LEARNING OUTCOME BASED CURRICULUM

M.SC STATISTICS

CURRICULUM AND SYLLABI

(FULL TIME AND ONLINE)

2024 Regulations

DEPARTMENT OF MATHEMATICS

DECLARATION

I, **Dr.T. JOHNSON**, Head of MATHEMATICS Department, hereby declare that this copy of the syllabus, M.Sc Statistics (Full Time and Online / 2024 regulations) from page 1 to 76 is the final version which is being taught in the class and uploaded in our University website. I assure that the Syllabus available in our University website is verified and found correct. The Curriculum and Syllabi have been approved by our Academic Council / Vice Chancellor.

Date:
Signature

DEPARTMENT OF MATHEMATICS

VISION STATEMENT

- The Department of Mathematics aspires for the highest standards of excellence in Teaching and Service. The Faculty as well as the Students, seek to be Critical thinkers and Problem solvers who contribute positively to the world in which we live and learn.

MISSION STATEMENT

M1	To provide opportunities for developing high quality Mathematical skills and abilities with an attitude for success
M2	To pursue Research and disseminate Research findings
M3	To Establish Consulting / Research relationship with Industry, Government and other external Agencies

PROGRAMME EDUCATIONAL OBJECTIVE (PEO)

PEO1	To grant a Master's degree course, appropriate to students with great aptitude in Statistics.
PEO2	Can be well prepared for successful careers in the profession or in research & innovation at an industry and/or in government in one or more of discipline of science and/ or sub-disciplines of Statistics.
PEO3	To provide feasible and sustainable solutions for real-life problems.
PEO4	To become professional statisticians in due course and will contribute effectively in service of humankind.

PEO WITH MISSION STATEMENT

	M1	**M2**	**M3**
PEO1	3	3	3
PEO2	3	3	2
PEO3	3	3	3
PEO4	2	3	3

PROGRAM OUTCOMES

PO1	Students gain best knowledge in the fields of Mathematics, Statistics, Finance, and Management.
PO2	Students can Identify, formulate and analyze complex statistical problems reaching substantiated conclusions using first principles of mathematics, natural sciences and statistics.
PO3	Solve the complex mathematical/statistical problems and design the system components or processes that meet the specified needs with appropriate considerations of public health and safety, cultural, societal, and environmental considerations.
PO4	Use research-based methods including design of experiments, analysis and interpretation of data and synthesis of information leading to logical conclusions.
PO5	Furthermore, students have the opportunity to obtain career opportunities in educational institutions, industries, Medical Field, Finance Sector and can also be admitted for research in reputed universities abroad.
PO6	Function effectively as an individual, and as a team member or leader in diverse teams, and in multidisciplinary environment.
PO7	Capability to use ICT tools in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data and further presentation.
PO8	Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.
PO9	Ability to update knowledge and skills, participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

PEO-PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
PEO1	3	3	2	2	3	3	2	3	2
PEO2	3	2	3	2	3	3	3	2	3
PEO3	2	2	3	3	3	2	3	2	2
PEO4	3	3	2	2	3	3	3	2	2

PROGRAMME SPECIFIC OUTCOMES

PSO1: Practical exercises done will enable students to analyze and interpret data and also to draw valid conclusions. This will enable students to face real time applications.

PSO2: To apply statistical sampling and inference techniques in real life situations

PSO3: To apply the techniques of stochastic modelling, experimental design, statistical quality control and lifetime data analysis in real life situations.

PSO4: To understand the applications of statistical techniques using statistical tools and its real time interpretations.

PEO-PSO

	PSO1	PSO2	PSO3	PSO4
PEO1	3	3	3	2
PEO2	3	3	3	3
PEO3	3	3	2	2
PEO4	3	2	3	3

M.Sc STATISTICS (Full Time and Online)

2024 Regulations
(for the students admitted from 2024-25)

I Semester

S. No.	Code	Course	Ty/Lb/IE/ ETL	L	T/S .Lr	P/ R	C
1	HMMS24001	Real Analysis & Linear Algebra	Ty	4	0/0	0/0	4
2	HMMS24002	Probability and Distributions	Ty	4	0/0	0/0	4
3	HMMS24ET1	Sampling Techniques	ETL	3	0/0	1/0	4
4	HMMS24003	Statistical Inference I	Ty	4	0/0	0/0	4
5	HMCC22001	Research Methodology	Ty	3	0/0	0/0	3
		TOTAL					19

II Semester

S. No.	Code	Course	Ty/Lb/IE /ETL	L	T/S .Lr	P/ R	C
1	HMMS24ET2	Statistical Quality Control and Reliability	ETL	3	0/0	1/0	4
2	HMMS24004	Trend Analysis and Index numbers	Ty	4	0/0	0/0	4
3	HMMS24005	Numerical Methods	Ty	4	0/0	0/0	4
4	HMMS24006	Statistical Inference II	Ty	4	0/0	0/0	4
5	HMAC22IXX	Audit Course	IE	2	0/0	0/0	0
		TOTAL					16

III Semester

S. No.	Code	Course	Ty/Lb/IE /ETL	L	T/S .Lr	P/ R	C
1	HMMS24ET3	Design of Experiments	ETL	3	0/0	1/0	4
2	HMOL22IE1	Open Elective (Swayam / NPTEL / Any MOOC)	IE	3	0/0	0/0	3
3	HMMS24EXX	Elective I	Ty	4	0/0	0/0	4
4	HMMS24EXX	Elective II	Ty	4	0/0	0/0	4
5	HMMS24IE1	Project Phase I	IE	0	0/0	2/0	2
		TOTAL					17

IV Semester

S. No.	Code	Course	Ty/Lb/IE/ ETL	L	T/S .Lr	P/ R	C
1	HMMS24ET4	Introduction to R Programming	ETL	3	0/0	1/0	4
2	HMMS24007	Multivariate Analysis and Non – Parametric Methods	Ty	4	0/0	0/0	4
3	HMMS24EXX	Elective III	Ty	4	0/0	0/0	4
4	HMMS24L01	Project Phase II	Lb	0	0/0	9/9	9
5	HMMS24IE2	Research Publication	IE	0	0/0	4/0	2
		TOTAL					23

List of Electives						
Sub. Code	**Title of Subject**	**Ty/Lb /ETL /IE**	L	T/S.Lr	P/R	C
HMMS24E01	Data Mining	Ty	4	0/0	0/0	4
HMMS24E02	Applied Regression Analysis	Ty	4	0/0	0/0	4
HMMS24E03	Survival Analysis	Ty	4	0/0	0/0	4
HMMS24E04	Basic Econometrics	Ty	4	0/0	0/0	4
HMMS24E05	Vital Statistics	Ty	4	0/0	0/0	4
HMMS24E06	Advanced Optimization Techniques	Ty	4	0/0	0/0	4
HMMS24E07	Stochastic Processes and Applications	Ty	4	0/0	0/0	4

AUDIT COURSE							
Sl.No	**Course Code**	**Course Name**	**Ty/Lb /ETL /IE**	**Teaching Scheme**			
				L	**T/S.Lr**	**P/R**	**C**
1	HMAC22I01	English for Research paper Writing	Ty	2	0/0	0/0	0
2	HMAC22I02	Disaster Management	Ty	2	0/0	0/0	0
3	HMAC22I03	Sanskrit for Technical Knowledge	Ty	2	0/0	0/0	0
4	HMAC22I04	Value Education	Ty	2	0/0	0/0	0
5	HMAC22I05	Constitution of India	Ty	2	0/0	0/0	0
6	HMAC22I06	Pedagogy Studies	Ty	2	0/0	0/0	0
7	HMAC22I07	Stress Management by Yoga	Ty	2	0/0	0/0	0
8	HMAC22I08	Personality Development through Life Enlightenment Skills	Ty	2	0/0	0/0	0
9	HMAC22I09	Life skill	Ty	2	0/0	0/0	0

Credit Distribution

Semester	**Credits**
I	19
II	16
III	17
IV	23
TOTAL	**75**

Total No. of credits: 75

TABLE - 1 **Components of Curriculum**

S. No	CATEGORY	Description	No. of Courses	Credits	Total	Credit Weightage In %	Contact hours
1	Core Courses	Core Theory	10	33	41	54.66	495
		Core Lab	04	08			240
2	Elective Courses	Department Electives/ Skill enhancement electives	03	09	09	12.00	135
3	Open Electives	Theory	01	03	03	04.00	45
		Lab					
4	Inter Disciplinary / Allied Courses	Theory				00.00	
		Lab					
5	Humanities & Social Sciences, Life Skills & SoftSkills	Language 1 & 2	N/A		04	05.33	
		English 1 & 2	N/A				
		Mathematics	4	04			60
		Soft Skills	N/A				
		Life Skill	01	00			
		Foreign Language	N/A				
		Environmental Studies					
		Management Papers	N/A				
		Entrepreneurship Development					
		Universal Human values					
		Entrepreneurship	N/A				
6	Projects /Internship /Core Skill	Project	02	11	13	17.33	60
		Core Skills	N/A				
		Internship / NSS / NCC	01	02			30
7	Research Componen t	Research Methodology, Publication, IPR and Patents etc.	02	05	05	6.66	75
8	Any other						
Total			**25**	**75**	**75**	**100**	**1140**

Table 2:

Revision/modification done in syllabus content:

S.No	Course(Subject) Code	Course (Subject) Name	Concept/ topic if any, removed in current curriculum	Concept/topic added in the new curriculum	% of Revision/ Modification done
1	HMMS24ET1	Sampling Techniques	Theory	ETL	40
2	HMMS24ET2	Statistical Quality Control and Reliability	Theory	ETL	40
3	HMMS24ET3	Design of Experiments	Theory	ETL	40
4	HMMS24ET4	Introduction to R Programming	Theory	ETL	40
5	HMCC22001	Research Methodology		Research component	100
6	HMAC22IXX	Audit course			100
7	HMOL22IE1	Open Elective			100
8	HMCF22I03	Research Publication			100
9	HMMS24E07	Stochastic Process and Applications		Elective	100
10	HMMS24007	Multi-Variate Analysis and Non-parametric methods	Test of goodness of fit and two sample problems	Signed test for paired data and K-Sample Test	40
11	HMMS24E04	Basic Econometrics		Elective	100

TABLE 3 : List of New Courses / value added courses / life skills / Electives / interdisciplinary / courses focusing onemployability / entrepreneurship / skill development

S.No	New Courses (subjects)	Value added Courses	Life Skill (Audit Course)	Electives	Inter Disciplinary	Focus on employability / Entrepreneurship / skill development
Sem. 1			English for Research paper Writing	Knowledge Engineering and Expert system	Research Methodology	
			Disaster Management			
			Sanskrit for Technical Knowledge			
			Value Education			
			Constitution of India			
			Pedagogy Studies			
			Stress Management by Yoga			
			Personality Development through Life Enlightenment Skills			
			Life Skill			
Sem. 2	Deep Learning Techniques, Fuzzy Logic and its Applications, Data Analytics Tools, Computational Intelligence			Reinforcement Learning, Data Visualization Techniques		Summer Internship
Sem. 3	Digital and Social Media Analytics, Web Analytics, Optimization Technique	Open Elective (Self study paper) Swayam/ NPTEL/any MOOC paper)		Block Chain and Artificial Intelligence, Multimedia Analytics		
Sem.4	Research Publication					Project Work

Subject Code: **HMMS24001**	Subject Name: **Real Analysis & Linear Algebra**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	**P/ R**	C
	Prerequisite: Basics of Calculus and Algebra	**Ty**	**4**	**0/0**	**0/0**	**4**
	L : Lecture T : Tutorial C: Credits					
	OBJECTIVES					

- Can be able to understand the Basic concepts in Real Analysis
- Can be able to understand the concepts in Limits and continuity
- Can be able to understand the Basic concepts in Riemann integrals
- Can be able to understand the concepts in Vector spaces
- Can be able to understand the concepts in Linear transformations

	COURSE OUTCOMES (Cos) Students completing this course will able to
CO1	understand the Basic concepts in Real Analysis
CO2	understand the Basic concepts in Limits and continuity
CO3	understand the Basic concepts in Riemann integrals
CO4	understand the Basic concepts in Vector spaces
CO5	understand the Basic concepts in Linear transformations

Mapping of Course Outcome with Program Outcome (POs)

Cos/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	2	3	3	2	2	1	3	3
CO2	3	2	3	2	3	3	2	3	2
CO3	3	2	2	3	2	3	2	3	3
CO4	3	2	2	2	2	3	2	3	3
CO5	3	2	2	2	2	3	2	3	2

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2
CO2	2	3	2
CO3	2	3	2
CO4	2	3	2
CO5	3	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
				√					

Subject Code: **HMMS24001**	Subject Name: **Real Analysis & Linear Algebra**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	**P/ R**	C
	Prerequisite: Basics of Calculus and Algebra	**Ty**	**4**	**0/0**	**0/0**	**4**

UNIT – I Sequence and Series **12 Hours**

Continuity and Derivability of a real valued function – Uniform Continuity – Point wise Convergence of sequence and series of functions – Uniform Convergence and its applications (without proof)

UNIT – II Limit and Continuity **12 Hours**

Limit, Continuity and Derivability of functions of two variables. Maxima and Minima of functions of two variables only

UNIT – III Integral Calculus **12 Hours**

The Riemann Integral – Partitions and Sums – Upper and Lower R – Integrals – Riemann Integrability – Riemann's necessary and sufficient conditions for R – Integrability – Problems – Algebra of Integrable functions. Fundamental theorem of Integral Calculus – First and Second Mean Value Theorems

UNIT- IV Vector Spaces **12 Hours**

Vector Spaces, Subspaces, Linear Independence and Dependence – Basis and Dimension – Sum of subspaces - Coordinates.

