: **Games and Strategies:** Introduction- Two-person Zero-sum Games - The Maximin - Minimax principle –Games without saddle points –mixed strategies.
(9 hours)

Book for Study:
Kanti Swarup., Gupta P.K., Man Mohan "An introduction to management science operation research" Sultan Chand and sons educational publishers, new Delhi, fifteenth edition

Unit 1 :   Chapters 2,3   Sections: 2.1,2.4,3.2
Unit 2 :   Chapter 10   Sections: 10.1,10.2,10.8,10.9
Unit 3 :   Chapter 11   Sections: 11.1 – 11.3,11.7
Unit 4 :   Chapter 12   Sections: 12.1 – 12.5
Unit 5 :   Chapter 17   Sections: 17.1 – 17.5

Books for Reference:
01. Sharma., "Operations Research", 2nd Edition, Vikas Publishing House Private Limited, New Delhi, 2002.
02. Arumugam.S., Thangapandi Isaac.A "Topics in operation research Linear programming" New gamma publishing house, Palayamkottai, March 2015.

Teaching Learning Methods:
- Lecture Method, ICT, Assignment, Quiz, Group Discussion

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level
CO1	Define and formulate linear programming problems and apply graphical method	**K3**
CO2	Be able to build and solve transportation models	**K3**
CO3	Use different methods to solve the assignment problems.	**K3**
CO4	Solve problems based on sequencing	**K3**
CO5	Apply game strategies to solve problems	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze K5 = Evaluate K6 Create

Mapping Course outcome with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2			2	2			3	3	3	3	3	23
CO2	3	2			2	2			2	2	2	2	2	24
CO3	3	2			2	2			3	3	3	3	3	24
CO4	3	2			2	2			2	2	2	2	2	23
CO5	3	2			2	2			2	2	2	2	2	24
Grand Total of Cos with POs & PSOs														105
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{118}{45}$														2.33

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.33
Observation	**Cos of Operations Research Techniques are strongly correlated with POs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Stellar Universe
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	: II UG	**Part**	: SLC
Semester	: IV	**Credits**	: 3
Course Code	: 22UMASL4		

Objectives:
This course enables the learners to acquire profound knowledge on stellar universe

Course Content:

Unit 1: Introduction – stellar motion – solar motion - distance of stars – magnitudes of stars

Unit 2: Apparent visual and photo visual magnitude/absolute magnitude

Unit 3: Colour and size of stars – dwarfs – main sequence stars – giants

Unit 4: Double and multiple stars – variable stars – novae – nebulae

Unit 5: Zodiacal constellations – winter, spring, summer, autumn constellations

Book for Study:

Kumaravelu, Susheela Kumaravelu, "Astronomy", Reprinted, Sri Vishnu Arts, 2004.

Unit 1 :	Chapter 17	sections: 335 - 339
Unit 2 :	Chapter 17	sections: 340 - 342
Unit 3 :	Chapter 17	sections: 343
Unit 4 :	Chapter 17	sections: 344 - 348
Unit 5 :	Chapter 17	sections: 349 – 352

Teaching Learning Methods:

● Lecture Method, ICT, Assignment, Quiz, Group Discussion

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level
CO1	Retrieve the fundamentals of solar and stellar systems	**K1**
CO2	Summarize the magnitude of apparent and photo visuals	**K2**
CO3	Explain the formation of stars	**K2**
CO4	Explicate the different types of stars	**K2**
CO5	Describe zodiacal constellations of different seasons	**K2**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze K5 = Evaluate K6 Create

Mapping Course outcome with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2		2		2			2		2		2	15
CO2	3	2		2		2			2		2		2	15
CO3	3	2		2		2			2		2		2	15
CO4	3	2		2		2			2		2		2	15
CO5	3	2		2		2			2		2		2	15
Grand Total of Cos with POs & PSOs														75
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{75}{35}$														2.14

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.14
Observation	Cos of Stellar Universe are strongly correlated with POs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514

DEPARTMENT OF MATHEMATICS

QUESTION PAPER PATTERN (UG)
(Core, Core Elective, Allied and Non-Major Elective)
(For those who join from 2022 onwards)

INTERNAL (40 MARKS)

SECTION – A (4 x 1 = 4 marks)

FOUR multiple choice questions. Each question carries one mark. (K1, K2)

SECTION – B (2 x 4 = 8 marks)

TWO questions with internal choice. Each question carries four marks. (K3, K4)

SECTION – C (4 x 7 = 28 marks)
FOUR questions with internal choice. Each question carries seven marks. (K3, K4, K5)

EXTERNAL (100 MARKS)

SECTION – A (10 x 1 = 10 marks)
TEN multiple choice questions. Each question carries one mark. (K1, K2)

SECTION – B (5 x 6 = 30 marks)
FIVE questions with internal choice. Each question carries six marks. (K3, K4)

SECTION – C (5 x 12 = 60 marks)
FIVE questions with internal choice. Each question carries twelve marks. (K3, K4, K5)

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514

DEPARTMENT OF MATHEMATICS

SCHEME OF EVALUATION (UG)

1. Continuous Internal Assessment

	Marks
Test – 1	40
Test – 2	40
Assignment / Seminar	20

Total	100
	------

2. Semester Examination   100 Marks

3. Total Marks = 50% C.I.A + 50% Semester Examinations

A candidate must score a minimum of 20 marks out of 50 in the semester examination and an overall aggregate minimum of 40 marks out of 100 for a pass.

			V SEMESTER		
III	19UMAC75	Core – 7 Modern Algebra	06	5	
	19UMAC85	Core – 8 Real Analysis	06	5	
	19UMAC95	Core – 9 Numerical Methods and Discrete Mathematics	06	5	
	19UMAD05	Core – 10 C++ Programming	04	3	
	19UMAP15	Core Lab – 1 – Programming Lab in C++	02	2	
	19UMAE15	Core Elective -1 Linear Programming	05	4	
	19UINT15	Internship	-	1	
V	19USSI16	Soft Skills	1	-	
		TOTAL	30	25	
			VI SEMESTER		
III	19UMAD16	Core – 12 Linear Algebra	06	5	
	19UMAD26	Core – 13 Complex Analysis	06	5	
	19UMAD36	Core – 14 Graph Theory	06	5	
	19UMAD46	Core – 15 Java Programming	04	3	
	19UMAP26	Core Lab – 2 - Programming Lab in Java11	02	2	
	19UMAE26	Core Elective – 2 Operations Research	05	4	
V	19USSI16	Soft Skills	1	2	
		TOTAL	30	26	

Semester Credits   I   II   III   IV   V   VI   Total

                    22   25   22   24   25   26   144

Part I   16 credits

Part II   16 credits

Part III

     Core   68

     Allied   16

     Core Electives   08

     Total   **92** credits

Part IV

     Non-Major Electives   4

     Skill based Electives   4

     Value Education   4

     Total   **12** credits

Part V

Extension Activities   2

ARISE   1

Bridge Course   1

Soft Skill   2

Communication Skills   1

Internship	01	
Total	**8** credits	

Self-Learning Courses

Semester	Sub Code	Title of the Paper	Credits
III	19UMASL3	Solar System	3
IV	19UMASL4	Stellar Universe	3
V	19UMASL5	Statistical Methods in Social Sciences	3
VI	19UMASL6	Mathematical Methods in Business	3

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR
DEPARTMENT OF MATHEMATICS
B.Sc. MATHEMATICS
CBCS PATTERN (From 2019 – 2020 onwards)

Programme Specific Outcomes

On completion of the programme, the students will be able to

PSO 1: Explicate the concepts of pure and applied Mathematics by demonstrating the knowledge and understanding of the mathematical principles in multidisciplinary environments.

PSO 2: Analyze and evaluate Mathematical concepts and principles with the utilization of the logical and scientific approach.

PSO 3: Develop the competency of integrating mathematics with other domains of science by applying the skills of problem solving in the fields of social science and technology.

PSO 4: Construct, create and communicate well-structured mathematical arguments with the interpretation and incorporation of mathematical ideas independently.

PSO 5: Appreciate the beauty of Mathematics with the attainment of proficiency in problem solving, computational skills, critical thinking, technical and quantitative reasoning skills.

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Modern Algebra
(For those who joined in June 2019 onwards)

Class	: III B.Sc. Mathematics	**Part**	: III Core 7
Semester	: V	**Hours**	: 90
Subject Code	: 19UMAC75	**Credits**	: 5

Objectives:
- To introduce the principal concepts of group to the students.
- To familiarize the learners with the notion of coset and its properties.
- To explore the idea of rings and the associated properties to the novice.
- To enable the learners get acquainted with the notion of ideal and its applications.
- To make the students acquire intense knowledge on integral domain.

Unit 1   Groups – definition and examples – Abelian groups – permutation groups – subgroups-cyclic groups – definitions – intersection and union of two groups – order of a group and order of an element   **(18 hours)**

Unit 2   Cosets and Lagrange's theorem – theorems of Euler and Fermat – normal subgroups – center of a group – quotient groups – Cayley's theorem – homomorphism – fundamental theorem   **(18 hours)**

Unit 3   Rings – definition and examples – types of rings – zero divisors – integral domain – field – finite integral domain – characteristic of a ring   **(18 hours)**

Unit 4   Sub rings – definition and examples – ideals – principal ideal – principal ideal domain – quotient rings – maximal and prime ideals   **(18 hours)**

Unit 5   Homomorphism of rings – fundamental theorem – field of quotients of an integral domain – ordered integral domain – unique factorization domain
                                                  (18 hours)

Book for Study

Arumugam S., Thangapandi Issac A., *Modern Algebra*, SCITECH Publications (India) Pvt Ltd., Chennai, 2018.
Unit 1 : Chapter 3 Sections: 3.0 - 3.7
Unit 2 : Chapter 3 Sections: 3.8 - 3.11
Unit 3 : Chapter 4 Sections: 4.1 - 4.5
Unit 4 : Chapter 4 Sections: 4.6 - 4.9
Unit 5 : Chapter 4 Sections: 4.10 - 4.13

Books for Reference:
1. Surjeet Singh, Qazi Zameerudin, *Modern Algebra*, Vikas Publishing House Private Limited, New Delhi, 2012.
2. Vasishtha A.R., *Modern Algebra*, Krishna Prakasham Mandir, Meerut, 2013.

Teaching Learning Methods:
- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Describe the concept of groups and their properties	K2
CO2	Explain the concept of cosets, normal subgroups, homomorphism and illustrate the implication of Lagrange's theorem	K3
CO3	Summarize the characteristics of Ring and compare its types	K4
CO4	Establish relationship between various kinds of ideals	K3
CO5	Make inference on integral domain and Unique factorization domain	K4

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2	2		3	3	2	2	2	24
CO2	3	3			2	2	2		3	2	2	2	2	23
CO3	3	3			2	2	2		3	3	2	2	2	24
CO4	3	3			2	2	2		3	2	2	2	2	23
CO5	3	3			2	2	2		3	3	2	2	2	24
Grand Total of Cos with POs & PSOs														118
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{118}{50}$														2.4

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	**0.01-1.0**	**1.01-2.0**	**2.1-3**
Quality	**Low**	**Medium**	**Strong**
Mean Value of Cos with POs & PSOs			**2.4**
Observation	**Cos of Modern Algebra are strongly correlated with POs & PSOs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Real Analysis
(For those who joined in June 2019 onwards)

Class	**: III B.Sc. Mathematics**	**Part**	**: III Core 8**
Semester	**: V**	**Hours**	**: 90**
Subject Code	**: 19UMAC85**	**Credits**	**: 5**

Objectives :
- To make the learners acquire intense knowledge on metric spaces and related concepts
- To enable the students get acquainted with the notions of interior, closure and dense sets
- To facilitate pupil comprehend the concept of completeness of metric spaces
- To explore the aspects of continuity and connectedness to the novice
- To enhance the student's comprehension on compactness of metric spaces

Course Outline:

Unit 1 Definition and examples of metric spaces – bounded sets – open ball – open sets – equivalent metrics – subspaces **(18 hours)**

Unit 2 Interior of a set – closed sets – closed ball – examples – closure – limit points – derived set – dense sets **(18 hours)**

Unit 3 Completeness – definition and examples – Cantor's intersection theorem – Baire's category theorem **(18 hours)**

Unit 4 Continuity – homeomorphisms – uniform continuity – connectedness – connected subsets of R – connectedness and continuity **(18 hours)**

Unit 5 Compactness – compact subsets of R – Heine-Borel theorem – equivalent characterizations for compactness **(18 hours)**

Book for Study

Arumugam S., Thangapandi Issac A., *Modern Analysis*, New Gamma Publishing House, Palayamkottai, 2017.
Unit 1 : Chapter 2 Sections: 2.1 – 2.5
Unit 2 : Chapter2 Sections: 2.6 – 2.10
Unit 3 : Chapter 3 Sections: 3.1 – 3.2
Unit 4 : Chapters 4& 5 Sections: 4.1 - 4.3, 5.1 – 5.3
Unit 5 : Chapter 6 Sections: 6.1 – 6.3

Books for Reference:
1. Sharma, J.N., Vasistha, A.R., *Real Analysis*, Krishna Prakashan Media(P) Ltd., Meerut, 2013.
2. Viswanatha Naik, K., *Real Analysi*s, Emerald Publishers, Chennai, 2013.

Teaching Learning Methods:
- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Describe the concept of metric spaces and open sets	**K2**
CO2	Differentiate open sets and closed sets	**K4**
CO3	Illustrate the concept of Complete metric spaces and deduce results	**K4**
CO4	Interpret on the properties of continuity and connectedness	**K3**
CO5	Relate the concept of compact spaces and develop the equivalent characterizations	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2	2		3	2		2	3	22
CO2	3	3			2	2	2		3	2		3	3	23
CO3	3	3			2	2	2		3	2		2	3	22
CO4	3	3			2	2	2		3	2	3	2	2	24
CO5	3	3			2	2	2		3	2		2	3	22
Grand Total of Cos with POs & PSOs														113
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{113}{46}$														2.5

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	**0.01-1.0**	**1.01-2.0**	**2.1-3**
Quality	**Low**	**Medium**	**Strong**
Mean Value of COs with POs & PSOs			2.5
Observation	**Cos of Real Analysis are strongly correlated with POs & PSOs**		

Numerical Methods and Discrete Mathematics
(For those who joined in June 2019 onwards)

Class : III B.Sc. Mathematics		**Part** : III Core 9
Semester : V		**Hours** : 90
Subject Code : 19UMAC95		**Credits** : 5

Objectives:
- To enable the students apply different formulae of interpolation and find the unknown values
- To develop the student's skill of solving problems in numerical differentiation and integration
- To stimulate the learners to solve differential equations by using numerical methods
- To make the learners acquire intense knowledge of lattices and related concepts
- To introduce Boolean algebra and simplification of Boolean polynomials to the students

Course Outline:

Unit 1: Interpolation – errors in polynomial interpolation – finite differences – Newton's formulae for interpolation – central difference interpolation formula - Lagrange's interpolation formula – error in Lagrange's interpolation formula

(18 hours)

Unit 2: Numerical differentiation – differentiation using Newton's formulae and Stirling's central difference formula – maxima and minima – numerical differentiation – Trapezoidal rule – Simpson's one-third and three-eight rules

(18 hours)

Unit 3: Numerical solution of ordinary differential equations – Taylor's series method – Picard's method – Euler methods – Runge-Kutta methods – predictor-corrector methods – Milne's method **(18 hours)**

Unit 4: Lattices – properties – new lattices – lattice homomorphism's – product lattices – modular and distributive lattices – complemented lattices

(18 hours)

Unit 5: Boolean algebra – De Morgan's laws – Boolean polynomials – minterm – maxterm – Karnaugh maps (up to 4 variables only) **(18 hours)**

Books for Study:

01. Sastry, S.S., *Introductory Methods of Numerical Analysis*, Prentice Hall of India Private limited, New Delhi, 2019
Unit 1 : Chapter 3   Sections : 3.1 – 3.4, 3.6, 3.7, 3.9.1, 3.9.2
Unit 2 : Chapter 5   Sections : 5.1 – 5.4
Unit 3 : Chapter 7   Sections : 7.1 – 7.6
02. Venkataraman, M.K., Sridharan, N.Chandrasekaran N., *Discrete Mathematics*, The National Publishing Company, Chennai, 2017.
Unit 4 : Chapter 10   Sections : 1 – 4
Unit 5 : Chapter 10   Sections : 5 – 7

Books for Reference:
1. Tremblay J.P., Manohar R., *Discrete Mathematical Structures with Applications to Computer Science*, McGraw-Hill International Editions, Singapore, 2011.
2. Dr.Venkataraman M.K., *Numerical Methods in Science and Engineering*, The National Publishing Company, Chennai, 2013.

