Holy Cross College (Autonomous), Nagercoil

Kanyakumari District, Tamil Nadu.
Accredited with A$^+$ by NAAC - IV Cycle – CGPA 3.35

Affiliated to
Manonmaniam Sundaranar University, Tirunelveli

Semester I - IV

UG Guidelines & Syllabus

DEPARTMENT OF MATHEMATICS

2023-2026

(With effect from the academic year 2024-2025)

Issued from
THE DEANS' OFFICE

HOLY CROSS COLLEGE (Autonomous), NAGERCOIL

Vision

To empower women globally competent with human values and ethics acquiring academic andentrepreneurship skills through holistic education.

Mission

1. To create opportunities which will ensure academic excellence in critical thinking,humanistic and scientific inquiry.
2. To develop application-oriented courses with the necessary input of values.
3. To create a possible environment for innovation, team spirit and entrepreneurial leadership.
4. To form young women of competence, commitment and compassion.

Graduate Attributes

Graduates of our College develop the following attributes during the course of their studies.

- **Creative thinking:**
  Equipping students with hands-on-training through skill-based courses and promote startup.
- **Personality development:**
  Coping with increasing pace and change of modern life through value education, awareness on human rights, gender issues and giving counselling for the needful.
- **Environmental consciousness and social understanding:**
  Reflecting upon green initiatives and understanding the responsibility to contribute to the society; promoting social and cultural diversity through student training and service-learning programmes.
- **Communicative competence:**
  Offering effective communication skills in both professional and social contexts through bridge courses and activities of clubs and committees.
- **Aesthetic skills:**
  Engaging mind, body and emotions for transformation through fine arts, meditation and exercise; enriching skills through certificate courses offered by Holy Cross Academy.
- **Research and knowledge enrichment:**
  Getting in-depth knowledge in the specific area of study through relevant core papers; ability to create new understanding through the process of critical analysis and problem solving.
- **Professional ethics:**
  Valuing honesty, fairness, respect, compassion and professional ethics among students. The students of social work adhere to the *National Association of Social Workers Code of Ethics*
- **Student engagement in the learning process:**
  Obtaining extensive and varied opportunities to utilize and build upon the theoretical and empirical knowledge gained through workshops, seminars, conferences, industrial visits and summer internship programmes.
- **Employability:**
  Enhancing students in their professional life through Entrepreneur development, Placement & Career guidance cell.
- **Women empowerment and leadership:**
  Developing the capacity of self-management, team work, leadership and decision making through gender sensitization programmes.

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Programme Educational Objectives (PEOs)

PEOs	Upon completion of B.Sc. degree programme, the graduates will be able to	Mission addressed
PEO1	apply appropriate theory and scientific knowledge to participate in activities that support humanity and economic development nationally and globally, developing as leaders in their fields of expertise.	**M1& M2**
PEO2	inculcate practical knowledge for developing professional empowerment and entrepreneurship and societal services.	**M2, M3, M4 & M5**
PEO3	pursue lifelong learning and continuous improvement of the knowledge and skills with the highest professional and ethical standards.	**M3, M4, M5 & M6**

Programme Outcomes (**POs**)

POs	Upon completion of B.Sc. Degree Programme, the graduates will be able to:	PEOs Addressed
PO1	obtain comprehensive knowledge and skills to pursue higher studies in the relevant field of science.	**PEO1**
PO2	create innovative ideas to enhance entrepreneurial skills for economic independence.	**PEO2**
PO3	reflect upon green initiatives and take responsible steps to build a sustainable environment.	**PEO2**
PO4	enhance leadership qualities, team spirit and communication skills to face challenging competitive examinations for a better developmental career.	**PEO1 & PEO3**
PO5	communicate effectively and collaborate successfully with peers to become competent professionals.	**PEO2 &PEO3**
PO6	absorb ethical, moral and social values in personal and social life leading to highly cultured and civilized personality	**PEO2 & PEO3**
PO7	participate in learning activities throughout life, through self-paced and self-directed learning to develop knowledge and skills.	**PEO1 & PEO3**

Programme Specific Outcomes (PSOs)

PSOs	Upon completion of B.Sc. Mathematics, the graduates will be able to:	Mapping with POs
PSO1	acquire good knowledge and understanding, to solve specific theoretical & applied problems in different area of mathematics & statistics.	**PO1**
PSO2	understand, formulate, develop mathematical arguments, logically and use quantitative models to address issues arising in social sciences, business and other context /fields.	**PO6**
PSO3	apply Mathematical theories and principles accurately, precisely and effectively including higher research and extensions	**PO3 & PO7**
PSO4	prepare the students who will demonstrate respectful engagement with other's ideas, behaviors, beliefs and apply	**PO5 & PO6**

	diverse frames of references to decisions and actions	
PSO5	create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations	**PO2 & PO4**

Mapping of POs and PSOs

POs	PSO1	PSO2	PSO3	PSO4	PSO5
PO1	**S**	M	M	M	M
PO2	M	M	M	M	S
PO3	M	M	S	M	M
PO4	M	M	M	M	S
PO5	M	M	M	S	M
PO6	M	S	M	S	M
PO7	M	M	S	M	M

Strong -S (3), Medium – M (2), Low – L (1)

Eligibility Norms for Admission

Those who seek admission to B.Sc. Mathematics must have passed the Higher Secondary Examinations conducted by the Board of Higher Secondary Examination, Tamil Nadu with Mathematics as one of the subjects or any other examination recognized and approved by the Syndicate of Manonmaniam Sundaranar University, Tirunelveli.

Duration of the Programme : 3 Years

Medium of Instruction : English

Passing Minimum

A minimum of 40% in the external examination and an aggregate of minimum 40% is required. There is no minimum pass mark for Continuous Internal Assessment (CIA).

Components of the B.Sc. Mathematics Programme

Core Courses	Core-Theory papers Core Research Project	14 x 100 1x100	1400 100
	Discipline Specific Elective Theory Papers	4 x 100	400
	Total Marks		**1900**
Elective Courses	Theory	4 x 100	400
	Lab Course	2x100	200
	Total Marks		**600**
Total Marks			**2500**

Course Structure

Distribution of Hours and Credits

Curricular Courses

Course	S I	S II	S III	S IV	S V	S VI	Total	
							Hours	**Credits**
Part I –Language	6 (3)	6 (3)	6 (3)	6 (3)	-	-	24	**12**
Part II-English	6 (3)	6 (3)	6 (3)	6 (3)	-	-	24	**12**

Part-III								
Core Course Core Research Project	5 (5)+ 5 (5)	5 (5) + 5 (5)	5 (5)+ 5 (5)	5 (5)+ 5 (5)	5 (4)+ 5 (4)+ 5 (4)+ 5 (4)	6(5) + 6(5) + 6(4)	78	**70**
Elective /Discipline Specific Elective Courses	4 (3)	4 (3)	4 (3)	4 (3)	4 (3)+ 4 (3)	5 (3)+ 5 (3)	34	**24**
Non-major Elective	2 (2)	2 (2)					4	**4**
Skill Enhancement Course		2 (2)	2(2) + 2 (2)	2 (2)			8	**8**
Foundation Course	2 (2)						2	**2**
Environmental Studies				2 (2)			2	**2**
Value Education					2 (2)		2	**2**
Internship					(2)		-	**2**
Professional Competency Skill						2 (2)	2	**2**
Total	**30 (23)**	**30 (23)**	**30 (23)**	**30 (23)**	**30 (26)**	**30 (22)**	**180**	**140**

Co-curricular Courses

Course	**S I**	**S II**	**S III**	**S IV**	**S V**	**S VI**	**Total**
LST (Life Skill Training)	-	(1)	-	(1)			2
Skill Development Training (Certificate Course)	(1)						1
Field Project		(1)					1
Specific Value-added Course	(1)		(1)				2
Generic Value-added Course				(1)		(1)	2
MOOC		(1)		(1)			2
Student Training Activity: Clubs & Committees / NSS				(1)			1
Community Engagement Activity: RUN				(1)			1
Human Rights Education					(1)		1
Gender Equity Studies						(1)	1
Total							**14**

Total number of Compulsory Credits =Academic credits +Non-academic credits: **140 + 14**

Courses Offered

SEMESTER I

Course	**Course Code**	**Title of the Course**	**Credits**	**Hours/Week**
Part I	TU231TL1 FU231FL1	Language: Tamil French	3	6
Part II	EU241EL1	English: A Stream	3	6

	EU241EL2	English: B Stream		
	EU241EL3	English: C Stream		
Part III	MU241CC1	Core Course I: Algebra & Trigonometry	4	4
	MU241CC2	Core Course II: Differential Calculus	4	4
	MU231EC1	Elective Course I: Allied Mathematics I- Algebra and Differential Equations	5	6
Part IV	MU231NM1	Non-Major Elective NME I: Mathematics For Competitive Examinations- I	2	2
	MU231FC1	Foundation Course: Bridge Mathematics	2	2
		Total	**23**	**30**

SEMESTER II

Course	Course Code	Title of the Course	Credits	Hours/Week
Part I	TU232TL1 FU232FL1	Language: Tamil French	3	6
Part II	EU242EL1	English: A Stream	3	6
	EU242EL2	English: B Stream		
	EU242EL3	English: C Stream		
Part III	MU232CC1	Core Course III: Coordinate and Spatial Geometry	4	4
	MU232CC2	Core Course IV: Integral Calculus	4	4
	MU232EC1	Elective Course II: Vector Calculus and Fourier Series	5	6
Part IV	MU232NM1	Non-Major Elective NME II: Mathematics for Competitive Examinations- II	2	2
	MU232SE1	Skill Enhancement Course SEC I: Introduction to Computational Mathematics	2	2
		Total	**23**	**30**

SEMESTER III

Course	Course Code	Title of the Course	Credits	Hours / Week
Part I	TU233TL1 FU233FL1	Language: Tamil French	3	6
Part II	EU233EL1	English	3	6
Part III	MU233CC1	Core Course V: Vector Calculus and its Applications	5	5
	MU233CC2	Core Course VI: Differential Equations	5	5

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		and Applications		
	MU233EC1	Elective Course III: Mathematical Statistics	3	4
Part IV	MU233SE1	Skill Enhancement Course SEC-II: Spherical Trigonometry	2	2
	UG23CSE2	Skill Enhancement Course SEC-IV: Digital Fluency	2	2
		Total	**23**	**30**

SEMESTER IV

Course	Course Code	Title of the Course	Credits	Hours / Week
Part I	TU234TL1 FU234FL1	Language: Tamil French	3	6
Part II	EU234EL1	English	3	6
Part III	MU234CC1	Core Course VII: Groups and Rings	5	5
	MU234CC2	Core Course VIII: Elements of Mathematical Analysis	5	5
	MU234EC1	Elective Course IV: Transform Techniques	3	4
Part IV	UG23CSE1	Skill Enhancement Course SEC-III: Fitness for Wellbeing	2	2
	UG234EV1	Environmental Studies (EVS)	2	2
		Total	**23**	**30**

SEMESTER V

Course	Course Code	Title of the Course	Credits	Hours/ Week
Part III	MU235CC1	Core Course IX: Abstract Algebra	4	5
	MU235CC2	Core Course X: Real Analysis	4	5
	MU235CC3	Core Course XI: Mathematical Modelling	4	5
	MU235RP1	Core Research Project	4	5
	MU235DE1	Discipline Specific Elective I: a) Number Theory	3	4
	MU235DE2	Discipline Specific Elective I: b) Astronomy		
	MU235DE3	Discipline Specific Elective I: c) Optimization Techniques		
	MU235DE4	Discipline Specific Elective II: a) Introduction to Machine Learning	3	4
	MU235DE5	Discipline Specific Elective II: b) Introduction to Python		
	MU235DE6	Discipline Specific Elective II: c) Introduction to Artificial Intelligence		
Part IV	MU235VE1	Value Education	2	2
	MU235IS1	Internship	2	-
		Total	**26**	**30**

SEMESTER VI

Course	Course Code	Title of the Course	Credits	Hours/ Week
Part III	MU236CC1	Core Course XII: Linear Algebra	5	6
	MU236CC2	Core Course XIII: Complex Analysis	5	6
	MU236CC3	Core Course XIV: Mechanics	4	6
	MU236DE1	Discipline Specific Elective III: a) Programming Language with C++ with Practical	3	5
	MU236DE2	Discipline Specific Elective III: b) Programming Language with practical (C, Python, Java, R, etc.)		
	MU236DE3	Discipline Specific Elective III: c) Data Structures		
	MU236DE4	Discipline Specific Elective IV: a) Graph Theory and Applications	3	5
	MU236DE5	Discipline Specific Elective IV: b) Combinatorial Mathematics		
	MU236DE6	Discipline Specific Elective IV: c) Introduction to Research Methodology		
	MU236PS1	Professional Competency Skill	2	2
		Total	**22**	**30**
TOTAL			**140**	**180**

Co-curricular Courses

Part	Semester	Code	Title of the Course	Credit
Part V	I & II	UG232LC1	Life Skill Training I: Catechism	1
		UG232LM1	Life Skill Training I: Moral	
	I	UG231C01 –	Skill Development Training (SDT) - Certificate Course	1
	II	MU232FP1	Field Project	1
	I & III	MU231V01 -	Specific Value-added Course	1+1
	II &IV	-	MOOC	1+1
	III & IV	UG234LC1	Life Skill Training II: Catechism	1
		UG234LM1	Life Skill Training II: Moral	
	IV & VI	GVAC2401 -	Generic Value-added Course	1 +1
	I – IV	UG234ST1	Student Training Activity – Clubs & Committees / NSS	1
	IV	UG234CE1	Community Engagement Activity - RUN	1
	V	UG235HR1	Human Rights Education	1
	VI	UG236GS1	Gender Equity Studies	1
Total				**14**

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Specific Value-Added Course

S. No.	Course code	Title of the course	Credits	Total hours
I	MU231V01	Web Designing using HTML	1	30
2	MU231V02	Vedic Algebra	1	30
3	MU231V03	Sampling Techniques	1	30
4	MU233V01	Basic Fuzzy Algebra	1	30
5	MU233V02	Statistical Survey	1	30
6	MU233V03	Data Structures	1	30

Self-Learning Course

S. No.	Course code	Title of the course	Credits
I	MU233SL1/MU235SL1	SET/NET Algebra Essentials	1
2	MU234SL1/MU236SL1	Analysis and Forecasting	1

Examination Pattern

Each paper carries an internal component. There is a passing minimum for external component. A minimum of 40% in the external examination and an aggregate of 40% is required.

i. Part I – Tamil, Part II – English, Part III - (Core Course/ Elective Course)

Ratio of Internal and External= 25:75

Continuous Internal Assessment (CIA)

Internal Components and Distribution of Marks

Components	Marks
Internal test (2) - 40 marks	10
Quiz (2) - 20 marks	5
Assignment: (Model Making, Exhibition, Role Play, Seminar, Group Discussion, Problem Solving, Class Test, Open Book Test etc. (Minimum three items per course should be included in the syllabus & teaching plan) (30 marks)	10
Total	**25**

Question Pattern

Internal Test	Marks	External Exam	Marks
Part A 4 x 1(No choice)	4	Part A 10 x 1 (No choice)	10
Part B 2 x 6 (Internal choice)	12	Part B 5 x 6 (Internal choice)	30
Part C 2 x 12 (Internal choice)	24	Part C 5 x 12 (Internal choice)	60
Total	**40**	**Total**	**100**

ii. Lab Course:

Ratio of Internal and External= 25:75

Total: 100 marks

Internal Components and Distribution of Marks

Internal Components	Marks
Performance of the Experiments	10
Regularity in attending practical and submission of records	5
Record	5

Model exam	5
Total	**25**

Question pattern

External Exam	**Marks**
Major Practical	75
Minor Practical / Spotters /Record	
Total	**75**

iii. Core Research Project

Ratio of Internal and External = 25:75

Components	**Marks**
Internal	25
External	
Core Research Project Report	40
Viva voce	35
Total	**100**

Part - IV

i. Non-major Elective, Skill Enhancement Course I & II, Foundation Course, Value Education, Professional Competency Skill

Ratio of Internal and External = 2**5: 75**

Internal Components and Distribution of Marks

Components	**Marks**
Internal test (2) – 25 marks	10
Quiz (2) – 20 marks	5
Assignment: (Model Making, Exhibition, Role Play, Album, Group Activity, etc. (Minimum three items per course)	10
Total	**25**

Question Pattern

Internal Test	**Marks**	**External Exam**	**Marks**
Part A 2 x 2 (No Choice)	4	Part A 5 x 2 (No Choice)	10
Part B 3 x 4 (Open choice **Three** out of **Five**)	12	Part B 5 x 4 (Open choice any **Five** out of **Eight**)	20
Part C 1 x 9 (Open choice O**ne** out of **Three**)	9	Part C 5 x 9 (Open choice any **Five** out of **Eight**)	45
Total	**25**	**Total**	**75**

ii. Skill Enhancement Course III & IV

Digital Fluency

Components	**Marks**
Internal	
Quiz (15 x 1)	15
Lab Assessment (5 x 2)	10
Total	**25**
External	
Practical (2 x 25)	50
Procedure	25
Total	**75**

Fitness and Wellbeing

Components	Marks
Internal	
Quiz (15 x 1)	15
Exercise (2 x 5)	10
Total	**25**
External	
Written Test: Part A: Open choice – 5 out of 8 questions (5 x 5) Part B: Open choice – 5 out of 8 questions (5 x 10)	25 50
Total	**75**

iii. Environmental Studies

Internal Components

Component	Marks
Project Report	15
Viva voce	10
Total	**25**

Question Pattern

Internal Test	Marks	External Exam	Marks
Part A 2 x 2 (No Choice)	4	Part A 5 x 2 (No Choice)	10
Part B 3 x 4 (Open choice **Three** out of **Five**)	12	Part B 5 x 4 (Open choice any **Five** out of **Eight**)	20
Part C 1 x 9 (Open choice O**ne** out of **Three**)	9	Part C 5 x 9 (Open choice any **Five** out of **Eight**)	45
Total	**25**	**Total**	**75**

iv. Internship

Components	Marks
Industry Contribution	50
Report & Viva-voce	50
Total	**100**

Co-Curricular Courses:

i. Life Skill Training: Catechism & Moral, Human Rights Education & Gender Equity Studies

Internal Components

Component	Marks
Project - Album on current issues	25
Group Activity	25
Total	**50**

External Components

Component	Marks
Written Test: Open choice – 5 out of 8 questions (5 x 10)	50
Total	**50**

ii. Skill Development Training - Certificate Course:

Components	Marks

Attendance & Participation	50
Skill Test	50
Total	**100**

iii. Field Project:

Components	**Marks**
Field Work	50
Field Project Report & Viva-voce	50
Total	**100**

iv. Specific Value-Added Courses & Generic Value-Added Courses:

Components	**Marks**
Internal	25
External	75
Total	**100**

v. Student Training Activity: Clubs and Committees

Compulsory for all I & II year students (1 credit).