UNIT –V Linear Transformation **12 Hours**

Linear Transformation, the Algebra of Linear Transformations, Isomorphism, Representation of Transformations by Matrices – Linear Functional

Total: 60 HRS

References Books:

1. Walter Rudin (1976) Principles of Mathematical Analysis, Third Edition, McGraw Hill.
2. Apostol, T.M (1985) Mathematical Analysis, Narosa.
3. White, A.J (1968) Real Analysis: An Introduction, Addison Wesley Publishing Co.
4. Kenneth Hoffman, Ray Kunze (1996) Linear Algebra, Prentice Hall India.
5. Finkbeiner , D. T (1978) Introduction to Matrices and Linear Transformations, W.H.Freeman & Co.

Subject Code: **HMMS24002**	Subject Name: **Probability and Distributions**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	**P/ R**	C
	Prerequisite: Basics of Probability	**Ty**	**4**	**0/0**	**0/0**	**4**

L : Lecture T : Tutorial C: Credits

OBJECTIVES

- Can be able to understand the Basic concepts in measures of central tendency
- Can be able to understand the Basic concepts in Correlation
- Can be able to understand the Basic concepts in Probability
- Can be able to understand the Basic concepts in Index numbers
- Can be able understand the Basic concepts in Time series

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	Understand the basic concepts of Statistics and various measures of Central Tendency and Dispersion
CO2	Understand the concept of Probability
CO3	Understand the Basic concepts in correlation
CO4	Understand the basic concepts of distributions
CO5	Learn about law of large numbers

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	3	3	3	3	2	2	3	2
CO2	3	2	3	3	3	2	1	3	3
CO3	3	3	3	2	2	3	2	3	3
CO4	3	3	3	2	2	2	2	3	1
CO5	2	3	3	2	2	3	3	2	2

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	2	3
CO5	2	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
				√					

Subject Code: **HMMS24002**	Subject Name: **Probability and Distributions**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	**P/ R**	C
	Prerequisite: Basics of Probability	**Ty**	**4**	**0/0**	**0/0**	**4**

UNIT - I Basic Statistics **12 Hours**

Variables – Uni-variate Data, Frequency Distribution, Measures of Central Tendency, Mean –Median – Mode, Quartiles, Measures of Dispersion – The Range – Quartile Deviation –Standard Deviation, Relative Measures of Dispersion, Coefficient of Variation, Quartile Coefficient of Variation, Measures of Skewness &Kurtosis.

UNIT -II Basics of Probability **12 Hours**

Axioms of Probability, Conditional probability, Total probability, Baye's Theorem, Random variable Probability mass function, Probability density function, Properties, Moments (Definition and simple problems).

UNIT- III Correlation and Regression **12 Hours**

Bi-Variate data, Applications of Correlation: Karl Pearson's Coefficient of Correlation, Rank Correlation: Spearman's Rank Correlation, Linear Regression.

UNIT –IV Basic Statistical Distribution and Central Limit Theorem **12 Hours**

Binomial, Poisson, Geometric, Uniform, Exponential, Normal distributions, Central Limit Theorem, Lindeberg-Levy Theorem, Cramer's Theorem

Unit – V Law of Large Numbers **12 Hours**

Chebychev's Inequality, Generalized Form of Bienaymc-Chebychev's Inequality. Weak Law of Large Numbers, Bernoulli's Law of Large Numbers,Khinchin's Theorem,Borel-CantelIi Lemma. *(Zero-One Law)*

Total: 60 HRS

Reference Books:

1. Gupta S.C., Kapoor V.K., *Fundamentals of Mathematical Statistics*, S.Chand & Co.,(2007).
2. Veerarajan T., *Probability, Statistics and, Random Processes*, Tata McGraw Hill Publishing., (2008).
3. Richard Johnson A., *Miller & Freund's Probability and statistics for Engineers (9th ed),* Prentice Hall of India, (2016).
4. Bhat, B. R. : Modern probability Theory, 3rd Edition, New Age India
5. Rohatgi, V. K. : Introduction to Probability Theory and Mathematical Statistic.

Subject Code: **HMMS24ET1**	Subject Name: **Sampling Techniques**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	P/R	C
	Prerequisite: Basics of Probability	**ETL**	**3**	**0/0**	**1/0**	**4**

L : Lecture T : Tutorial C: Credits

OBJECTIVES

- Can be able to understand the Basic concepts in Sampling
- Can be able to understand the Basic concepts in Random sampling
- Can be able to understand the Basic concepts in stratified sampling
- Can be able to understand the Basic concepts in systematic sampling
- Can be able to understand the Basic concepts in cluster sampling

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the Basic concepts in Sampling
CO2	understand the Basic concepts in Random sampling
CO3	understand the Basic concepts in stratified sampling
CO4	understand the Basic concepts in systematic sampling
CO5	understand the Basic concepts in cluster sampling

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	3	2	2	3	3	3	3	2
CO2	3	3	2	3	3	2	2	3	3
CO3	3	2	2	3	3	1	3	2	3
CO4	3	2	3	2	2	2	1	2	2
CO5	3	3	2	2	3	3	1	3	2

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	2	3
CO5	2	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
				√					

Subject Code: **HMMS24ET1**	Subject Name: **Sampling Techniques**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	**P/ R**	C
	Prerequisite: Basics of Probability	**ETL**	**3**	**0/0**	**1/0**	**4**

UNIT I - Introduction **9 Hours**

Advantages of the sampling method – The Principal steps in a sample survey – the role of sampling theory – probability sampling – alternatives to probability sampling – use of the Normal distribution – Bias and its effects

UNIT II - Simple Random Sampling **9 Hours**

Selection of Simple Random Sampling – Definition and Notation – properties of the estimates – variance of the estimates – confidence limits – random sampling with replacement – estimation of a ratio

UNIT III- Stratified Random Sampling **9 Hours**

Notations – properties of estimates – estimated variance and confidence – limits – optimum allocation – estimation of sample size with continuous data – Stratified sampling for proportions – estimation of sample size with proportions

UNIT IV - Systematic Sampling **9 Hours**

Variance of the estimated mean – comparison of Systematic with stratified random sampling – populations in random order – population with linear trend – methods for population with linear trend – populations with periodic variation – Auto correlated populations – Natural Populations

UNIT V - Cluster Sampling **9 Hours**

Reasons for Cluster Sampling – A Simple Rule – Cluster Sampling for proportions – Cluster units of unequal sizes – Sampling probability proportional to size – Selection with unequal probabilities with replacement – the optimum measure of size – sampling with unequal probabilities without replacement

Practicals: **15 Hours**

Simple Random Sampling with replacement and without replacement - Stratified Random Sampling - Systematic Sampling - Linear and Circular Systematic Sampling - Cluster Sampling problems.

Total: 60 HRS

Reference Books:

1. William G. Cochran (1977), Sampling Techniques third edition, John Wiley & Sons
2. S.C Gupta and V.K. Kapoor (2001), Fundamentals of Applied Statistics third edition, Sultan Chand & Sons.

Subject Code: **HMMS24003**	Subject Name: **Statistical Inference I**	**Ty/Lb/ ETL/IE**	**L**	**T / S.Lr**	**P/R**	C
	Prerequisite: Basics of Probability and Analysis	**Ty**	**4**	**0/0**	**0/0**	**4**
	L : Lecture T : Tutorial C: Credits					

OBJECTIVES

- To understand the Basic concepts of estimators
- To understand the Basic concepts of Minimum Variance Unbiased (M.V.U.) Estimator
- To understand the Basic concepts of Cramer-Rao Inequality
- To understand the Basic concepts in methods of estimation
- To understand the Basic concepts in confidence intervals

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the Basic concepts of estimators
CO2	understand the Basic concepts of Minimum Variance Unbiased (M.V.U.) Estimator
CO3	understand the Basic concepts of Cramer-Rao Inequality
CO4	understand the Basic concepts in methods of estimation
CO5	understand the Basic concepts in confidence intervals

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	2	3	3	2	3	2	3	2
CO2	2	2	3	2	3	2	3	2	2
CO3	2	1	2	2	2	1	2	2	1
CO4	3	2	3	2	2	3	3	3	3
CO5	3	2	3	3	2	3	2	3	3

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2
CO2	3	3	3
CO3	2	2	2
CO4	3	3	3
CO5	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
				√					

Subject Code: **HMMS24003**	Subject Name: **Statistical Inference I**	**Ty/Lb/ ETL/IE**	**L**	**T / S.Lr**	**P/R**	C
	Prerequisite: Basics of Probability and Analysis	**Ty**	**4**	**0/0**	**0/0**	**4**

Unit –I Properties of Estimators **12 Hours**

Characteristics of Estimators, Invariance Property of Consistent Estimators, Sufficient Conditions for Consistency, Efficient Estimators, Most Efficient Estimator'

Unit –II Factorization Theorem **12 Hours**

Minimum Variance Unbiased (M.V.U.) Estimator, Sufficiency, Factorization Theorem (Neyman), Fisher-Neyman Criterion

Unit –III Cramer-Rao Inequality **12 Hours**

Cramer-Rao Inequality, Minimum Variance Bound (MVB) estimator, Complete Family of Distributions. MVU and Blackwellisation. (Rao-Blackwell Theorem), MVUE

Unit –IV Methods of Estimation **12 Hours**

Methods or Estimation, Method of Maximum Likelihood Estimation, Method of Minimum Variance, Method of Moments, Invariance Property of MLE

Unit –V Confidence Intervals **12 Hours**

Confidence Interval and Confidence Limits, Confidence Intervals for Large Samples.

Total Hours:60

References Books:

1. Rohatgi, V.K.: An Introduction to Probability Theory and Mathematical Statistics (Wiley Eastern).
2. Gupta S.C., Kapoor V.K., Fundamentals of Mathematical Statistics, S. Chand & Co.,(2007).
3. Milton and Arnold – Introduction to probability and Statistics (4th Edition)-TMH publication.
4. Goon AM, Gupta MK, Das Gupta B: Outlines of Statistics, Vol-II, the World Press Pvt. Ltd., Kolkata.

Subject Code: HMCC22001	Subject Name: RESEARCH METHODOLOGY	Ty/Lb/ ETL/EVL	L	T/SLr	P/R	C
	Prerequisite: None	Ty	3	0/0	0/0	3

L:LectureT:TutorialSLr:SupervisedLearningP:ProjectR:ResearchC:CreditsT/L/ETL:Theory/Lab /Embedded Theory and Lab

OBJECTIVES:

- Design and formulation of research problem.
- Analyze research related information and statistical methods in research.
- Carryout research problem individually in a perfect scientific method
- Understand the filing patent applications processes, Patent search, and various tools of IPR, Copyright, and Trademarks

COURSEOUTCOMES(Cos): (3–5)Students completing the course were able to

CO1	Design and Formulation of research problem.
CO2	Analyze research related information and statistical methods in research.
CO3	Carryout research problem individually in a perfect scientific method
CO4	Understand Patent Filing application Process.
CO5	Patent Search and various tools used.

