

**THE GANDHIGRAM RURAL INSTITUTE
(DEEMED TO BE UNIVERSITY)**

**School of Health Sciences and Rural Development
Department of Rural Health and Development Studies**

CENTRE FOR APPLIED RESEARCH

BOARD OF STUDIES MEETING

HELD ON 25.08.2021

CENTRE FOR APPLIED RESEARCH

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THE GANDHIGRAM RURAL INSTITUTE
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CENTRE FOR APPLIED RESEARCH
Minutes of the Meeting of the Board of Studies

The meeting of the Board of Studies (BOS) of the Centre for Applied Research was held on 25.08.2020 at 11.00 am in the Centre for Applied Research, Gandhigram Rural Institute – Deemed to be University, Gandhigram. Dr. A. Balakrishnan, Professor & Director i/c, welcomed the gathering. The following members attended the meeting:

Members Present

1. **Dr. K. SENTHAMARAI KANNAN** – **Member**
Dean, Faculty of Science
Senior Professor & Head, Department of Statistics,
Manonmaniam Sundaranar University,
Tirunelveli - 627 012,
Email : senkannan2002@gmail.com
Mobile : 9443436364

2. **Dr. A. THOMAS WILLIAM** – **Member**
Associate Professor
Department of Rural Development Science
Arul Anandar College (Autonomous)
Karumathur, Madurai – 625514.
E-mail : williamsrvt@gmail.com
Mobile : 9443883894

3. **Dr. A. BALAKRISHNAN** – **Member**
Professor
Centre for Applied Research
GRI, Gandhigram

4. **Dr. M. HILARIA SOUNDARI** – **Member**
Associate Professor
Centre for Applied Research
GRI, Gandhigram

5. **Dr. S. GUNASEKARAN** – **Chair Person**
Professor & Director
Centre for Applied Research
GRI, Gandhigram

RESOLUTIONS:

After thorough discussions and deliberations, the board resolved the following:

- I. The Board of Studies resolved to approve the syllabi and Panel of Examiners for the UG/PG Course Work in respect of the following courses

Programme	Department	Code	Course	Sem.	Credit
PG	M.A – Political Science and Development Administration	21APRP0001	Research Methods	VII	4
		21APRP0002	Applied Statistics	VIII	4
	M.A Sociology	21APRP0001	Research Methods	VII	4
		21APRP0002	Applied Statistics	VIII	4
	M.A – Gandhian Thought and Peace Science	21APRP0001	Research Methods	II	4
		21APRP0002	Applied Statistics	II	4
	M.A – Rural Development	21APRP0001	Research Methods	II	4
		21APRP0002	Applied Statistics	II	4
	M.Sc – Home Science Extension and Communication	21APRP0101	Research Methods and Statistics	II	4
	M.Sc – Food Science and Nutrition	21APRP0101	Research Methods and Statistics	II	4
	M.Sc – Geo-informatics	21APRP0101	Research Methods and Statistics	III	4
	M.Voc Diary Production and Technology	21APRP0101	Research Methods and Statistics	II	4
	M.Tech – Renewable Energy	21APRP0102	Research Methodology & IPR	I	4
	M.Sc – Botany, Zoology & Microbiology	21APRP0103	Bio-Statistics	II	4
	MBA Management	21APRP0104	Business Research	II	4
21APRP0105		Quantitative Techniques	I	4	
UG	B.Com – Cooperation	21APRU0001	Elements of Research Methods	V	3
	B.Sc – Microbiology	21APRU0002	Allied Bio-Statistics – I	III	3+2
		21APRU0003	Allied Bio-Statistics – II	VI	3+2
	B.Sc – Agriculture	21APRU0004	Statistical Methods	III	1+1
	B.Voc – Diary Production Technology	21APRU0005	Introduction to Statistics	II	2

II. The BOS also resolved to approve the Syllabi and Panel of Examiners all UG and PG Course to be offered by the Centre for Applied Research from the Academic Year 2021 - 2022.


(K. SENTHAMARAJ KANNAN)


(A. THOMAS WILLIAM)


(A. BALAKRISHNAN)


(M. HILARIA SOUNDARI)


(S. GUNASEKARAN)

Programme Outcomes (PO)

PO1: To develop advanced skills in both research methodology and applied statistics. They will be proficient in designing, conducting, and analyzing research across diverse fields, utilizing appropriate statistical methods to interpret and validate research findings.

PO2: To gain a robust understanding of quantitative techniques and statistical methods. This includes expertise in handling complex data sets, applying various statistical models, and using software tools to perform advanced statistical analyses in both academic and practical contexts.

PO3: To acquire a comprehensive understanding of research methodology in conjunction with intellectual property rights (IPR). They will be able to effectively navigate the legal and ethical considerations related to research and data management, ensuring proper documentation and protection of intellectual property.

PO4: To develop specialized skills in biostatistics, with a focus on applying statistical techniques to biological and medical research. They will be adept at analyzing biological data, interpreting results, and contributing to research in fields such as microbiology, genetics, and health sciences.

PO5: To gain proficiency in applying statistical methods to business research and social science studies. They will be capable of conducting empirical research, performing data analysis, and deriving actionable insights to inform decision-making in various organizational and social contexts.

Programme Specific Outcomes (PSO)

PSO1: Graduates will be proficient in designing sophisticated research projects, applying advanced research methodologies, and employing statistical techniques to analyze and interpret diverse types of data across various fields.

PSO2: Graduates will exhibit expertise in quantitative techniques, including the ability to handle and analyze complex data sets, apply statistical models, and utilize specialized software tools for comprehensive statistical analyses in both academic and practical scenarios.

PSO3: Graduates will have a thorough understanding of research methodology combined with knowledge of intellectual property rights. They will be adept at managing legal and ethical considerations, ensuring proper documentation, and protecting intellectual property throughout the research process.

PSO4: Graduates will possess specialized skills in biostatistics, focusing on the application of statistical methods to biological and medical research. They will be skilled in analyzing biological data, interpreting results, and contributing to research in fields such as microbiology, genetics, and health sciences.

PSO5: Graduates will be proficient in applying statistical methods to business and social science research. They will be capable of conducting empirical research, analyzing data, and deriving actionable insights to support decision-making processes in various organizational and social contexts.