Teaching Learning Methods:
- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Apply the difference operators and the use of interpolation	K3
CO2	Use various methods to find the derivative of mathematical function	K3
CO3	Solve the problems on ordinary differential equations using different methods	K3
CO4	Describe the different types of lattices as algebraic structures	K2
CO5	Explain the concepts of Boolean algebra	K2

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3		2	2	3	2		3	2	3	2	2	27
CO2	3	3		2	2	3	2		3	2	3	2	2	27
CO3	3	3		2	2	3	2		3	2	3	2	2	27
CO4	3	3		2	2	3	2		3	2	3	2	2	27
CO5	3	3		2	2	3	2		3	2	3	2	2	27
Grand Total of Cos with POs & PSOs														135
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{135}{55}$														2.5

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.5
Observation	**Cos of Numerical methods & Discrete Mathematics are strongly correlated with POs & PSOs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
C++ Programming
(For those who joined in June 2019 onwards)

Class	**: III B.Sc. Mathematics**	**Part**	**: III Core 10**
Semester	**: V**	**Hours**	**: 60**
Subject Code	**: 19UMAD05**	**Credits**	**: 3**

Objectives :
- To foster the learner's comprehension on object oriented programming.
- To make the students get acquainted with the concept of functions in C++.
- To enable the pupil's understand and use classes and objects in programming.
- To facilitate the novice differentiate the types of constructors and destructors.
- To make the learners apply the concepts of operator overloading in programming.

Course Outline:

Unit 1: Principles of object oriented Programming – introduction to C++ – token – keywords – identifiers and constants – data types – expressions and control structures
(12 hours)

Unit 2: Functions – function prototyping – call by reference – return by reference – function overloading **(12 hours)**

Unit 3: Classes and objects – arrays within a class – memory allocation for objects – arrays of objects – friendly functions **(12 hours)**

Unit 4: Constructors and destructors – copy constructor – dynamic constructors – destructors
(12 hours)

Unit 5: Operator overloading – overloading unary operators – overloading binary operators – rules for overloading operators **(12 hours)**

Book for Study:
Balagurusamy E., *Object-Oriented Programming with C++,* Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018.
Unit 1 : Chapters 1 & 3
Unit 2 : Chapter 4
Unit 3 : Chapter 5 Sections: 5.1 to 5.15
Unit 4 : Chapter 6
Unit 5 : Chapter 7 Sections: 7.1 to 7.7

Books for Reference:
1. John Hubband R., *Programming with C++,* McGraw-Hill International Editions, Schaum's Outline Series, Singapore, 2011.
2. Venugopal K.R., Rajkumar, Ravi Sankar T., *Mastering C++,* Tata McGraw-Hill Company Limited, New Delhi, 2012.

Teaching Learning Methods:
- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Explain the characteristics of object oriented programming languages	K2
CO2	Understand function prototyping and function overloading	K2
CO3	Classify Classes and Objects and apply them in programming	K3
CO4	Distinguish Constructors and Destructors	K2
CO5	Illustrate the concept of operator overloading	K3

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2		2	2	3		3			18
CO2	3	3			2	2	2	2	3	2	3		2	24
CO3	3	3			2	2	2	2	3	2	3		2	24
CO4	3	3			2		2	2	3		3			18
CO5	3	3			2	2	2	2	3	2	3		2	24
Grand Total of Cos with POs & PSOs														108
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{108}{44}$														2.5

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.5
Observation	Cos of C++ Programming are strongly correlated with POs & PSOs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Programming Lab in C++
(For those who joined in June 2019 onwards)

Class	**: III B.Sc. Mathematics**	**Part**	**: III Core Lab - 1**
Semester	**: V**	**Hours**	**: 30**
Subject Code	**: 19UMAP15**	**Credits**	**: 2**

Objectives :

- To kindle the learner's skill of applying the concepts of C++ in programming
- To enhance the proficiency of the students in writing programs
- To facilitate pupil construct new programs to compute solutions to numerical problems
- To make the novice use functions in programs
- To enable the learners bridge the gap between theory and its application

Course Outline:

List of Programs

Write a C++ program
01. To find the roots of the Quadratic equation.

02. To print the Fibonacci sequence.

03. To compute Armstrong numbers.

04. To find prime numbers.

05. To print Floyd triangle.

06. To print the following output

    1
    2   2
    3   3   3 and so on.

07. To determine perfect numbers.

08. To sort in Ascending/Descending order.

09. To find variance and standard deviation for a given set of values.

10. To demonstrate the use of function overloading.

11. To calculate factorial and nCr value.

12. To check for palindromes.

13. To print the reverse of a number.

14. To find Matrix addition and multiplication.

15. To make use of copy constructors.

16. To overload unary and binary operators.

17. To use operator overloading.

18. To evaluate the definite integral using Trapezoidal rule.

19. To find the definite integral using Simpson's 1/3 rule.

20. To determine the definite integral using Simpson's 3/8 rule.

Book for Study:

Balagurusamy E, *Object-Oriented Programming with C++*,Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018.

Books for Reference:

1. John Hubband R*., Programming with C++*, McGraw-Hill International Editions, Schaum's Outline Series, Singapore, 2011.
2. Venugopal K.R., Rajkumar, Ravi Sankar T., *Mastering C++,* Tata McGraw-Hill Company Limited, New Delhi, 2012.

Teaching Learning Methods:

- Lecture Method, ICT, Hands-on -session

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Comprehend and apply the nuances of C++ programming language	**K3**
CO2	Use arrays to find matrix addition and multiplication	**K3**
CO3	Illustrate the utility of function and operator overloading in programs	**K3**
CO4	Write programs using classes and objects	**K3**
CO5	Compute numerical solutions to the problems through programs	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2	2	2	2		3			19
CO2	3	3			2	2	2	2	2		3			19
CO3	3	3			2	2	2	2	2		3			19
CO4	3	3			2	2	2	2	2		3			19
CO5	3	3			2	2	2	2	2		3			19
Grand Total of Cos with POs & PSOs														95
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{95}{40}$														2.4

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.4
Observation	**Cos of Programming Lab in C++ are strongly correlated with POs & PSOs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Linear Programming
(For those who joined in June 2019 onwards)

Class	: III B.Sc. Mathematics	**Part**	: III Core Elective 1
Semester	: V	**Hours**	: 75
Subject Code	: 19UMAE15	**Credits**	: 4

Objectives :
- To strengthen the beginner's knowledge in Operations research and foster their skills of formulating and solving linear programming problems (LPP)
- To stimulate the learner's skills of solving LPP by applying various methods
- To make the students employ the techniques of goal programming solving LPP with multiplicity of objectives.
- To foster the computational ability of the pupil in finding optimal solutions of transportation problems by using different methods
- To enable the novice solve the problems of assignment and travelling salesman

Course Outline:

Unit 1: Over view of Operations Research – definition of L.P.P – mathematical formulation – graphical solution – general linear Programming problems – canonical and standard forms – simplex method – properties of solutions

(15 hours)

Unit 2: Artificial variables – Big-M method- Algorithm of Penalty method – Two-phase simplex method and its algorithm – degeneracy and cycling of a linear programming problem

(15 hours)

Unit 3: Goal programming – formulation and categorization – graphical goal attainment method – simplex method for goal programming problem

(15 hours)

Unit 4: Transportation problems – initial basic feasible solution using north-west corner rule, matrix minima and Vogel's approximation methods – optimum solution using MODI method – unbalanced transportation problems

(15 hours)

Unit 5: Assignment problem – Formulation of Assignment Problem – Hungarian Algorithm – traveling salesman problem – Optimal solution to travelling salesman problem

(15 hours)

Book for Study:

Kanthi Swarup, Gupta P.K., Man Mohan, *Operations Research*, Sultan Chand Sons, Educational Publishers, New Delhi, 2019.
Unit 1 : Chapter 1, 2, 3
       Chapter 4   Sections: 4.1 – 4.3
Unit 2 : Chapter 4   Sections: 4.4 – 4.5
Unit 3 : Chapter 8   Sections: 8.1 – 8.5
Unit 4 : Chapter 10   Sections: 10.1 – 10.14
Unit 5 : Chapter 11   Sections: 11.1 – 11.3, 11.6

Books for Reference:

1. Kalavathy S., *Operations Research*, Vikas Publishing House Private Limited, New Delhi, 2012.

2. Panner Selvam R., *Operations Research*, Prentice Hall of India Private Limited, New Delhi, 2012.

Teaching Learning Methods:
- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Summarize the concepts of linear programming and apply graphical and simplex method to find the optimal solutions to LPP	K3
CO2	Select the suitable methods of solving linear programming problems	K4
CO3	Formulate goal programming and use apt techniques to find ideal solutions	K3
CO4	Solve the transportation problems using various methods	K3
CO5	Make use of Hungarian algorithm to find the best solution to assignment and traveling sales man problems	K3

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3		3	2	3	2		3	2	3	2	2	28
CO2	3	3		2	2	3	2		3	3	3	2	2	28
CO3	3	3		2	2	3	2		3	2	3	2	2	27
CO4	3	3		2	2	3	2		3	2	3	2	2	27
CO5	3	3		2	2	3	2		3	2	3	2	2	27
Grand Total of Cos with POs & PSOs														137
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{137}{55}$														2.5

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.5
Observation	Cos of Linear Programming are strongly correlated with POs & PSOs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATUR – 625 514

DEPARTMENT OF MATHEMATICS

Internship

(For those who joined in June 2019 onwards)

Class	: III B.Sc. Mathematics	**Part**	: V
Semester	: V	**Hours**	: 30
Subject Code	: 19UINT15	**Credits:**	1

Objectives :
- To get exposed to a new kind of learning environment
- To gain significant experience on working with mathematical applications
- To acquire the skills of employability

Outline

➢ The students shall undertake their internship from IV/V semester holidays and must submit the report and attendance certificate before the external examinations of VI semester.

➢ The students must periodically report their progress and status to their respective Staff-Incharge / supervisor.

➢ The students must complete their internship of 25 days by undertaking any one of the following ways
- The students shall work as intern in any of the related forums of their feasibility such as company, firms, NGO etc.
- The students shall participate in the internship programs offered by other Institutions / Colleges / Universities.
- The students shall work under faculty of other colleges and acquire exposure to any of the topics in mathematics.

Evaluation :

Internal - 50 marks
Attendance and Progress Report

External – 50 marks
Final Report & Viva-Voce

 Total   –   100 marks

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Articulate their acquired knowledge in different fields of study	**K3**
CO2	Acquire and employ the skills of communication, problem solving, critical thinking in the context of employability	**K3**
CO3	Correlate the theoretical conceptualization to practical utility	**K4**
CO4	Work in projects by experimenting, exploring, integrating and appreciating the implication of mathematical concepts	**K4**
CO5	Develop and apply the skill of documentation of their works	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2	2	2	2	3	2	3	3	2	2	2	3	31
CO2	3	2	2	2	2	3	2	3	3	2	2	2	3	31
CO3	3	2	2	2	2	3	2	3	3	2	2	2	3	31
CO4	3	2	2	2	2	3	2	3	3	2	2	2	3	31
CO5	3	2	2	2	2	3	2	3	3	2	2	2	3	31
Grand Total of Cos with POs & PSOs														155
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{155}{65}$														2.4

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.4
Observation	Cos of Internship are strongly correlated with POs & PSOs		

Attendance Certificate Proforma

[To be given in the institutional/organizational/company letterhead]

This is to certify that **<u>\<Student Name\></u>** of III B.Sc. Mathematics, Arul Anandar College (Autonomous), Karumathur, Madurai Dt has completed **<u>\<30\></u>** hours of internship at **<u>\<Institution / Company Name and Address\></u>** from **<u>\<Date\></u>** to **<u>\<Date\></u>**.

_____

Office Seal   **Signature**

Date   :   Name   :

Place   :   Designation   :

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATUR – 625 514
DEPARTMENT OF MATHEMATICS
Statistical Methods in Social Sciences
(For those who joined in June 2019 onwards)

Class	: III UG	Part	: SLC - Optional
Semester	: V	Credits	: 3
Subject Code	: 19UMASL5		

Objectives:
- To enable the learners compute measures of central tendency and dispersion
- To make the pupil familiarize with correlation computation
- To introduce the fundamentals of sampling and its kinds to the students
- To facilitate the comprehension and applications of learners on the notion of distribution
- To enhance the student's skill of computing analysis of variance

Course Outline:

Unit 1: Arithmetic mean – measures of dispersion – standard deviation – mean square deviation – coefficient of variation – variance

Unit 2: Correlation coefficient for two variables – rank correlation

Unit 3: Sampling – different kinds of samples

Unit 4: Small samples – t–distribution – F-distribution

Unit 5: Analysis of variance – one criterion and two criterion of classifications

Book for Study

Arumugam, S., *Statistics*, New Gamma Publishing House, Palayamkottai, 2004.
Unit 1 : Chapter 2   Sections: 2.1, 3.1
Unit 2 : Chapter 6   Sections: 6.0 – 6.2
Unit 3 : Chapter 14   Sections: 14.1
Unit 4 : Chapter 15   Sections: 15
Unit 5 : Chapter 17   Sections: 17.1, 17.2

Books for Reference:

1. Agarwal B.L., *Basic Statistics*, Wiley Eastern Limited, New Delhi, 2004.
2. Gupta S.P., *Statistical Methods*, Sultan Chand and Sons, New Delhi, 2006.