Mapping of Course Outcomes with Program Outcomes(POs)

COs/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	2	2	3	3	3	2	1	3	2
CO2	3	2	1	3	3	1	1	1	1	2	3	2	1
CO3	3	3	2	1	2	2	3	3	3	2	3	2	1
CO4	3	3	2	2	1	2	2	2	2	3	2	1	1
CO5	3	3	3	3	3	2	3	3	3	2	1	1	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Program Core	Program Elective	Humanities and Social Science	Open Elective	Skill Enhancing Elective	Inter Disciplinary /Allied	Skill Component	Practical / Project /Internship	Others
			✓						

Subject Code: HMCC22001	Subject Name: RESEARCH METHODOLOGY	Ty/Lb/ ETL/VL	L	T/SLr	P/R	C
	Prerequisite: None	Ty	3	0/0	0/0	3
L:LectureT:TutorialSLr:SupervisedLearningP:ProjectR:ResearchC: CreditsT/L/ETL:Theory/Lab /Embedded Theory and Lab						

Unit I **9Hrs**

Introduction to research, Definitions and characteristics of research, Types of Research, Research, Process,Problemdefinition,Objectives of Research, Research Questions, Research design, Quantitative vs. Qualitative Approach, Building and Validating Theoretical Models, Exploratory vs. Confirmatory Research, Experimental vs. Theoretical Research, Importance of reasoning in research.

Unit II **9Hrs**

Problem Formulation, Understanding Modeling & Simulation, Literature review, Referencing, Information Sources, Information Retrieval, Indexing and abstracting services, Citation indexes, Development of Hypothesis, Measurement Systems Analysis, Error Propagation, Validity of experiments, Statistical Design of Experiments, Data/Variable Types& Classification, Data collection, Numerical and Graphical Data Analysis: Sampling, Observation, Interpretation of Results.

Unit III **9Hrs**

Statistics: Probability & Sampling distribution, Estimation, Measures of central Tendency, Arithmetic mean, Median, Mode, Standard deviation, Coefficient of variation (Discrete serious and continuous serious),Hypothesis testing & application, Correlation & regression analysis, Orthogonal array, ANOVA, Standard error, Concept of point and interval estimation, Level of significance, Degree of freedom, Analysis of variance, One way and two way classified data,'F' test.

Unit IV **9Hrs**

Preparation of Dissertation and Research Papers, Tables and illustrations, Guide lines for writing the abstract, introduction, methodology, results and discussion ,conclusion sections of a manuscript. References, Citation and listing system of documents.

Unit V **9Hrs**

Intellectual property rights (IPR) patents copyrights Trademarks Industrial design geographical indication. Ethics of Research Scientific Misconduct Forms of Scientific Misconduct. Plagiarism, Unscientific practices in thesis work, Ethics in science.

Total Hrs: 45

Text Books:

1. K.S. Bordens, andB.B.Abbott,,"ResearchDesignandMethods– AProcessApproach",8thEdition,McGrawHill,2011.
2. C.R. Kothari, "ResearchMethodology– MethodsandTechniques",2ndEdition,NewAgeInternationalPublishers.

Subject Code: **HMMS24ET2**	Subject Name: **Statistical Quality Control and Reliability**	**Ty/Lb/ ETL/IE**	**L**	**T / S.Lr**	P/R	**C**
	Prerequisite: HMMS24002 – Probability and Distributions	**ETL**	**3**	**0/0**	**1/0**	**4**
	L : Lecture T : Tutorial C: Credits					
	OBJECTIVES					

- Can be able to understand the Basic concepts in SQC
- Can be able to understand the Basic concepts in Control charts
- Can be able to understand the Basic concepts in sampling plans
- Can be able to understand the Basic concepts in reliability
- Can be able to understand the Reliability function

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the Basic concepts in SQC
CO2	understand the Basic concepts in Control charts
CO3	understand the Basic concepts in sampling plans
CO4	understand the Basic concepts in reliability
CO5	understand the Reliability Function

Mapping of Course Outcome with Program Outcome (POs)

Cos/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	3	2	3	3	2	3	2	3
CO2	3	3	3	2	3	3	3	2	2
CO3	3	3	2	3	3	3	3	3	2
CO4	2	3	2	2	2	2	2	2	3
CO5	2	2	3	2	1	2	2	1	1

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2
CO2	3	3	3
CO3	3	2	3
CO4	2	2	3
CO5	2	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project		Internships/ Technical Skills		Soft Skills
				√							

Subject Code: **HMMS24ET2**	Subject Name: **Statistical Quality Control and Reliability**	**Ty/Lb/ ETL/IE**	**L**	**T / S.Lr**	P/ R	**C**
	Prerequisite: HMMS24002 – Probability and Distributions	**ETL**	**3**	**0/0**	**1/0**	**4**

Unit –I Basics of Control Charts **9 Hours**

Introduction, Basics of statistical quality control, Definition, Benefits of statistical quality control, Process control and product control ,Control limits, Specification limits and tolerance, limits . Control charts, control limits, Tools for S.Q.C. control charts for variables, $\bar{X}$ and R charts criterion for detecting lack of control in $\bar{X}$ and R charts, Interpretation of $\bar{X}$ and R charts ,Control chart for standard deviation

Unit –II Control Charts for Attributes **9 hours**

Control charts for attributes, control chart for fraction defective (p-chart), control chart for number of defectives (d-chart), control chart for number of defects per unit (c-chart) c-chart for variable sample size or u-chart

Unit – III Acceptance Sampling **9 hours**

Natural tolerance limits and specification limits, acceptance sampling inspection plans, sampling inspection plans for attributes single sampling plan, double sampling plan, single sampling *vs.* double sampling plans, sequential sampling plan

Unit –IV Basics of Reliability **9 Hours**

Component reliability and hazard models, MTTF, Derivation of reliability function by Markov model, system reliability models in series and parallel

Unit –V Parallel System Analysis **9 Hours**

K out of m systems, non- series parallel systems, maintainability function, Availability function, 2-unit parallel system with repair.

Practicals: **15 Hours**

Control charts for variables - $\bar{X}$ and R charts criterion for detecting lack of control in $\bar{X}$ and R charts - Interpretation of $\bar{X}$ and R charts - Control chart for standard deviation - control chart for fraction defective (p-chart) - control chart for number of defectives (d-chart) - control chart for number of defects per unit (c-chart)c-chart for variable sample size or u-chart - Finding Quality parameters for Single Sampling Plan - Double Sampling Plan

Total: 60 HRS

References Books:

1. Douglas C. Montgomery, Introduction to Statistical Quality Control, Wiley Eastern (2020)
2. Gupta S.C., Kapoor V.K., Fundamentals of Applied Statistics, S.Chand & Co.,(2007).
3. Arum Kumar, Alka Chaudhary, Applied Statistics, Krishna Prakasan,(2009)
4. John T. Burr Elementary Statistical Quality Control, 2nd Edition, CRC Press (2004).
5. Balagurusamy.E, Reliability Engineering, Tata McGraw Hill Education Pvt Ltd., Thirteenth reprint, (2012)
6. Grant, E.L. and R.S. Leaven worth (2004)- Statistical Quality Control, 2nd edition, Mc-Graw Hill Book Co.

Subject Code: **HMMS24004**	Subject Name: **Trend Analysis and Index numbers**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: HMMS24002 – Probability and Distributions	**Ty**	**3**	**1/0**	**0/0**	**4**
	L : Lecture T : Tutorial C: Credits					

OBJECTIVES

- Can be able to understand the concepts in Time series
- Can be able to understand the concepts in moving averages
- Can be able to understand the concepts in seasonal variation
- Can be able to understand the concepts in regression
- Can be able to understand the concepts in index numbers

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the concepts in Time series
CO2	understand the concepts in moving averages
CO3	understand the concepts in seasonal variation
CO4	understand the concepts in regression
CO5	understand the concepts in index numbers

Mapping of Course Outcome with Program Outcome (POs)

Cos/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	3	3	3	3	3	3	2	2
CO2	3	3	3	2	2	3	2	2	2
CO3	3	3	3	2	2	3	3	3	3
CO4	3	3	3	3	3	3	3	2	3
CO5	3	3	3	3	3	3	3	3	2

COs /PSOs	**PSO1**	**PSO2**	**PSO 3**
CO1	3	3	3
CO2	3	3	3
CO3	3	2	2
CO4	3	3	3
CO5	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
				√					

Subject Code: **HMMS24004**	Subject Name: **Trend Analysis and Index numbers**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: HMMS24002 – Probability and Distributions	**Ty**	**3**	**1/0**	**0/0**	**4**

Unit – I Basic Components of Time Series **12 Hours**

Components of Time series, trend, periodic changes, irregular (or random) component, Analysis of time series, Mathematical models for time series, uses of time series.

Unit - II Measurement of Trend Methods **12 Hours**

Measurement of Trend, graphic method, method of semi-averages, method of curve fitting by principle of least squares, growth curves and their fitting, moving average method, approximation to moving averages

Unit – III Measurement of Seasonal Variation Methods **12 Hours**

Measurement of seasonal variations, method of simple averages, ratio to trend method, ratio to moving average method, link relative method, de-seasonalisation of data, measurement of cyclic variations

Unit – IV Auto-Regression Analysis **12 Hours**

Auto-regression series first order auto-regression series (Markoff's series), second order auto-regression series (Yule's series), general auto-regression, Variate difference method

Unit – V Basics of Index Numbers **12 Hours**

Index numbers, construction of index numbers, Laspeyre's method, Paasche's method, Fisher method, Price index.

Total: 60 HRS

References Books:

1. Douglas. C. Montgomery, Cheryl Jennings, Murat Kuhalci. *Introduction to Time Series and Forecasting,* Second Edition, Wiley Eastern Pub.
2. A.K. Sharma, *Text Book of Index Number and Time Series*, Discovery publishing house,(2005)
3. Gupta S.C., Kapoor, V.K., *Fundamentals of Applied Statistics*, S. Chand & Co.,(2007).
4. Shumway & Stoffer (2011) *Time Series Analysis and its applications, with examples in R,* 3rd edition, Springer.
5. Brockwell & Davis (2016*) Introduction to Time Series and Forecasting*, 3rd edition, Springer.

Subject Code: **HMMS24005**	Subject Name: **Numerical Methods**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	**P/ R**	C
	Prerequisite: Algebra and Calculus	**Ty**	**3**	**1/0**	**0/0**	**4**
	L : Lecture T : Tutorial C: Credits					

OBJECTIVES

- Can be able to understand the Basic concepts in curve fitting
- Can be able to understand the Basic concepts in matrix methods
- Can be able to understand the concepts to solve equations
- Can be able to understand the Basic concepts in forward and backward differences
- Can be able to understand the concepts in numerical integration and differentiation

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the Basic concepts in curve fitting
CO2	understand the Basic concepts in matrix methods
CO3	understand the concepts to solve equations
CO4	understand the Basic concepts in forward and backward differences
CO5	understand the concepts in numerical integration and differentiation

Mapping of Course Outcome with Program Outcome (POs)

Cos/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	2	3	3	3	3	2	3	2
CO2	3	2	2	2	2	2	2	3	2
CO3	3	2	2	3	2	2	2	2	2
CO4	2	2	1	2	2	1	2	2	2
CO5	2	3	2	3	2	1	3	2	2

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3
CO2	3	3	3
CO3	3	2	2
CO4	3	2	2
CO5	2	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
				√					

Subject Code: **HMMS24005**	Subject Name: **Numerical Methods**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	**P/ R**	C
	Prerequisite: Algebra and Calculus	**Ty**	**3**	**1/0**	**0/0**	**4**

UNIT I CURVE FITTING & FINITE DIFFERENCES **12 Hours**

Curve Fitting-Method of group Averages-Principle of least square-Method of moments-Finite differences-Operators (Forward, Backward & Shifting) -Relationship between the operators

UNIT II SOLUTION OF SYSTEM OF EQUATIONS **12 Hours**

Gauss Elimination method – Gauss-Jordan method – Iterative methods – Gauss-Jacobi method – Gauss-Seidel method – Matrix Inversion by Gauss-Jordan method