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CENTRE FOR APPLIED RESEARCH

Course Code	Title of the Course	No. of Credits	Hours/Week	Evaluation (% Marks)		Total Marks
				CFA	ESE	
21APRP0001	Research Methods	4	4	40	60	100
21APRP0002	Applied Statistics	4	4	40	60	100
21APRP0101	Research Methods and Statistics	4	4	40	60	100
21APRP0102	Research Methodology & IPR	4	4	40	60	100
21APRP0103	Bio – Statistics	4	4	40	60	100
21APRP0104	Business Research	4	4	40	60	100
21APRP0105	Quantitative Techniques	4	4	40	60	100
21APRU0001	Elements of Research Methods	3	4	40	60	100
21APRU0002	Allied Bio-Statistics – I	3+2	5	40	60	100
21APRU0003	Allied Bio-Statistics – II	3+2	5	40	60	100
21APRU0004	Statistical Methods	3	4	40	60	100
21APRU0005	Introduction to Statistics	2	4	20	30	50

******* Courses Introduced**

Course Code & Title	RESEARCH METHODS (21APRP0001)		
Class	M.A Development Administration /M.A Gandhian Thought and Peace Science/M.A Sociology / MA Rural Development Studies	Semester	II / VII
Cognitive Level	K-1 Understanding the basics of research methodology		
	K-2 Constructing tools for data collection in research		
	K-3 Developing skill in preparing scientific research report		
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • identify and formulate a problem for research. • prepare suitable research design to study the research problem to be formulated • choose appropriate methods of sampling, tools and techniques of data collection • process the data collected in the field and analyze it using appropriate statistical methods and • prepare research report in a professional manner. 		

UNIT	Content	No. of Hours
I	Research: Definition, Characteristics and Functions of Research. Scientific method. Types of research: Pure, Applied and Action Research, Qualitative and Quantitative studies. Research Skills and Ethics, Research Ethics - Significance of Ethical Committee.	12
II	Steps in Research: Research Process, Selection and Formulation of Research Problem, Statement of the Problem and Definition of Terms, Objectives. Review of Literature, Data Base and Reference Management Software. Conceptual Framework, Types of Variables – Hypothesis: types, characteristics and functions.	13
III	Preparation of Research Design: Exploratory, Descriptive, Diagnostic and Experimental designs - types. Methods of Research: Multidisciplinary, Interdisciplinary and Transdisciplinary studies, Mixed methods. Participatory research: RRA, PRA and PLA.	13
IV	Sources and types of Data Collection - Ethical considerations in data collection - Conduct of Interview - Structured, semi-structured, and unstructured interviews, Observation, Schedule and Questionnaire. Sociometry, Psychological test and Projective techniques, Content analysis, Survey, Case study - Scaling Techniques – Online research methods – Pre- test, Test of reliability and validity.	13
V	Research Report: Format - types of reports – Citation styles – APA , MLA, Chicago style, Harvard style, Reference Materials, Bibliography, Webliography, Footnotes, Glossary, Index and Appendix. Preparation of Research Proposal, Plagiarism – Consequences, Prevention – Impact factor and Importance - dissemination of research findings - Online platforms - Policy briefs.	13
References	<ul style="list-style-type: none"> • Alan Bryman, Social research Methods, Oxford Publication, 2018. • Bandarkar and Wilkinson, <i>Methods and techniques of Social Research</i>, Bombay: Himalaya Publishing Co, 2010. • Goode and Hatt, <i>Methods in Social Research</i>, New Delhi: McGraw Hill, 2002. • Kothari.C.R, <i>Research Methodology</i>, New Delhi: Vishva Prakashan, 2001. • Lawrence Neuman.W, <i>Social Research Methods: Qualitative and Quantitative Approaches</i>, Pearson publishers, Chennai, (7th Ed), 2014. 	
Text Books	<ul style="list-style-type: none"> • Ranjith Kumar, <i>Research Methodology A Step-By-Step Guide for Beginners</i>, Singapore: Sage Publications Aisa- Pacific Pvt., Ltd, 2014. • Simon, Schuster, <i>Methods of Social Research</i>, Kenneth Bailey, 4th Edition, 2008 • Tony Brown and Liz Jones, <i>Action Research and Postmodernism</i>, Buckingham: Open University Press, 2001 • Tony Greenfield and Sue Greener, <i>Research Methods for Post Graduates</i>, John Wiley and Sons Ltd, 2016. • Vijayalakshmi.G. and Sivapragasam.C, <i>Research Methods: Tips and Techniques</i>, Chennai: MJP Publishers, 2009. 	
Websites	<ul style="list-style-type: none"> • https://www.coursera.org/browse/physical-science-and-engineering/research-methods • https://docs.wixstatic.com/ugd/87dd0d_ff020fea747047d19cb81d60e371ffaa.pdf?index=true • https://www.ncrm.ac.uk/ • https://www.scribbr.com/category/methodology/ 	

	<ul style="list-style-type: none"> • https://www.liberty.edu/online/courses/CJUS745
Course Outcomes	<p>On completion of the course, students should be able to</p> <p>C01: Develop expertise and skills to undertake independent research</p> <p>C02: Construct research tools</p> <p>C03: Understand research skills and ethics related issues</p> <p>C04: Apply of statistical tools from application perspective</p> <p>C05: Prepare research article and project report</p>

Course Code & Title	APPLIED STATISTICS (21APRP0002)		
Class	M.A Development Administration /M.A Gandhian Thought and Peace Science/M.A Sociology / MA Rural Development Studies	Semester	II/VIII
Cognitive Level	K-1 Imparting the knowledge on applications of Statistics on various disciplines.		
	K-2 Understanding various methods of performing sampling, correlation and regression.		
	K-3 Learning how to estimate errors and perform testing.		
Course Objectives	<p>The Course aims</p> <ul style="list-style-type: none"> • be familiar with the basic concepts and terminology of statistics. • understand the importance and application of statistics in different disciplines • choose appropriate sampling procedure and decide sample size. • develop skill in reading and understanding the results from data analysis • able to demonstrate competence in analyzing statistical data using software. 		

UNIT	Content	No. of Hours
I	Introduction to Statistics: Origin, scope, limitations and misuses of Statistics – Types of Statistics. Statistical Organizational set up in Central and State Governments. Recent trends in the application of Statistics – Big data and Business Analytics. Types of database.	12
II	Sampling Techniques: Basic Concepts of Census and sampling method, characteristics of a good sample, sampling unit, sampling frame. Determination of sample size. Random sampling Simple, Stratified, Systematics, Cluster, Multistage – Non-random sampling - Convenience Sampling, Purposive Sampling, Quota Sampling, Snowball Sampling, Volunteer Sampling . Sampling and Non-sampling errors.	13
III	Data Collection and Classification: Sources and types of statistical data. Nature of data - Classification of data, Scoring and Coding, Tabulation and presentation of data – Frequency distribution – Discrete, Continuous. Diagrammatic presentation of data: one, two and three-dimensional diagrams – Graphical representation of data – Histogram, Frequency polygon, Curve, O-give.	13
IV	Descriptive Statistics – Measures of central tendency: mean, median, mode. Measures of Dispersion: Mean deviation, Quartile deviation and Standard deviation– Coefficient of variation, Measures of Skewness (Pearson’s, Bowley’s and Kelly’s) and Kurtosis - Types, problems, Measures of Association – Correlation – Definition, Types, Methods, Problems and Regression analysis - Definition, Types, Methods, Problems.	13
V	Statistical Inference: Sampling distribution and standard error, Parameter and Statistic. Testing of Hypothesis - Estimator and estimate. Parametric and non-parametric tests - Students ‘t’ test and ‘z’ test, ‘F’ test, Chi-square test – Goodness of fit, Independent attributes. Factor Analysis and Structural Equation modeling (SEM) – Uses and applications. Using software for statistical analysis – SPSS, R, Excel, Nvivo.	13