Teaching Learning Methods:
- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Calculate mean and standard deviation for the given data	K3
CO2	Find the correlation coefficient using different methods	K3
CO3	Explain sampling and its types	K2
CO4	Apply parametric and non-parametric tests	K3
CO5	Employ ANOVA and make inferences	K3

K1 =Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2		2		2			3		3		2	17
CO2	3	2		2		2			3		3		2	17
CO3	3	2		2		2			2		2		2	15
CO4	3	2		2		2			3		3		2	17
CO5	3	2		2		2			3		3		2	17
Grand Total of Cos with POs & PSOs														83
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{83}{35}$														2.37

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	**0.01-1.0**	**1.01-2.0**	**2.1-3**
Quality	**Low**	**Medium**	**Strong**
Mean Value of Cos with POs & PSOs			**2.37**
Observation	**Cos of Statistical methods in Social Sciences are strongly correlated with POs**		

DEPARTMENT OF MATHEMATICS
Linear Algebra
(For those who joined in June 2019 onwards)

Class	: III B.Sc. Mathematics	**Part**	: III Core 11
Semester	: VI	**Hours**	: 90
Subject Code	: 19UMAD16	**Credits**	: 5

Objectives :
- To introduce the principal concepts of vector spaces to the students
- To familiarize the notion of basis, dimension and related properties to the learners
- To enable the learners get acquainted with the notion of inner product space and its applications
- To make the novice acquire intense knowledge on the theory of matrices
- To explore the ideas of eigen values and eigen vectors to the pupils

Course Outline:

Unit 1: Vector spaces – definition and examples – subspaces – linear transformations – fundamental theorem of homomorphism – span of a set   **(18 hours)**

Unit 2: Linear independence – basis and dimension – rank and nullity – matrix of a linear transformation – maximal linearly independent set – minimal generating set

(18 hours)

Unit 3: Inner product spaces – definition and examples – Schwartz inequality – orthogonality – Gram-Schmidt orthogonalization process – orthogonal complement

(18 hours)

Unit 4: Theory of matrices – algebra of matrices – types of matrices – inverse of a matrix canonical form – similarity of matrices – rank – simultaneous linear equations

(18 hours)

Unit 5: Characteristic equation of a matrix – Cayley-Hamilton theorem – eigen values and eigen vectors.   **(18 hours)**

Book for Study

Arumugam S., Thangapandi Issac A., *Modern Algebra*, SCITECH Publications(India) Pvt Ltd., Chennai, 2018.

Unit 1	: Chapter 5	Sections: 5.0 – 5.4
Unit 2	: Chapter 5	Sections: 5.5 – 5.8
Unit 3	: Chapter 6	Sections: 6.0 – 6.3
Unit 4	: Chapter 7	Sections: 7.0 – 7.3 , 7.5, 7.6
Unit 5	: Chapter 7	Sections: 7.7, 7.8

Books for Reference:

1. Surjeet Singh, Qazi Zameerudin, *Modern Algebra*, Vikas Publishing House Private Limited, New Delhi, 2012.
2. Vasishtha A.R., *Modern Algebra*, Krishna Prakasham Mandir, Meerut, 2013.

Teaching Learning Methods:
- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Explain the concept of vector spaces and linear transformations	**K3**
CO2	Illustrate the concept of linear independence and basis	**K3**
CO3	Describe the concept of inner product spaces and infer the implication of Gram-Schmidt orthogonalization process	**K4**
CO4	Justify the theoretical conceptualization of matrices	**K4**
CO5	Compute eigen values and eigen vectors and analyze their properties	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2	2		3	2	2	2	2	23
CO2	3	3			2	2	2		3	2	2	2	2	23
CO3	3	3			2	2	2		3	3	2	2	2	24
CO4	3	3			2	2	2		3	3	2	2	2	24
CO5	3	3			2	2	2		3	2	2	2	2	23
Grand Total of Cos with POs & PSOs														117
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{117}{50}$														2.3

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.3
Observation	**Cos of Linear Algebra are strongly correlated with POs & PSOs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Complex Analysis
(For those who joined in June 2019 onwards)

Class	**: III B.Sc. Mathematics**	**Part**	**: III Core 12**
Semester	**: VI**	**Hours**	**: 90**
Subject Code	**: 19UMAD26**	**Credits**	**: 5**

Objectives:

▪ To make the students apply Cauchy Riemann equations in finding the nature of the complex functions.
▪ To enable the learners compare and use different types of transformations.
▪ To enhance the pupil's skill of computing integrals of complex functions.
▪ To facilitate the novice analyze the nature of series and singularities.
▪ To estimate the value of definite integrals using calculus of residues

Course Outline:

Unit 1: Functions of a complex variable – limits – continuous functions – differentiability – Cauchy Riemann equations – analytic functions – harmonic functions – conformal mapping **(18 hours)**

Unit 2: Elementary transformations – bilinear transformations – cross ratio – fixed points of bilinear transformations – some special bilinear transformations

(18 hours)

Unit 3: Definite integrals – Cauchy's theorem – Cauchy's theorem for simply and multiply connected regions – Cauchy integral formula – maximum modulus theorem – higher derivatives **(18 hours)**

Unit 4: Series expansions – Taylor's series – Laurent's series – zeros of an analytic function – singularities – meromorphic function **(18 hours)**

Unit 5: Calculus of residues – residues – Cauchy's residue theorem – argument theorem – Rouche's theorem – fundamental theorem of algebra – evaluation of definite integrals

(18 hours)

Book for Study:

Arumugam S., Thangapand Issac A., Somasundaram A., *Complex Analysis*, SCITECH Publications (India) Pvt Ltd., Chennai, 2019.
Unit 1 : Chapter 2   Sections : 2.0 – 2.9
Unit 2 : Chapter 3   Sections : 3.0 – 3.5
Unit 3 : Chapter 6   Sections : 6.0 – 6.4
Unit 4 : Chapter 7   Sections : 7.0 – 7.4
Unit 5 : Chapter 8   Sections : 8.0 – 8.3

Books for Reference:

1. Karunakaran V., *Complex Analysis*, II edition, Narosa Publishing House Pvt. Ltd., New Delhi, 2006.
2. Lars V Ahlfors, *Complex Analysis,* McGraw Hill Book Company, Singapore, 2014 Reprint.

Teaching Learning Methods:

● Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Recall the concept of limits and continuity and apply the CR equations to determine the nature of complex functions	K3
CO2	Compare the different types of transformations and correlate the geometrical properties	K4
CO3	Find the integrals and deduce the higher derivatives of complex functions	K3
CO4	Categorize the singularities by analyzing the series expansions	K4
CO5	Calculate the residues and Estimate the values of integrals using contour integration	K3

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2	2		3	2	2	2	2	23
CO2	3	3			2	2	2		3	2	2	2	2	23
CO3	3	3			2	2	2		3	3	2	2	2	24
CO4	3	3			2	2	2		3	3	2	2	2	24
CO5	3	3			2	2	2		3	2	2	2	2	23
Grand Total of Cos with POs & PSOs														117
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{117}{50}$														2.3

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.3
Observation	**Cos of Complex Analysis are strongly correlated with POs & PSOs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Graph Theory
(For those who joined in June 2019 onwards)

Class	: III B.Sc. Mathematics	**Part**	: III Core 13
Semester	: VI	**Hours**	: 90
Subject Code	: 19UMAD36	**Credits**	: 5

Objectives :
- To introduce the learners, the fundamental concepts of Graph and its properties
- To disseminate the theoretical framework of connectedness and characterization of trees to the students
- To explicate the applications of Eulerian and Hamiltonian graphs to the novice.
- To enable the pupil comprehend planar graphs and apply the idea of planarity
- To explore the features of colourability to the learners

Course Outline:

Unit 1: Introduction – application of Graphs – finite and infinite graphs – incidence and degrees – isolated vertex-pendant vertex – null graph-isomorphism – sub graphs – walks, paths and circuits **(18 hours)**

Unit 2: Connected graphs – disconnected graphs – components – Euler graphs –Hamiltonian paths – Hamiltonian circuits – the travelling salesman problem **(18 hours)**

Unit 3: Trees – definition and examples – some properties of trees – pendant vertices in a tree – distance and centers in a tree – spanning trees – rank and nullity **(18 hours)**

Unit 4: Cut sets – definition and examples – fundamental cut sets – ring sum of cut sets – some properties of a cut set – all cut sets in a graph – connectivity and separability **(18 hours)**

Unit 5: Planar graphs – Kuratowski's two graphs – different representation of planar graphs – Euler's graphs – plane representation and connectivity – detection of planarity **(18 hours)**

Book for Study
Narsingh deo"Graph Theory with applications to Engineering and Computer Science" PHI learning private limited, New Delhi, 2018.
Unit 1 : Chapters 1, 2   Sections: 1.1 – 1.5, 2.1 – 2.4
Unit 2 : Chapter 2   Sections: 2.5 – 2.10
Unit 3 : Chapter 3   Sections: 3.1 – 3.4, 3.7
Unit 4 : Chapter 4   Sections: 4.1 – 4.3, 4.5
Unit 5 : Chapter 5   Sections: 5.2 – 5.5

Books for Reference:
1. Frank Harary., *Graph Theory*, Narosa Publishing House, Madras, 2011.
2. Arumugam S., Ramachandran S., *Invitation to Graph Theory*. SCITECH Publications (India) Pvt Ltd., Chennai, 2014.

Teaching Learning Methods:
- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Recall the fundamental concepts of Graph and its properties	**K2**
CO2	Establish and relate special graphs	**K3**
CO3	Describe tree and its properties.	**K2**
CO4	Classify connectivity and separability	**K4**
CO5	Focus on connectivity in Planar graphs	**K4**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2	2		3	2	3	2	2	24
CO2	3	3			2	2	2		3	2	2	3	2	24
CO3	3	3			2	2	2		3	2	2	2	2	23
CO4	3	3			2	2	2		3	3	2	3	3	26
CO5	3	3			2	2	2		3	3	2	3	3	26
Grand Total of Cos with POs & PSOs														123
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{123}{50}$														2.5

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.5
Observation	**Cos of Graph Theory are strongly correlated with POs & PSOs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Java Programming
(For those who joined in June 2019 onwards)

Class	: III B.Sc. Mathematics	**Part**	: III Core 14
Semester	: VI	**Hours**	: 60
Subject Code	: 19UMAD46	**Credits**	: 3

Objectives :
- To introduce the basic terminologies and operating mechanism of java language.
- To make the novice get acquainted with decision making, looping and branching
- To expose the concept of classes, objects and methods to the pupils
- To explore the notion of array and its utility in programming
- To foster the learner's comprehension of interfaces

Course Outline:

Unit 1: Java tokens –Java statements –Java Virtual Machine -Java constants, variables and data types – Symbolic Constants – Operators and expressions.   **(12 hours)**

Unit 2: Decision making and branching – if and switch statements – ?: operator – Decision making and looping – while, do and for statements – labeled loops
                                                                     (12 hours)

Unit 3: Classes, objects and methods – constructors – methods overloading – static members – Nesting of methods – Inheritance   **(12 hours)**

Unit 4: Arrays – one dimensional arrays -creating an array – two dimensional arrays –Strings – String manipulation   **(12 hours)**

Unit 5: Interfaces – defining interfaces – extending interfaces – implementing interfaces – accessing interface variables   **(12 hours)**

Book for Study:
Balagurusamy E., *Programming with Java A Primer*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2012.
Unit 1 : Chapter 3,4 &5 Sections: 3.6, 3.7,3.10, 4.1 – 4.11 ,5.1-5.15
Unit 2 : Chapter 6,7
Unit 3 : Chapter 8 Sections: 8.1 – 8.11
Unit 4 : Chapter 9 Sections: 9.1 – 9.5
 Unit 5 : Chapter 10 Sections: 10.1-10.5

Books for Reference:
1.Herbert Schildt., *The Complete Reference: Java J2SE*, Tata McGraw-Hill Publishers Private Limited, New Delhi, 2011.
2.John Hubbard R., *Programming with Java*, McGraw-Hill International Editions, Schaum's outline Series, Madras, 2012.

Teaching Learning Methods:
- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Apply the basics of java language in programming	**K3**
CO2	Employ different decision making statements in programming	**K3**
CO3	Construct classes and objects in programming to determine solutions	**K3**
CO4	Write programs using the concept of arrays	**K3**
CO5	Use the concepts of interfaces in programming	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2		2	2	3		3			18
CO2	3	3			2	2	2	2	3	2	3		2	24
CO3	3	3			2	2	2	2	3	2	3		2	24
CO4	3	3			2		2	2	3		3			18
CO5	3	3			2	2	2	2	3	2	3		2	24
Grand Total of Cos with POs & PSOs														108
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{108}{44}$														2.5

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.5
Observation	**Cos of Java Programming are strongly correlated with POs & PSOs**		

DEPARTMENT OF MATHEMATICS
Programming Lab in Java
(For those who joined in June 2020 onwards)

Class	: III B.Sc. Mathematics	**Part**	: III Core Lab - 2
Semester	: VI	**Hours**	: 30
Subject Code	: 19UMAP26	**Credits**	: 2

Objectives :
- To kindle the learner's skill of applying the concepts of Java in programming
- To enhance the proficiency of the students in writing programs and software development
- To facilitate pupil construct new programs based on numerical computations
- To make the novice use combination of Java functions in programs
- To enable the learners bridge the gap between theory and its applications

List of Programs

Write a Java program
1. To use command line argument.
2. To add the given numbers and find their average.
3. To find the factorial of a given number using the static function.
4. To compute the reverse of the given number.
5. To check whether a given number is Armstrong or not.
6. To find the prime numbers from 3 to 300.
7. To sort the numbers using the concepts of arrays.
8. To find the Fibonacci sequence.
9. To determine nCr and nPr for the given values n and r.
10. To narrate the student's details using class and objects.
11. To find y(x) at any value of x using Newton's forward interpolation formula.
12. To calculate y(x) at any value of x using Lagrange's formula.
13. To add the given two matrices.
14. To find the product the given two matrices.
15. To determine the transpose the given two matrices.
16. To find the derivatives of a function using Stirling's formula.
17. To manipulate the strings using string method.
18. To prepare shopping list.
19. To prepare employees details using inheritance
20. To find the area of two dimensional objects using interface.

Book for Study:

Balagurusamy E., *Programming with Java A Primer*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2012.

Books for Reference:

1. Herbert Schildt., *The Complete Reference: Java J2SE*, Tata McGraw-Hill Publishers Private Limited, New Delhi, 2011.
2. John Hubbard R., *Programming with Java*, McGraw-Hill International Editions, Schaum's Outline Series, Madras, 2012.

Teaching Learning Methods:

- Lecture Method, ICT, Hands-on -session

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Comprehend and apply the nuances of Java programming language	**K3**
CO2	Use arrays to handle matrix operations	**K3**
CO3	Illustrate the utility of decision making statements	**K3**
CO4	Write programs using classes and objects	**K3**
CO5	Employ the concept of interface in programming	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2	2	2	2	2		3			19
CO2	3	3			2	2	2	2	2		3			19
CO3	3	3			2	2	2	2	2		3			19
CO4	3	3			2	2	2	2	2		3			19
CO5	3	3			2	2	2	2	2		3			19
Grand Total of Cos with POs & PSOs														95
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{95}{40}$														2.4

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.4
Observation	Cos of Programming Lab in Java are strongly correlated with POs & PSOs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATUR – 625 514
DEPARTMENT OF MATHEMATICS
Operations Research
(For those who joined in June 2019 onwards)

Class	: III B.Sc. Mathematics	**Part**	: III Core Elective-2
Semester	: VI	**Hours**	: 75
Subject Code	: 19UMAE26	**Credits**	: 4

Objectives :
- To enable the learners apply various methods in solving game problems
- To make the pupil resolve the problems of sequencing and replacement
- To aid the novice acquire profound knowledge on different inventory models and its applications
- To strengthen the learner's comprehension on practical utility of queuing models and foster the skills of problem solving
- To facilitate the students design models of real situations using simulation

Course Outline:

Unit 1: Game and strategies – two-person zero sum games – maximin and minimax principle – games without saddle points – mixed strategies – graphical solution – dominance property – solution using L.P.P **(15 hours)**

Unit 2: Sequencing problems – problems with n jobs and two machines – n jobs with three machines – replacement problems **(15 hours)**

Unit 3: Inventory and its types, objectives and associated costs – inventory control problem – Economic order quantity model– deterministic inventory problems with and without shortages **(15 hours)**

Unit 4: Queuing theory – characteristics – Poisson and Exponential distributions – transient and steady state – Poisson process – finite and infinite queues – M/M/I and M/M/C models **(15 hours)**

Unit 5: Simulation – process of simulation – simulation models – generation of random numbers – Monte – Carlo simulation – simulation of inventory problems – simulation of queuing systems **(15 hours)**

Book for Study

Kanthi Swarup, Gupta P.K., Man Mohan, *Operations Research*, Sultan Chand Sons, Educational Publishers, New Delhi, 2019.