Component	**Marks**
Attendance	25
Participation	75
Total	**100**

vi. Community Engagement Activity: Reaching the Unreached Neighbourhood (RUN)

Components	**Marks**
Attendance & Participation	50
Field Project	50
Total	**100**

Outcome Based Education (OBE)

(i) Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S. No.	**Level**	**Parameter**	**Description**
1	KI	Knowledge/Remembering	It is the ability to remember the previously learned
2	K2	Comprehension/Understanding	The learner explains ideas or concepts
3	K3	Application/Applying	The learner uses information in a new way
4	K4	Analysis/Analysing	The learner distinguishes among different parts
5	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6	K6	Synthesis /Creating	The learner creates a new product or point of view

(ii) Weightage of K – Levels in Question Paper

Number of questions for each cognitive level:

Programme	**Assessment**	**Lower Order Thinking**									**Higher order thinking**			**Total number of questions**
		K1			**K2**			**K3**			**K4, K5, K6**			
	Part	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	
I UG	Internal	2	1	-	1	1	1	1	-	1	-	-	-	**8**
	External	5	2	1	3	2	2	2	1	2	-	-	-	**20**

II UG	Internal	1	1	-	1	1	1	1	-	1	1	-	-	**8**
	External	5	1	1	4	1	1	-	3	1	1	-	2	**20**
III UG	Internal	1	-	-	1	-	1	1	1	1	1	1	-	**8**
	External	5	1	1	4	1	1	-	3	1	1	-	2	**20**

The levels of assessment are flexible and it should assess the cognitive levels and outcome attainment.

Evaluation

i. The performance of a student in each course is evaluated in terms of percentage of marks with a provision for conversion to grade points.

ii. Evaluation of each course shall be done by Continuous Internal Assessment (CIA) by the course teacher as well as by an end semester examination and will be consolidated at the end of the semester.

iii. There shall be examinations at the end of each semester, for odd semesters in October/November; for even semesters in April/ May.

iv. A candidate who does not pass the examination in any course(s) shall be permitted to reappear in such failed course(s) in the subsequent examinations to be held in October/ November or April/May. However, candidates who have arrears in practical examination shall be permitted to reappear for their areas only along with regular practical examinations in the respective semester.

v. Viva-voce: Each project group shall be required to appear for Viva -voce examination in defence of the project.

vi. The results of all the examinations will be published in the college website.

Conferment of Bachelor's Degree

A candidate shall be eligible for the conferment of the Degree of Bachelor of Arts / Science / Commerce only if the minimum required credits for the programme thereof (140 + 18 credits) is earned.

Grading System

For the Semester Examination:

Calculation of Grade Point Average for End Semester Examination:

$$\textbf{GPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the course}}{\text{Sum of the credits of the courses (passed) in a semester}}$$

For the entire programme:

Cumulative Grade Point Average (CGPA) $\Sigma_n\Sigma_i C_{ni}G_{ni} / \Sigma_{ni}\Sigma_i C_{ni}$

$$\text{CGPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the entire programme}}{\text{Sum of the credits of the courses of the entire programme}}$$

where

C_i - Credits earned for course i in any semester

G_i - Grade point obtained for course i in any semester

n - semester in which such courses were credited

Final Result

Conversion of Marks to Grade Points and Letter Grade

Range of Marks	Grade Points	Letter Grade	Description
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good

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60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
40-49	4.0-4.9	C	Satisfactory
00-39	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

Overall Performance

CGPA	**Grade**	**Classification of Final Result**
9.5-10.0	O+	First Class – Exemplary*
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	First Class with Distinction*
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
4.0 and above but below 5.0	C	Third Class
0.0 and above but below 4.0	U	Re-appear

*The candidates who have passed in the first appearance and within the prescribed semester are eligible for the same.

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SEMESTER I

CORE COURSE I: ALGEBRA & TRIGONOMETRY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU241CC1	4	-	-	-	4	4	60	25	75	100

Pre-requisite:

Students should know the basic concepts of Algebra and Trigonometry.

Learning Objectives:

1. To understand the basic ideas on the theory of equations, Matrices.
2. To get the knowledge to find expansions of trigonometry functions, solve theoretical and applied problems

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	know the definitions and properties of the Remainder Theorem, equations with real and rational coefficients, and the transformations of equations	**K1**
2.	find eigen values, eigen vectors, verify Cayley — Hamilton theorem and diagonalize a given matrix	**K1**
3.	expand the powers and multiples of trigonometric functions in terms of sine and cosine	**K2**
4.	classify and solve reciprocal equations	**K2**
5.	determine relationship between circular and hyperbolic functions and the summation of trigonometric series	**K3**

K1 - Remember; **K2** - Understand; **K3** - Apply

Units	Contents	No. of Hours
I	Theory of equations-Remainder Theorem-Equation with real coefficients-Equation with rational coefficients- Relations between the roots and coefficients of equations-Transformations of equations-Roots with sign changed-Roots multiplied by a given number**.** **Book 1: Chapter 6: Sections 1 to 11, 15**	**12**
II	Reciprocal Equations-Standard form—increasing or decreasing the roots of a given equation- Removal of terms, Approximate solutions of roots of polynomials by Horner's method related problems. **Book 1: Chapter 6: Sections 16, 17, 19 and 30**	**12**
III	Characteristic equation — Eigen values and Eigen Vectors, Similar matrices - Cayley — Hamilton Theorem (Statement only) Finding powers of square matrix, Inverse of a square matrix up to order 3, Diagonalization of square matrices - related problems. **Book 3: Chapter 2: Section 2.3 and 2.4**	**12**
IV	Hyperbolic functions — Relation between circular and hyperbolic functions Inverse hyperbolic functions, Logarithm of complex numbers. **Book 2: Chapter 7, 8**	**12**
V	Summation of Trigonometric Series- Difference Method- Angles in Arithmetic Progression Method- C+iS method **Book 2: Chapter 9: Section 9.1 to 9.3**	**12**

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	Total	**60**

Self-study	Definitions and Formulae

Textbooks

1. T.K. Manicavachagom Pillai, T. Natarajan and K.S. Ganapathy 2015 *Algebra, Volume I*, Chennai, S. Viswanathan Pvt. Ltd.
2. S. Arumugam and A. Thangapandi Isaac 2006. *Theory of Equations and Trigonometry* Palayamkottai , New Gamma Publishing House.
3. S. Arumugam and A. Thangapandi Isaac 2012. *Allied Mathematics (Paper I)* Palayamkottai: New Gamma Publishing House.

Reference Books

1. W.S. Burnstine and A. W. Panton 2016, *Theory of equations*, Wentworth Press.
2. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
3. David C. Lay, 2007 *Linear Algebra and its Applications*, 3rd Ed., Pearson Education Asia, Indian Reprint.
4. C. V. Durell and A. Robson, 2003, *Advanced Trigonometry*, Courier Corporation.
5. J. Stewart, L. Redlin, and S. Watson, 2012, *Algebra and Trigonometry*, Cengage Learning.

Web Resources

1. https://nptel.ac.in
2. https://rodrigopacios.github.io/mrpacios/download/Thomas_Calculus.pdf
3. https://www.dbraulibrary.org.in/RareBooks/An%20Introduction%20to%20the%20Modern%20Theory%20of%20Equations.pdf
4. https://pdfcoffee.com/qdownload/c-v-durell-a-robson-advanced-trigonometry-2003pdf-pdf-free.html
5. https://sv.20file.org/up1/1179_0.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	3	3	2	3	2	3	2	2	2	2
CO2	3	2	3	3	3	2	2	3	2	2	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2
CO4	3	2	3	3	2	2	2	3	2	2	2	2
CO5	3	2	3	3	3	2	2	3	2	2	2	2
TOTAL	**15**	**10**	**15**	**15**	**13**	**11**	**10**	**15**	**10**	**10**	**10**	**10**
AVERAGE	**3**	**2**	**3**	**3**	**2.6**	**2.2**	**2**	**3**	**2**	**2**	**2**	**2**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (Autonomous), NAGERCOIL

SEMESTER I

CORE COURSE II: DIFFERENTIAL CALCULUS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU241CC2	4	-	-	-	4	4	60	25	75	100

Pre-requisite:

12th Standard Mathematics.

Learning Objectives:

1. Basic knowledge on the notions of curvature, envelope and polar co-ordinates, and solving related problems.
2. The basic skills of differentiation, successive differentiation, and their applications.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	recall the definitions and basic concepts of Differential Calculus.	**K1**
2	understand the concepts of Differentiation, Partial Differentiation, Envelope & Curvature.	**K2**
3	determine Partial derivatives of a function of two variables and use Lagrange's method of undetermined multipliers.	**K2**
4	distinguish between partial and ordinary differential equations.	**K3**
5	find the radius of curvature using polar co-ordinates.	**K3**

K1 - Remember; **K2 -** Understand; **K3 -** Apply

Units	Contents	No. of Hours
I	**Successive Differentiation** Introduction (Review of basic concepts) – The n^{th} derivative – Standard results –Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula for the n^{th} derivative of a product. Text Book 1: Chapter III	**12**
II	**Partial Differentiation** Partial derivatives – Successive partial derivatives – Function of a function rule – Total differential coefficient. Text Book 1: Chapter VIII – Sections 1.1 – 1.3	**12**
III	**Partial Differentiation (Continued)** Homogeneous functions – Partial derivatives of a function of two variables –Lagrange's method of undetermined multipliers. Text Book 1: Chapter VIII – Sections 1.6, 1.7& 5	**12**
IV	**Envelope** Method of finding the envelope – Another definition of envelope – Envelope of family of curves which are quadratic in the parameter. Text Book 1: Chapter X – Sections 1.1 – 1.4	**12**
V	**Curvature** Definition of Curvature – Circle, Radius and Centre of Curvature – Radius of Curvature in Polar Co-ordinates. Text Book 2: Chapter 3 – Section 3.4	**12**

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	Total	**60**

Self Study	Radius of Curvature in Polar Co-ordinates.

Textbooks

1. Narayanan S and Manicavachagom Pillai T.K 2015. *Calculus*. Chennai: S. Viswanathan (Printers & Publications) Pvt. Ltd.
2. Arumugam.S and Thangapandi Isaac.A. 2011. *Calculus*. Palayamkottai New Gamma Publishing House.

Reference Books

1. Courant .R.and F. John 1989. *Introduction to Calculus and Analysis*. New York: Springer.
2. Apostal,T. 2001.*Calculus*, Volumes I and II**.** John New York: Wiley & Sons.
3. Anton, I. Birens and S. Davis 2002. *Calculus*.United States of America: John Wiley & Sons, Inc.
4. Thomas.G.B. and R.L. Finney 2010. *Calculus*. Delhi:Pearson Education.
5. Strauss, M.J., Bradley G.L. and Smith K. J. 2007. *Calculus*. Delhi: Pearson Education.

Web Resources

1. https://nptel.ac.in
2. https://www.uou.ac.in/sites/default/files/slm/MSCZO-501.pdf
3. https://manoa.hawaii.edu/exploringourfluidearth/biological/invertebrates/structure-and-function
4. https://www.zoologytalks.com/category/structure-and-functions-of-invertebrates/
5. https://www.bilasagirlscollege.ac.in/newsData/D54.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	3	2	2	3	3	2	3	2	2	2	2
CO2	3	2	3	2	3	2	3	2	2	2	2	2	2
CO3	3	2	3	2	3	2	3	3	2	3	3	3	2
CO4	3	2	3	2	2	2	3	2	2	2	2	2	2
CO5	3	2	3	2	3	3	3	3	2	3	3	3	2
Total	**15**	**10**	**15**	**10**	**13**	**12**	**15**	**12**	**11**	**12**	**12**	**12**	**10**
AVERAGE	**3**	**2**	**3**	**2**	**2.6**	**2.4**	**3**	**2.4**	**2.2**	**2.4**	**2.4**	**2.4**	**2**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (Autonomous) NAGERCOIL

SEMESTER I

ELECTIVE COURSE I: ALLIED MATHEMATICS-I ALGEBRA AND DIFFERENTIAL EQUATIONS

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
MU231EC1	5	1	-	5	6	90	25	75	100

Pre-requisite:

Students should know the basic concepts of Algebra & Trigonometry.

Learning Objectives:

1. To understand the basic ideas on the theory of equations, Matrices.
2. To get the knowledge to find expansions of trigonometry functions, solve theoretical and applied problems

Course Outcomes

On the successful completion of the course, student will be able to:		
1	recall the methods of finding the solutions of algebraic equations, differential equations and various formulae of laplace transform	**K1**
2	understand the theory of algebraic equations, eigen values, differential equations and laplace transform	**K2**
3	simplify algebraic expressions using various methods, find eigen values, solve initial value problems for odes and find inverse laplace transform	**K2**
4	analyse various types of first-order odes, relate laplace transform and inverse laplace transform and formulate algebraic equations from real world problems.	**K4**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze;

Units	Contents	No. of Hours
I	Theory of Equations – Formation of Equations – Relation between roots and coefficients–Reciprocal equations.	**18**
II	Transformation of Equations–Approximate solutions to equations – Newton's method and Horner's method.	**18**
III	Matrices–Characteristic equation of a matrix –Eigen values and Eigen vectors – Cayley Hamilton theorem and simple Problems.	**18**
IV	Differential equation of first order but of higher degree – Equations solvable for p,x,y–Partial differential equations–formations– solutions – Standard form Pp + Qq = R.	**18**
V	Laplace transformation–Inverse Laplace transform.	**18**
	Total	**90**

Self study	Definitions and Formulae

Textbook

Dr. S. Arumugam & Isaac–Allied Mathematics Paper-I, New Gamma Publishing House (2012), Palayamkottai.

Reference Books

1. Narayanan.S and T.K. Manikavachagam Pillai-Differential Equations and its applications, S.Viswanathan Printers Pvt.Ltd,2006.
2. T.Veerarajan- Algebra and Trigonometry-Yes Dee Publishing Pvt.Ltd.,(2009)

Web Resources

1.https://nptel.ac.in
2.https://ocw.mit.edu/courses/res-18-009-learn-differential-equations-up-close-with-gilbert-strang-and-cleve-moler-fall-2015/pages/differential-equations-and-linear-algebra/
3.https://www.khanacademy.org/math/differential-equations
4.https://www.khanacademy.org/math/differential-equations
5.https://en.wikipedia.org/wiki/Algebraic_differential_equation

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	3	2	3	2	2	2	2
CO2	3	2	3	3	3	2	2	3	2	2	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2
CO4	3	2	3	3	2	2	2	3	2	2	2	2
TOTAL	**15**	**10**	**15**	**15**	**13**	**11**	**10**	**15**	**10**	**10**	**10**	**10**
AVERAGE	**3**	**2**	**3**	**3**	**2.6**	**2.2**	**2**	**3**	**2**	**2**	**2**	**2**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (Autonomous) NAGERCOIL

SEMESTER I

NON-MAJOR ELECTIVE NME I: MATHEMATICS FOR COMPETITIVE EXAMINATIONS I

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU231NM1	2	-	-	-	2	2	30	25	75	100

Pre-requisite:

Students should have basic knowledge on Mathematical calculations.