References	<ul style="list-style-type: none"> • Agarwal, Y.P, Statistical Methods, New Delhi: Sultan Chand and Sons, 1996. • Gupta, S.P and Gupta.M.P, Business Statistics, New Delhi: Sultan Chand and Sons, (19th Ed), 2019. • Gupta, S.P., Statistical Methods, Sultan Chand Publishers, New Delhi, (13thEd), 2019. • Kothari.C.R, Quantitative Techniques, New Delhi: Vikas Publishing House, 1998. • W.G.Cochran, Sampling Techniques, Wiley Eastern Ltd, New Delhi, 1985.
Text Books	<ul style="list-style-type: none"> • Gupta, S.C. Fundamentals of Statistics, Mumbai: Himalaya Publishing House, 2018. • Goon, A. M., M.K. Gupta, and B. Dasgupta, Fundamentals of Statistics, Vol. II, World Press, Kolkata, 2016. • Gupta. S.C. and Kapoor. V.k, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, (12th Ed), 2020. • Parimal Mukopadhyay, Mathematical Statistics (Third Edition), Books and Allied Private Limited, Kolkata, 2006. • Siegel, Sidney, Non-Parametric Statistics for Behavioural Sciences, New Delhi: McGraw Hill, 2006.
Websites	<ul style="list-style-type: none"> • https://www.bl.uk/reshelp/findhelpsubject/socsci/topbib/quantmethods/quantitative.pdf • https://www.sciencedirect.com/topics/nursing-and-health-professions/statistical-tool • https://www.edx.org/course/biostatistics-0 • http://www.calculator.net/sample-size-calculator.html • https://www.statisticssolutions.com/spss-statistics-help
Course Outcomes	<p>On completion of the course, students should be able to do</p> <p>C01: Get exposed to the recent trends in the application of Statistics.</p> <p>C02: Obtain insight in sampling techniques.</p> <p>C03: Learn data collection and its visualization techniques.</p> <p>C04: Study the concepts in Descriptive Statistics.</p> <p>C05: Acquiring knowledge on errors and test method.</p>

Course Code & Title	RESEARCH METHODS AND STATISTICS (21APRP0101)		
Class	M.Sc – Geo-informatics/Food Science and Nutrition/ Home Science & Communication/M.Voc Diary Production and Technology/M.A Rural Development Studies	Semester	II
Cognitive Level	K-1 Understanding the basics of research methods and statistics		
	K-2 Constructing tools for data collection in research		
	K-3 Developing skill in preparing scientific research report		
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • identify and formulate a problem for research. • prepare suitable research design to study a research problem to be formulated • choose appropriate methods of sampling, tools and techniques of data collection • process the data collected in the field and to analyze using appropriate statistical methods • prepare research report in a professional manner. 		

UNIT	Content	No. of Hours
I	Research: objectives, Functions - Problem-solving, Decision making, Characteristics of Scientific Research. Types of Research: Pure, Applied and Action Research. Steps in Research – Identifying and Selection of Research problem - Review of literature - Identifying relevant sources, Conceptual framework, Variables – Hypothesis - research hypothesis - Types – formulation and types. Research skills and ethics – Ethical committee and Plagiarism	12
II	Research design: Explorative, Descriptive, Experimental, Case study and Survey. Methods of Research: Multidisciplinary, Interdisciplinary and Transdisciplinary studies. Mixed Methods, Participatory research: RRA, PRA and PLA. Online research methods, Pilot Study and Pre-test.	13
III	Tools for Data collection: Types and sources of data, Interview, Schedule, Questionnaire and Observation. Scaling Techniques - Likert scale, Semantic differential scale, Guttman scale – Test of validity and reliability and its types - Research Report – Components, format and types of research report - Reference materials, quotations, bibliography, Webliography, footnotes, glossary and appendix, dissemination of research findings.	13
IV	Descriptive Statistics: Measures of central tendency – Mean, median, mode, Measures of dispersion – Range and Standard deviation with co-efficient, Skewness and Kurtosis – Correlation, Regression Analysis and types, methods, problems. Sampling techniques – random and non-random sampling. Statistical software and its uses.	13
V	Inferential Statistics: Basic concepts and Hypothesis testing and Estimation; Steps in hypothesis testing. Tests for Large and small samples – Z test, t-test and F-test, Chi-square test – Independent attributes, ANOVA – One way and two way, Mann-Whitney test, Kruskal wallis test, Wilcoxon Signed-Rank Test.	13
References	<ul style="list-style-type: none"> • Gupta S.P and M.P.Gupta, <i>Business Statistics</i>, New Delhi: Sultan Chand and Sons, (19th Ed), 2019. • Gupta.S.C, <i>Fundamentals of Statistics</i>, Mumbai: Himalaya Publishing House, 	

	<p>2018.</p> <ul style="list-style-type: none"> • Panneer Selvam, <i>Research Methodology</i>, New Delhi: PHI Learning Private Ltd, 2014. • Kothari.C.R, <i>Research Methodology</i>, New Delhi: Wishva Prakashan, 2019. • Tony Greenfield and Sue Greener, <i>Research Methods for Post Graduates</i>, John Wiley and Sons Ltd, 2016.
Text Books	<ul style="list-style-type: none"> • Cauvery.R. and Girija. M, <i>Research Methodology</i>, New Delhi: S.Chand and Company Ltd, 2010. • Gupta, S.P., <i>Statistical Methods</i>, New Delhi; Sultan Chand and Sons, 2012. • Nicholas Walliman, <i>Research Methods: The basics</i>. London; New York: Routledge, 2011. • Shajahan.S, <i>Research Methods for Management (Text and Cases)</i>, New Delh: Jaico Publishing House, 2006. • Vijayalakshmi.G. and Sivapragasam.C, <i>Research Methods: Tips and Techniques</i>, Chennai: MJP Publishers, 2009.
Websites	<ul style="list-style-type: none"> • https://www.ggu.edu/courses/syllabus.do?id=29059 • https://www.ncrm.ac.uk/ • https://www.scribbr.com/category/methodology/ • https://www.indiastat.com/ • https://online-learning.harvard.edu/subject/statistics • http://www.ddegjust.ac.in/studymaterial/mcom/mc-106.pdf
Course Outcomes	<p>On completion of the course, students should be able to</p> <p>C01: formulate a research problem</p> <p>C02: prepare suitable research design</p> <p>C03: choose appropriate methods of sampling and tools for data collection</p> <p>C04: process the data collected in the field and to analyze using appropriate statistical methods</p> <p>C05: prepare research report in a professional manner.</p>