UNIT III SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS **12 Hours**

Method of false position -Fixed point iteration method (single and multi variables)- Newton-Raphson method (single and multi variables)

UNIT IV NUMERICAL INTERPOLATION **12 HOURS**

Newton forward and backward differences – Central differences – Stirling's and Bessel's formulae – Interpolation with Newton's divided differences – Lagrange's method

UNIT V NUMERICAL DIFFERENTIATION AND INTEGRATION **12 Hours**

Numerical differentiation with interpolation polynomials – Numerical integration by Trapezoidal and Simpson's (both 1/3 rd & 3/8 th) rules – Two and three point Gaussian Quadrature formulae – Double integrals using Trapezoidal and Simpson's rules

Total: 60 HRS

Reference Books:

1. Veerarajan T., Numerical Methods, Tata McGraw Hill Publishing Co., (2007)
2. Sastry S.S., Introductory Methods of Numerical Analysis, Prentice Hall of India, (2012)

Subject Code: **HMMS24006**	Subject Name: **Statistical Inference II**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	**P/ R**	C
	Prerequisite: HMMS24003– Statistical Inference I	**Ty**	**3**	**1/0**	**0/0**	**4**
	L : Lecture T : Tutorial C: Credits					

OBJECTIVES

- Can be able to understand the Basic concepts in hypothesis
- Can be able to understand the Basic concepts in unbiased tests
- Can be able to understand the Basic concepts in normal population
- Can be able to understand the Basic concepts in non-parametric tests
- Can be able to understand the Basic concepts in sequential analysis

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the Basic concepts in hypothesis
CO2	understand the Basic concepts in unbiased tests
CO3	understand the Basic concepts in normal population
CO4	understand the Basic concepts in non-parametric tests
CO5	understand the Basic concepts in sequential analysis

Mapping of Course Outcome with Program Outcome (POs)

Cos/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	3	3	2	3	3	3	3	3
CO2	2	2	3	2	3	2	2	3	2
CO3	3	2	3	2	3	3	3	2	2
CO4	3	2	3	2	3	3	3	3	2
CO5	2	2	3	1	3	2	2	2	1

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3
CO2	3	3	3
CO3	3	2	2
CO4	3	3	3
CO5	2	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
				√					

Subject Code: **HMMS24006**	Subject Name: **Statistical Inference II**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	**P/ R**	C
	Prerequisite: HMMS24003– Statistical Inference I	**Ty**	**3**	**1/0**	**0/0**	**4**

Unit –I Basics of Testing of Hypothesis **12 Hours**

Introduction, Statistical Hypothesis (Simple and-Composite), Test of a Statistical Hypothesis, Null Hypothesis, Alternative Hypothesis, Critical Region, Types of Errors, level of Significance Power of the Test Steps in Solving Testing of Hypothesis Problem Optimum Tests Under Different Situations, Most Powerful Test (MP Test.). Uniformly Most Powerful Test

Unit –II Neyman-Pearson Fundamental Lemma **12 Hours**

Neyman-Pearson lemma, Unbiased Test and Unbiased Critical Region, Optimum Regions and Sufficient Statistics, likelihood Ratio Test, Properties of Likelihood Ratio Test.

Unit –III Statistical Testing Procedures **12 Hours**

Test for the Mean of a Normal Population, Test for the Equality of Means of Two Normal Populations, Test for the Equality of -Means of Several Normal Populations, Test for the Variance of a Normal Population, Test for Equality of Variances of two Normal populations, Test for the Equality of Variances of several Normal Populations

Unit –IV Basics of Non-Parametric Methods **12 Hours**

Non-parametric Methods, Advantages and Disadvantages of NP Methods over Parametric Methods - Kolmogrov – Smirnov one sample test – Ordinary sign test – Paired sample sign test

Unit –V Sequential Analysis **12 Hours**

Sequential Analysis, Sequential Probability Ratio Test (SPRT), Operating Characteristic (O.C.) Function of S.P.R.T, Average Sample Number (A.S.N.).

Total: 60 HRS

References Books:

1. Rohatgi, V.K.: An Introduction to Probability Theory and Mathematical Statistics (Wiley Eastern).
2. Gupta S.C., Kapoor V.K., Fundamentals of Mathematical Statistics, S.Chand & Co.,(2007).
3. Milton and Arnold – Introduction to probability and Statistics (4th Edition)-TMH publication.
4. Goon AM, Gupta MK, Das Gupta B : Outlines of Statistics , Vol-II, the World Press Pvt. Ltd., Kolkata.

Subject Code: **HMMS24ET3**	Subject Name: **Design of Experiments**	**Ty/Lb/ ETL/IE**	**L**	**T / S.Lr**	**P /R**	C
	Prerequisite: HMMS24003 Sampling Techniques	**ETL**	**3**	**0/0**	**1/0**	**4**
	L : Lecture T : Tutorial C: Credits					

OBJECTIVES

- **Can be able to understand the Basic concepts in data classification**
- **Can be able to understand the Basic concepts in 2 and 3-way classification**
- **Can be able to understand the Basic concepts in design of experiments**
- **Can be able to understand the Basic concepts in LSD**
- **Can be able to understand the Basic concepts in factorial experiments**

COURSE OUTCOMES (Cos)

Students completing this course will be **able to**

CO1	**understand the Basic concepts in data classification**
CO2	**understand the Basic concepts in 2 and 3 way classification**
CO3	**understand the Basic concepts in design of experiments**
CO4	**understand the Basic concepts in LSD**
CO5	**understand the Basic concepts in factorial experiments**

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	3	3	2	3	3	3	3	3
CO2	3	3	3	2	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3
CO4	2	3	3	2	3	3	3	2	2
CO5	3	3	3	3	3	3	3	2	2

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	**3**
CO2	3	3	**3**
CO3	2	3	**3**
CO4	3	2	**3**
CO5	3	3	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/ Technical Skills	Soft Skills
				√					

Subject Code: **HMMS24ET3**	Subject Name: **Design of Experiments**	**Ty/Lb/ ETL/IE**	**L**	**T / S.Lr**	**P /R**	C
	Prerequisite: HMMS24003 Sampling Techniques	**ETL**	**3**	**0/0**	**1/0**	**4**

Unit I Basics of Analysis of Variance **9 Hours**

ANOVA, Cochran's theorem (Statement only) one - way classification table, one-way classification table with data random effect

Unit II 2- Way Classification and 3- Way Classification **9 Hours**

2- way classification (one observation per cell),2- way classification (one observation per cell random effect model), ANOVA for 2 - way classified data with m observations per cell, ANOVA for 3-way classification.

Unit III Basic Experimental Designs **9 Hours**

Design of experiments, Introduction, terminology, three principles of experimental design, local control, plot size, CRD, RBD, Efficiency of RBD relative to CRD, Estimation of missing values in RBD, LSD, Advantages and disadvantages

Unit IV Statistical Analysis of LSD and ANCOVA **9 Hours**

Statistical analysis of m X m LSD for one observation per experimental unit, examples, Estimation of missing values in LSD, ANCOVA-Formation of table and examples only

Unit V Factorial Experiments **9 Hours**

Factorial experiments, advantages,2^n factorial design, Yate's method for 2^2 experiments, Yate's method for 2^3 experiments, BIBD Analysis.

Practicals: **15 Hours**

Completely Random Design - Randomized Block Design - Latin Square Design - 2^2 experiments - 2^3 experiments

Total: 60 HRS

References Books:

1. Douglas C. Montgomery, Design and analysis of experiments, 7th ed., John Wiley& sons, (2020)
2. Gupta S.C., Kapoor V.K., Fundamentals of Applied Statistics, S.Chand & Co.,(2007).
3. Veerarajan T., Probability, Statistics and Random processes,Tata McGraw Hill Pvt. Ltd.,
4. John T. Burr Elementary Statistical Quality Control, 2nd Edition, CRC Press (2004).
5. Das, M.N. and Giri, N. (1979) : Design and analysis of experiments, Wiley Eastern.

Subject Code: **HMOL22IE1**	Subject Name : **OPEN ELECTIVE (SELF STUDY PAPER) – SWAYAM / NPTEL / ANY MOOC**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: NIL	IE	3	0/0	0/0	3
L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab						

Open Elective (On Line Course through NPTEL/SWAYAM/Any MOOC)

Students should register for the online course with minimum course duration of 8 weeks through the online portals such as NPTEL/SWAYAM/Any MOOC in the beginning of the semester. The course can be core/interdisciplinary in such a way that the same course is not repeated during the course of study.

Students are expected to attend the online classes regularly and submit the weekly assignments before the due dates. Students should appear for the online examination and submit the certificate at the end of the semester. Internal examination will be conducted by the examiners duly appointed by the head of the department.

COURSE CODE: **HMDS22I02**	COURSE NAME:**PROJECT PHASE - I**	**Ty/Lb/ ETL/IE**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: NIL	IE	0	0/0	4/0	2

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL /IE: Theory/Lab/Embedded Theory and Lab/Internal Evaluation

OBJECTIVE:

The students should be made to

- The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue , address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : Students will be able to

CO1	Apply the knowledge and skills acquired in the course of study, addressing a specific problem or issue.
CO2	Design the software system effectively
CO3	Encourage students to think critically and creatively about societal issues and develop user friendly solution.
CO4	Support the field experience and get linked with the professional network.
CO5	Equip the students with industry knowledge and understanding of various possible technologies.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	2	3	2	3	2	2	3
CO2	3	3	3	3	3	3	3	2	2
CO3	3	3	3	3	3	3	3	2	2
CO4	3	2	3	3	3	3	2	3	3
CO5	2	2	2	2	2	2	3	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	2	2	2	2
CO5	3	2	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project
									✓

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
HMDS22I02	PROJECT PHASE – I	IE	0	0/0	4/0	2

DESCRIPTION:

Students should select the area of the project work and complete the literature survey. Student should identify the problem of study and start the work. Students are expected to do the project work **individually**. A guide will be allotted to each student based on the area of the Project work. Project reviews will be conducted once in a fortnight to assess the development of the project work. At the end of the semester students should submit a report of the work completed and should appear for a Project Viva-voce examination conducted by the internal examiner. Continuous assessment mark (50 marks) will be awarded based on the performance in the reviews. End semester mark (50 marks) will be awarded for project viva voce examination.

Total Hours: 60 hrs

Subject Code: **HMMS24ET4**	Subject Name: **Introduction to R Programming**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	P/R	C
	Prerequisite: Basics Statistics	**ETL**	**3**	**0/0**	**1/0**	**4**
	L : Lecture T : Tutorial C: Credits					

OBJECTIVES

- Can be able to understand the Basic concepts in Statistical Distributions
- Can be able to understand the Basic concepts in Statistical Distributions and their applications
- Can be able to understand the Basic concepts in basics of Bi- variate Analysis
- Can be able to understand the Basic concepts in Survival Analysis
- Can be able to understand the Basic concepts in R Graphs

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the Basic concepts in R Programming
CO2	understand the Basic concepts in Probability distributions and testing of hypothesis
CO3	understand the Basic concepts in research and research resources
CO4	understand the Basic concepts in academic writing
CO5	understand the Basic concepts in academic presentation

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	3	3	2	3	3	3	3	3
CO2	3	3	3	2	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3
CO4	2	3	3	2	3	3	3	2	2
CO5	3	3	3	3	3	3	3	2	2

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3
CO2	3	3	3
CO3	2	3	3
CO4	3	2	3
CO5	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
				√					

Subject Code: **HMMS24ET4**	Subject Name: **Introduction to R Programming**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	P/R	C
	Prerequisite: Basics statistics	**ETL**	**3**	**0/0**	**1/0**	**4**

UNIT-I-Introduction to R **9 Hours**

What is R-Installing R-Getting started with R-Console-Importing data-Saving file-R Studio-Descriptive Statistics in R

UNIT-II-Probability distributions and Testing of Hypothesis **9 Hours**

Binomial, Poisson and Normal Distributions-Parametric Tests, Semi-parametric Tests and Non-Parametric Tests

UNIT-III-Bivariate Analysis **9 Hours**

Correlation-Correlation in R-Commander-Simple Linear Regression-Simple Linear Regression in R-Multiple Linear Regression-Multiple Linear Regressions in R

UNIT-IV-Survival Analysis **9 Hours**
Introduction to Survival Analysis-Cox-Proportional Hazard Model-Stratified Cox-Regression model

UNIT-V- R Graphs **9 Hours**
Histogram-Stem & Leaf plot-Q-Q plot-Box-plot-Scatter plot-Pie-Chart-Vertical Bar Chart

Practicals: **15 hours**
Parametric and Non - parametric tests - Correlation - Regression - Survive Curve - Cox Proportional model - Histogram - Stem Leaf plot - Q - Q Plot - Box Plot - Scatter plot-Pie-Chart-Vertical Bar Chart

Total: 60 HRS

REFERENCES
[1] P Dalgaard. Introductory Statistics with R. Springer Verlag, 2002.
[2] D G Rossiter. Introduction to the R Project for Statistical Computing for use at ITC. International Institute for Geo-Information Science & Earth Observation (ITC), Enschede (NL), 3rd edition, 2007.
[3] Brian S. Everitt and Torsten Hothorn, A Handbook of Statistical Analyses Using R.