Unit 1	: Chapter 17	Sections: 17.1 – 17.7, 17.9
Unit 2	: Chapters 12, 18	Sections: 12.1 – 12.4, 18.1 – 18.3
Unit 3	: Chapter 19	Sections: 19.1 – 19.11
Unit 4	: Chapter 21	Sections: 21.1 – 21.9 (up to model V)
Unit 5	: Chapter 22	Sections: 22.1 – 22.9

Books for Reference:

1. Kalavathy S., *Operations Research*, Vikas Publishing House Private Limited, New Delhi, 2012.
2. Panner Selvam R., *Operations Research*, Prentice Hall of India Private Limited, New Delhi, 2012.

Teaching Learning Methods:
- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Apply various techniques of game to find optimal strategies	K3
CO2	Solve the problems of replacements and sequencing	K3
CO3	Compare the different inventory models and utilize in determining optimal order quantity	K4
CO4	Summarize the characteristics of queuing models and find the parameters	K3
CO5	Explain and use the concept of simulation to inventory and queuing systems	K3

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3		3	2	3	2		3	2	3	2	2	28
CO2	3	3		3	2	3	2		3	2	3	2	2	28
CO3	3	3		3	2	3	2		3	3	3	2	2	29
CO4	3	3		2	2	3	2		3	2	3	2	2	27
CO5	2	3		3	2	3	2		3	2	3	2	2	27
Grand Total of Cos with POs & PSOs														139
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{139}{55}$														2.5

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.5
Observation	Cos of Operations Research are strongly correlated with POs & PSOs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATUR – 625 514
DEPARTMENT OF MATHEMATICS
Mathematical Methods in Business
(For those who joined in June 2019 onwards)

Class	**: III UG**	**Part**	**: SLC-Optional**
Semester	**: VI**	**Credits: 3**	
Subject Code	**: 19UMASL6**		

Objectives:
- To impart the knowledge of law of indices and surds to the learners
- To make the students compute percentages of profit and loss
- To enable the pupils understand the chain rule and apply in direct & indirect proportion problems
- To explain the concept of ratio and proportion to the novice
- To enhance the student's problem solving skills based on simple interest & discount

Course Outline:

Unit 1: Roots – Square roots – Cube roots – Laws of indices – Surds – Law of Surds

Unit 2: Profit and Loss – Cost Price – Selling price – Percentage of profit and loss

Unit 3: Chain rule – Simple Proportion – Compound proportion – Direct and Indirect Proportion

Unit 4: Ratio and proportion – Product of extreme and means – Mean proportional

Unit 5: True Discount– Simple Interest – Present worth – Simple Interest on True Discount

Book for Study
Aggarwal, R.S., *Objective Arithmetic*, S.Chand & Company Ltd., New Delhi, 2015.
Unit 1 : Chapters 5 & 9
Unit 2 : Chapter 11
Unit 3 : Chapter 14
Unit 4 : Chapter 12
Unit 5 : Chapter 21

Books for Reference:
1. Ashish Aggarwal, *Quick Arithmetic*, S.Chand & Company Ltd., New Delhi, 2011.
2. David Novak, *Basic Mathematics*, D.C. Heath and Company, 2011.
3. Sharma J.N., Gupta R.K., Mathematical Methods, Krishna Prakasam Mandir, Meerut, 2010.

Teaching Learning Methods:
- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Find the roots of the equation	K3
CO2	Solve the problems based on percentage	K3
CO3	Calculate solutions to the problems of direct & indirect proportion	K3
CO4	Resolve the problems based on ratio and proportion	K3
CO5	Compute solutions to the problems of simple interest & discount	K3

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2		2		2			3		3		2	17
CO2	3	2		2		2			3		3		2	17
CO3	3	2		2		2			2		2		2	15
CO4	3	2		2		2			3		3		2	17
CO5	3	2		2		2			3		3		2	17
Grand Total of Cos with POs & PSOs														83
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{83}{35}$														2.37

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.37
Observation	Cos of Mathematical Methods in Business are strongly correlated with POs		

DEPARTMENT OF MATHEMATICS
ARUL ANANDAR COLLEGE (AUTONOMOUS)
M.Sc. MATHEMATICS
CBCS & OBE PATTERN (From 2022 – 2023 onwards)

Nature of the Course	Course Code	Course Title	Hr	Cr
FIRST YEAR – FIRST SEMESTER				
Core	22PMAC11	**Core – 1** Modern Algebra	06	05
	22PMAC21	**Core – 2** Real Analysis	06	05
	22PMAC31	**Core – 3** Numerical Analysis	06	05
	22PMAC41	**Core – 4** Statistics	06	05
Core Elective	22PMAE11	**Core Elective – 1** Graph Theory / Cryptography	06	04
		Total	**30**	**24**
FIRST YEAR – SECOND SEMESTER				
Core	22PMAC52	**Core – 5** Linear Algebra	06	05
	22PMAC62	**Core – 6** Measure and Integration	06	05
	22PMAC72	**Core – 7** Differential Equations	06	05
Core Elective	22PMAE22	**Core Elective – 2** Differential Geometry / Research Methodology	06	04
Non - Major Elective	22PMAN12	**Non-Major Elective** Numerical & Statistical Methods	04	04
Life Skills	22PLFS12	Life Skills	02+2*	02
		MOOC / SWAYAM		02**
		Total	**30**	**25**
SECOND YEAR – THIRD SEMESTER				
Core	22PMAC83	**Core – 8** Topology	06	05
	22PMAC93	**Core – 9** Classical Mechanics	06	05
	22PMAD03	**Core – 10** Complex Analysis	06	05
	22PMAD13	**Core – 11** Operations Research	06	05
Core Elective	22PMAE33	**Core Elective – 3** Mathematical Modeling / Calculus of Variations	06	04
		MOOC / SWAYAM		02**
		Total	**30**	**24**
SECOND YEAR – FOURTH SEMESTER				
Core	22PMAD24	**Core – 12** Functional Analysis	06	05
	22PMAD34	**Core – 13** Fuzzy Sets and Applications	06	05
	22PMAD44	**Core – 14** Project	12	05
Core Elective	22PMAE44	**Core Elective – 4** Automata Theory / Fluid Dynamics	06	04
		Total	**30**	**19**

Semester	I	II	III	IV	Total
Credits	24	25	24	19	92

* represents practical outside the class hour
** Extra credit course

Self-Learning Courses 2
The students can undertake any online courses offered by SWAYAM during any of the semesters and can earn extra credit.
Credit   2   per course
Maximum   4   credits

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Modern Algebra
(For those who join from June 2022 onwards)

Class : **M.Sc. Mathematics**	**Part** : **Core-1**
Semester : **I**	**Hours** : **90**
Course Code : **22PMAC11**	**Credits** : **5**

Objective:

This course will enable the learners acquire intense knowledge and analyze the concepts of groups, rings and fields

Course Content:

Unit 1: Another counting principle –conjugate – conjugate class – normalizer –– center of group- Cauchy theorem- partition **(18 Hours)**

Unit 2: Sylow's theorem – 1st, 2nd, 3rd proofs – p-Sylow subgroup- direct products of finite abelian groups **(18 hours)**

Unit 3: Euclidean ring – principle ideal ring – greatest common divisor- prime element – unique factorization theorem- a particular Euclidean ring– Gaussian integers– Fermat theorem

(18 hours)

Unit 4: Polynomial rings – division algorithm – irreducible polynomials - polynomials over the rational field– Gauss Lemma- Eisenstein criterion **(18 hours)**

Unit 5: Fields – extension fields – algebraic extension – roots of polynomials remainder theorem – splitting field – isomorphism between fields **(18 hours)**

Book for Study:

Herstein, I.N., *Topics in Algebra*, John Wiley and Sons Pvt. Ltd., Singapore, 2016.

Unit 1:	Chapter 2	Section	2.11
Unit 2:	Chapter 2	Sections	2.12 - 2.14
Unit 3:	Chapter 3	Sections	3.7 - 3.8
Unit 4:	Chapter 3	Sections	3.9 - 3.10
Unit 5:	Chapter 5	Sections	5.1 - 5.3

Books for References:

1. Vijay Khanna., *A course in Abstract Algebra*, V Edition, 2018.
2. Serge Lang, *Algebra*, Third Edition, Springer Graduate Texts in Mathematics, New York, 2002

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Illustrate the concepts of counting principle and explain the characterization of p-Sylow groups	**K2**
CO2	Infer the implications of Sylow's theorem to finite abelian groups	**K4**
CO3	Examine the theoretical conceptualization of Euclidean rings	**K4**

CO4	Draw inferences on the polynomial rings	**K4**
CO5	Summarize the algebraic extension of field, splitting field and the isomorphism between fields with suitable justifications	**K5**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2			2				3	2	2	3	3	20
CO2	3	3			2				3	2	3	3	2	21
CO3	3	2			2				3	2	3	3	3	21
CO4	3	3			2				3	2	3	3	2	21
CO5	3	2			2				3	2	2	3	3	20
Grand Total of Cos with POs & PSOs														103
Mean Value of Cos with POs & PSOs $= \dfrac{Grand\ Total\ of\ Cos\ with\ Pos\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{103}{40}$														2.58

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.58
Observation	COs of Modern Algebra are strongly correlated with POs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Real Analysis
(For those who join from June 2022 onwards)

Class	: M.Sc. Mathematics	**Part**	: Core-2
Semester	: I	**Hours**	: 90
Course Code	: 22PMAC21	**Credits**	: 5

Objective:

This course intends to facilitate the learners analyze the concepts of metric spaces, limits and continuity of functions.

Course Content:

Unit 1: Finite, countable and uncountable sets – metric spaces – compact sets –Heine Borel theorem-Weierstrass theorem- perfect sets –Cantor set- connected sets **(18 hours)**

Unit 2: Limits of functions – continuous function – continuity and compactness – continuity and connectedness – discontinuities – monotonic functions – infinite limits and limits at infinity
(18 hours)

Unit 3: Derivative of a real function – mean value theorems – generalized mean value theorem - continuity of derivatives – L'Hospital's Rule – derivatives of higher order – Taylor's theorem-differentiation of vector valued functions. **(18 hours)**

Unit 4: Riemann -Stieltjes Integral- definition and existence of the integral-properties – integration and differentiation – integration of vector-valued functions – rectifiable curves
(18 hours)

Unit 5: Sequences and series of functions-uniform convergence – uniform convergence and continuity – uniform convergence and integration – uniform convergence and differentiation - Equicontinuous families of functions – Stone-Weierstrass theorem.
(18 hours)

Book for Study:

Walter Rudin, *Principles of Mathematical Analysis*, McGraw-Hill International Editions, New Delhi, Third Edition,2017
Unit 1: Chapter 2   Sections 2.1-2.47
Unit 2: Chapter 4   Sections 4.1-4.34
Unit 3: Chapter 5   Sections 5.1-5.19
Unit 4: Chapter 6   Sections 6.1-6.27
Unit 5: Chapter 7   Sections 7.1-7.33

Books for References:

1. Tom M. Apostol, *Mathematical Analysis*, Addison-Wesley Publishing Company, London, 2010.
2. Richard R. Goldberg, *Methods of Real Analysis*, Oxford & IBH Publishing Company, New Delhi, 1970.

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Explain the concepts and theorems associated with compactness and connectedness	K2
CO2	Analyze the characterizations of the functions and find its limit	K4
CO3	Examines the theorems related to the derivatives	K4
CO4	Draw inferences on Riemann -Stieltjes integrals, properties and related concepts	K4
CO5	Infer the implications of uniform convergence	K4

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2			2				3	2	2	3	3	20
CO2	3	3			2				3	3	3	3	2	22
CO3	3	3			2				3	3	3	3	2	22
CO4	3	3			2				3	3	3	3	2	22
CO5	3	3			2				3	3	3	2	2	21
Grand Total of Cos with POs & PSOs														107
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ Pos\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{107}{40}$														2.68

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.68
Observation	Cos of Real Analysis are strongly correlated with POs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Numerical Analysis
(For those who join from June 2022 onwards)

Class	: M.Sc. Mathematics	**Part**	: Core-3
Semester	: I	**Hours**	: 90
Course Code	: 22PMAC31	**Credits**	: 5

Objective:

This course will make the learners apply the various numerical methods and analyze the nature of the numerical solutions.

Course Content:

Unit 1: Transcendental and polynomial equation – bisection method – secant and Regula – Falsi method – Newton– Raphson method – iteration methods based on second degree equation – Muller method – Chebyshev method – multi point iteration methods – system of non-linear equations – methods for complex roots
(18 hours)

Unit 2: System of linear algebraic equations and eigen value problem – direct methods – iteration methods – Jacobi-iteration method, Gauss-Seidel iteration method
(18 hours)

Unit 3: Interpolation and approximation: Hermite interpolation – piecewise and spline interpolation – bivariate interpolation **(18 hours)**

Unit 4: Numerical Differentiation and Numerical integration – extrapolation techniques – Gaussian quadrature – adaptive integration – multiple integrals – multiple integrals with variable limits **(18 hours)**

Unit 5: Numerical Solution of Partial Differential Equations: Representation as a difference equation – Laplace's equation on a rectangular region – iterative methods for Laplace's equation – The Poisson equation **(18 hours)**

Book for Study:

1. Jain M.K., Iyengar S.R.K. and Jain R.K., Numerical Methods for Scientific and Engineering Computations, Fourth Edition, New Age International private Limited, New Delhi, 2005.

Unit 1:	Chapter 2	Sections 2.1-2.4, 2.7, 2.8
Unit 2:	Chapter 3	Sections 3.1, 3.2, 3.4
Unit 3:	Chapter 5	Sections 4.5-4.7

2. Curtis. F. Gerald, Patrick & O. Wheatley, Applied Numerical Analysis, 5th Edition, Pearson Education, New Delhi, 2008.

Unit 4:	Chapter 4	Sections 4.9 - 4.12
Unit 5:	Chapter 7	Sections 7.3 - 7.6

Books for References:

1. Richard L.Barden.J.Bouglas Faires.,*Numerical Analysis,*IX Edition, Cengage Learning, 2011.
2. Radhey.,S.Gupta,Macwillan., *Elements of Numerical Analysis*, 2009.

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion.