Course Code & Title	RESEARCH METHODOLOGY AND IPR (21APRP0102)		
Class	M.Tech Renewable Energy	Semester	I
Cognitive Level	K-1 Understanding various terminologies in Research Methods		
	K-2 Analysis of Statistical Data		
	K-3 Calculate the Probability		
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • identify and formulate a problem for research. • prepare suitable research design, choose appropriate tools and techniques of data collection • process the data collected and do analysis using appropriate statistical methods • write research report independently and professionally 		

UNIT	Content	No. of Hours
I	Scientific Research – methods of acquiring knowledge - Literature review - Inductive and Deductive Reasoning, scientific method and its applications. New Developments in IPR: Administration of Patent System - Traditional Knowledge Case Studies. Plagiarism. Research Process: Selection of Research problem, Review of literature, Formulation of Hypothesis, Nature and Types of Variable. Data collection - Hypothesis formulation.	12
II	Research Design: Purpose, preparation and Types of research design – Historical, Descriptive, and Experimental. Field survey and evaluation research. Qualitative and Quantitative Studies – Mixed Methods. Multi-disciplinary, Interdisciplinary and Transdisciplinary Research.	13
III	Tools and techniques of data collection – Observation, interview, Inquiry Forms, Psychological tests, Projective techniques, rating scales, Likert and Thurstone, Guttman type scales, Focus Group discussion, and PRA. Validity and reliability. Structure and qualities of a Research Report; Dissemination of research findings, Evaluation of Research Report.	13
IV	Data Analysis: Data Bases. Categorization, Presentation of data - Diagrams and Frequency distributions – Central measures – Arithmetic mean, Median, Mode. Dispersion measures – Range, Quartile Deviation, Mean Deviation, Standard Deviation and Coefficient of variation – Skewness – Kurtosis. Probability Distribution – Normal, Binomial, Uniform. Correlation – Karl Pearson-Rank Correlation. Regression analysis – Simple and multiple.	13
V	Sampling: Probability and non-probability sampling techniques, sampling and non-sampling errors. Testing of Hypothesis: Basic concepts and steps; Statistical Tests – z test, t-test, Chi-square test, ANOVA – One way and Two way. Factor analysis – PCA and CFA and Discriminate analysis. Introduction to Structural Equation Modeling (SEM). Introduction to statistical Softwares.	13

References	<ul style="list-style-type: none"> • Gupta.S.C, <i>Fundamentals of Statistics</i>, Mumbai: Himalaya Publishing House, 2018. • Kothari.C.R, <i>Research Methodology</i>, New Delhi: Wishva Prakashan, 2019. • Panneer Selvam, <i>Research Methodology</i>, New Delhi: PHI Learning Private Ltd, 2014. • Tony Greenfield and Sue Greener, <i>Research Methods for Post Graduates</i>, John Wiley and Sons Ltd, 2016. • W.G.Cochran, <i>Sampling Techniques</i>, Wiley Eastern Ltd, New Delhi, 1985.
Text Books	<ul style="list-style-type: none"> • Cauvery.R. and Girija. M, <i>Research Methodology</i>, New Delhi: S.Chand and Company Ltd, 2010. • Gupta, S.P, <i>Statistical Methods</i>, New Delhi; Sultan Chand and Sons, 2012. • Nicholas Walliman, <i>Research Methods: The basics</i>. London; New York: Routledge, 2011. • Venkatachalapathy, S.G., Premraj, H., <i>Statistical Methods</i>, Chennai: Margham publications, 2015. • Vijayalakshmi.G. and Sivapragasam.C, <i>Research Methods: Tips and Techniques</i>, Chennai: MJP Publishers, 2009.
Websites	<ul style="list-style-type: none"> • https://www.ggu.edu/courses/syllabus.do?id=29059 • https://www.ncrm.ac.uk/ • https://www.scribbr.com/category/methodology/ • https://online-learning.harvard.edu/subject/statistics • http://www.ddegjust.ac.in/studymaterial/mcom/mc-106.pdf • https://www.statisticssolutions.com/spss-statistics-help
Course Outcomes	<p>On completion of the course, students should be able to do</p> <p>C01: Develop expertise and skills to undertake independent research in the renewable energy area</p> <p>C02: Development research questionnaire</p> <p>C03: Understand IPR related issues</p> <p>C04: Apply of statistical tools for the renewable energy system performance</p> <p>C05: Write research article and prepare project report</p>

Course Code & Title	BIO-STATISTICS (21APRP0103)		
Class	M.Sc MICROBIOLOGY/BOTANY/ZOOLOGY	Semester	II
Cognitive Level	K-1 Understanding basic concepts in Bio-Statistics		
	K-2 Comprehending statistical measures in the biological data analysis		
	K-3 Ability to interpret the statistical inference		
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • be familiar with statistics and its applications in biology • solve problems quantitatively using appropriate statistical measures • create and interpret visual representations of quantitative information • understand and critically assess data collection and its representation • Enhance the understanding of various rates, ratios and odds ratio. 		

UNIT	Content	No. of Hours
I	Introduction to Biostatistics: Development of Biostatistics and its applications - Sources of data - Secondary and Primary sources – Source of biological data - Classification and tabulation of data - frequency distribution – Discrete and Continuous – Diagrammatic – One, two, three dimensional and Graphical representation of statistical data.	12
II	Sampling Techniques: Meaning - Advantages, concept of parameter and statistics, sample size, sampling error, sampling frame. Types of samples – Probability sampling – simple, systematic, stratified, cluster, multi-stage sampling. Non-probability sampling – Purposive, Convenience, Judgment and snowball techniques.	13
III	Descriptive Statistics: Measures of central tendency – Mean – Arithmetic mean, Geometric mean, Harmonic mean, Median, Mode - Measures of Dispersion: –Range, Quartile Deviation, Mean Deviation, and Standard Deviation. Absolute and relative measures of dispersion. Skewness and kurtosis measures – Types and problems	13
IV	Correlation and Regression Analysis: Definition, uses, types of correlation, Regression Lines – Properties of regression lines and coefficients; Introduction to probability and its applications – Theoretical Distributions – Binomial, Poisson, and Normal distributions; Properties, uses and applications.	13
V	Inferential Statistics and Biological Measures: Hypothesis testing and Tests of significance - Test of attributes, small and large sample tests – Independent and dependent samples - Analysis of variance – one-way and two-way classifications; Measurement of risk, odds ratio and Bioassay and dose responses.	13
References	<ul style="list-style-type: none"> • Gupta. C.B, An Introduction to Statistical Methods, New Delhi: Vikas Publishers, (23rd Ed), 2004. • Gupta. S.P, Statistical Methods, New Delhi: Sultan Chand, 2017. • Hogg. R.T. and A.T. Craig. A.T, Introduction to mathematical Statistics, (7thEd), 2012. • Rangaswamy, A Textbook of Agricultural Statistics, (3rd Ed), New Age International 	