Subject Code: **HMMS24007**	Subject Name: **Multivariate Analysis and Non- Parametric methods**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	P/R	C
	Prerequisite: HMMS24002 Probability and Distributions	**Ty**	**4**	**0/0**	**0/0**	**4**
	L : Lecture T : Tutorial C: Credits					

OBJECTIVES

- Can be able to understand the Basic concepts in bivariate normal distribution
- Can be able to understand the Basic concepts in multi variate normal distribution
- Can be able to understand the Basic concepts in non-parametric tests
- Can be able to understand the Basic concepts in Kolmogrove Smirnov test
- Ca be able to understand the Basic concepts in Will Coxon and Mann Whitney U test

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the Basic concepts in bivariate normal distribution
CO2	understand the Basic concepts in multi variate normal distribution
CO3	understand the Basic concepts in non-parametric tests
CO4	understand the Basic concepts in sampling tests
CO5	understand the Basic concepts in rank tests

Mapping of Course Outcome with Program Outcome (POs)

Cos/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	2	2	2	3	2	3	2	2
CO2	2	2	2	2	3	2	3	2	2
CO3	3	2	2	3	3	2	2	2	3
CO4	3	2	3	3	3	2	3	2	3
CO5	3	2	3	3	3	2	3	2	3

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2
CO2	2	3	3
CO3	3	3	3
CO4	2	2	3
CO5	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
				√					

Subject Code: **HMMS24007**	Subject Name: **Multivariate Analysis and Non-Parametric methods**	**Ty/Lb/ ETL/IE**	L	**T / S.Lr**	P/ R	C
	Prerequisite: HMMS24002 Probability and Distributions	**Ty**	**4**	**0/0**	**0/0**	**4**

UNIT I Bivariate Normal Distribution **12 Hrs**

Bivariate Normal Distribution (BVN): p.d.f. of BVN, properties of BVN, marginal and conditional p.d.f. of BVN. Multivariate Data: Random Vector: Probability mass/density functions, Distribution function, Mean vector & Dispersion matrix, Marginal & Conditional distributions.

UNIT II Multivariate Normal Distribution and Multiple and Partial Correlation **12 Hrs**

Multivariate Normal distribution and its properties. Sampling distribution for mean vector and variance-covariance matrix. Multiple and partial correlation coefficient and their properties

UNIT III Basics of Non-Parametric Statistical Tests **12 Hrs**

Nonparametric Tests: Introduction and Concept, Parametric versus non-parametric tests, advantages and disadvantages of non-parametric tests. Test for randomness based on total number of runs, Empirical distribution function,

UNIT IV One Sample and Two Sample Non-Parametric Tests **12 Hrs**

Kolmogrov Smirnov test for one sample, Sign tests- one sample. Kolmogrov Smirnov two samples test.

UNIT V Rank Tests **12 Hrs**

Wilcoxon signed rank tests, Wilcoxon-Mann- Whitney U test, Kruskal-Wallis test.

Total: 60 HRS

Reference Books:

1. Bhuyan, KC., Multivariate Analysis and its Applications, New Central Book Agency (P) Limited
2. Gun, A.M., Gupta, M.K. and Das gupta, B.: An Outline of Statistical Theory, Vol.II, (4thed.), World Press.
3. Johnson, R.A. and Wichern, D.W. (2007): Applied Multivariate Analysis, 6thEdn., Pearson & Prentice Hall.
4. Anderson, T.W. (2003): An Introduction to Multivariate Statistical Analysis, 3rdEdn., JohnWile.

COURSE CODE: HMDS22L05	COURSE NAME : PROJECT PHASE – II	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
	Prerequisite: Nil	Lb	0	0/0	18/0	9

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab/ Internal Evaluation

OBJECTIVE:

The students should be made to

- The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue , address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs): Students will be able to

CO1	To explain the functionality of the system
CO2	To express proficiency in handling the technologies
CO3	To support the societal problems
CO4	To summarize the innovative ideas with good documentation
CO5	To validate the implementation of the software/Hardware system

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	3	3	2	3	3	1	2
CO2	3	3	3	3	3	3	3	2	2
CO3	3	3	3	3	3	3	3	2	2
CO4	3	2	3	3	3	3	2	3	3
CO5	1	2	2	2	2	2	3	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	2	2	2	2
CO5	3	2	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project
									✓

COURSE CODE	COURSE NAME	Ty/Lb/ ETL/IE	L	T/S.Lr	P/R	C
HMDS22L05	PROJECT PHASE – II	Lb	0	0/0	18/0	9

DESCRIPTION:

Students are expected to do a Project work either in an Industry or at the University in the area of specialization individually. Each student will be allotted a guide based on the area of Project work

Number of reviews will be conducted during the semester to monitor the development of project. Students have to submit the thesis at the end of the semester and appear for the Project Viva-Voce examination conducted by one internal examiner and one external examiner.

It is mandatory that the student should have presented his project work as a technical paper in National/international conference /Journals. A copy of the certificate in proof of paper presentation should be enclosed in the project report.

50% weightage (100 marks) will be given for the continuous assessment and 50% weightage (100 marks) for the Project viva a voce examination.

In case of industrial project certificate in proof has to be included in the report along with the bonafide certificate.

Subject Code: **HMDS22I03**	Subject Name : **RESEARCH PUBLICATION**	**Ty/Lb/ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: NIL	IE	0	0/0	4/0	2

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits

Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

Students are supposed to prepare and publish the article based on either his term paper or area of research in peer reviewed referred journal. Code of research publication ethics should be followed. After publishing the article students should present a seminar in presence of department faculties and PG students. At the end of semester viva examination will be conducted by the examiners appointed by the Head of the department.

ELECTIVES

Subject Code: **HMMS24E01**	Subject Name: **Data Mining**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Basics of Probability and Analysis	Ty	4/0	0/0	0/0	**4**

L : Lecture T : Tutorial C: Credits

OBJECTIVES

- Can be able to understand the Basic concepts in data mining
- Can be able to understand the Basic concepts in data processing
- Can be able to understand the Basic concepts in classification of data
- Can be able to understand the concepts in advanced classification methods
- Can be able to understand the Basic concepts in outlier analysis

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the Basic concepts in data mining
CO2	understand the Basic concepts in data processing
CO3	understand the Basic concepts in classification of data
CO4	understand the concepts in advanced classification methods
CO5	understand the Basic concepts in outlier analysis

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**			
CO1	3	2	2	2	3	3	2	3	2			
CO2	3	2	3	2	3	3	2	2	2			
CO3	3	2	2	2	3	3	2	2	2			
CO4	3	3	2	2	3	3	2	3	2			
CO5	3	3	2	2	3	3	2	3	2			

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3
CO2	3	2	3
CO3	3	3	3
CO4	2	3	3
CO5	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
					√				

Subject Code: **HMMS24E01**	Subject Name: **Data Mining**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Basics of Probability and Analysis	Ty	4/0	0/0	0/0	**4**
L : Lecture T : Tutorial C: Credits						

UNIT I INTRODUCTION TO DATA MINING **12 Hours**

Data Mining, Introduction, Types of Data and patterns that can Be Mined, Classification and Regression for Predictive Analysis, Cluster Analysis, Outlier Analysis, Technologies Used-Statistics, Machine, Database Systems and Data Warehouses, Information Retrieval

UNIT II DATA PREPROCESSING **12 Hours**

Data Preprocessing, Data Quality: Why Preprocess the Data, Major Tasks in Data Preprocessing
Data Cleaning, Missing Values, Noisy Data, Data Cleaning as a Process, Data Integration, Data Reduction, Data Reduction Strategies, Principal Components, Attribute Subset Selection, Regression and Log-Linear Models: Parametric. Model evaluation and selection.

UNIT III CLASSIFICATION-BASICS **12 Hours**

Classification, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification
Using IF-THEN Rules for Classification, Rule Extraction from a Decision Tree. Rule Induction Using a Sequential Covering Algorithm

UNIT IV CLASSIFICATION: ADVANCED METHODS **12 Hours**

Bayesian Belief Networks, Classification by Back propagation Support Vector Machines, Classification Using Frequent Patterns, k-Nearest-Neighbor Classifiers, Case-Based reasoning.

UNIT V OUTLIER DETECTION **12 HOURS**

Outlier Analysis, Types of Outliers Challenges of Outlier Detection, Outlier Detection Methods, Supervised, Semi-Supervised, and Unsupervised Methods. Statistical Methods, Proximity-Based Methods, and Clustering-Based Methods, Statistical Approaches, Parametric Methods, Nonparametric Methods, Grid-Based Method, Density-Based Outlier Detection, Clustering-Based Approach, Classification-Based Approaches.

Total: 60 HRS

Reference Books:

1. Micheline Kamber, Jian Pei, Jiawei Han,Data Mining Concepts and Techniques, Third Edition, Morgan Kaufmann Publishers, 2012.
2. Florin Gorunescu, Data mining concepts models and techniques, Springer Verlag ,2011.
3. Xindong Wu, Vipin Kumar, The Top Ten Algorithms in Data Mining, CRC press, 2009.

Subject Code: **HMMS24E02**	Subject Name: **Applied Regression Analysis**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: HMMA24002 Probability and Distributions	Ty	4	0/0	0/0	4

L : Lecture T : Tutorial C: Credits

OBJECTIVES

- Can be able to understand the Basic concepts in linear model
- Can be able to understand the Basic concepts in matrices
- Can be able to understand the Basic concepts in regression
- Can be able to understand the Basic concepts in ANOVA
- Can be able to understand the Basic concepts in correlation matrix

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the Basic concepts in linear model
CO2	understand the Basic concepts in matrices
CO3	understand the Basic concepts in regression
CO4	understand the Basic concepts in ANOVA
CO5	understand the Basic concepts in correlation matrix

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	3	3	2	3	3	2	3	2
CO2	3	2	3	2	3	3	3	3	2
CO3	3	3	3	2	3	3	3	2	2
CO4	3	3	3	3	3	3	3	2	2
CO5	3	2	3	3	3	3	2	2	2

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
					√				

Subject Code: **HMMS24E02**	Subject Name: **Applied Regression Analysis**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: HMMA24002 Probability and Distributions	Ty	4	0/0	0/0	4
L : Lecture T : Tutorial C: Credits						

Unit-I Simple Regression **12 Hours**

The Linear Model and Assumptions -Least Squares Estimation -Predicted Values and Residuals -Analysis of Variation in the Dependent - Precision of Estimates - Tests of Significance and Confidence Intervals - Regression Through the - Models with Several Independent Variables -Violation of Assumptions.

Unit-II Matrices **12 Hours**

Basic Definitions - Special Types of Matrices - Matrix Operations - Geometric Interpretations of Vectors. - Linear Equations and Solutions - Orthogonal Transformations and Projections – Eigen values and Eigenvectors -Singular Value Decomposition

Unit-III Multiple Regression in Matrix Notation **12 Hours**

The Model -The Normal Equations and Their Solution - The Y and Residuals Vectors -Properties of Linear Functions of Random Vectors - Properties of Regression Estimates Matrix Formulae.

Unit-IV Analysis of Variance and Quadratic Forms **12 Hours**

Introduction to Quadratic Forms - Analysis of Variance - Expectations of Quadratic - Distribution of Quadratic - General Form for Hypothesis Testing - The General Linear Hypothesis -Special Cases of the General Form - A Numerical Example - Computing Q from Differences in Sums of Squares - The R-Notation to Label Sums of Squares - Example: Sequential and Partial Sums of Squares

Unit-V Five Independent Variables **12 Hours**

Spartina Biomass Production in the Cape Fear Estuary- Regression Analysis for the Full Model-The Correlation Matrix-Multiple Regression Results: Full Model-Simplifying the Model-Results of the Final Model.