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Up to
CO1	Determine solutions of the system of equations by applying various methods	K3
CO2	Employ the suitable method of computing solutions to system of linear equations	K3
CO3	Apply various methods of interpolation and interpret on the solutions to the real-life problems	K3
CO4	Calculate derivatives and integrands using numerical methods	K3
CO5	Solve partial differential equations using different methods and analyze its nature of the solutions	K4

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3	2	2	3				3	2	3	2	2	25
CO2	3	3	2	2	3				3	2	3	2	2	25
CO3	3	3	2	2	3				3	3	3	2	2	26
CO4	3	3	2	2	3				3	2	3	2	2	25
CO5	3	3	2	2	3				3	2	3	2	2	25
Grand Total of COs with POs & PSOs														126
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ Pos\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{126}{50}$														2.52

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.52
Observation	COs of Numerical Analysis are strongly correlated with POs		

Statistics
(For those who have join from June 2022 onwards)

Class	: M.Sc. Mathematics	**Part**	: Core-4
Semester	: I	**Hours**	: 90
Subject Code	: 22PMAC41	**Credits**	: 5

Objectives

This course will facilitate the learners apply and analyze various statistical concepts

Course Content:

Unit 1: Random variables – probability density function – distribution function – discrete & continuous random variable – mathematical expectations – important inequalities **(18 hours)**

Unit 2: Distribution of two random variables – expectation – bivariate random variables - marginal and conditional distributions – correlation coefficient – Independent random variables **(18 hours)**

Unit 3: Convergence in probability – convergence in distribution –moment generatingfunctions technique – the central limit theorem **(18 hours)**

Unit 4: Generating functions-Laplace transforms- Laplace (Steltjes) transform of probability distribution of a random variable-Classification of distributions. **(18 hours)**

Unit 5: Markov chains definitions and examples-higher transition Probabilities-Generalization of independent Bernoulli trials-Classification of states and chains-determination of higher transition Probabilities-Stability of a Markov system-graph theoretic approach. **(18 hours)**

Book for Study:

Robert V Hogg, Allen T Craig, *Introduction to Mathematical Statistics*, Pearson Education, Fifth Edition, Third Indian Reprint, Singapore, 2020.

Unit :1	Chapter 1	Sections	1.5 – 1.10
Unit :2	Chapter 2	Sections	2.1 – 2.6
Unit :3	Chapter 5	Sections	5.1 – 5.4

J. Medhi, Stochastic Processes, 4th Edition, New Age International(P) Ltd, 2017.

Unit: 4	Chapter 1	Sections	1.1 – 1.4
Unit: 5	Chapter 2	Sections	2.1 – 2.7

Books for Reference:
1. Sheldon Ross, A first Course in Probability, Collier Macmillan Publication, 2009.
2. Charles M Grinskad., J.Laurie Snell ., Introduction to Probability, Americal Mathematical Society,II Revised Edition, 2012.

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Comprehend the concepts of random variables and its implications	K2
CO2	Solve the problems based on various distributions	K3
CO3	Determine solutions to the problems using central value limit theorem	K3
CO4	Make inferences on the transforms of probability distribution	K4
CO5	Apply the concepts of Markov chain and Markov processes in finding steady state solutions.	K3

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create
Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COswith POs & PSOs
CO1	3	3	3	3	3				3	2	3	3	2	28
CO2	3	3	3	3	3				3	2	3	3	2	28
CO3	3	3	3	3	3				3	2	3	3	2	28
CO4	3	3	3	3	3				3	3	3	2	2	28
CO5	3	3	3	3	3				3	3	3	2	2	28
Grand Total of Cos with POs & PSOs														140
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ Pos\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{140}{50}$														2.8

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.8
Observation	COs of Statistics are strongly correlated with POs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Graph Theory
(For those who join from June 2022 onwards)

Class	: M.Sc. Mathematics	**Part**	: Core Elective 1a
Semester	: I	**Hours**	: 90
Course Code	: 22PMAE11 (A)	**Credits**	: 4

Objectives:

This course facilitates the learners to apply and analyze the concepts of trees, matchings, planarity, colourings and networks

Course Content:

Unit 1:   Trees and connectivity- Definition and simple properties – Bridges- Spanning trees – Connector problems- Shortest path problems – Cut vertices and connectivity

(18 hours)

Unit 2:   Matchings – Matchings and augmenting paths- The marriage problem – The personnel assignment problem- matching algorithm for bipartite graphs- Hungarian Algorithm- optimal assignment problem- Kuhn –Munkres algorithm

(18   hours)

Unit3:   Planar graphs- Plane and planar graphs- Euler's formula- The platonic bodies- Kuratowski's theorem- Non – Hamiltonian plane graphs- The dual of a plane graphs   **(18 hours)**

Unit4:   Colourings: Vertex Colouring-Critical graphs-Cliques-Edge Colouring

(18   hours)

Unit5:   Networks: Flows and cuts-The Ford and Fulkerson Algorithm – Separating Sets

(18 hours)

Book for Study:

John Clark and Derek Allan Holton, *A First Look at Graph Theory,* Allied Publishers Limited, New Delhi, 2005.

Unit 1 :	Chapter 2	Sections	2.1-2.6
Unit 2 :	Chapter 4	Sections	4.1-4.4
Unit 3 :	Chapter 5	Sections	5.1-5.6
Unit 4 :	Chapter 6	Sections	6.1,6.3-6.6
Unit 5 :	Chapter 8	Sections	8.1-8.3

Books for References:

1. Chartrand, Gary, and Ping Zhang. *A first course in graph theory*, Courier Corporation, 2013
2. Harary, Graph *Theory*, Narosa Publishing Company, New Delhi, 2008.

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Determine solutions to shortest path problems using the notion of spanning tree	K3
CO2	Employ various algorithms in finding solution to assignment problem	K3
CO3	Describe and make inferences on planar graphs	K4
CO4	Apply the suitable algorithm of vertex coloring to solve problems	K3
CO5	Examine the aspects of network on applying respective algorithms	K4

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3	2	2	3		2		3	3	3	3	2	29
CO2	3	3	2	2	3		2		3	3	3	3	2	29
CO3	3	3	2	2	3		2		3	2	3	3	2	28
CO4	3	3	2	2	3		2		3	3	3	3	2	29
CO5	3	2	2	3	3		2		3	2	2	3	3	28
Grand Total of COs with POs & PSOs														143
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ Pos\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{143}{55}$														2.6

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.6
Observation	COs of Graph Theory are strongly correlated with POs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Cryptography
(For those who join from June 2022 onwards)

Class	**: M.Sc. Mathematics**	**Part**	**: Core Elective 1b**
Semester	**: I**	**Hours**	**: 90**
Course Code	**: 22PMAE11 (B)**	**Credits: 4**	

Objectives:

        This course facilitates the learners to gain profound knowledge on encryption and its associated algorithms

Course Content:

Unit I: Symmetric key encryption Symmetric key encryption-Stream ciphers-Block Ciphers - DES-Modes of operation   **(18 Hours)**

Unit II: Public-key cryptography Modular arithmetic-Discrete key log function-RSA system.   **(18 Hours)**

Unit III: Operations in RSA Digital signature-Hash functions-Merkle's method- Probabilistic signatures   **(18 Hours)**

Unit IV: Discrete logarithm Elgamal's encryption-Digital signature algorithm - Robin's encryption   **(18 Hours)**

Unit V: Protocols Kerberos-Diffie-Hellman key agreement-Fiat-Shamir identification scheme Zero knowledge   **(18 Hours)**

Book for Study:

Hans Delfs and Hellmut Knebl , *Introduction To Cryptography*, Springer Publication, 2013

Unit I :	Chapter 2	Sections	2.1-2.2
Unit II :	Chapter 3	Sections	3.1-3.3
Unit III:	Chapter 3	Section	3.4
Unit IV :	Chapter 3	Section	3.5
Unit V :	Chapter 4	Sections	41.1-4.2

Book for References:

1. Koblitz., *A course in Number Theory and Cryptography*, Springer Verlag, 2014.
2. Oded Goldreich, *Foundations of Cryptography(Basic Tools),* Cambridge 2001.

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Comprehends the concepts of symmetric key encryption	K2
CO2	Explain RSA system and its implications	K2
CO3	Employ various functions of RSA	K3
CO4	Apply the algorithms of encryption	K3
CO5	Outline the extended features of encryption algorithms	K2

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create
Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3	2			2			2	2	2	2	2	20
CO2	3	3	2			2			3	2	2	2	2	21
CO3	3	3	2			2			3	2	2	2	2	21
CO4	3	3	3	2		2			3	3	2	2	2	25
CO5	3	3	3	2		2			3	3	2	2	2	25
Grand Total of Cos with POs & PSOs														112
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ Pos\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{112}{47}$														2.38

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.38
Observation	**COs of Cryptography are strongly correlated with POs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Linear Algebra
(For those who join from June 2022 onwards)

Class	: M.Sc. Mathematics	**Part**	: Core-5
Semester	: II	**Hours**	: 90
Course Code	: 22PMAC52	**Credits**	: 5

Objective:

The course enables the students to acquire profound knowledge and analyze the concepts of dual spaces, inner product spaces, different transformations and quadratic forms

Course Content:

Unit 1: Dual spaces – vector space homomorphism – dimension – dual spaces – linear functional – dual basis and annihilator

(18 hours)

Unit 2: Inner product spaces – definition – norm – Schwarz-inequality – orthogonal compliment – orthonormal set and Gram–Schmidt orthogonalization process

(18 hours)

Unit 3: Linear transformation – algebra of linear transformations – invertible-minimal polynomial- range and rank - characteristic roots and matrices **(18 hours)**

Unit 4: Canonical Forms – triangular form – definition – similar - invariant– nilpotent transformations – Jordan form-trace and transpose **(18 hours)**

Unit 5: Hermitian - unitary and normal transformations - quadratic forms: basic properties of quadratic forms – diagonalization of quadratic forms

(18 hours)

Book for Study:

Herstein I.N., Topics *in Algebra,* Second Edition, John Wiley and Sons Pvt. Ltd., Singapore, 2016

Unit 1 :	Chapter 4	Section	4.3
Unit 2 :	Chapter 4	Section	4.4
Unit 3 :	Chapter 6	Sections	6.1 - 6.3
Unit 4 :	Chapter 6	Sections	6.4 - 6.6,6.8
Unit 5 :	Chapter 6	Sections	6.10 - 6.11

Books for Reference:

1. Kenneth Hoffman and Ray Kunze, *Linear Algebra*, Pearson Ed, Second Edition first Indian reprint 2003

2. Vijay Khanna., *A course in Abstract Algebra*, V Edition, 2018.

3. Teaching Learning Methods:
   Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Explain the concepts of dual space with illustrations	K2
CO2	Apply Gram–Schmidt orthogonalization process to inner product space	K3
CO3	Examine the concepts of linear transformation through matrix representations	K4
CO4	Make inferences on the canonical forms of linear transformations	K4
CO5	Conceptualize and apply the diagonalization of quadratic forms	K4

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create
Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2							3	2	2	3	3	18
CO2	3	3							3	3	3	2	3	20
CO3	3	3							3	2	3	3	2	19
CO4	3	3	3	3	3				3	2	3	3	2	28
CO5	3	3	3	3	3				3	3	3	2	3	29
Grand Total of Cos with POs & PSOs														114
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ Pos\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{114}{41}$														2.78

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.78
Observation	COs of Linear Algebra are strongly correlated with POs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Measure and Integration
(For those who join from June 2022 onwards)

Class	: M.Sc. Mathematics	**Part**	: Core-6
Semester	: II	**Hours**	: 90
Course Code	: 22PMAC62	**Credits**	: 5

Objectives :
      This course is intended to facilitate the learners analyze the concepts of integrals and measure spaces

Course Content:

Unit 1:   Measure on the real line – Lebesgue outer measure – σ – algebra- Borel set - measurable sets and functions- Lebesgue measurable function – Borel function
      (18 hours)

Unit 2:   Integration of functions of a real variable: integration of non-negative functions – general integral – integration of series – Riemann and Lebesgue integrals
      (18 hours)

Unit 3:   Abstract measure spaces – measures and outer measures – completion of a measure – measure spaces – integration with respect to a measure – measure spaces – integration with respect to a measure   **(18 hours)**

Unit 4: L^p spaces – convex functions – Jensen's inequality   **(18 hours)**

Unit 5:   Convergence in Measure – Almost uniform convergence – Signed Measures and Halin Decomposition – The Jordan Decomposition.   **(18 hours)**

Books for Study:
De Barra, G., *Measure Theory and Integration*, First reprint, Wiley Eastern Limited, New Delhi, 2019.
Unit 1: chapter2 Sections 2.1, 2.2, 2.4
Unit 2: Chapter3 Sections 3.1 -3.4
Unit 3: Chapter5 Sections 5.1 -5.6
Unit 4: Chapter6 Sections 6.1, 6.3
Unit 5: Chapter7 Sections 7.1, 7.2 and Chapter8 Section 8.1, 8.2

Books for References:
1. Royden.H.L., *Real Analysis*, Prentice Hall of India, III Edition, 2007.
2. Munroe,M.E. *Measure and Integration*. Addison-Wesley Mass. Stockholm, 2009.

Teaching Learning Methods:
    Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):
On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Comprehends the concept of Lebesguemeasure with illustrations	K2
CO2	Compare the approaches of Riemann and Lebesgue integrals	K4
CO3	Examine the nature of measure spaces	K4
CO4	Make inferences on the conceptualization of measure space	K4
CO5	Infer on decomposition theorems	K4

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2				3	2	3	3	2	21
CO2	3	3			2				3	2	3	3	2	21
CO3	3	3			2				3	2	3	3	2	21
CO4	3	2			2				3	2	3	3	2	20
CO5	3	3			2				3	2	3	3	2	21
Grand Total of Cos with POs & PSOs														104
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ Pos\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{104}{40}$														2.6

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.6
Observation	**Cos of Measure and Integration are strongly correlated with POs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Differential Equations
(For those who join from June 2022 onwards)

Class	: M.Sc. Mathematics	**Part**	: Core-7
Semester	: II	**Hours**	: 90
Course Code	: 22PMAC72	**Credits**	: 5

Objective:

The course facilitate the learner to apply and analyze various methods of solving differential equations.

Course Content:

Unit 1: Initial value problems for the homogeneous equation – solutions of the homogeneous equation – Wronskian and linear independence – reduction of the order of a homogeneous equation – non-homogeneous equation **(18 hours)**

Unit 2: Homogeneous equations with analytic coefficients – the Legendre equation – the Euler equation – second order equation with regular singular points **(18 hours)**

Unit 3: The Bessel's equation – regular singular points at infinity – equations with variables separated – exact equations – the method of successive approximations – Lipschitz condition **(18 hours)**

Unit 4: Convergence of the successive approximations – non-local existence of solutions – approximations to solutions – equations with complex valued functions-some special equations-complex n-dimensional space-systems as vector equations **(18 hours)**

Unit 5: Eigen Values, Eigenfunctions, and the Vibrating String-Boundary value problems-Derivation of the Wave equation-Solution of the Wave Equation-The Heat equation-The Dirichlet problem for Disc-Poisson Integral-Sturm_Liouville Problems **(18 hours)**

Books for Study:

1. Earl A Coddington, *An Introduction to Ordinary Differential Equations,* Prentice-Hall India Private Limited, New Delhi, 2014

Unit 1	:	Chapter 3	Sections	3.1 – 3.6
Unit 2	:	Chapter 3	Sections	3.7 -3.8
		Chapter 4	Sections	4.1 - 4.4
Unit 3	:	Chapter 4	Sections	4.7 - 4.9
		Chapter 5	Sections	5.1 - 5.5
Unit 4	:	Chapter 5	Sections	5.6 - 5.9
		Chapter 6	Sections	6.3- 6.5

2. George F.Simmons and Steven G.Krantz, *Differential Equations,* McGraw-Hill International Editions, Singapore, 2016

Unit 5	:	Chapter 6	Sections	6.2 – 6.5

Books for References:

1. Deo S.G. and Raghavendra.V, *Text Book of Ordinary Differential equations and Stability Theory*,Tata McGraw Hill Publishing Company Ltd., New Delhi, 2007.