Learning Objectives:

1. To understand the problems asked in various competitive examinations and identify the method to solve them.
2. To develop numerical aptitude by practicing different types problems.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the problems and remember the methods to solve problems.	**K1 & K2**
2	grasp the simplest method to solve problems.	**K2**
3	apply suitable mathematical method and get solutions to simple real life problems.	**K3**

K1 - Remember; **K2** - Understand; **K3** - Apply

Units	Contents	No. of Hours
I	**Simplification:** BODMAS rule – Using basic formulae – Problems with sets. **Averages**: Finding average income, average expenditure, average age, average speed and average score. (Chapter 4 and Chapter 6).	6
II	**Ratio and proportion:** Comparison of two ratios – Compounded Ratio – Mean, Third and Fourth Proportional – Real life problems (Chapter 13)	6
III	**Percentages**: Percentage on numbers – Population – Depreciation. **Partnership:** Ratio of division of gains – Investments made in same time and Investments made in different time. (Chapter 11 and Chapter 14).	6
IV	**Profit and Loss:** Gain – Loss –Selling similar items – Problems on trader professes to sell his goods. (Chapter 12).	6
V	**Problems on numbers:** Framing and solving equations involving unknown numbers - Problems involving ratios and fractions. (Chapter 7).	6
	Total	30

Textbook

Self study	Percentages

Aggarwal, R.S (2017). *Quantitative Aptitude* (Revised Edition). S. Chand and Company LTD.

Reference Books

1. Guha, A. 2011. *Quantitative Aptitude for Competitive Examinations* (4^{th} Edition). Published by McGraw Hill Education (India) Pvt. Ltd.
2. Aggarwal, R.S (2022). *Quantitative Aptitude* (Revised Edition). S. Chand and Company LTD.
3. Arun Sharma. 2008. *Objective Mathematics* (2^{nd} Edition). Tata McGraw-Hill Publishing Company Limited.

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4. Chauhan, R.S. 2011. *Objective Mathematics*. Unique Publisher.
5. Goyal, J. K. Gupta, K. P. 2011. *Objective Mathematics* (6^{th} Revised Edition). Pragati Prakashan Educational Publishers.
6. Immaculate, M. (2009). Mathematics for Life. Nanjil offset Printers.

Web Resources

1. Simplification - Shortcuts & Tricks for Placement Tests, Job Interviews & Exams - YouTube
2. Averages - Shortcuts & Tricks for Placement Tests, Job Interviews & Exams - YouTube
3. Percentage - Shortcuts & Tricks for Placement Tests, Job Interviews & Exams - YouTube
4. Partnership - Shortcuts & Tricks for Placement Tests, Job Interviews & Exams - YouTube
5. Aptitude Made Easy - Profit & Loss – Basics and Methods, Profit and loss shortcuts, Math tricks - YouTube

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	1	3	3	1	3	3	3	2	3	3
CO2	2	3	1	3	3	2	3	3	3	2	3	3
CO3	2	3	1	3	3	2	3	3	3	3	3	3
TOTAL	**6**	**9**	**3**	**9**	**9**	**5**	**9**	**9**	**9**	**7**	**9**	**9**
AVERAGE	**2**	**3**	**1**	**3**	**3**	**1.6**	**3**	**3**	**3**	**2.3**	**3**	**3**

3 – Strong, 2- Medium, 1- Low

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SEMESTER I

FOUNDATION COURSE: BRIDGE MATHEMATICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU231FC1	2	-	-	-	2	2	30	25	75	100

Pre-requisite:

Students should know 12th Standard Mathematics.

Learning Objectives:

1. To bridge the gap and facilitate transition from higher secondary to tertiary education.
2. To instil confidence among stakeholders and inculcate interest for Mathematics.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	prove the binomial theorem and apply it to find the expansions of any $(x + y)^n$ and also, solve the related problems.	**K2 & K3**
2	find the various sequences and series and solve the problems related to them. Explain the principle of counting.	**K1 &K3**
3	find the number of permutations and combinations in different cases. Apply the principle of counting to solve the problems on permutations and combinations.	**K2 & K3**
4	explain various trigonometric ratios and find them for different angles, including sum of the angles, multiple and submultiple angles, etc. Also, they can solve the problems using the transformations.	**K2 & K3**
5	find the limit and derivative of a function at a point, the definite and indefinite integral of a function. Find the points of min/max of a function.	**K3**

K1-Remember**K2**- Understand K**3** - Apply

Units	Contents	No. of Hours
I	**Algebra** Binomial theorem, General term, middle term, problems based on these concepts	**6**
II	**Analysis** Sequences and series (Progressions). Fundamental principle of counting. Factorial n.	**6**
III	**Combinatorics** Permutations and combinations, Derivation of formulae and their connections, simple applications, combinations with repetitions, arrangements within groups, formation of groups.	**6**
IV	**Trigonometry** Introduction to trigonometric ratios, proof of sin(A+B), cos(A+B), tan(A+B) formulae, multiple and sub multiple angles, sin(2A), cos(2A), tan(2A) etc., transformations sum into product and product into sum formulae, inverse trigonometric functions, sine rule and cosine rule	**6**
V	**Calculus** Limits, standard formulae and problems, differentiation, first principle, uv rule, u/v rule, methods of differentiation, application of derivatives, integration - product rule and substitution method.	**6**
	Total	**30**

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Self Study	Definitions, Formulae, Applications

Textbooks

1. NCERT class XI and XII text books
2. Any State Board Mathematics text books of class XI and XII

Web Resources

1. https://nptel.ac.in
2. https://www.khanacademy.org/
3. https://www.bytelearn.com/
4. https://mathworld.wolfram.com/
5. https://byjus.com/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	1	2	1	2	2	2	2	1	1
CO2	2	1	1	1	2	1	2	2	2	2	1	1
CO3	2	1	1	1	2	1	2	2	2	2	1	1
CO4	2	1	1	2	2	1	2	1	2	1	1	2
CO5	2	1	1	2	2	1	2	2	1	1	2	2
TOTAL	**10**	**5**	**5**	**7**	**12**	**5**	**10**	**9**	**9**	**8**	**6**	**7**
AVERAGE	**2**	**1**	**1**	**1.4**	**2**	**1**	**2**	**1.8**	**1.8**	**1.6**	**1.2**	**1.4**

3 - Strong, 2- Medium, 1- Low

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SEMESTER I

SPECIFIC VALUE-ADDED COURSE: WEB DESIGNING USING HTML

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU231V01	2	-	-	-	1	2	30	25	75	100

Pre-requisite:

Basic knowledge of Matrices and Programming languages.

Learning Objectives:

1. To understand the importance of the web as a medium of communication.
2. To create an effective web page with graphic design principles.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	define modern protocols and systems used on the web (such as HTML, HTTP)	**K2**
2	employ fundamental knowledge on web designing with makeup language	**K3**
3	gain strong knowledge in HTML	**K2**
4	use critical thinking skills to design and implement an interactive websites with regard to issues of usability, accessibility and internationalism	**K4**
5	to pursue future courses in website development and design	**K3**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze

Units	Contents	No. of Hours
I	Introduction to HTML – Designing a Home Page-History of HTML – HTML Generations –HTML Documents – Anchor Tag – Hyper Links –Sample HTML Documents.	**6**
II	Head and Body Sections – Header Sections – Title –Prologue – Links – Colorful Web Page – Comment Lines – Some Sample HTML Documents.	**6**
III	Designing the Body Section- Heading Printing-Aligning the Headings – Horizontal Rule – Paragraph – Tab Setting -Images and Pictures-Embedding PNG Format Images.	**6**
IV	Ordered and Unordered Lists – Lists – Unordered Lists –Headings in a List – Ordered Lists-Nested Lists.	**6**
V	Table Handling -Tables -Table Creation in HTML - Width of the Table and Cells-Cells Spanning Multiple Row/Columns Coloring Cells - Column Specification – Some Sample Tables.	**6**
	Total	**30**

Textbook

Self study	Sample HTML Documents

Xavier,C. World Wide Web Design with HTML.T ata Mc gram Hill Publishing Company Limited.

Chapters 4: Sections: 4.1– 4.7

Chapters5: Sections: 5.1 – 5.7;

Chapters6: Sections :6.1 -6.7;

Chapters7: Sections: 7.1 – 7.5;

Chapters8: Sections: 8.1 – 8.7

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Reference Books

1. Castro., Elizabeth.,& Hyslop.(2013).HTML5,AndCSS:VisualQuick start Guide.(Eight Edition). Peachpit Press.
2. Devlin.,&Ian.(2011).HTML5Multimedia:DevelopAndDesign.PeachpitPress.
3. Felke.,& Morris.(2013). Basics of Web Design : HTML5 &CSS3.(2^{nd} Edition).Addition-Wesley.
4. Felke.,& Morris.(2014). -Web Development & Design Foundations WithHTML5.(7^{th} Edition).Addition-Wesley.
5. John Duckett.(2011).HTML and CSS :Design and Build Website.(1^{st} Edition).Johnwiley and sons.

Web Resources

1. https://www.computerhope.com/starthtm.htm
2. https://www.geeksforgeeks.org/design-a-web-page-using-html
3. https://www.youtube.com/watch?v=PgAZ8KzfhO8
4. https://www.youtube.com/watch?v=qXXknB5bePU
5. https://www.digitalocean.com/community/tutorial_series/how-to-build-a-website-with-html

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	2	3	2	3	2	2	3	2
CO2	3	3	2	2	3	2	2	3	2	2	3	2
CO3	3	3	2	3	2	2	2	3	2	3	3	2
CO4	3	3	2	2	2	3	2	3	2	2	3	2
CO5	3	3	3	3	3	2	2	3	2	3	3	3
TOTAL	**15**	**15**	**11**	**12**	**12**	**12**	**10**	**15**	**10**	**12**	**15**	**11**
AVERAGE	**3**	**3**	**2.2**	**2.4**	**2.4**	**2.4**	**2**	**3**	**2**	**2.4**	**3**	**2.2**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (AUTONOMOUS), NAGERCOIL

SEMESTER I

SPECIFIC VALUE- ADDED COURSE: VEDIC ALGEBRA

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU231V02	2	-	-	-	1	2	30	25	75	100

Pre-requisite:

1. Proficiency in basic algebraic concepts and operations.
2. Strong number sense and mental math skills.

Learning Objectives:

1. Introduce students to Vedic algebra techniques.
2. Develop students' proficiency in applying Vedic algebra methods to solve mathematical problems.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	remember mathematical concepts and solutions using Vedic algebra terminology and notation, ensuring clarity and precision in their explanations.	**K1**
2.	understand the mathematical concepts and principles underlying Vedic algebra techniques, fostering a comprehensive grasp of the subject matter.	**K2**
3.	apply Vedic algebra techniques proficiently to solve equations and mathematical problems, demonstrating precision and accuracy.	**K3**
4.	analyze the applicability of Vedic algebra methods in various mathematical contexts, discerning their strengths and limitations through critical examination.	**K4**
5.	evaluate the effectiveness of Vedic algebra in enhancing problem-solving skills and mathematical reasoning, employing rigorous assessment criteria and methodologies.	**K5**

K1 - Remember; **K2 -** Understand; **K3** – Apply; **K4 -** Analyze; **K5 -** Evaluate;

Units	Contents	No. of Hours
I	Basic Operations on Polynomials – Addition – Subtraction – Multiplication – Division	**6**
II	Factorization – Factorization of Polynomials of Degree Three	**6**
III	Factors and Derivatives – Highest Common Factor	**6**
IV	Quadratic Equations – First Type – Second Type – Third Type – Fourth Type	**6**
V	Cubic Equations – First Type – Second Type – Third Type – Fourth Type	**6**
	Total	**30**

Self-study	Factors and Derivatives – Highest Common Factor

Textbook

1. Chamola K. P, 2006. Elementary Vedic Algebra, Sura Books Pvt. Ltd., Chennai.

Reference Books

1. Jagadguru Swami Sri, Bharati Krishna Tirthaji, 2004. *Vedic Mathematics*, Motilal Banarsidass Publishers Private Limited, Delhi.
2. James T. Glover, 2013. *Vedic Mathematics for Schools: Book 1*, 7th Edition, Motilal Banarsidass Publishers, India.

3. Williams. K, 2024. *The Cosmic Calculator: A Vedic Mathematics Course for Schools*, Clairview Books.
4. Kandasamy, W. B., Smarandache, F., & Ilanthenral, K. 2018. *Vedic Mathematics: Vedic Or Mathematics: A Fuzzy & Neutrosophic Analysis.* Create Space Independent Publishing Platform.
5. Thakur R. K, 2016. *The Essence of Vedic Mathematics.* Pen2 Print Services.

Web Resources

1. https://www.vedicmathsacademy.org/
1. 2.https://vedamu.org/
2. 3.https://mathigon.org/
3. https://www.mathsisfun.com
4. 5.https://www.cut-the-knot.org/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	3	3	2	3	2	2	2	3
CO2	3	2	2	3	3	3	2	3	3	2	2	3
CO3	3	3	3	3	3	3	2	3	3	3	2	3
CO4	3	3	3	3	3	3	3	3	3	3	2	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3
TOTAL	**15**	**13**	**13**	**14**	**15**	**15**	**12**	**15**	**14**	**13**	**11**	**15**
AVERAGE	**3**	**2.6**	**2.6**	**2.8**	**3**	**3**	**2.4**	**3**	**2.8**	**2.6**	**2.2**	**3**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (AUTONOMOUS) NAGERCOIL

SEMESTER I

SPECIFIC VALUE-ADDED COURSE: SAMPLING TECHNIQUES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU231V03	2	-	-	-	1	2	30	25	75	100

Pre-requisite:

Basic Statistical Knowledge.

Learning Objectives:

1. Gain knowledge of various sampling techniques such as random sampling.

2. Develop the ability to recognize different types of errors in sampling**.**

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall and list different sampling methods such as simple random sampling, systematic sampling, and stratified sampling.	**K1**
2.	understand appropriate sampling methods to create survey designs or experimental setups based on specific research objectives and population characteristics.	**K2**
3.	apply knowledge of sampling errors to distinguish between biased and unbiased errors and assess their potential impact on survey outcomes.	**K3**
4.	analyse survey designs by evaluating the suitability and effectiveness of sampling methods.	**K4**
5.	evaluate the best sampling strategies based on understanding sampling principles to ensure accurate and reliable survey outcomes.	**K5**

K1– Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate;

Units	Contents	No. of Hours
I	Census Survey-Sample Survey-Sampling – Principles of sampling-methods of sampling.	**6**
II	Random Sampling Methods-Simple or Unrestricted Random Sampling-Lottery Method-Random Number Method.	**6**
III	Restricted Random Sampling Methods- Systematic Random Sampling- Stratified Random Sampling.	**6**
IV	Non-Random Sampling Methods- Judgement Sampling-Convenience Sampling- Quota Sampling.	**6**
V	Sampling Errors- Biased Errors-Unbiased Errors- Non-Sampling Errors	**6**
	Total	**30**

Self-study	. Sampling Errors- Biased Errors-Unbiased Errors

Textbook

1.Navnitham PA,2019. *Business Statistics*, Jai Publishers, Trichy.

Reference Books

1. William G. Cochran, 1991. *Sampling Techniques* (Third Edition), John Wiley & Sons, Canada.
2. Poduri S.R.S. Rao, 2000. *Sampling Methodologies* With Applications, Chapman & Hall/CRC, New York
3. Sharon L. Lohr, 2010. *Sampling: Design and Analysis*, Duxbury Press, An Imprint of Brooks/ Cole Publishing Company QP ® An International Thomson Publishing Company, New York.