Total: 60 HRS

Text Book

1. John O. Rawlings, Sastry G. Pantula, David A. Dickey - Applied Regression Analysis – Springer second edition
2. Sanford Weisberg - Applied Linear Regression - Wiley Fourth Edition

Subject Code: **HMMS24E03**	Subject Name: **Survival Analysis**	**Ty/Lb/ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Basics of Probability	Ty	4	0/0	0/0	4

L : Lecture T : Tutorial C: Credits

OBJECTIVES

- Can be able to understand the Basic concepts in Survival analysis
- Can be able to understand the Basic concepts in survival curves
- Can be able to understand the Basic concepts in hazard models
- Can be able to understand the Basic concepts in Evaluating the Proportional Hazards Assumption
- Can be able to understand the Basic concepts in stratified Cox methods

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the Basic concepts in Survival analysis
CO2	understand the Basic concepts in survival curves
CO3	understand the Basic concepts in hazard models
CO4	understand the Basic concepts in Evaluating the Proportional Hazards Assumption
CO5	understand the Basic concepts in stratified Cox methods

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**			
CO1	3	3	3	2	3	3	3	2	3			
CO2	3	2	3	2	2	3	2	2	3			
CO3	3	3	3	3	3	2	3	3	3			
CO4	2	2	3	2	3	3	3	2	2			
CO5	3	3	3	2	3	3	2	3	3			

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3
CO2	3	3	3
CO3	2	3	3
CO4	2	3	2
CO5	3	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/ Technical Skills	Soft Skills
					√				

Subject Code: **HMMS24E03**	Subject Name: **Survival Analysis**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Basics of Probability	Ty	4	0/0	0/0	4
L : Lecture T : Tutorial C: Credits						

Unit-I Survival Analysis **12 Hours**

Introduction - Survival analysis-Censored Data-Terminology - Goals of survival analysis -Descriptive measures of survival

Unit-II Kaplan-Meier Survival Curves **12 Hours**

Introduction -Kaplan-Meier Survival Curves -The Log-Rank Test - General features of KM curves-The log-rank test for two groups -The log-rank test for several groups- Alternatives to the log rank test-Confidence intervals for KM curves

Unit-III The Cox Proportional Hazards Model **12 Hours**

Cox PH - The formula for the Cox PH model- Why the Cox PH model is - ML estimation of the Cox PH model - Computing the hazard - Interval estimation: interaction- Adjusted survival curves using the Cox PH model - The meaning of the PH assumption - The Cox likelihood - Using age as the time scale

Unit-IV Evaluating the Proportional Hazards Assumption **12 Hours**

Background- Checking the proportional hazards assumption-Graphical approach- log–log plots - observed versus expected plots-The goodness-of-fit (GOF) -Testing approach-Assessing the PH assumption using time dependent covariates

Unit-V The Stratified Cox **12 Hours**

Stratified Cox - General Stratified Cox (SC) Model -The No-Interaction Assumption - How to Test It - Second Example Involving -Several Stratification Variables-A Graphical View of the Stratified Cox Approach-The Stratified Cox Likelihood

Total: 60 HRS

Text Book

1. David G. Kleinbaum, Mitchel Klein-Survival Analysis – Springer Third Edition
2. ELISA T. LEE , JOHN WENYU WANG -Statistical Methods for Survival Data Analysis- A JOHN WILEY & SONS, INC., PUBLICATION
3. JERALD F. LAWLESS -Statistical Models and Methods for Lifetime Data - A JOHN WILEY & SONS, INC., PUBLICATION.

Subject Code: **HMMS24E04**	Subject Name: **Basic Econometrics**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Basics of Statistics	Ty	4	0/0	0/0	4

L : Lecture T : Tutorial C: Credits

OBJECTIVES

- Can be able to understand the Basic concepts in Statistics
- Can be able to understand the Basic concepts in data representation
- Can be able to understand the Basic concepts in measures of central tendency
- Can be able to understand the Basic concepts in probability
- Can be able to understand the Basic concepts in random variables

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the Basic concepts in Statistics
CO2	understand the Basic concepts in data representation
CO3	understand the Basic concepts in measures of central tendency
CO4	understand the Basic concepts in probability
CO5	understand the Basic concepts in random variables

Mapping of Course Outcome with Program Outcome (POs)

Cos/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	3	3	2	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	2	3
CO4	3	3	3	2	3	3	3	3	2
CO5	3	3	3	2	3	2	3	2	2

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	2
CO2	3	2	2
CO3	2	3	3
CO4	3	2	2
CO5	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
					√				

Subject Code: **HMMS24E04**	Subject Name: **Basic Econometrics**	**Ty/Lb/ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: Basics of Statistics	Ty	4	0/0	0/0	4
L : Lecture T : Tutorial C: Credits						

Unit 1: Methodology of Econometrics **12 Hours**

Methodology of Econometrics – Type of Econometrics – Mathematical and Statistical Pre requisites– The role of computer

Unit 2: Single Equation Regression Models **12 Hours**

The nature of Regression Analysis – Two variable Regression Analysis – some basic ideas - Two Variable Regression Model- The problem of Estimation.

Unit 3: Classical Normal Linear Regression Model **12 Hours**

Properties of OLS estimators – The method of maximum likelihood estimation of two variables Regression models

Unit 4: Two variables Regression: Interval Estimation and Testing **12 Hours**

Statistical Perquisites - Interval Estimation – Some basic ideas Confidence intervals for regression Co - efficient, Confidence interval for, and confidence interval for and simultaneously

Unit 5: Regression Analysis and Analysis of Variance **12 Hours**

The problem of prediction - mean prediction - individual prediction – Reporting the results of Regression Analysis – Evaluating the results of Regression Analysis

Total: 60 HRS

Reference Books:

1. Damodaran N. Gujarati (2003) Basic Econometrics, McGraw Hill, USA
2. Damodaran N. Gujarati (2004) Basic Econometrics, Students Solution Manual for use with Econometrics, McGraw Hill, USA

Subject Code: **HMMS24E05**	Subject Name: **Vital Statistics**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: HMMS24002 Probability and Distributions	Ty	4	0/0	0/0	4

L : Lecture T : Tutorial C: Credits

OBJECTIVES

- Can be able to understand the Basic concepts in vital Statistics
- Can be able to understand the Basic concepts in mortality table
- Can be able to understand the Basic concepts in fertility rate
- Can be able to understand the Basic concepts in vital Index
- Can be able to understand the Basic concepts in mortality rate

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the Basic concepts in vital Statistics
CO2	understand the Basic concepts in mortality table
CO3	understand the Basic concepts in fertility rate
CO4	understand the Basic concepts in vital Index
CO5	understand the Basic concepts in mortality rate

Mapping of Course Outcome with Program Outcome (POs)

Cos/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	3	3	3	3	2	2	2	3
CO2	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	2	3	2	2	3	3
CO5	3	3	3	3	3	2	3	3	3

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3
CO2	3	3	3
CO3	3	2	3
CO4	3	3	2
CO5	3	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
					√				

Subject Code: **HMMS24E05**	Subject Name: **Vital Statistics**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: HMMS24002 Probability and Distributions	Ty	4	0/0	0/0	4
L : Lecture T : Tutorial C: Credits						

UNIT I Basic Vital Rates **12 Hours**

Introduction, uses of vital statistics, Methods of obtaining vital statistics measurement of population rates and ratios of vital events measurement of mortality, Crude death rate (C.D.R.) Specific death rates (S.D.R.) Infant mortality rate (I.M.R.) , Standardized death rates

UNIT II Life Table **12 Hours**

Mortality table (or life table), stationary population stable population, central mortality, force of mortality, Assumptions, Descriptions and construction of life table, Uses of life tables, Abridged life table.

UNIT III Fertility Methods **12 Hours**

Reed Merrell method, Greville's method, King's method, Fertility, Crude birth rate (C.B.R.), General fertility rate (G.F.R.) Specific fertility rate (S.F.R.) Total fertility rate (T.F.R.).

UNIT IV Measures of Population Growth **12 Hours**

Measurement of population growth, Pearl's vital index, Gross reproduction rate (G.R.R.), Net reproduction rate (N.R.R.)

UNIT V Laws of Mortality **12 Hours**

Graduation of mortality rates, Makeham's graduation formula, Gompertz Makeham formula for mortality, Makeham's second law of mortality.

Total: 60 HRS

Reference Books:

1. Gupta S.C., Kapoor V.K., Fundamentals of Applied Statistics, S. Chand & Co.,(2007).
2. A.K.Sharma, Textbook of Business Statistics (Unit IV),DPH New Delhi, 2005.

Subject Code: **HMMS24E06**	Subject Name: **Advanced Optimization Techniques**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: HMMS24001 Real Analysis and Linear Algebra	Ty	4	0/0	0/0	4

L : Lecture T : Tutorial C: Credits

OBJECTIVES

- Can be able to understand the Basic concepts in optimization
- Can be able to understand the Basic concepts in linear programming
- Can be able to understand the Basic concepts in transportation problems
- Can be able to understand the Basic concepts in integer programming
- Can be able to understand the Basic concepts in inventory models

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the Basic concepts in optimization
CO2	understand the Basic concepts in linear programming
CO3	understand the Basic concepts in transportation problems
CO4	understand the Basic concepts in integer programming
CO5	understand the Basic concepts in inventory models

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	3	3	3	3	3	3	3	2
CO2	3	3	3	3	2	3	2	3	2
CO3	3	3	3	3	3	3	2	3	2
CO4	2	3	2	3	2	3	2	2	1
CO5	2	3	2	2	2	3	2	2	1

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3
CO2	3	2	2
CO3	3	3	3
CO4	2	3	2
CO5	3	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
					√				

Subject Code: **HMMS24E06**	Subject Name: **Advanced Optimization Techniques**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: HMMS24001 Real Analysis and Linear Algebra	Ty	4	0/0	0/0	4
L : Lecture T : Tutorial C: Credits						

UNIT I Basics of Optimization **12 Hours**

Introduction to Optimization – Classical Optimization Theory – Unconstrained Problems – Necessary and Sufficient Conditions – The Newton - Raphson Method – Constrained Problems Equality Constraints – Inequality Constraints

UNIT II Linear Programming **12Hours**

Introduction to Linear Programming – Two-Variable LP Model – Graphical Solution – Solutions of Maximization and Minimization Models – Simplex Method – Computational Details of the Simplex Algorithm - M-Method –Two-phase Method Degeneracy.

UNIT III Transportation Models **12 Hours**

Transportation Model – Definition – Determination of The Starting Solution – Iterative Computations of the Transportation Algorithm- Simplex Method Explanation of the Method of Multipliers – The Assignment Model – The Hungarian Method – Simplex Explanation of the Hungarian Method – The Transshipment Model.

UNIT IV Integer Programming **12 Hours**

Integer Linear Programming – Illustrative Applications – Branch-and-Bound Algorithm – Cutting Plane Algorithm – Traveling Salesperson Problem – B&B Solution Algorithm.

UNIT V Dynamic Programming Models **12 Hours**

Deterministic Dynamic Programming – Recursive Nature of Computations in DP – Forward and Backward Recursion – Cargo Loading Model – Workforce Size Model – Equipment Replacement Model – Investment and Inventory Models.

Total: 60 HRS

References Books:

1. Taha, H.A (2002), Operations Research- An Introduction, Prentice Hall India.
2. Hillier, Lieberman (2001) An Introduction to Operations Research, McGrawHill,
3. Wagner, H.M (2000) Principles of Operations Research, Prentice-Hall India,.
4. Nocedal, Wright, (2003) Numerical Optimization, Springer.
5. Gupta, P.K Man Mohan (2001) Problems in Operations Research, Sultan Chand.