2. Sankar Rao.S, *Introduction to Partial Differential Equations*, Prentice Hall of India, New Delhi. 2016.

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Solve homogeneous equations by using suitable methods	**K3**
CO2	Apply Legendre and Euler equations and make inferences on the solutions to the differential equations	**K3**
CO3	Solve Bessel's equation	**K3**
CO4	Find solutions to Cauchy problem and linear equations	**K3**
CO5	Employ different methods to solve linear and non-linear partial differential equations	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3	2	2	3				3	3	3	2	3	27
CO2	3	3	2	2	3				3	2	3	3	3	27
CO3	3	3	2	2	3				3	3	3	2	3	27
CO4	3	3	2	2	3				3	3	3	2	3	27
CO5	3	3	2	2	3				3	3	3	2	3	27
Grand Total of COs with POs & PSOs														135
Mean Value of COs with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ Pos\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{135}{50}$														2.7

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.7
Observation	COs of Differential Equation are strongly correlated with POs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Differential Geometry
(For those who join from June 2022 onwards)

Class	: M.Sc. Mathematics	**Part**	: Core Elective 2a
Semester	: II	**Hours**	: 90
Course Code	: 22PMAE22 (A)	**Credits**	: 4

Objectives:
The course makes the learner apply, analyze and evaluate the concepts and properties of spaces curves and surfaces.

Course Content:

Unit 1: Space curves-Definition of a space curve - Arc length - tangent - normal and binormal - curvature and torsion - contact between curves and surfaces
(18 hours)

Unit 2: Tangent surface - Involutes and evolutes - Intrinsic equations - Fundamental Existence Theorem for space curves - Helices
(18 hours)

Unit 3: Local intrinsic properties of a surface - Curves on a surface - Surface of revolution - Helicoids - Metric - Direction coefficients - Families of curves - Isometric correspondence - Intrinsic properties **(18 hours)**

Unit 4: Geodesics - Canonical geodesic equations - Normal property of geodesics - Geodesics curvature - Gauss - Bonnet Theorem - Gaussian curvature
(18 hours)

Unit 5: Local non-intrinsic properties of a surface-Principal curvature - Lines of curvature - Developable - Developable associated with space curves and with curves on surface - Minimal surfaces - Ruled surfaces-The fundamental equation of surface theory- Parallel surfaces
(18 hours)

Book for Study:
WillmoreT.J., *An Introduction to Differential Geometry*, Oxford University Press, New Delhi 2014.

Unit 1 : Chapter 1 Sections 1 - 6
Unit 2 : Chapter 1 Sections 7 - 9
Unit 3 : Chapter 2 Sections 1-9
Unit 4 : Chapter 2 Sections 10 -12, 15-17

Books for References:

1. Dirk J. Struik, *Lectures on Classical Differential Geometry*, Addison Wesley Publishing Company, 1950
2. Barrett O'Neill*, Elementary Differential Geometry*, Second Edition, Academic Press, 2006.

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Comprehends the fundamental concepts of space curves and surfaces	K2
CO2	Characterize the nature of the surfacesand find the involute and evolute of various surfaces	K3
CO3	Infer on the intrinsic properties of surfaces and Helicoids	K4
CO4	Determine Geodesics of different surfaces	K3
CO5	Make inferences on the properties of developable curves and minimal surfaces	K4

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COswith POs & PSOs
CO1	3	3			2				3	2	3	3	2	21
CO2	3	3			2				3	3	3	2	2	21
CO3	3	3			2				3	2	3	3	2	21
CO4	3	3			2				3	3	3	2	2	21
CO5	3	2			2				3	2	3	3	2	20
Grand Total of COs with POs & PSOs														104
Mean Value of COs with POs & PSOs $= \dfrac{Grand\,Total\,of\,Cos\,with\,Pos\,\&\,PSOs}{Number\,of\,Cos\,relating\,with\,POs\,\&\,PSOs} = \dfrac{104}{40}$														2.6

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.6
Observation	COs of Differential Geometry are strongly correlated with POs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Research Methodology
(For those who join from June 2022 onwards)

Class	: **M.Sc. Mathematics**	**Part**	: **Core Elective 2b**
Semester	: **II**	**Hours**	: **90**
Course Code	: **22PMAE22 (B)**	**Credits**	: **4**

Objectives:

This course enables the learners to understand the basics of research and its associated concepts.

Course Content:

Unit I: Meaning of research-objectives of research - motivation in research-types of research-research approaches-significance of research- research methods versus methodology-research and scientific method- importance of knowing how research is done-research process - criteria of good research- problems encountered by researchers in India defining the research problem :selecting the problem- necessity of defining the problem- technique involved in defining a problem   **(18 Hours)**

Unit II : Meaning of research design-need for research design-features of a good design-important concepts relating to research design -different research designs-basic principles of experimental designs. sampling design: census and sample survey- implications of a sample design-steps in sampling design -criteria of selecting a sampling procedure-characteristics of a good sample design-different types of sample designs- random sample from an infinite universe-complex random sampling designs.   **(18 Hours)**

Unit III: Measurement in research - measurement scales-sources of error in measurement-tests of sound measurement- technique of developing measurement tools-scaling -meaning of scaling-scale classification bases-important scaling techniques-scale construction techniques.
                                                                                                                                          (18 Hours)

Unit IV: Collection of primary data- observation method - interview method- collection of data through questionnaires-collection of data through schedules -difference between questionnaires and schedules-some other methods of data collection- collection of secondary data - selection of appropriate method for data collection-case study method.
                                                                                                                                          (18 Hours)

Unit V: Meaning of interpretation-technique of interpretation-precaution in interpretation-significance of report writing-difference steps in writing report-layout of the research report-types of reports- oral presentation-mechanics of writing a research report   **(18 hours)**

Book for Study:

Kothari, C.R., *Research Methodology – Methods Techniques*. New Age International Publishers, 2010

Unit I :	Chapter 1	Sections	1.1 – 1.12
	Chapter 2	Sections	2.1 – 2.4
Unit II :	Chapter 3	Sections	3.1-3.6
	Chapter 4	Sections	4.1-4.4

Unit III: Chapter 5   Sections   5.1-5.4

         Chapter 6   Sections   6.1-6.4

Unit IV : Chapter 14   Sections   14.1-14.11

Book for References:

1. Yogesh Kumar Singh., *Fundamentals of Research Methodology and Statistics*, New Age International (P) Limited, Publishers, 2015

2. R. L. Dominoswki, *Research Methods*, Prentice Hall, 1981

Teaching Learning Methods:

    Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Comprehends the basics of research	**K2**
CO2	Interpret on different types of samplings	**K2**
CO3	Explain various scales of measurements	**K2**
CO4	Outlines the different methods of data collection	**K2**
CO5	Draft research report with essential components	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3	2		2				2	3	2	2	2	21
CO2	3	3	2		2				3	3	3	3	3	25
CO3	3	3	2		2				3	2	3	3	3	24
CO4	3	3	2		2				2	3	2	2	2	21
CO5	3	3	2		2				2	3	2	2	2	21
Grand Total of COs with POs & PSOs														112
Mean Value of COs with POs & PSOs $= \dfrac{Grand\,Total\,of\,Cos\,with\,Pos\,\&\,PSOs}{Number\,of\,Cos\,relating\,with\,POs\,\&\,PSOs} = \dfrac{112}{45}$														2.49

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.49
Observation	**COs of Research Methodology are strongly correlated with POs**		

Numerical and Statistical Methods

(For those who join from June 2022 onwards)

Class	: M.Sc. (Other Major)	Part	: NME-1
Semester	: II	Hours	: 60
Course Code	: 22PMAN12	Credits	: 4

Objective:

This course enables the learners to apply the numerical and statistical methods in solving the real life problems.

Course Content:

Unit 1: Algebraic and Transcendental Equations: Bisection Method – Iteration Method – The Method of False Position – Newton- Raphson – Method. **(12 hours)**

Unit 2: System of linear equation: Gauss elimination, Gauss Jordon elimination – triangularization method –iterative Methods, Jacobi, Gauss-Seidel iteration. **(12 hours)**

Unit 3: interpolation with equal intervals – Newton forward and backward formula - central difference formula – Gauss forward and backward formula – Stirling's formula – Bessel's formula –numerical differentiation: maximum and minimum values of a tabulated function. numerical integration: trapezoidal rule – Simpson's rule **(12 hours)**

Unit 4: Correlation coefficient – rank correlation coefficient of determination – linear regression – Method of least squares – Fitting of the curve of the form ax+b, $ax^2 +bx+c$, ab^x and ax^b **(12 hours)**

Unit 5: Binominal distribution – poisson distribution – normal distribution – properties and applications **(12 hours)**

Book for Study:

1. S.S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India, Pvt. Ltd., 2012.

Unit 1:	Chapter 2	Sections	2.1-2.5
Unit 2:	Chapter 7	sections	7.5.1,7.5.3,7.6
Unit 3:	Chapter 3	Sections	3.1, 3.3.1-3.3.3, 3.7.1-3.7.3
	Chapter 6	Sections	6.1, 6.2.1, 6.3, 6.4.1-6.4.3

2. S.C. Gupta and V.K. Kapoor, Elements of Mathematical Statistics, Sultan Chand & Sons, (2006).

Unit 4:	Chapter 9	Sections	9.1.1,9.1.2,9.3
	Chapter 10	Sections	10.1,10.3,10.6,10.7.1-10.7.3
Unit 5:	Chapter 7	Sections	7.2,7.3.1
	Chapter 8	Sections	8.2

Books for References:

1. Jain M.K., Iyengar S.R.K. and Jain R.K., Numerical Methods for Scientific and Engineering Computations, Fourth Edition, New Age International private Limited, New Delhi, 2005.

2. Sancheti D.C. and Kapoor V.K., *Statistics (Theory, Methods and Applications)*, Sultan Chand and Sons, New Delhi, 7th Edition, 2007.

Teaching Learning Methods:

Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Determine solutions of the system of equations by applying various methods	K3
CO2	Find the solution to the system of linear equations using suitable methods	K3
CO3	Use various methods of interpolation and iterative methods in solving problems	K3
CO4	Employ correlation and regression to the find the relationship between the variables of the study	K3
CO5	Apply Poisson and normal distributions to solve real life problems.	K3

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze K5 = Evaluate K6 = Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3					2		3	3	3		2	19
CO2	3	3					2		3	3	3		2	19
CO3	3	3					2		3	3	3	3	2	22
CO4	3	3	3				2		3	3	3		2	22
CO5	3	3					2		3	3	3		2	19
Grand Total of Cos with POs & PSOs														101
Mean Value of COs with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ Pos\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{101}{37}$														2.73

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.73
Observation	**COs of Research Methodology are strongly correlated with POs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS

QUESTION PAPER PATTERN (PG)
(Core, Core Elective and Non-Major Elective)
(For those who join from 2022 onwards)
INTERNAL (40 MARKS)

SECTION – A (8 x 1 = 8)
EIGHT multiple choice questions. Each question carries 1 mark. (K1, K2)

SECTION – B (4x 8 = 32)
FOUR questions with internal. Each question carries 8 marks. (K3, K4, K5)

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
SCHEME OF EVALUATION (PG)

1. Continuous Internal Assessment

	Marks
Test – 1	40
Test – 2	40
Assignment / Seminar	20

Total	100
	------

2. Semester Examination   100 Marks

3. Total Marks = 50% C.I.A + 50% Semester Examinations

A candidate must score a minimum of 23 marks out of 50 in the semester examination and an overall aggregate minimum of 50 marks out of 100 for a pass.

TOPOLOGY
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	**: II M.Sc. Mathematics**	**Part**	**: Core - 8**
Semester	**: III**	**Hours**	**: 90**
Course Code	**: 22PMAC83**	**Credits**	**: 5**

Objective:

This course will enable the learners to comprehend and profusely analyze the concepts of topology

Unit 1	**Topological Spaces:** Topological spaces – definition of topological space – basis for a topology – order topology – product topology – projections – subspace topology	
		(18 hours)
Unit 2:	**Continuous Functions:** Closed sets and limit points – closure and interior of a set – Hausdorff space continuous functions – homeomorphism- the pasting lemma – metric topology – sequence lemma – uniform limit theorem.	**(18 hours)**
Unit 3:	**Connectedness and Compactness:** Connected spaces – definition – connected subsets in the real line – intermediate value theorem – path connected – Compact spaces – definition – tube lemma – finite intersection property – compact subspaces of the real line.	**(18 hours)**
Unit 4:	**Countability and Separation Axioms:** The countability axioms – Lindelof space – regular and normal space – the separation axioms – The Urysohn Lemma.	
		(18 hours)
Unit 5:	**Nets and Filters:** Definition and convergence of Nets- Topology and convergence of Nets – Filters and their convergences – Ultrafilters and compactness.	
		(18 hours)

Book for Study:

01. James, R. Munkres, *Topology*, II Edition, Pearson India Education Services Pvt.Ltd,2015.

Unit 1 :	Chapter 2	sections	12 - 16
Unit 2 :	Chapter 2	sections	17 - 21
Unit 3 :	Chapter 3	sections	23 ,24,26 & 27
Unit 4:	Chapter 4	sections	30-33

02. K.D. Joshi, Introduction to General Topology, I Edition, New Age International (p) Limited publishers

Unit 5:	Chapter 10	sections 1-4	

Books for Reference:

1. George F. Simmons, *Introduction to Topology and Modern Analysis*, Tata McGraw-Hill, 16th Reprint, 2011.

2. Chandrasekhara Rao, K., *Topology*, Narosa Publishing House, 2nd Reprint, 2015.

Teaching Learning Methods:

- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Explain various kinds of topologies with illustrations	K3
CO2	Deduce the implications of lemmas related to continuous functions	K4
CO3	Interpret on the theorems associated with connectedness and compactness	K4
CO4	Analyze the nature of separation axioms of the given topological spaces	K4
CO5	Construct the net and filters on given topological spaces	K4

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2							3	2	3	3	3	19
CO2	3	2							3	2	3	2	2	17
CO3	3	2							3	2	3	2	2	17
CO4	3	2							3	2	2	3	2	17
CO5	3	2							3	2	3	3	2	18
Grand Total of Cos with POs & PSOs														88
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{88}{35}$														2.5

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.5
Observation	**Cos of Topology are strongly correlated with POs & PSOs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
CLASSICAL MECHANICS
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	: II M.Sc. Mathematics	**Part**	: Core - 9
Semester	: III	**Hours**	: 90
Course Code	: 22PMAC93	**Credits**	: 5

Objectives :

This course facilitates the learners acquire intense knowledge and deep sense of analyzing on the characteristics of the dynamical systems.

Course Content:

Unit 1: **Survey of Elementary Principles :** Mechanics of a particle- Mechanics of a system of particles-Constraints-D'Alembert's principle and Lagrange's equations – velocity dependent potentials dissipative function – applications of Lagrangian formulation.