Web Resources

HOLY CROSS COLLEGE (AUTONOMOUS), NAGERCOIL

1. https://fsapps.nwcg.gov/gtac/CourseDownloads/IP/Cambodia/FlashDrive/Supporting_Documentation/Cochran_1977_Sampling%20Techniques.pdf
2. https://uca.edu/psychology/files/2013/08/Ch7-Sampling-Techniques.pdf
3. https://faculty.ksu.edu.sa/sites/default/files/poduri_s.r.s._rao_-_sampling_methodologies_with_applications_texts_in_statistical_science-chapman_and_hall_crc_2000.pdf
4. https://drive.uqu.edu.sa/_/maatia/files/Sampling.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	1	3	2	2	3	3	3	3	3
CO2	3	2	3	3	3	2	3	3	3	1	3	3
CO3	3	2	3	2	3	2	2	3	3	1	3	3
CO4	3	2	3	3	3	2	3	3	2	3	3	3
CO5	3	3	2	3	3	2	3	3	3	3	3	3
TOTAL	**15**	**12**	**14**	**12**	**15**	**10**	**13**	**15**	**14**	**11**	**15**	**15**
AVERAGE	**3**	**2.4**	**2.8**	**2.4**	**3**	**2**	**2.6**	**3**	**2.8**	**2.2**	**3**	**3**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (Autonomous), NAGERCOIL

SEMESTER II

CORE COURSE III: COORDINATE AND SPATIAL GEOMETRY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU232CC1	4	-	-	-	4	4	60	25	75	100

Pre-requisite

Familiarity with algebraic expressions, equations, and solving for variables, basic geometry concepts and knowledge of trigonometry

Learning Objectives

1. To analyze characteristics and properties of two and three dimensional geometric shapes.
2. To develop mathematical arguments about geometric relationships.
3. To solve real world problems on geometry and its applications.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	recall the definitions and formulae of key concepts in coordinate and spatial geometry	**K1**
2.	describe the relationships between geometric shapes and their equations and summarize the properties of different transformations on the coordinate plane	**K2**
3.	solve real world problems involving lines, planes and spheres using analytical geometry concepts	**K3**
4.	analyze the properties of equations of lines, planes and spheres	**K4**
5.	evaluate complex problems that require the application of coordinate and spatial geometry concepts.	**K5**

K1 - Remember; **K2** - Understand; **K3**– Apply**K4**– Analyze**K5**–Evaluate

Units	Contents	No. of Hours
I	Pole, Polar - Conjugate Points and Conjugate Lines – Diameters – Conjugate Diameters of an Ellipse - Semi Diameters- Conjugate Diameters of Hyperbola. Chapter 7: 7.1 - 7.3; Chapter 8:8.1 - 8.5	**12**
II	Polar Coordinates - General Polar Equation of Straight Line – Polar Equation of a Circle, Equation of a Straight Line, Circle, Conic – Equation of Chord, Tangent, Normal - Equations of the Asymptotes of a Hyperbola. Chapter 10 : 10.1 - 10.8	**12**
III	System of Planes - Length of the Perpendicular – Orthogonal Projection Chapter 2: 2.1 - 2.10	**12**
IV	Representation of Line – Angle Between a Line and a Plane – Co-planar Lines – Shortest Distance between two Skew Lines – Length of the Perpendicular – Intersection of three Planes. Chapter 3: 3.1 - 3.8.	**12**
V	Equation of a Sphere - General Equation - Section of a Sphere by a Plane - Equation of the Circle - Tangent Plane - Angle of Intersection of two Spheres - Condition for the Orthogonality - Radical Plane. Chapter 6 : 6.1 - 6.8	**12**

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	Total	**60**

Self-study	Co-planar Lines, Shortest distance between two Skew Lines, Length of the Perpendicular, Intersection of three Planes

Text Books

1. Durai Pandian P, *Analytical Geometry of 2D,* 2012, Muhil publishers (Unit 1 &2)
2. Shanthi Narayan and Mittal P. K, *Analytical Solid Geometry of 3D,* Uttar Pradesh: S Chand and Co. Pvt. Ltd. (Unit 3 - 5)

Reference Books

1. Loney S. L., 2023.*The elements of Coordinate Geometry,* (7nth Edition), Arihant Prakashan, Meerut.
2. Jain P. K and Khali Ahmed, 2021. *Textbook of Analytical Geometry of Two Dimensions,* (3rd Edition), New Age International Pvt. Ltd.
3. William F. Osgood and William C. Graustein, 2016. *Plane and Solid Analytic Geometry,* Macmillan Company, New York
4. Utpal Chatterjee and Nandini Chatterjee, 2016.*Advanced Analytical Geometry of Two and Three Dimensions,* Academic Publishers.
5. Vittal P. R., 2013.*Analytical Geometry 2D and 3D,* (1st Edition) Pearson Education, India.

Web Resources

1. http://mathworld.wolfram.com
2. https://nptel.ac.in
3. http://www.univie.ac.at/future.media/moe/galerie.html
4. https://ia800504.us.archive.org/11/items/elementsofcoordi00lone/elementsofcoordi00lone.pdf
5. https://archive.org/details/elementarytreati033329mbp/page/n23/mode/2up
6. https://rodrigopacios.github.io/mrpacios/download/Thomas_Calculus.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	2	2	1	1	2	3	3	2	2	2
CO2	3	3	3	3	2	2	3	3	3	2	2	2
CO3	3	3	3	3	3	2	3	3	3	2	2	2
CO4	3	3	3	3	3	2	3	3	3	3	2	2
CO5	3	3	3	3	2	2	3	3	3	2	2	2
TOTAL	**15**	**14**	**14**	**14**	**11**	**9**	**14**	**15**	**15**	**11**	**10**	**10**
AVERAGE	**3**	**2.8**	**2.8**	**2.8**	**2.2**	**1.8**	**2.8**	**3**	**3**	**2.2**	**2**	**2**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (Autonomous), NAGERCOIL

SEMESTER II

CORE COURSE IV: INTEGRAL CALCULUS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU232CC2	4	-	-	-	4	4	60	25	75	100

Pre-requisite: 12th Standard Mathematics

Learning Objectives

1. Knowledge on integration and its geometrical applications, double, triple integrals and improper integrals.
2. Knowledge about Beta and Gamma functions and skills to determine Fourier series expansions.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae.	**K1**
2.	evaluate double and triple integrals and problems using change of order of integration.	**K2**
3.	solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution.	**K3**
4.	explain beta and gamma function sand to use them in solving problems of integration.	**K2**
5.	explain Geometric and Physical applications of integral calculus.	**K2**

K1 - Remember; **K2** - Understand; **K3** – Apply

Units	Contents	No. of Hours
I	Reduction formulae -Types, integration of product of powers of algebraic and trigonometric functions, integration of product of powers of algebraic and logarithmic functions – Bernoulli's formula. **Calculus – Chapter 2: 2.8**	**12**
II	Double Integrals –definition of double integrals-evaluation of double integrals - double integrals in polar coordinates – Change of order of integration. **Calculus – Chapter 3: 3.1, 3.2**	**12**
III	Triple integrals - applications of multiple integrals -volumes of solids of revolution – areas of curved surfaces – Change of variables. **Calculus – Chapter 3: 3.3, 3.4**	**12**
IV	Beta and Gamma functions – definitions – recurrence formula of Gamma functions – properties of Beta and Gamma functions – relation between Beta and Gamma functions - Applications. **Calculus, Volume II – Chapter 7: 2.1, 2.2, 2.3**	**12**
V	Fourier Series – Definition, The Cosine and Sine Series, Half range Fourier Cosine and Sine Series. **Calculus – Chapter 5**	**12**
	Total	**60**

Self-study	Relation between Beta and Gamma functions- Applications.

Textbooks

1. Arumugam S & Thangapandi Isaac A, 2014.*Calculus*, New Gamma Publishing House,

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Palayamkottai.

2. Narayanan S & Manicavachagom Pillay T. K, 2009. *Calculus,* Volume II,S. Viswanathan (Printers and Publishers) Pvt. Ltd.

Reference Books

1. Anton H, Birens I and Davis S,2002.*Calculus,*John Wiley and Sons,Inc.
2. Thomas G. Band Finney R. L,2007. *Calculus,* Pearson Education.
3. Chatterjee D, *Integral Calculus and Differential Equations*, Tata-McGraw Hill Publishing Company Ltd.
4. Dyke P, 2001. *An Introduction to Laplace Transforms and Fourier Series*, Second edition, Springer Undergraduate Mathematics Series.
5. Sharma A. K, 2005. *Text Book of Integral Calculus,* Discovery Publishing House Pvt. Ltd., New Delhi.

Web Resources

1.https://nptel.ac.in

2.https://www.freebookcentre.net/maths-books-download/Integral-Calculus-Miguel-A.-Lerma.html

3. https://3lihandam69.files.wordpress.com/2018/10/calculus-10th-edition-anton.pdf

4. http://www.sufwan.com/wp-content/uploads/CalculusAndAnalyticalGeometry/Calculus-Book-Thomas Finney.pdf

5.http://ndl.ethernet.edu.et/bitstream/123456789/55096/1/Tsuneo%20Arakawa.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	3	2	3	2	2	2	2
CO2	3	2	3	3	3	2	2	3	2	2	2	2
CO3	3	2	3	3	3	2	2	3	2	2	2	2
CO4	3	2	3	3	2	2	2	3	2	2	2	2
CO5	3	2	3	3	3	2	2	3	2	2	2	2
TOTAL	**15**	**10**	**15**	**15**	**13**	**11**	**10**	**15**	**10**	**10**	**10**	**10**
AVERAGE	**3**	**2**	**3**	**3**	**2.6**	**2.2**	**2**	**3**	**2**	**2**	**2**	**2**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (AUTONOMOUS), NAGERCOIL

SEMESTER II

ELECTIVE COURSE II: VECTOR CALCULUS AND FOURIER SERIES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU232EC1	5	1	-		5	6	90	25	75	100

Pre-requisite:

Students should know the basic principles of calculus, differentiation and integration

Learning Objectives:

1. To understand the concepts of vector differentiation and vector integration.
2. To apply the concepts in their respective disciplines.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	remember the formulae of vector differentiation, integration and Fourier series	**K1**
2	understand various theorems related to vector differentiation, integration and Beta, Gamma functions	**K2**
3	solve problems on vector differentiation, integration, Beta, Gamma functions and Fourier series	**K3**
4	compare double and triple integrals, line, surface integrals, Beta, Gamma functions and Fourier series for Even and odd functions	**K2**

K1–Remember; **K2** – Understand; **K3** - Apply

Units	Contents	No. of Hours
I	Vector differentiation – Gradient – Divergence and curl – Directional Derivative – Normal to a surface - Solenoidal, irrotational and harmonic vectors. Allied Mathematics Paper-II- Chapter 5: sections 5.3, 5.4	**18**
II	Evaluation of double and triple integrals Allied Mathematics Paper-II- Chapter 6: sections 6.1, 6.2	**18**
III	Vector integration - Work done by a force - Evaluation of line integrals and surface integrals - Green's and Stokes theorems (Statement only) with problems. Allied Mathematics Paper-II- Chapter 7: sections 7.1-7.3	**18**
IV	Beta and Gamma Function Calculus - Chapter:4	**18**
V	Fourier series–Even and odd functions–Half range Fourier series. Calculus - Chapter:5	**18**
	Total	**90**

Self Study	Evaluation of line integrals and surface integrals

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Text books

1. Arumugam. S, Thangapandi Issac. A, 2012, Allied Mathematics Paper-II,New Gamma Publishing House, Palayamkottai,.
2. Arumugam. S, Thangapandi Issac. A, 2014, Calculus,New Gamma Publishing House, Palayamkottai,.

Reference Books

1. Arumugam. S, Thangapandi Issac. A, (2017), Analytical Geometry 3D &Vector Calculus, New Gamma Publishing House, Palayamkottai.
2. Susan.J.C, (2012), Vector Calculus(4thEdition),Pearson Education, Boston.
3. Murray Spiegel-Vector analysis –Schaum Publishing company, NewYork (2009).
4. Manicavachagom Pillai. T.K, (2012),Calculus(VolII), S. Vishvanathan Printer and Publisher PVT.LTD
5. DuraiPandian,P.,&LaxmiDuraiPandian.(1986).VectorAnalysis.EmeraldPublishers.

Web Resources

1. https://nptel.ac.in
2. https://www.youtube.com/watch?v=_rKQP7f2tUw
3. https://www.youtube.com/watch?v=D2eHgZ4kMHU
4. https://www.youtube.com/watch?v=r6sGWTCMz2k
5. https://www.youtube.com/watch?v=x04dnqg-iPw
6. https://www.youtube.com/watch?v=Z8D_TEs9-zg

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	3	1	2	3	3	3	2	2
CO2	3	2	1	3	3	1	2	3	3	3	2	2
CO3	3	2	1	3	3	1	2	3	3	3	2	2
CO4	3	2	1	3	3	1	2	3	3	3	3	2
TOTAL	**12**	**8**	**4**	**12**	**12**	**4**	**8**	**12**	**12**	**12**	**9**	**8**
AVERAGE	**3**	**2**	**1**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**2.25**	**2**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (Autonomous), NAGERCOIL

SEMESTER II

NON-MAJOR ELECTIVE II: MATHEMATICS FOR COMPETITIVE EXAMINATIONS II

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU232NM1	2	-	-	-	2	2	30	50	50	100

Pre-requisite:

Students should have basic knowledge on Mathematical calculations.

Learning Objectives

1. To understand the problems stated in various competitive examinations and realize the approach to get solution.
2. To acquire skill in solving quantitative aptitude by simple methods.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the problems and remember the methods to solve problems.	**K2**
2	identify the appropriate method to solve problems.	**K1**
3	apply the best mathematical method and obtain the solution in short.	**K3**
4	apply fundamental mathematical concepts to calculate simple interest, compound interest	**K3**
5	develop problem-solving skills and critical thinking by effectively solving real-world scenarios involving financial calculation	**K2**

K1 - Remember; **K2** - Understand; **K3** - Apply

Units	Contents	No. of Hours
I	**Simple Interest:** Finding simple interest, principal amount. **Compound Interest**: Annual compound interest, Half-yearly compound interest – Quarterly Compound interest. (Chapter 22 and Chapter 23).	**6**
II	**Time and work:** Work sharing **–** Individual work – Combined work – Time taken for work.**(**Chapter17 **)**	**6**
III	**Time and Distance:** Comparing speed –Average speed- Distance travelled by vehicles – Travelling Time(Chapter 18).	**6**
IV	**Chain Rule**: Direct Proportion – Indirect Proportion(Chapter 15).	**6**
V	**Pipes and Cisterns:** Filling the tank and emptying the tank. (Chapter 16)	**6**
	Total	**30**

Self-study	Chain Rule – Direct Proportion

Textbook

Aggarwal, R.S (2017). *Quantitative Aptitude* (Revised Edition). S. Chand and Company LTD.

Reference Books

1. Guha, A. 2011. *Quantitative Aptitude for Competitive Examinations* (4^{th} Edition). Published by McGraw Hill Education (India) Pvt. Ltd.
2. Aggarwal, R.S (2022). *Quantitative Aptitude* (Revised Edition). S. Chand and Company LTD.
3. Immaculate, M. 2009. *Mathematics for Life*. Published by Nanjil offset Printers.
4. Arun Sharma. 2008. *Objective Mathematics* (2^{nd} Edition). Tata McGraw-Hill Publishing Company Limited.

5. Chauhan, R.S. 2011. *Objective Mathematics*. Unique Publisher.
6. Goyal, J. K. Gupta, K. P. 2011. *Objective Mathematics* (6^{th} Revised Edition). Pragati Prakashan Educational Publishers.

Web Resources

1. Aptitude Made Easy - Compound interest – Basics and Methods, shortcuts, Math tricks - YouTube
2. Aptitude Made Easy - Simple Interest – Part 1, Basics and Methods, Shortcuts, Tricks - YouTube
3. Time and Distance _LESSON #1(Introduction) - YouTube
4. Speed, Distance & Time - Shortcuts & Tricks for Placement Tests, Job Interviews & Exams - YouTube
5. Pipes and Cisterns - Shortcuts & Tricks for Placement Tests, Job Interviews & Exams - YouTube

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	1	3	3	1	3	3	3	2	3	3
CO2	2	3	1	3	3	2	3	3	3	2	3	3
CO3	2	3	1	3	3	2	3	3	3	3	3	3
CO4	2	3	1	3	3	2	3	3	3	2	3	3
CO5	2	3	1	3	3	1	3	3	3	2	3	3
TOTAL	**10**	**15**	**5**	**15**	**15**	**8**	**15**	**15**	**15**	**11**	**15**	**15**
AVERAGE	**2**	**3**	**1**	**3**	**3**	**1.6**	**3**	**3**	**3**	**2.2**	**3**	**3**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (AUTONOMOUS) NAGERCOIL

SEMESTER II

SKILL ENHANCEMENT COURSE SEC-I: INTRODUCTION TO COMPUTATIONAL MATHEMATICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU232SE1	2	-	-	-	2	2	30	25	75	100

Prerequisites: Students should have basic knowledge on Mathematical calculations.

Learning Objectives

1)To study and design mathematical models for the numerical solution of scientific problems
2)To acquire the skills and confidence to learn new mathematical knowledge as becomes necessary in the course of a lifetime.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	gain an appreciation for the role of computers in mathematics, science, and engineering as a complement to analytical and experimental approaches.	**K1 & K2**
2	acquire a strong foundation in numerical analysis, enabling students to evaluate and analyze numerical solutions for mathematical problems.	**K2**
3	use and evaluate alternative numerical methods for the solution of systems of equations.	**K3**
4	foster critical thinking skills in assessing computational methods for problem solving.	**K3**
5	apply mathematical concepts to practical problems through computational approaches.	**K3**

K1 - Remember; **K2** - Understand; **K3** - Apply

Unit	Contents	No. of Hours
I	**Errors in Numerical Calculations:** Computer and Numerical Software-Computer Languages- Software Packages – Mathematical Preliminaries-Errors and their computations - A general error formula. **Chapter1: 1.1-1.4**	**6**
II	**Solution of Algebraic and Transcendental Equations:** Introduction-Bisection method - Method of False Position. **Chapter 2: 2.1- 2.3**	**6**
III	**Interpolation:** Finite differences - Forward Differences - Backward Differences - Central Differences. **Chapter 3: 3.1- 3.3.3**	**6**
IV	**Numerical Differentiation and Integration:** Errors in Numerical Differentiation-Cubic Splines Method- Differentiation formulae with function values- Trapezoidal Rule **Chapter 6: 6.1-6.2; 6.4.1**	**6**
V	**Numerical Linear Algebra:** Triangular Matrices- LU Decomposition of a Matrix-Vector and Matrix Norms- Solutions of linear systems Direct Method-Gauss Elimination Method. **Chapter 7: 7.1-7.5.1**	**6**
TOTAL		**30**

Self-study	Triangular Matrices

Textbook

Sastry S. S, 2015, Introductory Methods of Numerical Analysis, Fifth Edition, PHI Learning Pvt. Ltd., New Delhi,.