	<p>Publishers, New Delhi, 2020.</p> <ul style="list-style-type: none"> • Rohatgi, V. K. and A. K. md. Ehsanes Saleh(2009) An Introduction to Probability Theory and Mathematical Statistics, 2nd Edition, Wiley Eastern Limited, New Delhi.
Text Books	<ul style="list-style-type: none"> • Qazi Shoeb Ahmad, Viseme Ismail, Biostatistics, University Science press, new Delhi, (1st Edition), 2008. • Sampath Kumar V.S; Bio-Statistics, Manomaniam Sundaranar University Publication, Tirunelveli, 1997. • Verma B.L, Shukla G.D and Srivastava.R.N, Biostatistics – Perspectives in Health Care; Research and Practice, New Delhi: CBS Publishers & Distributors, 1993. • Veer Bala Rastogi, Biostatistics, Medtech publication, (3rd revised Edition), 2017. • W.G.Cochran, Sampling Techniques, Wiley Eastern Ltd, New Delhi, (1985).
Websites	<ul style="list-style-type: none"> • https://www.biostat.washington.edu/about/biostatistics • http://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/BS704_BiostatisticsBasics • https://www.edx.org/course/biostatistics-0
Course Outcomes	<p>On completion of the course, students should be able to do</p> <p>C01: Get acquainted with basic concepts of statistics and its relevance with the core subject.</p> <p>C02: Visualization of biological data using diagrams, charts and graphs.</p> <p>C03: Analyze the different sample characteristics using descriptive statistics.</p> <p>C04: Observe and interpret the relationship between various biological parameters.</p> <p>C05: Calculate and interpret regression estimates made on biological data.</p>

Course Code & Title	BUSINESS RESEARCH (21APRP0104)		
Class	MBA Management Programme	Semester	II
Cognitive Level	K-1 Understanding the basics of business research		
	K-2 Acquiring the skills for data collection		
	K-3 Developing the ability to prepare a research report		
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • Define research problem in business and identify research gaps • Formulate and execution of research design • Prepare and administer tools and techniques of data collection • Acquire skill in preparation and presentation of research report. 		

UNIT	Content	No. of Hours
I	Scientific Research: Principles – characteristics and functions of research, scientific method-steps in research. Types of research: Pure, Applied and Action Research, Qualitative and Quantitative studies – Research ethics and skills - Ethical committee.	12
II	Research process: Formulation of Research problem, Criterion for selection of a topic, Definition of terms and Objective; Review of literature - Variables - Hypothesis: characteristics and functions.	13
III	Research Design: Exploratory, Descriptive and Experimental designs - Market Surveys – Purpose and methods- Case Study – purpose and methods - Intervention and Interdisciplinary Studies. Mixed Methods - Advantages.	13
IV	Data Collection: Sources of data – Primary and secondary – Tools and techniques for data collection- Interview, Observation, Questionnaire, Schedule – online research methods - Psychological Test - Pre-test -Scaling Techniques- Validity and Reliability and its types.	13
V	Research Report: Characteristics and format - types of reports - Software for reference management- Plagiarism, Bibliography, webiligrabhy. Dissemination of research findings - Utility for policies and programmes.	13
References	<ul style="list-style-type: none"> • David Gray, (2017), Doing Research in Business world, SAGE Publications Ltd,New Delhi. • John.W.Creswell, (1994), Research Design Qualitative and quantitative Approaches, Sage Publication, • Buckingham, William M.K., (2001), Research Methods, Atomic Publishing, New Delhi. • Young, P.V., (2003), Scientific Social Surveys and Research, Practice Hall, New Delhi • Krishnaswami O.R. and M.Ranganatham, Methodology of Research in Social Sciences, Mumbai: Himalaya Publishing House, 2010. 	
Text Books	<ul style="list-style-type: none"> • Kothari, C.R and Garg, Gaurav, “Research Methodology: Methods and 	

	<p>Techniques”, 4th ed. New Age International Publishers, 2019.</p> <ul style="list-style-type: none"> • R. Panneerselvam, “Research Methodology,” Prentice- Hall India (P) Ltd., New Delhi, 2013. • Bhandarkar, P.L., and Wilkinson, T.S., “Methodology and Techniques of Social Research”, 24th ed. Himalaya Publishing House, 2017 • Krishnaswamy O R and Ranganatham M. (2019 ed.) METHODOLOGY OF RESEARCH IN SOCIAL SCIENCES, Himalaya Publication, India • Hatt K Paul and Goode J William, (2016), METHODS IN SOCIAL RESEARCH, Asia Law House.
Websites	<ul style="list-style-type: none"> • https://www.sociosite.net/databases.php • https://socialresearchmethods.net/ • https://www.researchgate.net/publication/319207471 handbook of research <u>methodology</u> • http://www.unrisd.org/ • http://shodhganga.inflibnet.ac.in/bitstream/10603/3727/12/12_chapter%202.pdf
Course Outcomes	<p>On completion of the course, students should be able to</p> <p>C01: Expertise in the skills for doing business research</p> <p>C02: Prepare questioners and schedules</p> <p>C03: Familiarize the research ethics</p> <p>C04: Apply of statistical tools from application perspective</p> <p>C05: Prepare business research article and business project report</p>

Course Code & Title	QUANTITATIVE TECHNIQUES FOR MANAGEMENT (21APRP0105)		
Class	MBA MANAGEMENT	Semester	I
Cognitive Level	K-1 Getting to know about data, data types and calculation of various measures.		
	K-2 Imparting the knowledge of performing analysis on various tests of hypothesis.		
	K-3 Learning how to use some selective tools for testing of hypothesis for non-parametric data based on sample size and number of samples.		
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • Gain knowledge in data collection and presentation. • Understand the basics of statistical techniques for business management. • Understand the concept of probability and its distributions in the context of decisionmaking. • Gainskills in the application of statistical techniques in business related data analysis. 		

UNIT	Content	No. of Hours
I	Quantitative techniques for Decision Making: Data Driven Decision in Management – Concepts. Data: Types, sources, and methods of collecting data. Big Data Analytics – Scope and its importance to a business. Business Analytics: Meaning and applications in managerial decision making.	12
II	Descriptive Analysis: Measures of Central Tendency – Mean, Median and Mode, Arithmetic Mean, Geometric Mean, and Harmonic Mean; Measures of Variation – Range, Mean Deviation, Quartile Deviation, Standard Deviation and Co-efficient of Variation – Measure of Skewness and Kurtosis and problems – its uses in management.	13
III	Probability Theory: Basic concepts and importance of Probability – Axioms of Probability – Addition and Multiplication Theorems and simple problems; Probability Distributions and Applications – Binomial, Poisson, Uniform, Normal Distributions.	13
IV	Sampling Techniques: Concepts of Census and Sampling– Probability and Non-probability techniques. Basic concepts and steps in hypothesis testing – Sampling distribution – Standard Error – Type I and Type II errors – Significant level, Tests of significance – large and small sample tests- Chi-square test – goodness of fit and independent attributes - Analysis of variance (ANOVA) – one way and two-way classifications.	13
V	Forecasting Methods for Management: Concept of Correlation Analysis – Types of Correlation and its applications in managerial decision making; Concept of Regression Analysis – Types of Regression – Simple and multiple and problems – Coefficient of determination. Time Series Analysis – Trend Analysis – Moving average methods.	13
References	<ul style="list-style-type: none"> • Gupta, S.P. (2014), Statistical Methods, (13thEd), Sultan Chand Publishers, New Delhi • Gerald Keller, (2014), Statistics for Management and Economics, (10thEd), Cengagelearning. 	