Subject Code: **HMMS24E07**	Subject Name: **Stochastic Processes and Applications**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: HMMS24002 Probability and Distributions	Ty	4	0/0	0/0	4

L : Lecture T : Tutorial C: Credits

OBJECTIVES

- Can be able to understand the Basic concepts in transforms
- Can be able to understand the Basic concepts in Markov chains
- Can be able to understand the Basic concepts in Markov processes
- Can be able to understand the Basic concepts in Renewal processes
- Can be able to understand the Basic concepts in Queuing problems

COURSE OUTCOMES (Cos)

Students completing this course will be able to

CO1	understand the Basic concepts in transforms
CO2	understand the Basic concepts in Markov chains
CO3	understand the Basic concepts in Markov processes
CO4	understand the Basic concepts in Renewal processes
CO5	understand the Basic concepts in Queuing problems

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**			
CO1	3	2	3	2	2	2	3	3	2			
CO2	3	2	2	2	3	2	3	3	2			
CO3	3	3	2	2	2	3	2	3	2			
CO4	2	2	2	2	1	2	2	2	1			
CO5	3	2	2	2	3	2	3	3	2			

COs /PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2
CO2	3	3	3
CO3	3	3	3
CO4	2	2	2
CO5	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/ Project	Internships/ Technical Skills	Soft Skills
					√				

Subject Code: **HMMS24E07**	Subject Name: **Stochastic Processes and Applications**	**Ty/Lb/ ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: HMMS24002 Probability and Distributions	Ty	4	0/0	0/0	4
L : Lecture T : Tutorial C: Credits						

UNIT I Basics of Stochastic Process **12 Hrs**

Generating Function: Mean and Variance, Generating Function of Bivariate Distribution, Laplace Transform, Some Important Properties of Laplace Transforms, Inverse Laplace Transform, Laplace (Stieltjes) Transform of a Probability Distribution or Random Variable, The Laplace Transform of the Distribution Function in Terms of the Density Function

UNIT II Markov Chains Models **12 Hrs**

Markov chains Transition Matrix, Order of a Markov Chain, Markov Chains as Graphs, Higher Transition Probabilities, Markov-Bernoulli Chain Classification of States: Determination of Higher Transition Probabilities Aperiodic Chain: Limiting Behaviour, Stability of A Markov System, Computation of the Equilibrium Probabilities, Reducible Chains, Finite Reducible Chains with a Single Closed Class, Chain with One Single Class of Persistent Non-null, Aperiodic States, Absorbing Markov Chains

UNIT III Markovian Process **12 Hrs**

Markov Processes with Continuous State Space Introduction: Brownian Motion Wiener Process, Differential Equations for A Wiener Process, Kolmogorov Equations, First Passage Time Distribution for Wiener Process, Distribution of the First Passage Time to a Fixed Point, Ornstein-Uhlenbeck Process

UNIT IV Renewal Theory **12 Hrs**

Renewal Processes and Theory, Renewal Process, Renewal Process in Discrete Time
Renewal Theory in Discrete Time, Renewal Processes in Continuous Time, Renewal Function and Renewal Density Renewal Equation, Stopping Time, Wald's Equation, Renewal Theorem, Elementary Renewal Theorem, Applications, Renewal Theorems (Blackwell's and Smith's)

UNIT V Applications of Stochastic Models **12 Hrs**

Applications in Stochastic Models, Queueing Systems and Models, Queueing Processes, Steady State Distribution, Little's Formula, Birth and Death Processes in Queueing Theory. The Model M/M/S, Model M/M/S/S: Erlang Loss Model, Non-Markovian Queueing Models, Queues with Poisson Input: Model M/G/1, Pollaczek-Khinchine Formula, Busy Period, Markov Chain Monte Carlo (MCMC) simulation.

Total: 60 HRS

Reference Books:

1. Medhi, J, Stochastic Processes, New Academic Science, 2009.
2. Sheldon Ross, Simulation, Academic Press fifth edition, 2013.
3. Sheldon M. Ross · Stochastic Processes, Wiley Eastern,1995

AUDIT COURSES

Subject Code: HMAC22I01	Subject Name ENGLISH FOR RESEARCH PAPER WRITING	TY/ LB/ ETP/ IE	L	T	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives To know the art of writing the research paper and thesis to Ensure the good quality of paper at very first-time submission.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

CO1	Understand that how to improve your writing skills and level of readability
CO2	Learn about what to write in each section
CO3	Understand the skills needed when writing a Title
CO4	Understand the skills needed when writing a Abstract
CO5	Understand the skills needed for writing a manuscript ready for submission

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	1	1	1	1	1	3	1	1	1			
CO2	1	1	1	1	1	3	1	1	1			
CO3	1	1	1	1	1	3	1	1	1			
CO4	1	1	1	1	1	3	1	1	1			
CO5	1	1	1	1	1	3	1	1	1			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	1	1	1				
CO2	1	1	1				
CO3	1	1	1				
CO4	1	1	1				
CO5	1	1	1				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program Core	Program elective	Humanities and social Science	Open Elective	Skill enhancing elective	Inter Disciplinary/Allie	Skill Component	Practical /Project/internship	Others			
						✓						

Subject Code: HMAC22I01	Subject Name ENGLISH FOR RESEARCH PAPER WRITING	TY/ LB/ ETP/ IE	L	T	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

UNIT I: **5 Hrs**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II: **5 Hrs**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT III: **5 Hrs**

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

UNIT IV: **5Hrs**

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

UNIT V: **5Hrs**

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT VI: **5Hrs**

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Total no of Hours: 30

TEXT / REFERENCE BOOKS

- Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
- Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
- Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
- Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Subject Code: HMAC22I02	Subject Name DISASTER MANAGEMENT	TY/ LB/ ETP/ IE	L	T	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives: Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

CO1	Evaluate disaster risk reduction and humanitarian response policy and practice from Multiple perspectives.
CO2	Develop an understanding of standards of humanitarian response and practical relevance in Specific types of disasters and conflict situations.
CO3	Understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	3	1	1	1			
CO2	1	1	1	1	1	3	1	1	1			
CO3	1	1	1	1	1	3	1	1	1			

COs / PSOs	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	1	1	1
CO3	1	1	1

1/2/3 **indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Program Core	Program elective	Humanities and social Science	Open Elective	Skill enhancing elective	Inter Disciplinary/Allie	Skill Component	Practical /Project/internship	Others
						✓			

Subject Code: HMAC22I02	Subject Name DISASTER MANAGEMENT	TY/ LB/ ETP/ IE	L	T	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

UNIT I INTRODUCTION **5 Hrs**

Disaster: Definition, Factors and Significance; Difference Between HazardAnd Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS: **5 Hrs**

Economic Damage, Loss OfHuman And Animal Life, Destruction Of Ecosystem.Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods,Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA **5 Hrs**

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards WithSpecial Reference To Tsunami; Post-Disaster Diseases And Epidemics.

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT **5 Hrs**

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard;EvaluationOf Risk: Application of remote sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT V RISK ASSESSMENT **5 Hrs**

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

UNIT VI DISASTER MITIGATION **5 Hrs**

Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation,Programs Of Disaster Mitigation In India.

Total No. of Hours: 30

SUGGESTED READINGS:

- R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'NewRoyal book Company.
- Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall OfIndia, New Delhi.
- Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &DeepPublication Pvt. Ltd., New Delhi.

Subject Code: HMAC22I03	Subject Name SANSKRIT FOR TECHNICAL KNOWLEDGE	TY/ LB/ ETP/ IE	L	T	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives To get a working knowledge in illustrious Sanskrit, the scientific language in the world Learning of Sanskrit to improve brain functioning, to develop the logic in mathematics, science & other subjects enhancing the memory power. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

CO1	Understanding basic Sanskrit language
CO2	Ancient Sanskrit literature about science & technology can be understood
CO3	Being a logical language will help to develop logic in students

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	1	1	1	1	1	3	1	1	1			
CO2	1	1	1	1	1	3	1	1	1			
CO3	1	1	1	1	1	3	1	1	1			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	1	1	1					
CO2	1	1	1					
CO3	1	1	1					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program Core	Program elective	Humanities and social Science	Open Elective	Skill enhancing elective	Inter Disciplinary/Allie	Skill Component	Practical /Project/internship	Others			
						✓						

Subject Code: HMAC22I03	Subject Name SANSKRIT FOR TECHNICAL KNOWLEDGE	TY/ LB/ ETP/ IE	L	T	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

UNIT I **10 Hrs**

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences

UNIT II **10 Hrs**

Order Introduction of roots Technical information about Sanskrit Literature

UNIT III **10 Hrs**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Total No. of Hours: 30

TEXT BOOKS/ REFERENCE

- Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
- "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
- "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Subject Code: HMAC22I04	Subject Name VALUE EDUCATION	TY/ LB/ ETP/ IE	L	T	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives .Understand value of education and self- development, Imbibe good values in students. Let them should know about the importance of character.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to

CO1	Knowledge of self-development
CO2	Learn the importance of Human values
CO3	Developing the overall personality

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	1	1	1	1	1	3	1	1	1			
CO2	1	1	1	1	1	3	1	1	1			
CO3	1	1	1	1	1	3	1	1	1			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	1	1	1				
CO2	1	1	1				
CO3	1	1	1				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program Core	Program elective	Humanities and social Science	Open Elective	Skill enhancing elective	Inter Disciplinary/Allie	Skill Component	Practical /Project/internship	Others			
						✓						

Subject Code: HMAC22I04	Subject Name VALUE EDUCATION	TY/ LB/ ETP/ IE	L	T	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

UNIT I **6 Hrs**

Values and self-development –Social values and individualattitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments

UNIT II **8 Hrs**

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

UNIT III **8 Hrs**

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labor. Universal brotherhood and religious tolerance True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT IV **8 Hrs**

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

Total No. of Hours: 30

Suggested reading

Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford UniversityPress, New Delhi

Subject Code: HMAC22I05	Subject Name : CONSTITUTION OF INDIA	TY/ LB/ ETP/ IE	L	T / S	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism To address therole of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to know

CO1	Understand and explain the significance of Indian Constitution as the fundamental law of the land
CO2	Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building.
CO3	Analyze the Indian political system, the powers and functions of the Union, State and Local Governments in detail
CO4	Understand Electoral Process, Emergency provisions and Amendment procedure.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	1	1	1	1	1	3	1	1	1			
CO2	1	1	1	1	1	3	1	1	1			
CO3	1	1	1	1	1	3	1	1	1			
CO4	1	1	1	1	1	3	1	1	1			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	1	1	1				
CO2	1	1	1				
CO3	1	1	1				
CO4	1	1	1				

1/2/3 **indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Program Core	Program elective	Humanities and social Science	Open Elective	Skill enhancing elective	Inter Disciplinary/Allie	Skill Component	Practical /Project/internship	Others			
						✓						

Subject Code: HMAC22I05	Subject Name : CONSTITUTION OF INDIA	TY/ LB/ ETP/ IE	L	T / S	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

UNIT I: HISTORY OF MAKING OF THE INDIAN CONSTITUTION: 3 Hrs

History Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble Salient Features

UNIT II PHILOSOPHY 3 Hrs

Philosophy of the Indian Constitution: Preamble Salient Features

UNIT III: CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES: 6 Hrs

Fundamental Rights, Right to Equality , Right to Freedom , Right against Exploitation, Right to Freedom of Religion , Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy and Fundamental Duties.

UNIT IV: ORGANS OF GOVERNANCE 6 Hrs

Parliament Composition, Qualifications and Disqualifications, Powers and Functions Executive President, Governor Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions.

UNIT V: LOCAL ADMINISTRATION: 6 Hrs

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayat raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT VI: ELECTION COMMISSION 6 Hrs

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Total Number of Hours: 30

TEXT / REFERENCE BOOKS:

- The Constitution of India, 1950 (Bare Act), Government Publication.
- Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
- M. P. Jain, Indian Constitution Law, 7th Edn. Lexis Nexis, 2014. 4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Subject Code: HMAC22I06	Subject Name: PEDAGOGY STUDIES	TY/ LB/ ETP/ IE	L	T / S	P/ R	C
	Prerequisite: Nil	IE	2	0	0	0

L :Lecture T :Tutorial P:ProjectR:ResearchC:CreditsT/L:Theory/Lab

ObjectivesStudentswillbeableto:4.Reviewexistingevidenceonthereviewtopictoinformprogramme design and Policy making undertaken by the DfID, other agencies and researchers.5.Identify critical evidence gaps to guide the development.