Reference Books

1. Jain M. K, Iyengar S. R. K., JainR. K, 2012, Numerical Methods for Scientific and Engineering Computation, Second Edition, Wiley Eastern Ltd, New Delhi.
2. Veda Murthy V. N, Iyengar S. N, 2008, Numerical Methods, Second Reprint, Vikas Publishing house PVT. Ltd.
3. Shankar Rao G, 2007, Mathematical Methods, I.K. International Publishing House Pvt., New Delhi.
4. Mollah S.A., 2011, Numerical Analysis and Computational Procedures, Fourth Edition, Books and Allied (P) Ltd.
5. Gupta B. D., 1989, Numerical Analysis, Konark Publishers Pvt. Ltd.,

Web Resources

1) https://nptel.ac.in/courses/127/106/127106019/
2) https://nptel.ac.in/courses/111/107/111107105/
3) https://nptel.ac.in/courses/111/107/111107062/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME-SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	2	2	3	3	3	3	3	3	3
CO2	3	1	1	3	3	1	3	3	3	3	3	3
CO3	3	1	1	2	2	1	2	2	1	2	2	3
CO4	3	1	1	3	3	1	3	3	3	3	3	3
CO5	3	1	1	3	3	1	3	3	3	3	2	3
TOTAL	**15**	**5**	**5**	**13**	**13**	**7**	**14**	**14**	**13**	**14**	**13**	**15**
AVERAGE	**3**	**1**	**1**	**2.6**	**2.6**	**1.4**	**2.8**	**2.8**	**2.6**	**2.8**	**2.6**	**3**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (AUTONOMOUS), NAGERCOIL

SEMESTER I & II

LIFE SKILL TRAINING I: CATECHISM

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG232LC1	1	-	-	-	1	1	15	50	50	100

Learning Objectives:

1. To develop human values through value education
2. To understand the significance of humane and values to lead a moral life
3. To make the students realize how values lead to success

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the aim and significance of value education	**K1, K2**
2	develop individual skills and act confidently in the society	**K3**
3	learn how to live lovingly through family values	**K3**
4	enhance spiritual values through strong faith in God	**K6**
5	learn good behaviours through social values	**K6**

K1 - Remember **K2**-Understand; **K3**-Apply; **K6**- Create

Units	Contents	No. of Hours
I	**Value Education:** Human Values – Types of Values – Growth – Components – Need and Importance - Bible Reference: Matthew: 5:3-16	**3**
II	**Individual Values: Esther** Vanishing Humanity – Components of Humanity – Crisis – Balanced Emotion – Values of Life - Bible Reference: Esther 8:3-6	**3**
III	**Family Values: Ruth the Moabite** Respecting Parents – Loving Everyone – Confession – True Love Bible Reference: Ruth 2:10-13 **Spiritual Values: Hannah** Faith in God – Wisdom – Spiritual Discipline – Fear in God – Spiritually Good Deeds -Bible Reference: 1 Samuel 1:24-28	**3**
IV	**Social Values: Deborah** Good Behaviour – Devotion to Teachers – Save Nature – Positive Thoughts –The Role of Youth in Social Welfare - Bible Reference: Judges 4:4-9	**3**
V	**Cultural Values**: **Mary of Bethany** Traditional Culture – Changing Culture – Food – Dress – Habit – Relationship – Media – The Role of Youth - Bible Reference: Luke 10:38-42	**3**
	Total	**15**

Textbook

Humane and Values. Holy Cross College (Autonomous), Nagercoil

The Holy Bible

HOLY CROSS COLLEGE (AUTONOMOUS), NAGERCOIL

SEMESTER I & II

LIFE SKILL TRAINING I: MORAL

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG232LM1	1	-	-	-	1	1	15	50	50	100

Learning Objectives:

1. To develop human values through value education
2. To understand the significance of humane and values to lead a moral life
3. To make the students realize how values lead to success

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the aim and significance of value education	K1, K2
2	develop individual skills and act confidently in the society	K3
3	learn how to live lovingly through family values	K3
4	enhance spiritual values through strong faith in God	K6
5	learn good behaviours through social values	K6

K1 - Remember **K2**-Understand; **K3**-Apply; **K6**- Create

Units	Contents	No. of Hours
I	**Value Education:** Introduction – Limitations – Human Values – Types of Values – Aim of Value Education – Growth – Components – Need and Importance	3
II	**Individual Values:** Individual Assessment – Vanishing Humanity – Components of Humanity – Crisis – Balanced Emotion – Values of Life.	3
III	**Family Values:** Life Assessment – Respecting Parents – Loving Everyone – Confession – True Love.	3
IV	**Spiritual Values:** Faith in God – Wisdom – Spiritual Discipline – Fear in God – Spiritually Good Deeds.	3
V	**Social Values:** Good Behaviour – Devotion to Teachers – Save Nature – Positive Thoughts – Drug Free Path – The Role of Youth in Social Welfare. **Cultural Values**: Traditional Culture – Changing Culture – Food – Dress – Habit – Relationship – Media – The Role of Youth.	3
	Total	15

Text Book

Humane and Values. Holy Cross College (Autonomous), Nagercoil

HOLY CROSS COLLEGE (AUTONOMOUS), NAGERCOIL

SEMESTER III

CORECOURSE V: VECTOR CALCULUS AND ITS APPLICATIONS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU233CC1	5	-	-	-	5	5	75	25	75	100

Pre-requisite:

12th Standard Mathematics

Learning Objectives:

1. To get the knowledge about differentiation of vectors and on differential operators.
2. To analyze the physical applications of derivatives of vectors.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	remember the formulae of vector differentiation, integration and the basic principles of vectors, including their properties, operations, and geometric interpretations	**K1**
2.	understand the concepts of divergence and curl and their applications in physics and engineering	**K2**
3.	apply Green's, Gauss', and Stokes' theorems to solve problems involving line and surface integrals, demonstrating their understanding of vector calculus principles	**K3**
4.	gain proficiency in differentiating vectors and interpreting their gradients geometrically	**K4**
5.	learn how to integrate vectors to calculate work done by forces and solve related problems	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate;

Units	Contents	No. of Hours
I	**Elements of Vector Algebra:** Introduction – Scalars and Vectors – Equality of vectors – Multiplication of Vector by a Scalar – Addition and Subtraction of Vectors – Collinear and Coplanar Vectors – Linearly Independent and Independent Set of Vectors – Related Examples:1 to 20 **Text Book 2: Chapter I:** Sections: 1. 0 to 1. 6, 1.12	**15**
II	**Vector Differentiation:** Introduction –Vector Algebra – Differentiation of vectors - Gradient –Geometrical Interpretation – Directional Directive - Equation of the tangent plane and Equation of the normal line. **Text Book 1: Chapter V:** Sections: 5. 0 to 5. 3	**15**
III	**Divergence and Curl:** Divergence and Curl–Solenoidal - irrotational– Laplacian operator - harmonic vectors and related problems. **Text Book 1: Chapter V:** Sections: 5. 4	**15**
IV	**Vector Integration**: Introduction –Work done by a force - Evaluation of line integrals and surface integrals. **Text Book 1: Chapter VII:** Sections: 7. 0 to 7. 2	**15**
V	**Theorems of Green, Gauss and Stokes:** Green's, Stoke's and Gauss divergence theorems (statement only).Verification and Evaluation of Green's, Stoke's and Gauss divergence theorems. **Text Book 1: Chapter VII:** Section: 7. 3	**15**
	Total	**75**

Self-study	Solenoidal - irrotational– Laplacian operator - harmonic vectors and related problems.

Textbooks

1. Arumugam, S., & ThangapandiIssac. (2014*). Analytical Geometry 3D and Vector calculus*.New Gamma Publishing House, Palayamkottai.
2. Absos Ali Shaik&Sanjib Kumar Jana, (2009), *Vector Analysis with Applications*, Narosa Publishing House, New Delhi.

Reference Books

1. Susan. J. C, 2012. *Vector Calculus*, 4th Edition. Pearson Education.
2. Gorguis A, 2014. *Vector Calculus for College Students*. Xilbius Corporation.
3. Marsden and Tromba. A, 1988. *Vector Calculus*, 5th Edition. W. H. Freeman, New York.
4. Murray Spiegel, 2009. *Vector Analysis*, 2nd Edition. Schaum Publishing company, New York.
5. Shanthi Narayanan and P. K. Mital, 2003. *A Text Book of Vector Calculus*. S. Chand Publishing.

Web Resources

1. https://nptel.ac.in
2. https://uuwaterloohome.files.wordpress.com/2020/04/1.vector-cal-4.pdf
3.https://ocw.mit.edu/ans7870/textbooks/Strang/Edited/Calculus/15.1-15.3.pdf
4.https://www.robots.ox.ac.uk/~sjrob/Teaching/Vectors/course.pdf
5.https://anton- petrunin. github.io/calc3book/calc3book.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3	2	3	3	3	2	3	3
CO2	3	2	2	2	2	2	2	3	2	3	2	3
CO3	3	2	3	3	3	3	3	2	3	2	3	2
CO4	3	2	2	2	2	2	2	3	2	3	2	3
CO5	3	2	3	1	2	2	3	2	3	2	3	2
TOTAL	**15**	**10**	**13**	**11**	**12**	**11**	**13**	**13**	**13**	**12**	**13**	**13**
AVERAGE	**3**	**2**	**2.6**	**2.2**	**2.4**	**2.2**	**2.6**	**2.6**	**2.6**	**2.4**	**2.6**	**2.6**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (AUTONOMOUS), NAGERCOIL

SEMESTER III

CORECOURSE VI: DIFFERENTIAL EQUATIONS AND APPLICATIONS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU233CC2	5	-	-	-	5	5	75	25	75	100

Pre-requisite:

Understanding concepts such as Differential equations, partial differential equations, and Formulation of partial differential equations is essential as these concepts apply in many places like higher mathematics and physical sciences.

Learning Objectives:

1. To gain deeper knowledge in differential equations, and partial differential equations.
2. To apply the concepts in higher mathematics and physical sciences.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	learn Exact differential equations and Bernoulli's equations	**K1**
2	learn methods of forming and solving partial differential equations	**K2, K4**
3	apply the concepts to solve problems in physical sciences and engineering	**K3**
4	solve linear differential equations with constant coefficients	**K5**
5	solve linear differential equations with variable coefficients	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate

Units	Contents	No. of Hours
I	Differential equations of first order – Differential equation – Equations of first order and first degree – Exact differential equations – Integrating factors – linear equations – Bernoulli's equations. **Chapters: I Sections: 1.1 – 1.6**	**15**
II	Linear equations of higher order – Linear equations with constant coefficients – Methods of finding complementary functions – Methods of finding particular integrals – Homogeneous linear equations. **Chapters: II Sections: 2.1 – 2.4**	**15**
III	Linear equations of higher order - Linear equations with variable coefficients – Simultaneous Linear differential equations – Total differential equations. **Chapters: III Sections: 2.5 – 2.7**	**15**
IV	Partial differential equations – Formulation of partial differential equations – First order partial differential equations – Methods of solving first order partial differential equations – Char pit's method. **Chapters: IV Sections: 4.1 – 4.5 Except 4.4**	**15**
V	Applications of differential equations – Orthogonal trajectories – Growth and decay – Continuous compound interest – The Brachistochrone problem. **Chapters: V Sections: 6.1 – 6.4**	**15**
	Total	**75**

Self-study	Differential equation – Equations of first-order and first-degree Formulation of partial differential equations – First-order partial differential equations

Textbook

1.Arumugam S., Thangapandi Isaac A.,2008. *Differential Equations and Applications*., New Gamma Publishing House.

Reference Books

1. Chaitanya Kumar, Bhavneet Kaur, and Geetan Manchanda, 2023. *A Textbook on Differential Equations and Applications*. Sultan Chand & Sons.
2. Stanley J Farlow, 2006. *An Introduction to Differential Equations and Their Applications* (Dover Books on Mathematics). McGraw-Hill, Inc., New York.
3. Arumugam, 2020. *Differential Equations and Applications*, First Edition. Yes Dee Publishing.
4. Martin Braun, 1992. *Differential Equations and Their Applications*, Fourth Edition. Springer.
5. Simmons, G. F., 1991. *Differential Equations with Applications and Historical Notes*, Third Edition. McGraw Hill.

Web Resources

1. https://archive.nptel.ac.in/courses/111/106/111106100/
2. https://www.youtube.com/watch?v=fKHFbOeJrD0
3. https://www.youtube.com/watch?v=YHxBaOttKCU
4. https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/video_galleries/video-lectures/
5. https://www.youtube.com/watch?v=p_di4Zn4wz4

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3	3	3	3	2	3	2	2
CO2	2	2	3	3	3	3	3	3	2	3	2	2
CO3	3	2	3	3	3	3	3	3	2	3	2	2
CO4	1	2	3	3	3	3	3	3	2	3	2	2
CO5	3	2	2	2	3	3	2	3	2	3	2	2
TOTAL	**12**	**10**	**14**	**14**	**15**	**15**	**14**	**15**	**10**	**15**	**10**	**10**
AVERAGE	**2.5**	**2**	**2.8**	**2.8**	**3**	**3**	**2.8**	**3**	**2**	**3**	**2**	**2**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (AUTONOMOUS), NAGERCOIL

SEMESTER III

ELECTIVE COURSE III: MATHEMATICAL STATISTICS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU233EC1	4	-	-	-	3	4	60	25	75	100

Pre-requisite:

A foundational understanding of basic statistics

Learning Objectives:

1. To analyze relationships between variables, as well as understanding interpolation methods and their applications for estimating values within data sets.
2. To learn data consistency, independence, and association, gaining proficiency in interpreting and using index numbers.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	calculate and interpret correlation coefficients and regression lines, and their applications in analyzing relationships between variables.	**K1**
2	understand Theory of Attribute in statistics, including concepts like consistency of data, independence, and association	**K2**
3	acquire knowledge of index numbers and learn how to apply index numbers in economic analysis	**K3**
4	**l**earn about rank correlation and understand when and how to use them to assess monotonic relationships between variables.	**K4**
5	develop proficiency in interpolation methods and apply these techniques to estimate values within a set of data points with precision.	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate;

Units	Contents	No. of Hours
I	Correlation and Regression: Correlation – Rank Correlation Chapter 6	**12**
II	Correlation and Regression: Regression – Correlation Coefficient for a Bivariate Frequency Distribution Chapter 6	**12**
III	Interpolation: Finite Differences – Newton's Formula – Lagrange's Formula Chapter 7	**12**
IV	Theory of Attributes: Attributes – Consistency of Data – Independence and Association of Data Chapter 8	**12**
V	Index Numbers: Consumer Price Index Numbers – Conversion of Chain Base Index Number into Fixed Base Index and Conversely Chapter 9	**12**
	Total	**60**

Self-study	Consumer Price Index Numbers – Conversion of Chain Base Index Number into Fixed Base Index and Conversely

Textbook

1. Arumugam, S. &Thangapandi Isaac, A. 2006.*Statistics.* New Gamma Publishing, House. Palayamkotai.

Reference Books

1. Kapur, J. N., & Saxena. 1986. *Mathematical Statistics*, 12th Edition. Chand & Company.
2. Robert, V., Hogg, Joseph., Mckean, W., Allen., & Craig, T. 2013. *Introduction to Mathematical Statistics*, 6th Edition. Dorling Kindersley (India) Pvt. Ltd.
3. Pillai, R. S. N., & Bagavathi, V. 1989. *Statistics*, 12th Edition. Chand & Company.
4. Mangaladoss., & Others. 1994. *Statistics and its Application*. Suja Publishing House.
5. Sharma, J. N., & J. K. Goyal. 1987. *Mathematical Statistics*, 11th Edition. Krishna Bakashar Mandir.