	<ul style="list-style-type: none"> Levin, Rubin, (2013) Statistics for Management, (13th Ed) Pearson Education, New Delhi. Paul Newbold, William L. Carlson, Betty M. Thorne, (2020), Statistics for Business and Economics, (9th Ed), Pearson Publishing. Srivastava, T, Rago. S, (2012) Statistics for Management, Tata McGraw Hill, New Delhi.
Text Books	<ul style="list-style-type: none"> Anderson, Sweeney Williams, (2015) Quantitative Methods for Business, (13thEd), Cengagelearning. David Gray, (2019), Doing Research in the Business World, (2nd Ed), Sage Publishing. David Gray, (2019), Doing Research in the Business World, (2nd Ed), Sage Publishing. Rohatgi, V. K.and A. K. md.EhsanesSaleh(2009) An Introduction to Probability Theory and Mathematical Statistics, 2nd Edition, Wiley Eastern Limited, New Delhi. R.V. Hogg and A.T. Craig, (2012), Introduction to mathematical Statistics,(7thEd).
Websites	<ul style="list-style-type: none"> https://www.bl.uk/reshelp/findhelpsubject/socsci/topbib/quantmethods/quantitative.pdf https://www.sciencedirect.com/topics/nursing-and-health-professions/statistical-tool https://www.researchgate.net/publication/308133810 Basic statistical tools in research and data analysis https://www.surveysystem.com/sscalc.htm http://www.calculator.net/sample-size-calculator.html https://www.statisticssolutions.com/spss-statistics-help
Course Outcomes	<p>On completion of the course, students should be able to do</p> <p>C01: Learn about data related concepts and big data and its scope in managerial decisions</p> <p>C02: Get acquainted with Descriptive Analysis of data like Measures of Central Tendency and other methods.</p> <p>C03: Acquire insight on the concepts and importance of Probability theory.</p> <p>C04: Know various sampling techniques, errors and tests in Statistics.</p> <p>C05: Understand the application of probability distributions for managerial decisions</p>

Course code & Title	ELEMENTS OF RESEARCH METHODS (21APRU0001)		
Class	B.Com Cooperation	Semester	V
Cognitive Level	K-1 Understanding the concept of Research Methods		
	K-2 Knowing the tools for data collection and analysis of statistical data		
	K-3 Comprehending the skill of report writing.		
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • understand the basics, methods and procedures of research, and acquire knowledge in data analysis • identify and formulate a problem for research • choose the appropriate tools and techniques of data collection • prepare a suitable research design to carryout research • learn different methods of sampling and • write research report to suit their purpose 		

UNIT	Content	No. of Hours
I	Research: Definition, objectives, characteristics and types of research – systematic, empirical, critical – Scientific method, Steps in research – Identification and Selection of problem for research – Sources of review of literature – Hypothesis: concept, characteristics and types. Types of Research	9
II	Preparation of Research Design: Need and components of research design, Methods of research – Explorative, Descriptive, Experimental studies. Case study, Survey and Participatory research. Trans disciplinary Research. Problem identification.	9
III	Types and Sources of data: Tools for Data Collection – Primary and secondary – Observation, Interview, Schedule, and Questionnaire. Pilot study and Pre-test. Plagiarism – Consequences - Prevention – Use of Reference materials. Research Report – Types, Format and Characteristics of a research report.	10
IV	Sampling Techniques: Census vs Sampling methods. Probability and Non- Probability methods, Processing of Data – scoring, coding, Nature of data - classification and tabulation of data, diagrammatic – one, two, three dimensional and graphical presentation.	10
V	Quantitative Data Analysis: Measures of central tendency - mean, median and mode; Measures of dispersion – Range, Variance, Standard Deviation - Correlation and regression analysis, and Uses of Software in data analysis. Statistical Inference - Test of Hypothesis small and large sample tests – Independent and dependent samples.	10
References	<ul style="list-style-type: none"> • Gosh.B.N, <i>Scientific Methods and Social Research</i>, New Delhi: Sterling Publishers, 1997. • Gupta.S.C, <i>Fundamentals of Statistics</i>, Mumbai: Himalaya Publishing House, 2018. • Hans Raj, <i>Theory and Practice in Social Research</i>, Delhi: Surjeet Publications, 2002. • Kothari.C.R, <i>Research Methodology</i>, New Delhi: Vishva Prakashan, (4th Ed) 2019. 	

	<ul style="list-style-type: none"> • Vino Chandra.S.S, An and Hareendran.S, <i>Research Methodology</i>, Pearson, (1st Ed), 2017. 	
Text Book	<ul style="list-style-type: none"> • Anol Bhatta cherjee, <i>Social Science Research: Principles, Methods, and Practices</i>, University of South Africa: Global Text project Publisher, 2012. • Krishnaswami.O.R. and M.Ranganatham, <i>Methodology of Research in Social Sciences</i>, Mumbai: Himalaya Publishing House, 2010. • Sadhu.A.N. and Singh.A, <i>Research Methodology in Social Sciences</i>, Mumbai: Himalaya Publishing House, 2005. • Thomas William A., <i>Research Methods Quantitative, Qualitative & Mixed Methods</i>, Authors Press, New Delhi 2021. • Vijayalakshmi.G. and Sivapragasam.C, <i>Research Methods: Tips and Techniques</i>, Chennai: MJP Publishers, 2009. 	
Website	<ul style="list-style-type: none"> • https://www.researchprospect.com/research-methodology/ • https://www.bl.uk/reshelp/findhelpsubject/socsci/topbib/quantmethods/quantitative.pdf • https://www.researchgate.net/publication/308133810 <u>Basic statistical tools in research and data analysis</u> • http://www.calculator.net/sample-size-calculator.html • https://www.statisticssolutions.com/spss-statistics-help 	
Course Outcomes	<p>On completion of the course, students should be able to</p> <p>C01: know the basic of research methods and statistics</p> <p>C02: identify and formulate a problem for research</p> <p>C03: choose the appropriate tools and techniques of data collection</p> <p>C04: learn different methods of sampling and</p> <p>C05: write research report to suit their purpose</p>	