(18 hours)

Unit 2: **Variational Principles and Lagrange's Equation:** Hamilton's principle – some techniques of the calculus of variations – derivation of Lagrange's equations forms – Hamilton's principle – Hamilton's principle to non holonomic systems.

(18 hours)

Unit 3: **The Two-Body Central Force Problem:** The two-body central force problem – classification of orbits – Virial theorem – differential equation for the orbit and integrable power law potentials. **(18 hours)**

Unit 4: **The Kinematics of Rigid Body Motion:** Betrand's theorem – Kepler's problem inverse square law force – Kepler's equation of motion & first integrals – Laplace – Runge – Lenz Vector. **(18 hours)**

Unit 5: **The Hamilton Equations of Motion:** Legendre Transformations – the Hamilton equation of motion – Routh Procedure – derivation of Hamilton equation from variation principle – the principle of least action. **(18 hours)**

Book for Study:

Herbert Goldstein, "Classical Mechanics, 2nd Edition", Twentieth Reprint, Narosa Publishing House, New Delhi, 2007.

Unit 1 :	Chapter 1	Sections 1.4 – 1.6
Unit 2 :	Chapter 2	Sections 2.1 – 2.4
Unit 3 :	Chapter 3	Sections 3.1 – 3.5
Unit 4:	Chapter 3	Section 3.6 – 3.9
Unit 5:	Chapter 8	Sections 8.1 – 8.3, 8.5, 8.6

Books for Reference:

1. D. T. Greenwood, "Classical Dynamics", Prentice Hall of India, New Delhi, 1985.

2. N.C.Rane and P.S.C.Joag, "Classical Mechanics", Tata McGraw Hill, 1991.

Teaching Learning Methods:

- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Apply Lagrangian's equation to various dynamical systems	K3
CO2	Employ Hamilton's principle to non-holonomic system	K3
CO3	Determine the differentiation of central orbits and apply the respective theorems to the problems	K3
CO4	Analyse the implications of Kepler's law	K4
CO5	Summarize the applications of Legendre's transformation	K5

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	2	2	3						3	2	3	2	2	19
CO2	2	2	3	2					3	2	3	2	2	21
CO3	2	2	3						3	2	3	2	2	19
CO4	3	2	3						3	2	3	2	2	20
CO5	2	2	2	2	2				3	2	3	2	2	22
Grand Total of Cos with POs & PSOs														101
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{101}{43}$														2.3

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.3
Observation	Cos of Classical Mechanics are strongly correlated with POs & PSOs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Complex Analysis
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	: II M.Sc. Mathematics	**Part**	: Core - 10
Semester	: III	**Hours**	: 90
Course Code	: 22PMAD03	**Credits**	: 5

Objective :

This course aims in making the learners to explore the concepts of analytic functions, conformal mapping, singularities and harmonic functions.

Course Content:

Unit 1: **Analytic Function:** Polynomials – rational functions – sequences – series – uniform convergence – power series – Abel's limit theorem. **(18 Hours)**

Unit 2: **Conformality:** Analytic functions in regions – conformal mapping – length and area – **Linear Transformations:** cross ratio – elementary conformal mappings – elementary Riemann surfaces. **(18 Hours)**

Unit 3: **Complex Integration**: Line Integrals – line Integrals as functions of arcs – Cauchy's theorems – Cauchy's integral formula – higher derivatives. **(18 hours)**

Unit 4: **Local Properties of Analytical Functions**: Removable singularities – Taylor's theorem – zeros and poles – general form of Cauchy's theorem – calculus of residues – residue theorem – evaluation of definite integrals. **(18 hours)**

Unit 5: **Harmonic functions:** Poisson's formula – Schwarz's theorem – power series expansions – Weierstrass theorem – Taylor's series – Laurent series **(18 hours)**

Book for Study:

Lars V Ahlfors, "Complex Analysis", Tata McGraw-Hill International Edition, Singapore, Third Edition, 1979.

Unit 1: Chapter 2   Sections 1.2 – 1.4, 2.1 – 2.5
Unit 2: Chapter 3   Sections 2.2 – 2.4, 3.1 – 3.5, 4.1 – 4.3
Unit 3: Chapter 4   Sections 1.1, 1.3 – 1.5, 2.1 – 2.3
Unit 4: Chapter 4   Sections 3.1 – 3.4, 4.1, 4.4 – 4.6, 5.1 – 5.3
Unit 5: Chapter 4   Sections 6.1 – 6.4 &
          Chapter5   Sections1.1 – 1.3

Books for Reference:

1. J.B. Conway, "Functions of one complex variables", Springer - Verlag, International student Edition, Narosa Publishing Co., 1978.

2. E. Hille, "Analytic function Theory", (2 vols.), Gonm & Co, 1959.

Teaching Learning Methods:

- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Analyze the nature of the analytical functions and find the radius of convergence of power series	**K4**
CO2	Test the conformality of mappings and compare various transformations	**K4**
CO3	Evaluate complex contour integrals by applying Cauchy's theorem and Integral formula	**K3**
CO4	Classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.	**K4**
CO5	Illustrate and express the functions of a complex variable as Taylor's series and Laurent's series	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2							3	2	3	2	2	17
CO2	3	3			2				3	2	3	2	2	20
CO3	3	2			2				3	2	3	2	2	19
CO4	3	3			2				3	2	3	2	2	20
CO5	3	2							3	2	3	2	2	17
Grand Total of Cos with POs & PSOs														93
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{93}{38}$														2.4

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.4
Observation	Cos of Complex Analysis are strongly correlated with POs & PSOs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
OPERATIONS RESEARCH
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	: II M.Sc. Mathematics	**Part**	: Core - 11
Semester	: III	**Hours**	: 90
Course Code	: 22PMAD13	**Credits**	: 5

Objective:

This course will make the learners comprehend and apply different optimizing techniques

Course Content:

Unit 1: **Integer Linear Programming:** Illustrative Applications-Capital Budgeting, Set, Covering Problem, Fixed –Charge Problem, Either –Or And If-Then Constraints - Integer Programming Algorithms: Branch And Bound (B & B) Algorithm – Zero – One Implicit Enumeration Algorithm –Cutting Plane Algorithm. **(18 hours)**

Unit 2: **Deterministic Dynamic Programming:** Recursive Nature Of Computations In DP – Forward And Backward Recursion – Selected DP Applications Cargo – Loading Model – Work Force Size Model –Equipment Replacement Model–Investment Model–Inventory Models. **(18 hours)**

Unit 3: Probabilistic Inventory Models: Continuous Review Models - Probabilitized EOQ Model- Probabilistic EOQ Model – Single Period Models- No-Setup Model (Newsvendor Model)- Setup Policy (S-S Policy)- Multiperiod Model. **(18 hours)**

Unit 4: Classical Optimization Theory: Unconstrained Extremal Problems – Necessary And Sufficient Conditions – Newton - Raphson Method – Constrained Problems – Equality Constraints – Inequality Constraints- Karush –Kuhn-Tucker Conditions (KKT). **(18 hours)**

Unit 5: Nonlinear Programming Algorithms: Unconstrained Nonlinear Algorithms – Direct Search Method – Gradient Method – Constrained Nonlinear Algorithms – Separable Programming – Quadratic Programming **(18 hours)**

Book for Study:
Taha H.A., "Operations Research – An Introduction", IX Edition, Pearson Education Inc, 2011

Unit :1	Chapter 9	Sections 9.1,9.2
Unit :2	Chapter 12	Sections 12.1-12.4
Unit :3	Chapter 16	Sections 16.1-16.3
Unit :4	Chapter 20	Sections 20.1, 20.2
Unit :5	Chapter 21	Sections 21.1,21.2

Books for Reference:

1. Kantiswaroop, P.K.Gupta and Manmohan, "Operations Research", Sultan Chand & Sons, New Delhi,15th edition, reprinted 2011.

2. Sharma., "Operations Research", 2nd Edition, Vikas Publishing House Private Limited, New Delhi, 2002.

Teaching Learning Methods:
● Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Find optimal solutions for Integer Linear Programming problems using algorithmic approaches	**K3**
CO2	Determine solutions for real life applications applying Dynamic Programming approach	**K3**
CO3	Calculate optimal order quantity of probabilistic inventory models	**K4**
CO4	Solve the problems using classical optimization theory	**K3**
CO5	Apply various methods to solve for non linear programming problems.	**K3**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2	2	2	2				3	3	3	2	2	24
CO2	3	2	2	2	2				3	3	3	2	2	24
CO3	3	2	2	2	2				3	3	3	2	2	24
CO4	3	2	2	2	2				3	3	3	2	2	24
CO5	3	2	2	2	2				3	3	3	2	2	24
Grand Total of Cos with POs & PSOs														120
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{120}{50}$														2.4

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.4
Observation	**Cos of Operations Research are strongly correlated with POs & PSOs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
MATHEMATICAL MODELING
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	**: II M.Sc. Mathematics**	**Part**	**: Core Elective – 3a**
Semester	**: III**	**Hours**	**: 90**
Course Code	**: 22PMAE33 (A)**	**Credits**	**: 4**

Objective:
This course enables the students to connect the real world with mathematics and find mathematical solution for real life problems.

Course Content:

Unit 1: Modeling Change: Modeling change with difference equations- approximating change with difference equations – solutions to dynamical systems- systems of difference equations.
(18 hours)

Unit 2: The Modeling Process, Proportionality and Geometric Similarity: Mathematical models – modeling using proportionality – modeling using geometric similarity – automobile gasoline mileage- body weight & height, strength & agility. **(18 hours)**

Unit 3: Discrete Probabilistic Modeling: Probabilistic modeling with discrete systems- modeling component and system reliability- linear regression. **(18 hours)**

Unit 4: Optimization of Discrete Models: An overview of optimization modeling – linear programming - geometric solutions – algebraic solutions – simplex method. **(18 hours)**

Unit 5: Modeling with a Differential Equation: Population growth- prescribing drug dosage- braking distance revisited- graphical solutions of autonomous differential equations- numerical approximation methods- separation of variables. **(18 hours)**

Book for study: Frank R. Giordano, William P. Fox, Steven B. Horton "A First Course in Mathematical Modeling", Cengage Learning.

Unit 1:	Chapter 1	Section 1.1 to 1.4
Unit 2:	Chapter 2	Section 2.1 to 2.5
Unit 3:	Chapter 6	Section 6.1 to 6.3
Unit 4:	Chapter 7	Section 7.1 to 7.4
Unit 5:	Chapter 11	Section 11.1, 11.4-11.7

Books for References:
1. Principles of Mathematical Modeling (Ideas, Methods, Examples) A.A. Samarskii, A.P. Mikhailov © 2002 by Taylor & Francis Group, LLC
2. Mathematical modelling- Applications with GeoGebra., Jonas Hall and Thomas Lingefjärd @ 2017 by John Wiley & Sons.

Teaching Learning Methods:
● Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Examine the implications of difference equations in model formulation	**K4**
CO2	Analyze the mathematical models framed using statistical methods	**K4**
CO3	Infer the applications of probabilistic modeling to discrete systems	**K4**
CO4	Illustrate the applications of mathematical models using Linear programming problems.	**K4**
CO5	Interpret the intervention of differential equations in mathematical modeling.	**K4**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3	2	2	2				3	3	3	2	3	26
CO2	3	3	2	2	2				3	3	3	2	3	26
CO3	3	3	2	2	2				3	3	3	2	3	26
CO4	3	3	2	2	2				3	3	3	2	3	26
CO5	3	3	2	2	2				3	3	3	2	3	26
Grand Total of Cos with POs & PSOs														130
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{130}{50}$														2.6

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.6
Observation	Cos of Mathematical Modelling are strongly correlated with POs & PSOs		

DEPARTMENT OF MATHEMATICS
CALCULUS OF VARIATIONS
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	: II M.Sc. Mathematics	**Part**	: Core Elective – 3b
Semester	: III	**Hours**	: 90
Course Code	: 22PMAE33 (B)	**Credits**	: 4

Objective:
This course enable the students comprehend and apply the techniques of solving different types of differential equations.

Course Content:

Unit 1: The concept of variation and its properties : Euler's equation - variational properties for functional - functionals dependent on higher order derivatives - functions of several independent variables - some applications to problems of mechanics.   **(18 hours)**

Unit 2: Movable boundary for a functional dependent on two functions : one sided variations – reflection and refraction of extremals - diffraction of light rays.   **(18 hours)**

Unit 3: Regularity conditions : - special kinds of kernals - Eigen values and Eigen functions - convolution integral - reduction to a system of algebraic equations – Fredholm alternative - an approximation method.   **(18 hours)**

Unit 4: Method of successive approximations :iterative scheme - Volterra integral equations - some results about the resolvent kernel - the method of solution of Fredholm equation - Fredholm first theorem   **(18 hours)**

Unit 5: Integral equations : Initial value problems - boundary value problem -singular integral equations – the Abel integral equations.   **(18 hours)**

Book for study:
    01. A. S. Gupta, Calculus of Variations with Applications, PHI, New Delhi, 2005.
Unit I :   Chapter - 1   Sections 1.1 - 1.7
Unit II :   Chapter - 2   Sections 2.1 - 2.5
    02. Ram P. Kanwal, Linear Integral Equations, Theory and Techniques, Academic Press, New York, 1971.
Unit III :   Chapter - 1   Sections 1.1 - 1.5
                 Chapter - 2   Sections 2.1 - 2.5
 Unit IV   Chapter - 3   Sections 3.1 - 3.5
                 Chapter - 4   Sections 4.1 - 4.3
Unit V :   Chapter - 5   Sections 5.1 - 5.3
                 Chapter - 8   Sections 8.1 - 8.2

Books for References:

Pars, Leopold Alexander. *An introduction to the calculus of variations*. Courier Corporation, 2013.

Teaching Learning Methods:
● Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Apply vibrational properties to solve higher order differential equations	K3
CO2	Solve problems based on reflection and refraction of extremals	K3
CO3	Use methods based on Eigen values to find solutions to the problems	K3
CO4	Employ iterative methods to find solutions to the given problems	K3
CO5	Obtain and analyse the solutions to initial and boundary value problems using different methods	K4

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3	2	2	2				3	3	3	2	3	26
CO2	3	3	2	2	2				3	3	3	2	3	26
CO3	3	3	2	2	2				3	3	3	2	3	26
CO4	3	3	2	2	2				3	3	3	2	3	26
CO5	3	3	2	2	2				3	3	3	2	3	26
Grand Total of Cos with POs & PSOs														130
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{130}{50}$														2.6

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.6
Observation	Cos of Calculus of Variation are strongly correlated with POs & PSOs		

Functional Analysis
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	: II M.Sc. Mathematics	**Part**	: Core - 12
Semester	: IV	**Hours**	: 90
Course Code	: 22PMAD24	**Credits**	: 5

Objective:

This course enables the learners to comprehend and analyze the associations between algebraic and topological structures.

Course Content:

Unit 1:   **Algebraic systems :** Linear spaces – dimension of a linear space – linear transformations – algebras   **(18 hours)**

Unit 2:   **Banach spaces :** Continuous linear transformations – Hahn – Banach theorem – natural imbedding of N in N** – open mapping theorem – conjugate of an operator

            (18 hours)

Unit 3:   **Hilbert spaces :** Orthogonal complements – orthogonal sets – Bessel's inequality – conjugate space H*   **(18 hours)**

Unit 4:   **Theory of operators :** Adjoint of an operator – self adjoint operators – normal and unitary operators – projections   **(18 hours)**

Unit 5:   **Finite dimensional spectral theory :** Matrices – determinants – spectrum of an operator – spectral theorem – general preliminaries on Banach algebras – regular and singular elements   **(18 hours)**

Book for Study:

Simmons, G. F., *Introduction to Topology and Modern Analysis*, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2006.