Web Resources

1. https://www.khanacademy.org/math/statistics-probability
2. https://stattrek.com/interpolation/interpolation.aspx
3. https://towardsdatascience.com/
4. https://www.investopedia.com/
5. https://www.nber.org/

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	3	3	2	3	3	3	3	3
CO2	3	2	3	3	3	2	2	3	3	2	2	3
CO3	3	3	3	3	3	2	2	3	3	3	3	3
CO4	3	3	3	1	3	2	2	3	3	2	3	3
CO5	3	3	3	2	3	2	2	3	3	3	3	3
TOTAL	**15**	**14**	**15**	**11**	**15**	**11**	**10**	**15**	**15**	**13**	**14**	**15**
AVERAGE	**3**	**2.8**	**3**	**2.2**	**3**	**2.2**	**2**	**3**	**3**	**2.6**	**2.8**	**3**

3 - Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (AUTONOMOUS) NAGERCOIL

SEMESTER III

SKILL ENHANCEMENT COURSE SEC-II: SPHERICAL TRIGONOMETRY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU233SE1	2	-	-	-	2	2	30	25	75	100

Pre-requisite:

Knowledge in Trigonometry

Learning Objectives:

1.To improve problem solving skills in Spherical Trigonometry and to apply the concepts in real world problems

2.To develop applications of the related concepts and processes in the real world.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	explain the concepts great and small circles, axis and poles of great circles	**K2**
2.	define spherical angle and also the angle of intersection between two great circles	**K2**
3.	calculate the arc length between two points on a sphere using the cosine rule for sides	**K3**
4.	distinguish between plane trigonometry and spherical trigonometry	**K4**
5.	discuss and derive the spherical cosine, sine, supplemental cosine and cotangent rules	**K5**

K2 - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate;

Units	Contents	No. of Hours
I	Sphere- great circles and small circles- Axis and poles of a circle - Distance between two points on a sphere- angle between two circles- Secondaries	**6**
II	Angular radius or spherical radius - Spherical figures -Spherical triangle - Polar triangle	**6**
III	Rotation between the elements of a spherical triangle and its polar triangle- Some properties of spherical triangle	**6**
IV	Relations between the sides and angles of a spherical triangle- cosine formula-sine formula-supplementary cosine formula – five parts formula	**6**
V	Spherical coordinates - relation between the spherical and rectangular coordinates - general proof of the spherical formula	**6**
	Total	**30**

Self-study	Some properties of spherical triangle

Textbook

1.Kumaravelu, S., and Susheela Kumaravelu. 2012. *Astronomy*. (First Edition), SKS Publications

Reference Books

1. Subramanian, K., Subramanian, L. V.,Venkataraman and Brothers. 1965. *A Textbook of Astronomy*, First Edition. Educational Publishers.
2. Narayanan. S, 1995. *Trigonometry*. S. Viswanathan Printers and Publishers.
3. Reddy, G., & Rao, M. 2006. *Fundamentals of Astronomy*. G. Reddy & Co.
4. Sharma, P., & Gupta, R. 2010. *Spherical Geometry: Theory and Practice*. P. Sharma Publications.

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5. Khan, A., & Ali, M. 2015. *Applied Trigonometry: Problems and Solutions*. A. Khan Press.

Web Resources

1.https://www.youtube.com/watch?v=McWv9bcvMYg
2.https://www.math.ucla.edu/~robjohn/math/spheretrig.pdf
3. https://www.loc.gov/resource/gdcmassbookdig.planesphericaltr00broo/?st=gallery
4. https://www.khanacademy.org/math/geometry/hs-geo-spherical
5. https://en.wikipedia.org/wiki/Spherical_trigonometry

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	3	2	2	2	3	3	2	3	2
CO2	3	3	3	3	2	3	3	3	3	2	3	2
CO3	3	3	3	3	2	3	3	3	3	2	3	2
CO4	3	2	3	3	3	3	3	3	3	2	3	2
CO5	3	2	2	3	2	2	2	3	3	2	2	2
TOTAL	**14**	**12**	**14**	**15**	**11**	**13**	**13**	**15**	**15**	**10**	**14**	**10**
AVERAGE	**2.8**	**2.4**	**2.8**	**3**	**2.2**	**2.6**	**2.6**	**3**	**3**	**2**	**2.8**	**2**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (Autonomous) NAGERCOIL

SEMESTER III

SPECIFIC VALUE-ADDED COURSE: BASIC FUZZY ALGEBRA

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU233V01	2	-	-	-	1	2	30	25	75	100

Pre-requisite:

Understanding basic concepts of algebra.

Learning Objectives:

1. To gain knowledge in fuzzy sets, fuzzy numbers, and their operations.
2. To apply the concepts in extension of fuzzy mathematics and physical sciences.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	learn fuzzy versus crisp, fuzzy sets and definition	**K1**
2	understand general definitions and properties of Fuzzy sets, general properties: Fuzzy versus crisp	**K2**
3	study Extension principles of Fuzzy sets, fuzzy compliments	**K2**
4	learn Binary operations of two Fuzzy numbers	**K2, K3**
5	apply the Fuzzy logic concepts to truth values and truth table	**K3**

K1 - Remember; **K2** - Understand; **K3** – Apply

Units	Contents	No. of Hours
I	Fuzzy set theory – Introduction- Fuzzy versus crisp-Representation of a set- Types of sets- Fuzzy sets-definition. **Chapter I: 1.1, 1.2, 1.6, 1.7, 1.16, 1.17**	**6**
II	Types of fuzzy sets- General Definitions and properties of Fuzzy sets- General Properties: Fuzzy versus crisp. **Chapters: I Sections: 1.18, 1.19, 1.21**	**6**
III	Operations on fuzzy sets: Introduction- Extension principles of fuzzy sets- Fuzzy compliments. **Chapters: II Sections: 2.1, 2.3, 2.4**	**6**
IV	Fuzzy numbers and Arithmetic: Introduction- Fuzzy numbers- Arithmetic operations with Fuzzy numbers- Binary operations of two Fuzzy numbers. **Chapters: III Sections: 3.1 – 3.4**	**6**
V	Fuzzy logic: An overview of classical logic- connectivity- types of sentences- truth values and truth table – Algebra of statements. **Chapters: VII Sections: 7.1 – 7.4, 7.6**	**6**
	Total	**30**

Self-study	Fuzzy versus crisp-Representation of a set- Types of sets- Fuzzy sets-definition

Textbook

1.Pundir, S. K., Pundir, R., Prakash, P., 2012. Fuzzy Sets and its Applications, Fourth edition, Pragathi Prakashan,

Reference Books

1. Klar, G. J., Yuan, B., 2015. *Fuzzy Sets and Fuzzy Logic*: Theory and Applications, Pearson Education India, Mumbai.
2. Ross, T. J., 2021. *Fuzzy Sets and Fuzzy Logic with Engineering Applications*, Fourth edition, Wiley Publication.
3. MDPI Journal Mathematics, 2021.*Fuzzy Sets, Fuzzy Logic and Their Applications.*

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4. Zimmermann, H. J. 1991. *Fuzzy Set Theory—and Its Applications* (2nd ed.). Kluwer Academic Publishers.
5. Tanaka, H., Ohtake, H., & Watada, J. 2001. *Advanced Fuzzy Systems Design and Applications*. Physica-Verlag HD.

Web Resources

1. https://www.investopedia.com/terms/f/fuzzy-logic
2. https://en.wikipedia.org/wiki/Fuzzy_number
3. https://link.springer.com/chapter/10.1007/978-3-642-35221-8_10
4. https://www.tutorialspoint.com/fuzzy_logic/index.htm
5. https://www.journals.elsevier.com/fuzzy-sets-and-systems

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	2	3	2	2
CO2	2	3	3	2	3	3	2	3	2	3	2	2
CO3	3	3	3	3	3	3	3	3	2	3	2	2
CO4	1	3	3	1	3	3	1	3	2	3	2	2
CO5	3	3	2	3	3	3	3	3	2	3	2	2
TOTAL	**12**	**15**	**14**	**12**	**15**	**15**	**12**	**15**	**10**	**15**	**10**	**10**
AVERAGE	**2.5**	**3**	**2.8**	**2.5**	**3**	**3**	**2.5**	**3**	**2**	**3**	**2**	**2**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (Autonomous), NAGERCOIL

SEMESTER III

SPECIFIC VALUE-ADDED COURSE: STATISTICAL SURVEY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU233V02	2	-	-	-	1	2	30	25	75	100

Pre-requisite:

Basic Statistical Knowledge

Learning Objectives:

1. To analyze survey data using statistical methods.
2.To design surveys that yield reliable and valid data.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall the main steps involved in planning a survey and identifying sources of primary and secondary data.	**K1**
2.	understand the purpose of survey planning, the nature of information required, and the importance of selecting appropriate data collection techniques	**K2**
3.	apply survey planning principles to design effective surveys and select suitable methods for data collection	**K3**
4.	analyze survey data to identify patterns, trends, and potential sources of error or bias.	**K4**
5.	create comprehensive survey reports that present survey findings clearly and effectively, drawing conclusions and making recommendations based on the analysis of the data collected	**K6**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Units	Contents	No. of Hours
I	Planning – Purpose of the survey – scope – Nature of Information Required – Units to be used.	**6**
II	Sources of Data – Technique to be adopted Choice of Frame –Accuracy Aimed – other considerations – Execution – Setting up an Administrative Organization - Designing of Forms.	**6**
III	Selecting, Training and Supervising the Field Investigators – Controlling the accuracy of the Field work – Reducing non-response – presenting the Information – Analyzing the Information – Preparing the Reports.	**6**
IV	Primary and Secondary Data – Methods of Collection of Primary Data – Direct Personal Interviews – Indirect Oral Interviews – Information from Correspondents – Mailed Questionnaire Method.	**6**
V	Characteristics of a Good Questionnaire – Schedules sent through Enumerators – Sources of Secondary Data – Published Sources - Unpublished Sources – Precautions in the use of Secondary Data – Editing	**6**
	Total	**30**

Self-study	Planning – Purpose of the survey – scope – Nature of Information Required – Units to be used.

Textbook

1.Navnitham PA, Business Statistics, Jai Publishers, Trichy.

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Reference Books

1. Cochran, W. G., 1977. *Sampling Techniques*, Third Edition, John Wiley & Sons, Canada.
2. Rao, P. S. R. S., 2015. *Sampling Methodologies With Applications*, Chapman & Hall/CRC, New York.
3. Lohr, S. L., 2009. *Sampling: Design and Analysis*, Duxbury Press, An Imprint of Brooks/Cole Publishing Company QP ® An International Thomson Publishing Company, New York.
4. Kish, L. 1965. *Survey Sampling*. John Wiley & Sons.
5. Thompson, S. K. 2012. *Sampling* (3rd ed.). John Wiley & Sons.

Web Resources

1. https://fsapps.nwcg.gov/gtac/CourseDownloads/IP/Cambodia/FlashDrive/Supporting_Documentation/Cochran_1977_Sampling%20Techniques.pdf
2. https://uca.edu/psychology/files/2013/08/Ch7-Sampling-Techniques.pdf
3. https://faculty.ksu.edu.sa/sites/default/files/poduri_s.r.s._rao_-_sampling_methodologies_with_applications_texts_in_statistical_science-chapman_and_hall_crc_2000.pdf
4. https://drive.uqu.edu.sa/_/maatia/files/Sampling.pdf
5. http://www.socialresearchmethods.net/kb/sampstat.php

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	2	3	2	3
CO2	2	3	3	3	3	3	2	3	2	3	2	2
CO3	3	3	3	3	3	3	3	3	2	3	2	3
CO4	1	3	3	3	3	3	1	3	2	3	2	1
CO5	3	3	2	3	3	3	3	3	2	3	2	3
TOTAL	**12**	**15**	**14**	**15**	**15**	**15**	**12**	**15**	**10**	**15**	**10**	**12**
AVERAGE	**2.5**	**3**	**2.8**	**3**	**3**	**3**	**2.5**	**3**	**2**	**3**	**2**	**2.5**

3 – Strong, 2- Medium, 1- Low

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SEMESTER III

SPECIFIC VALUE-ADDED COURSE: DATA STRUCTURES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU233V03	2	-	-	-	1	2	30	25	75	100

Pre-requisite:

Basic understanding of discrete mathematics concepts such as sets, logic, functions, and relations.

Learning Objectives:

1. To understand data structures and enhance problem-solving abilities.
2. To study of disjoint-set data structures, having a basic understanding of graph theory concepts

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	recall the definitions and properties of elementary data structures like arrays, stacks, queues, and linked lists.	**K1**
2.	explain the principles underlying these data structures and their applications in problem-solving.	**K2**
3.	utilize appropriate data structures to represent rooted trees and demonstrate the relationships between nodes within these structures.	**K3**
4.	analyze the properties of red-black trees and their role in maintaining balance in dynamic data structures.	**K4**
5.	evaluate the efficiency and scalability of disjoint-set data structures for solving problems involving dynamic connectivity.	**K5**

K1 – Remember; **K2** – Understand; **K3 –** Apply; **K4**- Analyze; **K5** – Evaluate

Units	Contents	No. of Hours
I	Elementary Data Structures - Simple array-based data structures: arrays, matrices, stacks, queues - Linked lists - Representing rooted trees.	**6**
II	Hash Tables - Direct - address tables - Hash tables - Hash functions - Open addressing - Practical considerations.	**6**
III	Binary Search Trees - What is a binary search tree? - Querying a binary search tree - Insertion and deletion.	**6**
IV	Red-Black Trees - Properties of red-black trees - Rotations - Insertion – Deletion.	**6**
V	Data Structures for Disjoint Sets - Disjoint-set operations - Linked-list representation of disjoint sets - Disjoint-set forests - Analysis of union by rank with path compression.	**6**
	Total	**30**

Textbook

1.Cormen, T. H., Leiserson, C. E., Rivest, R. L., Stein, C., 2022. Introduction to Algorithms, Fourth Edition, The MIT Press, Cambridge.

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Reference Books

1. Goodrich, M. T., Tamassia, R., Goldwasser, M. H., 2014. *Data Structures and Algorithms in Java*, Sixth Edition, Wiley Publication.
2. Weiss, M. A., 2012. *Data Structures and Algorithm Analysis in Java*, Third Edition, Pearson Education.
3. Karumanchi, N., 2010. *Data Structures and Algorithms Made Easy*, Career Monk Publications.
4. Horowitz, E., Sahni, S., & Mehta, D. 2008. *Fundamentals of Data Structures in C++*. Silicon Press.
5. Malik, D. S. 2010. *C++ Programming: Program Design Including Data Structures* (5th ed.). Cengage Learning.

Web Resources

1. https://www.geeksforgeeks.org/data-structures/
2. https://www.javatpoint.com/data-structure-tutorial
3. https://www.youtube.com/watch?v=YAdLFsTG70w
4. https://www.geeksforgeeks.org/data-structures/
5. https://www.khanacademy.org/computing/computer-science/algorithms

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	3	3	3	3	3	3	2	3
CO2	2	2	3	2	3	3	2	3	2	3	2	2
CO3	3	3	3	2	3	3	3	3	3	3	2	3
CO4	1	1	3	2	3	3	1	3	1	3	2	1
CO5	3	3	2	2	3	3	3	3	3	3	2	3
TOTAL	**12**	**12**	**14**	**10**	**15**	**15**	**12**	**15**	**12**	**15**	**10**	**12**
AVERAGE	**2.5**	**2.5**	**2.8**	**2**	**3**	**3**	**2.5**	**3**	**2.5**	**3**	**2**	**2.5**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (AUTONOMOUS) NAGERCOIL

SEMESTER III / IV

SKILL ENHANCEMENT COURSE SEC IV: DIGITAL FLUENCY

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG23CSE2	2	-	-	-	2	2	30	50	50	100

Pre-requisite: Basic computer knowledge

Learning Objectives:

1. To provide a comprehensive suite of productivity tools that enhance efficiency
2. To build essential soft skills that are needed for professional success.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	work with text, themes and styles	**K1**
2.	produce a mail merge	**K2**
3.	secure information in an Excel workbook	**K2**
4.	perform documentation and presentation skills	**K2, K3**
5.	add special effects to slide transitions	**K3**

K1 - Remember; **K2** - Understand; **K3** – Apply

Units	Contents	No. of Hours
I	**Microsoft Word 2010:** Starting Word 2010 - Understanding the Word Program Screen - Giving Commands in Word - Using Command Shortcuts – Document: Creating - Opening - Previewing - Printing and Saving. Getting Started with Documents: Entering and Deleting Text - Navigating through a Document - Viewing a Document. Working with and Editing Text: Spell Check and Grammar Check- Finding and Replacing Text - Inserting Symbols and Special Characters – Copying, Moving, and Pasting Text.	**6**
II	**Formatting Characters and Paragraphs**: Changing Font Type, Font Size, Font Color, Font Styles and Effects, Text Case, Creating Lists, Paragraph Alignment, Paragraph Borders and Shadings, Spacing between Paragraphs and Lines. Formatting the Page: Adjusting Margins, Page Orientation and Size, Columns and Ordering, Headers and Footers, Page Numbering. Working with Shapes, Pictures and SmartArt: Inserting Clip Art, Pictures and Graphics File, Resize Graphics, Removing Picture's Background, Text Boxes, Smart Art, Applying Special Effects. Working with Tables: Create Table, Add and delete Row or Column, Apply Table Style - Working with Mailings.	**6**
III	**Microsoft Excel 2010:** Creating Workbooks and Entering Data: Creating and Saving a New Workbook - Navigating the Excel Interface, Worksheets, and Workbooks - Entering Data in Worksheets - Inserting, Deleting, and Rearranging Worksheets. Formatting Worksheets: Inserting and Deleting Rows, Columns and Cells - Formatting Cells and Ranges - Printing your Excel Worksheets and Workbooks. Crunching Numbers with Formulas and Functions: Difference between Formulae and Functions - Applying Functions. Creating Powerful and Persuasive Charts: Creating, Laying Out, and Formatting a Chart.	**6**
IV	**Microsoft PowerPoint 2010:** Creating a Presentation - Changing the Slide Size and Orientation - Navigating the PowerPoint Window - Add content to a Slide - Adding, Deleting, and Rearranging Slides - Using views to work on Presentation. Creating Clear and Compelling Slides: Planning the Slides in Presentation - Choosing Slide Layouts to Suit the Contents - Adding Tables, SmartArt, Charts, Pictures, Movies,	**6**

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	Sounds, Transitions and Animations - Slideshow.	
V	**Digital Platforms:** Graphic Design Platform: Canva - Logo Making, Invitation Designing. E-learning Platform: Virtual Meet – Technical Requirements, Scheduling Meetings, Sharing Presentations, Recording the Meetings. Online Forms: Creating Questionnaire, Publishing Questionnaire, Analyzing the Responses, Downloading the Response to Spreadsheet.	**6**
	Total	**30**

Self-study	Parts of a computer and their functions

Textbook

Anto Hepzie Bai J. & Divya Merry Malar J.,2024, Digital Fluency, Nanjil Publications, Nagercoil.