Course Code & Title	21APRU0002 ALLIED BIO-STATISTICS - I	No. of Credits: 4 (3 + 1)	3 hours
Programme	B.Sc Microbiology	Semester - III	Max. Marks: 100
Cognitive Level	K-1	Understanding the terminologies and basic concepts in Bio-Statistics	
	K-2	Developing Skills in computation of basic statistical measures in the biological data analysis and Evaluation	
	K-3	Interpretation of results that are obtained after applying statistical methods	
Course Objectives	<ul style="list-style-type: none"> To understand the basic concepts and terms and its relevance in biology. To develop computation skills in statistics and analyze data using relevant statistical methods. 		
UNIT	CONTENT		NO. OF HOURS
I	Introduction to Biostatistics – definition – Types of data – Collection of data – Sources of data in Biological Science – Limitation and uses of statistics. Biological scales of measurement.		6
II	Classification of data- Quantitative, qualitative, chronological, geographical - Tabulation of data – Diagrammatic – One, two, three dimensional, pictogram and cartogram and Graphic representation – Histogram Frequency polygon – Frequency curve of data and uses.		16
III	Measures of Central Tendency – Mathematical average - Mean –Arithmetic, Geometric, Harmonic, and Weighted – Positional averages – Median, Mode – Merits and Demerits.		8
IV	Measures of Variation - Range, Mean deviation, Quartile deviation, Standard deviation - Relative measures – Merits and Demerits.		12
V	Measures of skewness – Definition, Types; Karl Pearson’s coefficient of Skewness – Bowley’s Co-efficient of Skewness – Kelly’s Co-efficient of Skewness - Measures of Kurtosis – Definitions, Types and Measures; Simple problems.		12
PRACTICAL	1. Graphical presentation of data – Diagrams, Frequency curves and polygons.		4
	2. Measures of Central values – Mean, median and mode.		6
	3. Measures of dispersion – Range, standard deviation and coefficient of variation.		6

	4. Correlation & Regression analysis – Computation of correlation coefficient and determination of regression equations.	4
REFERENCES	<p>Text Books:</p> <ul style="list-style-type: none"> • Daniel WW,(1987). Biostatistics, John Wiley and Sons, New York • Gupta. S.C. and Kapoor. V.k, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, (12th Ed), 2020. • Sampath Kumar V.S; Bio-Statistics, Manomaniam Sundaranar University Publication, Tirunelveli, 1997. • Verma B.L, Shukla G.D and Srivastava.R.N, <i>Biostatistics – Perspectives in Health Care</i>; Research and Practice, New Delhi: CBS Publishers & Distributors, 1993. • Veer Bala Rastogi, Bio-statistics, Medtech publication, (3rd revised Edition), 2017. 	
REFERENCE BOOKS	<ul style="list-style-type: none"> • Gupta. C.B, An Introduction to Statistical Methods, New Delhi: Vikas Publishers, 2004. • Gupta. S.P, <i>Statistical Methods</i>, New Delhi: Sultan Chand& Sons, 2014. • R.V. Hogg and A.T. Craig, Introduction to mathematical Statistics, (7thEd), 2012. • Rangaswamy, A Textbook of Agricultural Statistics, (3rd Ed), New Age International Publishers, New Delhi, 2020. • Rohatgi, V. K. and md. Ehsanes Saleh, A.K, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Limited, New Delhi, (2nd Ed), 2009 	
WEBSITE	<ul style="list-style-type: none"> • https://www.biostat.washington.edu/about/biostatistics • http://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/BS704 BiostatisticsBasics • https://www.edx.org/course/biostatistics-0 	
COURSE OUTCOMES	<p>On completion of the course, students will be able to do the following:</p> <p>CO1: Learn the basic concepts of statistics and its relevance with core subject.</p> <p>CO2: Visualize biological data using Tables, diagrams and charts.</p> <p>CO3: Present the characteristics of sample using descriptive statistics.</p> <p>CO4: Highlight the relationship between various biological parameters.</p> <p>CO5: Calculate regression estimates and perform analysis and interpretation of biological data.</p>	

Course Code & Title	21APRU0003 ALLIED BIO-STATISTICS - II	No. of Credits: 4 (3 + 1)	3 hours
Class	B.Sc Microbiology	Semester – IV	Max. Marks: 100
Cognitive Level	K-1 Obtaining Knowledge on application of Statistics and its scope in Biosciences		
	K-2 Developing insight in computing statistical measures in the biological data analysis		
	K-3 Evaluating and Interpreting the statistical results		
Course Objectives	<ul style="list-style-type: none"> To understand the basic concepts and terms and its relevance in biology. To develop computation skills in statistics and analyze data using relevant statistical methods. 		
UNIT	CONTENT		NO. OF HOURS
I	Probability – Basic concept, Definition; Addition and Multiplication Theorems (without proof). Simple Problems.		6
II	Sampling – Definition, basic concepts; types of Sampling – sample versus census, types of population, Random sampling - Simple, stratified, systematic, cluster, multistage and non-Random sampling – convenience, snowball, judgment, Determination of sample size – sampling error and non-sampling error.		6
III	Sampling distribution – Poisson, Binomial, Normal - Standard error – Type I error and type II error – Level of significance and confidence interval - Test of Significance - Alternative Hypothesis, Null hypothesis – Large sample tests with regard to Mean, Differences of Means, Proportions and difference of Proportions		8
IV	Test of Significance - Small Sample Test with regard to Mean, Difference of Means and Variances – Paired t test - Chi – square test - goodness of fit and attributes – Procedures and simple problems.		12
V	Analysis of variance (ANOVA) – Basic concepts and examples – explanation. ANOVA for one way and two way classifications – Procedures and simple problems.		12
PRACTICAL	1. Test of significance – Large sample tests and Test of significance for attributes.		6
	2. Test of significance – Small sample tests		4