Unit 1 :	Chapter 8	Sections 42 - 45
Unit 2 :	Chapter 9	Sections 46 - 51
Unit 3 :	Chapter 10	Sections 52 - 55
Unit 4 :	Chapter 10	Sections 56 - 59
Unit 5 :	Chapter 11	Sections 60 - 63
	Chapter 12	Sections 64 - 65

Books for Reference:

1. Walter Rudin, *Functional Analysis*, Tata McGraw-Hill publishing Co. Ltd., New Delhi, 2006.

2. Casper Goffman and George Pedrick, *First Course in Functional Analysis*, Prentice Hall of India Private Ltd., 1987.

Teaching Learning Methods:

- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Apply their knowledge on linear spaces and linear transformations	**K3**
CO2	Examine the theoretical justifications in Hahn-Banach and Open Mapping theorems and deduce a few applications	**K4**
CO3	Infer the geometrical properties of orthogonality in Hilbert Spaces	**K3**
CO4	Classify various operators on Hilbert Spaces	**K3**
CO5	Illustrate the concepts and implications of finite dimensional spectral theory	**K4**

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	3			2				2	2	3	2	3	20
CO2	3	3			2				3	3	3	2	3	22
CO3	3	3			2				3	3	3	2	3	22
CO4	3	3			2				3	3	3	2	3	22
CO5	3	3			2				2	3	3	2	3	21
Grand Total of Cos with POs & PSOs														107
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{107}{40}$														2.7

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.7
Observation	Cos of Functional Analysis are strongly correlated with POs & PSOs		

Fuzzy Sets and Applications
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	: II M.Sc. Mathematics	**Part**	: Core - 13
Semester	: IV	**Hours**	: 90
Course Code	: 22PMAD34	**Credits**	: 5

Objectives :

This course enables the learners to gain more insights on the theoretical conceptualization of fuzzy sets and its applications

Course outline:

Unit 1: **Classical Sets to Fuzzy Sets & Fuzzy Sets versus Crisp Sets** : Overview of crisp sets – Fuzzy sets- types- basic concepts – additional properties of α-cuts - representation of fuzzy sets– decomposition theorems of fuzzy sets-extension principle for fuzzy sets.

(18 hours)

Unit 2: **Operation on Fuzzy Sets**: Types of operations – fuzzy compliments –First, Second Characterization theorem of fuzzy complements - fuzzy intersections: t-norms – fuzzy union: t-co norms - combination of operations. **(18 hours)**

Unit 3: **Fuzzy Arithmetic & Fuzzy Relations**: Fuzzy number – linguistic variables – arithmetic operation on intervals – arithmetic operations on fuzzy numbers – binary fuzzy relation-fuzzy equivalence relation-fuzzy compatibility relation-fuzzy ordering relation

(18 hours)

Unit 4: **Constructing Fuzzy Sets and Operations on Fuzzy Sets** : Overview of methods of constructing fuzzy sets- direct methods with one expert-direct methods with multiple experts-indirect method with one expert-indirect methods with multiple experts

(18 hours)

Unit 5: **Fuzzy Decision Making** : Individual Decision Making - Multi person Decision Making - Multi Criteria Decision Making – Multi Stage Decision Making – Fuzzy Ranking Methods.

(18 hours)

Book for Study :

01. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic Theory and Applications", PHI Learning Private Limited, New Delhi, 2016.

Unit 1 :	Chapter 1	Sections 1.1 – 1.5
	Chapter 2	Sections 2.1 – 2.3
Unit 2 :	Chapter 3	Sections 3.1 – 3.5
Unit 3 :	Chapter 4	Sections 4.1 – 4.5
	Chapter 5	Sections 5.3 – 5.7
Unit 4 :	Chapter 10	Sections 10.1 – 10.6
Unit 5 :	Chapter 15	Sections 15.1 – 15.6

Books for Reference:

01. Zimmermann, "Fuzzy set theory and its applications" Affiliated East West Press Pvt Ltd, 2nd Edition, 1996.
02. George J.Klir and Tina A.Folger, "Fuzzy sets, Uncertainty and information" PHI Learning Pvt limited, New Delhi, 2009.

Teaching Learning Methods:

● Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Illustrate fuzzy set and its properties	K2
CO2	Apply various operations on fuzzy sets and make interpretations	K3
CO3	Correlate fuzzy and crisp approaches in different kinds of relations	K4
CO4	Differentiate the utility of direct and indirect methods in constructing fuzzy sets	K4
CO5	Make inferences on applications of fuzzy decision making models	K4

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COswith POs & PSOs
CO1	3	3							3	3	3	2	2	19
CO2	3	3							3	3	3	2	2	19
CO3	3	3							3	3	3	2	2	19
CO4	3	3	3	3	3				3	3	3	3	3	30
CO5	3	2	3	3	3				3	3	3	3	3	29
Grand Total of Cos with POs & PSOs														116
Mean Value of Cos with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ Pos\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{116}{41}$														2.83

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.83
Observation	Cos of Fuzzy Sets and Applications are strongly correlated with POs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Project
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class   **: II M.Sc. Mathematics**   **Part**   **: Core - 14**
Semester   **: IV**   **Credits : 5**
Course Code **: 22PMAD44**

Objective
This course intends to make the learners acquire intense knowledge on the nuances of research and facilitates them to apply the mathematical concepts to design solutions to social problems

Course Outline:
The students undertake the project during the IV semester after the preliminary steps of student allotment to staff and topic selection in the III semester.

The students must attend atleast one conference/seminar at international/national/state level and it is made mandatory for internal assessment.

The student's progress is periodically assessed by the project guide through tests and presentation.

The significant research work is encouraged for presentations and publications in conferences and journals

Evaluation:

Internal – 50 Marks
Certificate of Participation / Presentation in conferences / seminars at international / national / state level – 10 Marks
Internal Viva-Voce- 15 Marks
Dissertation – 25 Marks

External Viva-Voce – 50 Marks

Total – 100 Marks

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Gain new insights and apply in the respective field of study	K3
CO2	Illustrate the concept of lab to land in the project	K3
CO3	Develop and apply the nuances of documentation of the works based on mathematical conceptualizations and implications	K3
CO4	Appraise and appreciate mathematical interventions in real life scenario	K4
CO5	Design innovative projects with the application of mathematical concepts towards scientific and societal development	K6

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2	2	2	3		2		3	3	2	3	3	28
CO2	3	2	3	3	3		2		3	3	3	3	3	31
CO3			2	2	2		2					3	2	13
CO4	3	2	3	3	3		2		3	3	3	3	3	31
CO5	3	2	3	2	3		2		3	3	3	3	3	30
Grand Total of Cos with POs & PSOs														133
Mean Value of Cos with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{133}{50}$														2.7

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of Cos with POs & PSOs			2.7
Observation	**Cos of Project are strongly correlated with POs & PSOs**		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Automata Theory
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	: II M.Sc. Mathematics	**Part**	: Core Elective - 4a
Semester	: IV	**Hours**	: 90
Course Code	: 22PMAE44 (A)	**Credits:**	4

Objective:

This course enables the learners to comprehend, apply and analyze the conceptualization and the characteristics of finite automata

Course Content:

Unit 1 : **Finite Automata and Regular expressions**: Definitions and examples - Deterministic and Nondeterministic finite Automata- Finite Automata with moves - Regular expressions and their relationship with automation.

(18 hours)

Unit 2 : **Context free grammar**s: Derivation trees –Simplification of Context free grammas - Chomsky Normal form – Greibach normal form. **(18 hours)**

Unit 3 : **Pushdown Automata:** Definition and examples - Relation with Context free languages. **(18 hours)**

Unit 4 : **Finite Automata and lexical analysis**- Role of a lexical analyzer - Minimizing thenumber of states of a DFA -Implementation of a lexical analyzer.

(18 hours)

Unit 5 : **Basic parsing techniques**- Parsers - Bottom up Parsers - Shift reduce - operatorprecedence - Top down Parsers - Recursive descent - Predictive parsers.

(18 hours)

Books for Study:

1. John E. Hopcroft and Jeffrey D. Ullman, *Introduction to Automata theory, Languages and Computations*, Narosa Publishing House, Chennai, 2000.

Unit 1 :	Chapter 2	Sections 2.1 – 2.5
Unit 2 :	Chapter 4	Sections 4.1 – 4.6
Unit 3 :	Chapter 5	Sections 5.2, 5.3

2. A.V. Aho and Jeffrey D. Ullman, *Principles of Compiler Design*, Narosa Publishing House, Chennai, 2002.

Unit 4 :	Chapter 3	Sections 3.1 – 3.8
Unit 5 :	Chapter 5	Sections 5.1 – 5.5

Books for Reference:

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Second Edition, Prentice Hall, 1997.
2. A.V. Aho, Monica S. Lam, R. Sethi, J.D. Ullman, Compilers: Principles, Techniques, and Tools, Second Edition, Addison-Wesley, 2007.

Teaching Learning Methods:

- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Illustrate finite automata and its kinds	K3
CO2	Compare various kinds of grammars and its implications	K4
CO3	Establish automation in relation with context free languages	K3
CO4	Analyze the role of lexical analyzer	K4
CO5	Apply the parsing techniques in generating Strings	K3

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2							3	2	3	2	2	17
CO2	3	3							3	2	3	2	2	18
CO3	3	2							3	2	3	2	2	17
CO4	3	2							3	2	3	2	2	17
CO5	3	3							3	2	3	2	2	18
Grand Total of COs with POs & PSOs														87
Mean Value of COs with POs & PSOs = $\frac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \frac{87}{35}$														2.5

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.5
Observation	COs of Automata Theory are strongly correlated with POs & PSOs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514
DEPARTMENT OF MATHEMATICS
Fluid Dynamics
(For those who joined in 2022 onwards or later under new CBCS – OBE pattern)

Class	: II M.Sc. Mathematics	**Part: Core Elective – 4b**	
Semester	: IV	**Hours : 90**	
Course Code	: 22PMAE44 (B)	**Credits: 4**	

Objective:

This course enables the learners comprehend and analyze the characteristics of fluids motion with mathematical theories and implications.

Course Content:

Unit 1 : **Real fluids and ideal fluids** – velocity of a fluid at a point – streamlines and path lines steady and unsteady flows – velocity potential – vorticity vector – local and particle rates of change – equation of continuity – worked examples – acceleration of a fluid – conditions at a rigid boundary – general analysis of fluid motion

(18 hours)

Unit 2 : **Pressure at a point in a fluid at rest** – pressure at a point in a moving fluid – conditions at a boundary of two inviscid immiscible fluids – Euler's equations of motion – Bernoulli's equation – worked examples – discussion of the case of steady motion under conservative body forces – some flows involving axial symmetry – some special two–dimensional flows – some further aspects of vortex motion

(18 hours)

Unit 3 : **Sinks and Doublets:** Introduction – sources – axis symmetric flows – Stoke's stream function – some special forms of the stream function for axis – symmetric irrotational motions **(18 hours)**

Unit 4 : **Two–dimensional flow:** – use of cylindrical polar co–ordinates – stream function – complex potential for two–dimensional – irrotational – incompressible flow – complex velocity potential for standard two–dimensional flow: uniform stream – line sources and line sinks – line doublets – line vortices – some worked examples – Milne–Thomson circle theorem – some applications of the circle theorem – extension of the circle theorem – theorem of Blasius **(18 hours)**

Unit 5 : **Stress components in a real fluid**: relations between Cartesian components of stress – translational motion of fluid element – the rate of strain quadric and principal stress **(18 hours)**

Books for Study:

Chorlton F., Textbook of Fluid Dynamics, New Delhi: CBS Publishers and Distributors. Print. 2004
Unit 1 : Chapter 1
Unit 2 : Chapter 2
Unit 3 : Chapter 3
Unit 4 : Chapter 4
Unit 5 : Chapter 5

Books for Reference:

- Goyal and Gupta, Fluid Dynamics, Pragati Prakashan Educational Publishers. Print. 2016.
- Bansal J.L, Viscous Fluid Dynamics, Delhi:Oxford & IBH Publishers.Print. 1996

Teaching Learning Methods:

- Lecture Method, ICT, Assignment, Quiz, Group Discussion

Course Outcomes (CO):

On completion of this course the students will be able to

Course Outcome No.	Course Outcome	Knowledge Level Upto
CO1	Describe the general analysis of fluid motion	K2
CO2	Apply Bernoulli's and Euler's equation of motion to make inferences on the fluid motion	K3
CO3	Use Stoke's stream function in determining the fluid motion	K3
CO4	Make inferences on two dimension flow of the fluid using Milne–Thomson circle theorem & theorem of Blasius	K3
CO5	Compares the Cartesian components of stress and different types of motion	K4

K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate, K6 = Create

Mapping Course Outcomes with

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Sum of COs with POs & PSOs
CO1	3	2							3	2	3	2	2	17
CO2	3	3							3	2	3	2	2	18
CO3	3	2							3	2	3	2	2	17
CO4	3	2							3	2	3	2	2	17
CO5	3	3							3	2	3	2	2	18
Grand Total of COs with POs & PSOs														87
Mean Value of COs with POs & PSOs = $\dfrac{Grand\ Total\ of\ Cos\ with\ POs\ \&\ PSOs}{Number\ of\ Cos\ relating\ with\ POs\ \&\ PSOs} = \dfrac{87}{35}$														2.5

Strong – 3, Medium – 2, Low – 1

Mapping Scale	1	2	3
Relation	0.01-1.0	1.01-2.0	2.1-3
Quality	Low	Medium	Strong
Mean Value of COs with POs & PSOs			2.5
Observation	COs of Fluid Dynamics are strongly correlated with POs & PSOs		

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514

DEPARTMENT OF MATHEMATICS

QUESTION PAPER PATTERN (PG)
(Core, Core Elective and Non-Major Elective)
(For those who join from 2022 onwards)

INTERNAL (40 MARKS)

SECTION – A (8 x 1 = 8)

EIGHT multiple choice questions. Each question carries 1 mark. (K1, K2)

SECTION – B (4 x 8 = 32)

FOUR questions with internal choice. Each question carries 8 marks. (K3, K4, K5)

EXTERNAL (100 MARKS)

SECTION – A (10 x 1 = 10 marks)
TEN multiple choice questions. Each question carries one mark. (K1, K2)

SECTION – B (5 x 6= 30 marks)
FIVE questions with internal choice. Each question carries six marks. (K3, K4)

SECTION – C (5 x 12 = 60 marks)
FIVE questions with internal choice. Each question carries twelve marks. (K3, K4,K5)

ARUL ANANDAR COLLEGE (AUTONOMOUS), KARUMATHUR – 625 514

DEPARTMENT OF MATHEMATICS

SCHEME OF EVALUATION (PG)

1. Continuous Internal Assessment

	Marks
Test – 1	40
Test – 2	40
Assignment / Seminar	20

Total	100
	------

2. Semester Examination   100 Marks

3. Total Marks = 50% C.I.A + 50% Semester Examinations

A candidate must score a minimum of 23 marks out of 50 in the semester examination and an overall aggregate minimum of 50 marks out of 100 for a pass.