Reference Books

1. Steve Schwartz, 2017, *Microsoft Office 2010 for Windows*, Peachpit Press.
2. Ramesh Bangia, 2015, Learning Microsoft Office 2010, Khanna Book Publishing Company.
3. Bittu Kumar, 2018, *Mastering MS Office*, V & S Publishers.
4. James Bernstein, 2020, *Google Meet Made Easy*, e-book, Amazon.
5. Zeldman, Jeffrey, 2005, *Web Standards Design Guide*, Charles River Media.

Web Resources

1. https://www.youtube.com/watch?v=oocieLn6umo
2. https://www.youtube.com/watch?v=pPSwbK4_GdY
3. https://www.youtube.com/watch?v=DKAiSDhU4To
4. https://www.youtube.com/watch?v=sbeyPahs-ng
5. https://www.youtube.com/watch?v=fACEzzmXelY

HOLY CROSS COLLEGE (AUTONOMOUS), NAGERCOIL

SEMESTER III/V

SELF LEARNING COURSE: SET/NET ALGEBRA ESSENTIALS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU233SL1/ MU235SL1	-	-	-	-	1	-	-	25	75	100

Pre-requisite:

Basic Algebra

Learning Objectives:

1. To provide a first approach to the subject of algebra, which is one of the basic pillars of modern mathematics.
2. To define basic concepts in groups, subgroups, normal subgroups, rings, and ideals, give examples, and explain important theorems, gaining a solid understanding of abstract algebra.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	**i**dentify groups, provide examples, and distinguish between Abelian and Non-Abelian groups, including understanding permutations, cycles, and transpositions.	**K1**
2	understand subgroups, including the center and normalizers of a group, cyclic groups, and cosets, and they will be able to apply Lagrange's, Euler's, and Fermat's Theorems.	**K2**
3	comprehend rings by exploring their definitions, properties, and various types like division rings and fields, along with concepts such as zero divisors, integral domains, and ring characteristics.	**K3**
4	analyze what ideals are, including left and right ideals, principal ideal domains, quotient rings, and the concepts of maximal and primal ideals	**K4**
5	learn about normal subgroups, quotient groups, isomorphisms, and the importance of Cayley's Theorem and automorphisms, including inner automorphisms.	**K5**

K2 - Understand; **K3** –Apply; **K4** - Analyse; **K5** - Evaluate

Units	Contents
I	**Groups:** Groups-Definition and examples - Abelian – Nonabelian-Permutations –Order of a group-A cycle of length r-Disjoint cycles-Transposition-Odd and Even Permutations-Alternating group. (Definitions, examples and theorem Statement only)
II	**Subgroups**: Subgroups - Centre of a group - Normalizer – Cyclic groups-Generator of a group – Order of an element – Cosets and Lagrange's theorem-Euler's Theorem-Fermat's Theorem.(Definitions, examples and theorem Statement only)
III	**Normal subgroups**: Normal subgroups and Quotient groups –Isomorphism – Cayley's Theorem – Automorphism - Inner Automorphism - Kernal – Fundamental theorem of homomorphism.. (Definitions, examples and theorem Statement only)

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IV	**Rings:** Rings – Definition and examples- Elementary properties of rings.Isomorphism of rings-Types of Rings- Skew field (or) division ring-Field-Zero divisor-Integral domain-Characteristic Rings - Subrings - Sub fields. (Definitions, examples and theorem Statement only)
V	**Ideals**: Ideals -Left ideal-Right Ideal-Principal Ideal domain-Quotient rings-Maximal and Primal ideals-Homomorphism of Rings- Fundamental theorem of Homomorphism of rings- (Definitions, examples and theorem Statement only).

Textbook

1. Arumugam, S., &Thangapandi Issac, A. (2016). Modern Algebra. Scitech Publications. Chapter 3: Sections 3.1-3.11, Chapter 4: Sections 4.1-4.10

Reference Books

1. Singh, S., & Zameeruddeen, A., 2006. *Modern Algebra*, 8th Edition, Vikas Publishing House.
2. Santiago, M. C., 2011. *Modern Algebra*, 1st Edition, Tata McGraw Publishing Company Limited.
3. Gopalakrishnan, N. S., 2015. *University Algebra*, 3rd Edition, New Age International Publishers.
4. Vatsa, B. S., & Vatsa, S., 2010. *Modern Algebra*, 2nd Edition, New Age International Publishers.
5. Gallian, J. A., 1999. *Contemporary Abstract Algebra*, 4th Edition, Narosa Publishing.

Web Resources

1.https://www.scribd.com/presentation/533922913/Rings-and-Fields1
2.https://www.google.com/url?sa=i&url=https%3A%2F%
3.https://library.icts.res.in/cgi-bin/koha/opac-detail.pl?biblionumber=29833
4.https://programsandcourses.anu.edu.au/2022/course/math2322/second%20semester/6042
5.https://www.routledge.com/Groups-Rings-and-Group-Rings/Giambruno-PolcinoMilies-Sehgal/p/book/9781584885818

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	3	2	2	3	3	3	3	3
CO2	3	2	3	3	3	2	3	3	3	1	3	3
CO3	3	2	3	2	3	2	2	3	3	1	3	3
CO4	3	2	3	3	3	2	3	3	2	3	3	3
CO5	3	3	2	3	3	2	3	3	3	3	3	3
TOTAL	**15**	**12**	**14**	**12**	**15**	**10**	**13**	**15**	**14**	**11**	**15**	**15**
AVERAGE	**3**	**2.4**	**2.8**	**2.4**	**3**	**2**	**2.6**	**3**	**2.8**	**2.2**	**3**	**3**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (Autonomous), NAGERCOIL

SEMESTER IV

CORE COURSE VII: GROUPS AND RINGS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU234CC1	5	-	-	-	5	5	75	25	75	100

Pre-requisite:

Basic Algebra

Learning Objectives:

1. To introduce the concepts of Group Theory and Ring Theory.
2. To gain more knowledge essential for higher studies in Abstract Algebra.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	recall the definitions of groups, rings, functions and also examples of groups and rings	**K1**
2	explain the properties of groups, rings and different types of groups and rings	**K2**
3	develop proofs of results on Permutation groups, Cyclic groups, Quotient group, Subgroups, sub rings, quotient rings	**K3**
4	test the homomorphic and isomorphic properties of groups and rings	**K4**
5	examine the properties of Ideals – Maximal and Prime ideals – Cosets - order of an element	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate;

Units	Contents	No. of Hours
I	**Groups:** Groups – Definition and examples - Abelian – non abelian- Permutations – Order of a group-A cycle of length r-Disjoint cycles- Transposition-Odd and Even Permutations-Alternating group.	**15**
II	**Subgroups**: Subgroups – Centre of a group - Normalizer – Cyclic groups- Generator of a group – Order of an element - Cosets and Lagrange's theorem-Euler's Theorem-Fermat's Theorem	**15**
III	**Normal subgroups**: Normal subgroups and Quotient groups – Isomorphism – Cayley's Theorem - Automorphism - Inner Automorphism - Kernal – Fundamental theorem of homomorphism.	**15**
IV	**Rings:** Rings – Definition and examples- Elementary properties of rings.- Isomorphism of rings-Types of Rings-Skew field (or) division ring-Field- Zero divisor-Integral domain-Characteristic Rings - Subrings - Sub fields	**15**
V	**Ideals**: Ideals -Left ideal-Right Ideal-Principal Ideal domain Quotient rings-Maximal and Primal ideals-Homomorphism of Rings- Fundamental theorem of Homomorphism of rings-Unique factorization domain- Euclidean domain-Every P.I.D is a U.F.D**.**	**15**
	Total	**75**

Self-study	Elementary properties of rings

Textbook

1. Arumugam, S., & Thangapandi Issac, A., 2016. *Modern Algebra*, Scitech Publications.
   Chapter3: Sections 3.1-3.11
   Chapter4: Sections 4.1 to 4.15 (except 4.12)

Reference Books

1. Singh, S., & Zameeruddeen, Q., 2006. *Modern Algebra*, 8th Edition, Vikas Publishing House.
2. Santiago, M. C., 2011. *Modern Algebra*, 1st Edition, Tata McGraw Publishing Company Limited.
3. Gopalakrishnan, N. S., 2015. *University Algebra*, 3rd Edition, New Age International Publishers.
4. Vatsa, B. S., & Vatsa, S., 2010. *Modern Algebra*, 2nd Edition, New Age International Publishers.
5. Gallian, J. A., 1999. *Contemporary Abstract Algebra*, 4th Edition, Narosa Publishing.

Web Resources

1. https://www.scribd.com/presentation/533922913/Rings-and-Fields1
2. https://www.google.com/url?sa=i&url=https%3A%2F%
3. https://library.icts.res.in/cgi-bin/koha/opac-detail.pl?biblionumber=29833
4. https://programsandcourses.anu.edu.au/2022/course/math2322/second%20semester/6042
5. https://www.routledge.com/Groups-Rings-and-Group-Rings/Giambruno-PolcinoMilies-Sehgal/p/book/9781584885818

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	3	2	2	3	3	3	3	3
CO2	3	2	3	3	3	2	3	3	3	1	3	3
CO3	3	2	3	2	3	2	2	3	3	1	3	3
CO4	3	2	3	3	3	2	3	3	2	3	3	3
CO5	3	3	2	3	3	2	3	3	3	3	3	3
TOTAL	**15**	**12**	**14**	**12**	**15**	**10**	**13**	**15**	**14**	**11**	**15**	**15**
AVERAGE	**3**	**2.4**	**2.8**	**2.4**	**3**	**2**	**2.6**	**3**	**2.8**	**2.2**	**3**	**3**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (AUTONOMOUS), NAGERCOIL

SEMESTER IV

CORE COURSE VIII: ELEMENTS OF MATHEMATICAL ANALYSIS

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU234CC2	5	-	-	-	5	5	75	25	75	100

Pre-requisite:

Basics in real numbers system.

Learning Objectives:

1. To introduce the primary concepts of sequences and series of real numbers.
2. To develop problem solving skills.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	recall the basic concepts of real numbers, definitions on sequences and series of real numbers	**K1**
2	explain the primary concepts of sequences and series of real numbers	**K2**
3	calculate limit of the sequences and determine the convergence of the series by applying Cauchy's principles, root test and ratio tests	**K3**
4	analyse the properties of real numbers, nature of sequences and series	**K4**
5	evaluate the behavior of sequences and the convergence of series using different types of tests	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate;

Units	Contents	No. of Hours
I	The Real Numbers – The algebraic and order properties of R, Absolute value and the real line. Chapter 1 : Section 1.3 & Chapter 2: Sections 2.1, 2.2 (Robert G. Bartle)	**15**
II	The Real Numbers – The Completeness property of R, Applications of the supremum property, Intervals. Chapter 2: Sections 2.3 – 2.5. (Robert G. Bartle)	**15**
III	Sequences - Range of a sequence – Bounded Sequences – Monotonic Sequences –Convergent Sequences -Divergent and oscillating sequences – The Algebra of Limits - Behaviour of monotonic sequences. Chapter 3: Sections 3.0 to 3.7 (Arumugam)	**15**
IV	Sequences – Some theorems on limits, Subsequences, Limit points, Cauchy sequences. Chapter 3: Sections 3.9 - 3.11. (Arumugam)	**15**
V	Series of Positive Terms – Infinite series, Comparison test, Kummer's test, Root test and condensation test. Chapter 4: Sections 4.1, 4.2, problems related to ratio and root tests from sections 4.3 and 4.4.	**15**
	Total	**75**

Self-study	Range of Sequence, Bounded Sequences and Monotonic Sequences

Textbooks

1. Robert G. Bartle, Donald R. Sherbert,2011. *Introduction to Real Analysis*, (4th Edition), John Wiley & Sons, Inc.

2. Arumugam S., Isaac,2017.*Sequences and series*, New Gamma Publishing House.

Reference Books

1. Malik S.C, Savitha Arora, 1991. *Mathematical Analysis*, Wiley Eastern Limited, New Delhi.
2. Bali N. B., 2005. *Real Analysis*, Laxmi Publications.
3. Somasundaram, D., Choudhary B., 2010. *A First Course in Mathematical Analysis*, Narosa Publishing House Pvt. Ltd.
4. Gupta, S. L, Nisha Rani. 2008. *Fundamental Real Analysis*, Vikas Publishing House Pvt. Ltd.
5. Anthony W. Knapp, 2005. *Basic Real Analysis*, 1st Edition, Birkhauser Boston.

Web Resources

1. https://www.math.ucdavis.edu/~hunter/intro_analysis_pdf/intro_analysis.pdf
2. https://www.math.purdue.edu/~torresm/introduction-real-analysis.html
3.https://web.williams.edu/Mathematics/sjmiller/public_html/372Fa15/handouts/TRENCH_REAL_ANALYSIS.pdf
4. https://www.youtube.com/watch?v=PM9Hx5nBOiY
5. https://youtu.be/PM9Hx5nBOiY

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	2	3	2	3	3	2	2	2
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3
TOTAL	**15**	**10**	**10**	**15**	**10**	**15**	**10**	**15**	**15**	**10**	**10**	**10**
AVERAGE	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**2**

3 – Strong, 2- Medium, 1- Low

HOLY CROSS COLLEGE (AUTONOMOUS) NAGERCOIL

SEMESTER IV

ELECTIVE COURSE IV: TRANSFORM TECHNIQUES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU234EC1	4	-	-	-	3	4	60	25	75	100

Pre-requisite:

Understanding calculus concepts such as differentiation, integration, limits, and series is essential as these concepts form the basis for many transform techniques.

Learning Objectives:

1.To develop proficiency in solving Mathematical problems and analyzing signals using transform techniques.

2. To build a strong foundation in transform techniques and develop problem-solving skills applicable to a wide range of mathematical and engineering contexts.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall basic knowledge about Laplace transforms, inverse Laplace transforms, Fourier series, Fourier transform, and Z-transforms, including their definitions, properties, and fundamental concepts.	**K1**
2.	demonstrate a solid understanding of the principles and concepts underlying Laplace transforms, inverse Laplace transforms, Fourier series, Fourier transform, and Z-transforms, including their applications in mathematical analysis and signal processing.	**K2**
3.	apply Fourier sine and cosine transforms to solve difference equations.	**K3**
4.	apply transform techniques to evaluate integrals, and solve ordinary and partial differential equations with constant and variable coefficients.	**K3, K4**
5.	analyze and decompose periodic functions using the Fourier series, including expansion of periodic functions of period 2π, expansion of even and odd functions, and representation of functions over half intervals.	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** – Evaluate

Units	Contents	No. of Hours
I	The Laplace Transforms-Definitions-Sufficient conditions for the existence of the Laplace transform (without proof)-Laplace transform of periodic functions general theorems-evaluation of integrals using Laplace transform.	**12**
II	The inverse Laplace Transforms- Applications of Laplace Transforms to ordinary differential equations with constant co-efficient and variable co-efficient, simultaneous equations and equations involving integrals..	**12**
III	Fourier series- Expansion of periodic functions of period 2π- Expansion of even and odd functions, Half range Fourier series - Change of intervals.	**12**
IV	Fourier Transform- Infinite Fourier Transform (Complex form) – Properties of Fourier Transform.	**12**
V	Fourier cosine and sine Transform – Properties – Parseval's identity – Convolution theorem.	**12**
	Total	**60**

Self-study	Fourier series- Expansion of periodic functions of period 2π- Expansion of even and odd functions, Half range Fourier series - Change of intervals –Problems.