COURSEOUTCOMES(COs):Attheendofthiscoursethestudentswouldbeabletoknow

CO1	What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?
CO2	What is the evidence on the effectiveness of the seped agogical practices, in what conditions, And with what population of learners?
CO3	Howcanteachereducation(curriculumandpracticum)andtheschoolcurriculumand Guidance materials best support effective pedagogy?

Mapping of Course Outcomes with Program Outcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	1	1	1	1	1	3	1	1	1			
CO2	1	1	1	1	1	3	1	1	1			
CO3	1	1	1	1	1	3	1	1	1			
COs / PSOs	**PSO1**	**PSO2**	**PSO3**									
CO1	1	1	1									
CO2	1	1	1									
CO3	1	1	1									

H/M/L indicates Strength of Correlation 3- High,2-Medium, 1-Low

Category	Program Core	Program elective	Humanities and social Science	Open Elective	Skill enhancing elective	Inter Disciplinary/Allie	Skill Component	Practical /Project/internship	Others			
						✓						

Subject Code: HMAC22I06	Subject Name: PEDAGOGY STUDIES	TY/ LB/ ETP/ IE	L	T / S	P/ R	C
	Prerequisite: Nil	IE	2	0	0	0

UNIT I: INTRODUCTION AND METHODOLOGY: **6 Hrs**

Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

UNIT II: THEMATIC OVERVIEW: **6 Hrs**

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT III: EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES **6 Hrs**

Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV: PROFESSIONAL DEVELOPMENT: **6 Hrs**

Alignment with classroom practices and follow up support Peer support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes

UNIT V: RESEARCH GAPS AND FUTURE DIRECTIONS **6 Hrs**

Research design Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Total Number of Hours: 30

TEXT / REFERENCE BOOKS:

- Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261. 2.
- Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379. 3.
- Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
- Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and

reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282. 5.

- Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
- Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
- www.pratham.org/images/resource%20working%20paper%202.pdf.

Subject Code : HMAC22I07	Subject Name : STRESS MANAGEMENT BY YOGA	TY/ LB/ ETP/ IE	L	T / S	P/ R	C
	Prerequisite : None	IE	2	0	0	0

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :
To introduce health psychology and arrive at the introduction to the philosophy and practice of yoga.

COURSE OUTCOMES (Cos) : (3 – 5)
Students completing the course were able to

CO1	Compile the models of health and the psychological component of health
CO2	Classify healthy behavior and health compromising behavior
CO3	Deduce the impact of stress on health and apply effective stress management strategies
CO4	Extrapolate the role of yoga in health care

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	1	1	1	1	1	3	3			
CO2	3	3	2	1	1	1	1	3	3			
CO3	3	3	2	1	1	1	1	3	3			
CO4	3	3	2	1	1	1	1	3	3			
COs/PSOs	PSO1	PSO2	PSO3									
CO1	1	1	1									
CO2	1	1	1									
CO3	1	1	1									
CO4	1	1										

Category	Program Core	Program elective	Humanities and social Science	Open Elective	Skill enhancing elective	Inter Disciplinary/Allied	Skill Component	Practical /Project/internship	Others	
						✓				

Subject Code : HMAC22I07	Subject Name : STRESS MANAGEMENT BY YOGA	TY/ LB/ ETP/ IE	L	T / S	P/ R	C
	Prerequisite : None	IE	2	0	0	0

UNIT I UNDERSTANDING STRESS 6 Hrs

Stress and lifestyle disorders: Meaning and definition, development of stress; nature of stressors: Frustration, pressure; Factors predisposing stress: life events and daily hassles; Burnout. Coping with stress: Problem oriented and emotion oriented. Stress management: Meaning and definition; Changing thoughts, behavior and physiological responses.

UNIT II YOGA PHILOSOPHY 10 Hrs

Introduction to Yoga and Yogic Practices – Definition, History, Aim and Objectives, Four Paths of Yoga and Principles of Yoga, Hatha Yoga – Distinction between Yoga and Non Yogic Practices, Concept of Yogic diet, Purpose and Utility of Asanas in Hatha Yoga , Introduction to Patanjali,

UNIT III YOGA IN HEALTH CARE 14 Hrs

Yoga for specific lifestyle disorders: Asthma, Sleeplessness, Diabetes, Blood pressure and Heart Diseases. Research evidence on the impact of yoga intervention on lifestyle disorders. Halasana and Matsyasana for Thyroid, Dhanurasana and Bhujangasana for Polycystic Ovarian Syndrome Disease, Shishuasana and AdhoMukhaSvanasana for Arthritis, SuptaMatsyendrasana and Vrikshasana for Lower back pain, ArdhaMatsyendrasana and Chakrasana for Diabetes, Apanasana and Paschimottanasana for Indigestion and Stomach Disorder, Padmasana and Sirsasana for Migraine, BaddhaKonasana and Sukhasana for Depression, Balasana and Shavasana for Sleeplessness. Evaluation of the applications of psychological knowledge in the area of health and identification of gaps.

Total no. of periods: 30

REFERENCES

- Taylor, S.E (2006). Health Psychology. New Delhi: Tata McGraw Hill
- Serafini, E.P & Smith T.W. (2012). Health Psychology: Bio psychosocial Interventions. New Delhi: Wiley
- Hatha Yoga Pradipika by Swami Svatmarama.
- BKS Iyengar (2013). YOGA - The Path to Holistic Health

Subject Code: HMAC22I08	Subject Name PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	TY/ LB/ ETP/ IE	L	T	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

Objectives To learn to achieve the highest goal happily, To become a person with stable mind, pleasing personality and determination. To awaken wisdom in student

COURSE OUTCOMES (COs) : At the end of this course the students would be able to know

CO1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
CO2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity
CO3	Study of Neetishatakam will help in developing versatile personality of students.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	1	1	1	1	1	3	1	1	1			
CO2	1	1	1	1	1	3	1	1	1			
CO3	1	1	1	1	1	3	1	1	1			

COs / PSOs	PSO1	PSO2	PSO3						
CO1	1	1	1						
CO2	1	1	1						
CO3	1	1	1						

1/2/3 **indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Program Core	Program elective	Humanities and social Science	Open Elective	Skill enhancing elective	Inter Disciplinary/Allied	Skill Component	Practical /Project/internship	Others			
						✓						

Subject Code: HMAC22I08	Subject Name PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	TY/ LB/ ETP/ IE	L	T	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0
L : Lecture T : Tutorial	P : Project R : Research C: Credits T/L: Theory/Lab					

UNIT I: NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY 10 Hrs

Verses- 19,20,21,22 (wisdom) Verses- 29, 31, 32 (pride & heroism) Verses- 26,28,63,65 (virtue) Verses- 52, 53, 59 (dont's)Verses-71, 73, 75, 78 (do's)

UNIT II APPROACH TO DAY TO DAY WORK AND DUTIES. 10 hrs

Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47, 48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5, 13, 17, 23, 35, Chapter 18-Verses 45, 46, 48.

UNIT III STATEMENTS OF BASIC knowledge. 10hrs

Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16, 17, 18 Personality of Role model.Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36, 37, 42, Chapter 4-Verses 18, 38, 39 Chapter18 –Verses 37, 38, 63

Total Number of Hours: 30

TEXT / REFERENCE BOOKS

1."Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath,
3. Rashtriya Sanskrit Sansthanam, New Delhi.

Subject Code: HMAC22I09	Subject Name LIFE SKILLS	TY/ LB/ ETP/ IE	L	T	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L: Theory/Lab

OBJECTIVES

Understand the positive effect of being open to experiences, Be familiar with impulse control and pro social behaviour Describe emotional intelligence, social intelligence, and integrative thinking for effective Leadership Describe basic managerial skills. And self-management skills.

COURSE OUTCOMES (COs) : At the end of this course the students would be able to know

CO1	Develop the tendency to accept self and others unconditionally
CO2	Regulate their emotional impulsivity and demonstrate pro social behaviour
CO3	Inculcate emotional and social intelligence and integrative thinking for effective Leadership.
CO4	Demonstrate a set of practical skills such as time management, self-management, handling conflicts, and team leadership.
CO5	Create and maintain an effective and motivated team to work for the society

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	1	1	1	1	3	2	2	1	1			
CO2	1	1	1	1	3	2	1	1	1			
CO3	1	2	1	1	3	3	1	1	2			
CO4	2	2	1	1	3	3	2	1	3			
CO5	1	2	1	1	3	3	2	1	2			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	1	1	1				
CO2	1	1	1				
CO3	1	1	1				
CO4	1	1	1				
CO5	1	1	1				

1/2/3 **indicates Strength of Correlation 3- High, 2- Medium, 1-Low**

Category	Program Core	Program elective	Humanities and social Science	Open Elective	Skill enhancing elective	Inter Disciplinary/Alli	Skill Component	Practical /Project/internshi	Others			
						✓						

Subject Code: HMAC22I09	Subject Name LIFE SKILLS	TY/ LB/ ETP/ IE	L	T	P/ R	C
	Prerequisite: Nil	IE	2	0/0	0/0	0
L : Lecture T : Tutorial	P : Project R : Research C: Credits T/L: Theory/Lab					

UNIT I: OPENNESS TO EXPERIENCE **6 Hrs**

Developing the tendency to accept and appreciate self and others, the Insights, ideas, values, feelings, and behaviors, cultivate willingness to try new things as well as engage in imaginative and intellectual activities, and creative thinking "thinking outside of the box." Skills.

UNIT II: CONSCIENTIOUSNESS **6 Hrs**

Developing the ability to regulate their impulse control in order to engage in goal-directed behaviors, managing negative emotions such as anger, worry, and sadness and Developing organized and structured approach

UNIT III: PRO SOCIAL BEHAVIOR **6 Hrs**

Pro social behavior:developing trust, altruism, kindness, affection, empathetic understanding, Sharing, comforting and cooperating, Assertiveness, emotional expressiveness and social interaction.

UNIT IV: INNOVATIVE LEADERSHIP **6 Hrs**

Understanding: Concept of emotional and social intelligence, the persona of a leader for deriving holistic inspiration, Drawing insights for leadership, leadership qualities essential to sail through difficult situations, Importance of ethics, Ethical decision-making, Personal and professional moral codes of conduct, Creating a harmonious life.

UNIT V: MANAGEMENT SKILLS : **6 Hrs**

Basic Managerial Skills - Planning for Effective Management, Organize Teams, Delegation of Tasks, Time Management, Conflict and Stress Management. Self-management Skills -Understanding Self-concept, Developing Self-awareness, Self-examination, Self-reflection and introspection, Self-regulation.

Total Number of Hours: 30

REFERENCES AND SUGGESTED READINGS

- A.Pervin& O. P. John (Eds.), Handbook of personality: Theory and research (Vol. 2, pp. 102–138). New York: Guilford Press.
- Harry Beilin (1982) The Development of Prosocial Behavior, Academic Press
- Ashokan, M. S. 2015. Karmayogi: A Biography of E. Sreedharan. London: Penguin.
- O'Toole, J. 2019. The Enlightened Capitalists: Cautionary Tales of Business Pioneers Who Tried to Do Well by Doing Good. New York Harper Collins
- Brown, T. 2012. Change by Design. Harper Business, New , New York
- Lynn A.B. 2015. The Emotional Intelligence Activity Book: 50 Activities for Promoting EQ at Work, Gildan Media Corporation, New York

- Kelly T., and Kelly D. 2014. Creative Confidence: Unleashing the Creative Potential Within Us All. William Collins Harper Collins Publishers India
- Kurien, V., and Salve, G. 2012. I Too Had a Dream. Roli Books Private Limited New Delhi
- Carnegie D. 2018. Overcoming Worry and Stress. New Delhi: Manjul Publishing House.
- Collins Jim. 2001. Good to Great. New York: Harper Business, 136 Life Skills (JeevanKaushal) Facilitators' Manual 2022
- Covey, Stephen R. 2020. 30th ed. The 7 Habits of Highly Effective People. New Delhi: Simon & Schuster.
- Dawkins E.R. 2016. 52 Weeks of Self Reflection—Your Guided Journal of Self Reflection. A B Johnson Publishing, United States
- Drucker, Peter F. 2006. The Effective Executive. New York: Harper Business.
- Goleman D. 1995. Emotional Intelligence. New Delhi: Bloomsbury Publishing India Private Limited.
- Robbins S. P., Coulter M., and Fernandez A. 2019. Management. 14th edition. Noida, India: Pearson Education.