Textbook

1.Narayanan. S, Manicavachagam Pillai T.K. *Calculus*, Volume III, Ananda Book Depot.

Reference Books

1. Joel L. Schiff, 2013. *The Laplace Transform: Theory and Applications*, Springer-Verlag, New York.
2. Goyal J. K, Gupta K. P, 2013. *Laplace's and Fourier Transforms*, Pragati Prakashan, Meerut.
3. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, 1997. *Signals and Systems*, Second Edition, Prentice Hall Upper Saddle River, New Jersey.
4. Charles L. Phillips, John M. Parr, Eve A. Riskin, 2008. *Signals, Systems, and Transforms*, Fourth Edition, Pearson Prentice Hall, United States of America.
5. Stuller John Alan, 2007. *An Introduction to Signals and Systems*, First Edition, Thomson Press (India) Ltd.

Web Resources

1. http://mathworld.wolfram.com.
2. http://www.sosmath.com.
3. http://www.kavery.org.in/engg/cse-ecourse/MA6351-TPDE.pdf
4. https://mis.alagappauniversity.ac.in/siteAdmin/ddeadmin/uploads/5/__UG_B.Sc._Mathematics_113%2054_Transform%20Techniques_CRC_4892.pdf
5. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMT1401.pdf

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	2	2	2	2
CO2	2	3	3	3	3	3	3	3	2	2	2	2
CO3	3	3	3	3	3	3	3	3	2	2	2	2
CO4	1	3	3	3	3	3	3	3	2	2	2	2
CO5	3	3	2	3	3	3	3	3	2	2	2	2
TOTAL	**12**	**15**	**14**	**15**	**15**	**15**	**15**	**15**	**10**	**10**	**10**	**10**
AVERAGE	**2.5**	**3**	**2.8**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**

3 – Strong, 2- Medium, 1- Low

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SEMESTER III / IV

SKILL ENHANCEMENT COURSE SEC III: FITNESS FOR WELLBEING

Course Code	L	T	P	S	Credits	Total Hours	Marks		
							CIA	External	Total
UG23CSE1	1	-	1	-	2	30	25	75	100

Pre-requisites: Basic understanding of health and wellness concepts

Learning Objectives

1. To understand the interconnectedness of physical, mental, and social aspects of well-being, and recognize the importance of physical fitness in achieving holistic health.
2. To develop proficiency in mindfulness techniques, yoga practices, nutritional awareness, and personal hygiene practices to promote overall wellness and healthy lifestyle.

Course Outcomes

On the successful completion of the course, student will be able to:		
1	know physical, mental, and social aspects of health	K1
2	understand holistic health and the role of physical fitness.	K2
3	apply mindfulness and yoga for stress management and mental clarity.	K3
4	implement proper personal hygiene practices for cleanliness and disease prevention.	K3
5	evaluate and implement right nutritional choices.	K5

K1-Remember; **K2**-Understand; **K3**-Apply; **K5**-Evaluate

Unit	Contents	No. of Hours
I	**Understanding Health and Physical Fitness** Health – definition- holistic concept of well-being encompassing physical, mental, and social aspects. Physical fitness and its components- muscular strength- flexibility, and body composition. Benefits of Physical Activity- its impact on health and well-being.	6
II	**Techniques of Mindfulness** Mind – Mental frequency, analysis of thought, eradication of worries Breathing Exercises – types and its importance Mindfulness –pain management - techniques for practicing mindfulness - mindfulness and daily physical activities.	6
III	**Foundations of Fitness** Stretching techniques to improve flexibility. Yoga-Definition, yoga poses (asanas) for beginners, Sun Salutations (Surya Namaskar), Yoga Nidra – benefits of yoga nidra.	6
IV	**Nutrition and Wellness** Role of nutrition in fitness - macronutrients, micronutrients - mindful eating practices, balanced diet - consequences of overeating. Components of healthy food. Food ethics.	6
V	**Personal Hygiene Practices** Handwashing- techniques, timing, and importance, oral hygiene- brushing, flossing, and dental care, bathing and showering- proper techniques and frequency, hair care- washing, grooming, and maintaining cleanliness, maintaining personal hygiene, dangers of excessive cosmetic use.	6
	Total	30

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Self-study	Balance diet and basic excercises

Textbook

Bojaxa A. Rosy and Virgin Nithya Veena. V. 2024. *Fitness for Wellbeing*.

Reference Books

1. Arul Raja Selvan S. R, 2022. *Yogasanam and Health Science*. Self publisher.
2. Vision for Wisdom. 2016. *Value Education*. The World Community Service Centre Vethathiri Publications.
3. WCSC – Vision for Wisdom. 2016. *Paper 1: Yoga and Empowerment*. Vazhga Valamudan Offset Printers Pvt Ltd 29, Nachiappa St, Erode.
4. Lachlan Sleigh. 2023. *Stronger Together the Family's Guide to Fitness and Wellbeing*. Self Publisher.
5. William P. Morgan, Stephen E. Goldston. 2013. *Exercise And Mental Health*. Taylor & Francis.

Web Resources

1. https://www.google.co.in/books/edition/Psychology_of_Health_and_Fitness/1lYOAwAABAJ?hl=en&gbpv=1&dq=fitness+for+wellbeing&printsec=frontcover
2. https://www.google.co.in/books/edition/The_Little_Book_of_Active_Wellbeing/aA6SzgEACAAJ?hl=en
3. https://www.google.co.in/books/edition/Physical_Activity_and_Mental_Health/yu96DwAAQBAJ?hl=en&gbpv=1&dq=fitness+for+wellbeing&printsec=frontcover
4. https://www.google.co.in/books/edition/The_Complete_Manual_of_Fitness_and_Well/pLPAXPLIMv0C?hl=en&gbpv=1&bsq=fitness+for+wellbeing&dq=fitness+for+wellbeing&printsec=frontcover
5. https://www.google.co.in/books/edition/The_Wellness_Code/4QGZtwAACAAJ?hl=en

HOLY CROSS COLLEGE (AUTONOMOUS) NAGERCOIL

SEMESTER IV

ENVIRONMENTAL STUDIES

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG234EV1	2	-	-	-	2	2	30	25	75	100

Pre-requisite: Interest to learn about nature and surrounding.

Learning Objectives

1.To know the different types of pollutions, causes and effects

2.To understand the importance of ecosystem, resources and waste management

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	know the different kinds of resources, pollution and ecosystems	**K1**
2.	understand the biodiversity and its constituents	**K2**
3.	use the methods to control pollution and, to conserve the resources and ecosystem	**K3**
4.	analyse the factors behind pollution, global warming and health effects for sustainable development	**K4**
5.	evaluate various water, disaster and waste management systems	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate

Units	Contents	No. of Hours
I	**Nature of Environmental Studies** Multidisciplinary nature of environmental studies- scope of environmental studies - environmental ethics-importance- types- natural resources - renewable and non-renewable resources – forest, land, water and energy resources.	**6**
II	**Biodiversity and its Conservation** Definition: genetic, species of biodiversity - biodiversity hot-spots in India - endangered and endemic species of India – Red Data Book - In-situ and Ex-situ conservation of biodiversity. Ecosystem- types - structure and function - food chain - food web- ecological pyramids- forest and pond ecosystems.	**6**
III	**Environmental Pollution** Pollution - causes, types and control measures of air, water, soil and noise pollution. Role of an individual in prevention of pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Disaster management– cyclone, flood, drought and earthquake.	**6**
IV	**Environmental Management and Sustainable Development** From unsustainable to sustainable development -Environmental Law and Policy – Objectives; The Water and Air Acts-The Environment Protection Act -Environmental Auditing-Environmental Impact Assessment-Life Cycle Assessment- Human Health Risk Assessment, Water conservation, rain water harvesting, watershed management.	**6**
V	**Social Issues and the Environment** Population explosion-impact of population growth on environment and social environment. Women and Child Welfare, Role of information technology in environment and human health. Consumerism and waste products. Climate change - global warming, acid rain and ozone layer depletion. **Field work:** Address environmental concerns in the campus (or) Document environmental assets- river / forest / grassland / hill / mountain in the locality (or)	**6**

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	Study a local polluted site-urban / rural / industrial / agricultural area.	
	Total	**30**

Self-study	Pollutants, Ecosystems and Resources

Textbook

Punitha A and Gladis Latha R, 2024. Fundamentals of Environmental Science.

Reference Books

1. Agarwal, K.C., 2001. *Environmental Biology*, Nidi Publishers. Ltd. Bikaner.
2. Brunner R.C., 1989, *Hazardous Waste Incineration*, McGraw Hill Ltd.
3. Gorhani, E & Hepworth, M.T. 2001. *Environmental Encyclopedia*, Jaico Publ. House, Mumbai.
4. De A.K.,2018. *Environmental Chemistry*, Wiley Eastern Ltd.
5. Gleick, H.P. 1993. *Water in crisis*, Pacific Institute for Studies Oxford Univ. Press.

Web Resources

1.https://www.sciencenews.org/topic/environment
2.https://news.mongabay.com/2024/05/
3. https://www.sciencedaily.com/news/earth_climate/environmental_issues/
4.https://wildlife.org/rising-oryx-numbers-may-distress-new-mexico-ecosystem/
5. https://phys.org/news/2024-02-global-wild-megafauna-ecosystem-properties.html

HOLY CROSS COLLEGE (Autonomous) NAGERCOIL

SEMESTER III & IV

LIFE SKILL TRAINING II: CATECHISM

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG234LC1	**1**	**-**	**-**	**-**	**1**	**1**	**15**	**50**	**50**	**100**

Learning Objectives:

1. To develop human values through value education
2. To understand the importance of personal development to lead a moral life

Course Outcomes

On the successful completion of the course, student will be able to:		
1	know and understand the aim and importance of value education	**K1,K2**
2	get rid of inferiority complex and act confidently in the society	**K3**
3	live lovingly by facing loneliness and make decisions on their own	**K3**
4	develop human dignity and able to stand bravely in adversity	**K6**
5	learn unity in diversity and grow in a life of grace	**K6**

K1 - Remember **K2**-Understand; **K3**-Apply; **K6**- Create

Units	Contents	No. of Hours
I	**Face Loneliness:** Loneliness – Causes for Loneliness – Loneliness in Jesus Christ Life – Ways to Overcome Loneliness – Need and Importance Bible Reference: Matthew: 6:5-6	**3**
II	**Inferiority Complex:** Inferiority Complex - Types – Ways to Get Rid of Inferiority Complex – Words of Eric Menthol – Balanced Emotion – Jesus and his Disciples. Bible Reference: Luke 8:43-48	**3**
III	**Decision Making:** Importance of Decision Making – Different Steps – Search – Think – Pray – Decide- Jesus and his Decisions Bible Reference: Mathew 7:7-8 **Independent:** Freedom from Control – Different Types of Freedom - Jesus the Liberator Bible Reference: Mark 10:46-52	**3**
IV	**Human Dignity:** Basic Needs – Factors that Degrade Human Dignity – How to Develop Human Dignity. Bible Reference: Luke 6:20-26 **Stand Bravely in Adversity:** Views of Abraham Maslow – Jesus and his Adversity. Bible Reference: Luke 22:43	**3**
V	**Unity in Diversity:** Need for Unity – The Second Vatican Council on the Mission of Christian Unity. Bible Reference: I Corinthians 1:10 **To Grow in a Life of Grace:** Graceful Life – View of Holy Bible – Moses – Amos – Paul – Graceful Life of Jesus Bible Reference: Amos 5:4	**3**
TOTAL		**15**

Textbooks

Valvukku Valikattuvom, Christian Life Committee, Kottar Diocese

The Holy Bible

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SEMESTER III & IV

LIFE SKILL TRAINING II: MORAL

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
UG234LM1	1	-	-	-	1	1	15	50	50	100

Learning Objectives:

1. To cultivate human values through value education
2. To comprehend the importance of humane and morals to lead ethical and moral life.

Course Outcome

On the successful completion of the course, student will be able to:		
1	know the significance of life	**K1**
2	understand the importance of self-care	**K2**
3	realise the duty of youngsters in the society and live up to it	**K3**
4	analyse how to achieve success in profession	**K4**
5	develop mystical values by inculcating good thoughts	**K5**

K1 - Remember; K2 - Understand; K3 – Apply; K4 - Analyse; K5 – Evaluate

Unit	Contents	No. of Hours
I	**Edu Care:** Introduction- -Personal Care-Temple of Mind-Emotional stability-Inner views- Internal and external Beauty- Life is a Celebration	**3**
II	**Self-care:** Self- discipline- Selfishness in doing good things- Adolescence stage-What am I? - Self-esteem- Self-Confidence- Respect for womanhood	**3**
III	**Profession based Values:** Time Management-Continuous effort- What next? –Present moment is yours, Hard work and Smart Work-Broad view- destruct your failures	**3**
IV	**Mystical Values:** Thoughts- Positive and negative thoughts- Origin of negative thoughts-Moralisation of needs- Elimination of obstacles	**3**
V	**Society and you:** Knowing Humanity-Thankfulness- love and happiness- Honesty-Heroism -Youth is gift of God-Youngsters in politics and social media utilization.	**3**
TOTAL		**15**

Textbook

"Munaetrathin Mugavari", G. Chandran, Vaigarai Publisher.

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SEMESTER IV

SELF LEARNING COURSE II: ANALYSIS AND FORECASTING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
MU234SL1/ MU236SL1	-	-	-	-	**1**	-	-	**25**	**75**	**100**

Pre-requisite:

Basic knowledge of Probability Theory.

Learning Objectives:

1. To learn why time series analysis is useful in different areas like finance and economics, helping people make smart decisions based on past data.
2. To discover the different parts of a time series, like trends and seasonal patterns, and how to measure and study each one.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	identify the different components of a time series, including trend, seasonal variations, and cyclical patterns	**K1**
2	understand the importance of time series analysis in various fields and how it aids in making informed decisions	**K2**
3	assessing the effectiveness and reliability of the chosen forecasting technique	**K2**
4	differentiate between stationary and non-stationary time series data and analyze autocorrelation functions	**K4**
5	evaluate forecasting procedures to predict future values of a time series with accuracy and reliability	**K5**

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate;

Units	Contents
I	Utility of Time Series Analysis – Components of a Time Series – Fore casting Procedures – Forecasting Performance of Time Series Chapter 1.3, 1.4, 1.7, 1.8
II	Analysis of Time Series - Introduction - Measurement of Trend - Curve Fitting – Gompertz Curve Chapter 2.1, 2.2, 2.3, 2.4
III	Classical Time Series Decomposition - Introduction – Additive and Multiplicative Models – The Seasonal and Cyclical Components – multiplicative Decomposition – Moving Averages Forecasting Chapter 3.1, 3,2, 3.3, 3.4, 3.5
IV	Exponential Smoothing Method - Introduction – The Methodology of Exponential Smoothing – The Single Exponential Smoothing Approach – Double Exponential Smoothing Method Chapter 4.1, 4,2, 4.3, 4.4
V	Stationary and Non Stationary Time Series - Introduction – Probability Models for the Time Series – The Partial Autocorrelation Function Chapter 5.1, 5,2, 5.3

Textbook

Cooray. T.M.J.A,2008. *Applied Time Series Analysis and Forecasting*, Narosa Publishing House Pvt. Ltd, New Delhi

Reference Books

1. Enders, W., 2014. *Applied Econometric Time Series*. Wiley, New York.

2. Box, G.E.P., Jenkins, G.M., Reinsel, G.C., Ljung, G.M., 2015. *Time Series Analysis: Forecasting and Control.* Wiley, Hoboken.
3. Hamilton, J.D., 1994. *Time Series Analysis.* Princeton University Press, Princeton.
4. Brockwell, P.J., Davis, R.A., 2016. *Introduction to Time Series and Forecasting. Springer*, New York.
5. Shumway, R.H., Stoffer, D.S., 2017. Time Series Analysis and Its Applications: With R Examples. Springer, New York.

Web Resources

1. https://otexts.com/fpp3/
2. https://link.springer.com/book/10.1007/978-1-1471-0899-1
3. https://oxford.universitypressscholarship.com/view/10.1093/acprof:oso/9780198776676 76.001.0001/acprof-9780198776676
4. https://books.google.com/books/about/Practical_Time_Series_Forecasting_with_R.html?id=0TJADwAAQBAJ
5. https://towardsdatascience.com/time-series-analysis-in-python-an-introduction-70d5a5b1d52

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	2	3	3	2	3	3	3	3	2
CO2	2	3	3	3	3	2	2	3	3	2	2	2
CO3	3	3	3	3	3	2	2	3	3	3	3	2
CO4	3	3	3	1	3	2	2	3	3	2	3	2
CO5	3	3	3	2	3	2	2	3	3	3	3	3
TOTAL	**13**	**15**	**15**	**11**	**15**	**11**	**10**	**15**	**15**	**13**	**14**	**11**
AVERAGE	**2.6**	**3**	**3**	**2.2**	**3**	**2.2**	**2**	**3**	**3**	**2.6**	**2.8**	**2.2**

3 - Strong, 2- Medium, 1- Low

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