	3. Chi-square test – Independence of attributes (for 2 X 2 contingency table)	4
	4. Analysis of variance – One-way and Two-way classifications.	6
REFERENCES	<ul style="list-style-type: none"> • Qazi Shoeb Ahmad, Viseme Ismail, Biostatistics, University Science press, new Delhi, (1st Edition), 2008. • Rohatgi, V. K. and Md. Ehsanes Saleh. A.K, An Introduction to Probability Theory and Mathematical Statistics, 2nd Edition, Wiley Eastern Limited, New Delhi, 2009. • Siegel, Sideny, Non-Parametric Statistics for Behavioral Sciences, New Delhi: MCGraw Hill, 2006. • Verma B.L, Shukla G.D and Srivastava.R.N, Biostatistics – Perspectives in Health Care; Research and Practice, New Delhi: CBS Publishers & Distributors, 1993. • Veer Bala Rastogi, Biostatistics, Medtech publication, (3rd revised Edition), 2017. 	
TEXT BOOKS	<ul style="list-style-type: none"> • Gupta. C.B, An Introduction to Statistical Methods, New Delhi: Vikas Publishers, (23rd Ed), 2004. • Gupta. S.P, Statistical Methods, New Delhi: Sultan Chand, 2017. • Goon, A.M., M. K. Gupta and B. Das Gupta, Fundamentals of Statistics- Vol. II., World Press, Ltd, Kolkata. 2016. • Hogg. R.T. and A.T. Craig. A.T, Introduction to mathematical Statistics, (7thEd), 2012. • Rangaswamy, A Textbook of Agricultural Statistics, (3rd Ed), New Age International Publishers, New Delhi, 2020. 	
WEBSITE:	<ul style="list-style-type: none"> • https://www.biostat.washington.edu/about/biostatistics • https://www.biostat.washington.edu/about/biostatistics • https://www.agrimoon.com/wp-content/uploads/Statistics.pdf • https://www.coursera.org/courses?query=biostatistics 	
COURSE OUTCOMES	<p>On completion of the course, students will be able to do the following:</p> <p>C01: Knowing the terminologies and primitive concepts of statistics and its scope in the domain subject.</p> <p>C02: Describe various techniques of probability and sampling.</p> <p>C03: Know the different method of Visualizing the biological experimental results in an impressive presentation.</p> <p>C04: Interpret output from the various estimation and hypothesis testing procedures covered in the course.</p> <p>C05: Evaluate Performance by making various estimates and carrying out analysis on biological data.</p>	

Course Code & Title	STATISTICAL METHODS (21APRU0004)		
Class	B.Sc Agriculture	Semester	III
Cognitive Level	K-1 Be acquainted with the knowledge of Applications of statistics in Agriculture.		
	K-2 Understand the significance of statistical measures.		
	K-3 Describe Agriculture data and quantitative information.		
Course Objectives	<p>The Course aims</p> <ul style="list-style-type: none"> • be familiar with statistics and its applications in biology • solve problems quantitatively using appropriate statistical measures • create and interpret visual representations of quantitative information • understand and critically assess data collection and its representation • understand various rates, ratios and odds ratio 		

UNIT	Content	No. of Hours
I	Introduction to Statistics: Meaning, Functions, and its applications in Agriculture. Sources and types of data. Frequency – discrete and continuous and cumulative frequency distribution. Graphical and diagrammatic representation of data – bar chart, multiple bar chart, pie chart, pictogram and cartogram.	12
II	Sampling Methods: Sampling versus Census. Sampling size, Sample frame. Types of population. Sampling techniques – Random and Non - random sampling. Sampling and Non-sampling errors.	13
III	Descriptive Statistics: Measures of Central tendency – mean, median, mode. Measures of Dispersion - range, quartile deviation, mean deviation, standard deviation with relative measures.	13
IV	Correlation and Regression: Meaning and Definition of Correlation, Scatter Diagram, Karl Pearson’s Coefficient of Correlation, Spearman’s rank Correlation and uses of correlation. Regression - Meaning and Definition – Simple and Multiple regression and simple problems,	13
V	Inferential Statistics: Introduction to Test of hypothesis, Basic steps - parameter and statistic. Parametric and non-parametric tests - Student’s -t- test and ‘z’ test, ‘F’ test, Chi-square test – ANOVA – one way and two way and Repeated measures ANOVA. Design of experiments.	13
PRACTICAL	<ol style="list-style-type: none"> 5. Graphical Representation of Data – Diagrams, Frequency curves and polygons. 6. Measures of Central Tendency – Means, median and mode. 7. Measures of dispersion – Range, standard deviation and coefficient of variation 8. Measures of skewness & kurtosis and Moments. 9. Correlation & Regression analysis – Computation of correlation coefficient and determination of regression equations. 10. Test of significance – Small and Large sample tests and Test of significance attributes. 11. Chi-square test – Independence of attributes for 2x2 contingency table. 	

	12. Analysis of variance One-way classification.	
References	<ul style="list-style-type: none"> • Gurumani, N., An Introduction to Bio-Statistics, Chennai, MJP Publication, 2004. • Gupta, S.C. and V.K. Kapoor (2020) Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi. • Goon, A.M., M.K. Gupta and B. Das Gupta (2016) Fundamentals of Statistics- Vol. II, World Press Ltd, Kolkata. • Rangaswamy, A Textbook of Agricultural Statistics, (3rd Ed), New Age International Publishers, New Delhi, 2020. • Sampath Kumar V.S; Biostatistics, Manomaniam Sundaranar University Publication, Tirunelveli, 1997. 	
Text Books	<ul style="list-style-type: none"> • Gupta, S.P. Statistical Methods, Sultan and Chand Publishers, New Delhi, 2014. • Gupta, C.B. An Introduction to Statistical Methods, Vikas Publishers, New Delhi, (23rd Ed), 2004. • Rohatgi, V. K. and A. K. md. Ehsanes Saleh, An Introduction to Probability Theory and Mathematical Statistics, 2nd Edition, Wiley Eastern Limited, New Delhi, 2009. • Sampath, S. Sampling Theory and Methods (Second Edition), Narosa Publishing House, New Delhi, 2006. • Vijayalakshmi G and Sivapragasam C. Research Methods: Tips and Techniques, MJP Publishers Chennai, 2009. 	
Websites	<ul style="list-style-type: none"> • http://mospi.nic.in/agriculture-statistics • https://iasri.icar.gov.in/ • https://www.agrimoon.com/wp-content/uploads/Statistics.pdf • http://sphweb.bumc.bu.edu/otlt/MPH Modules/BS/BS704 BiostatisticsBasics • https://ecourses.icar.gov.in/ 	
Course Outcomes	<p>On completion of the course, students should be able to do</p> <p>C01: Get familiar with basic concepts and terms</p> <p>C02: Learn the problem solving techniques using appropriate statistical measures</p> <p>C03: Visualize and present the interpreted statistical data.</p> <p>C04: Make valid decisions applying statistical methods.</p> <p>C05: Obtain knowledge on various parametric and non-parametric methods.</p>	

Course Code & Title	INTRODUCTION TO STATISTICS (21APRU0005)		
Class	B.Voc DAIRY PRODUCT AND TECHNOLOGY	Semester	II
Cognitive Level	K-1 Understand the origin, significance, and scope of Statistics.		
	K-2 Know the significance of presenting data in the form of tables and diagrams.		
	K-3 Learn computational aspects of basic statistical measures.		
Course Objectives	<p>The Course aims</p> <ul style="list-style-type: none"> • To enable students to be familiar with basic concepts and terms and the uses of statistics in quality control • To develop skills among the students to carryout analysis using appropriate statistical tools 		

UNIT	Content	No. of Hours
I	Introduction to Statistics – Source of data Collection, Nature of data, Classification and Tabulation of data – Frequency distribution – Graphical and Diagrammatic representation of data and uses of diagrams, graphs. Scope and limitations. Measurement of scale.	12
II	Descriptive Statistics – Measures of Central Tendency – mean, median, mode - Measures of Dispersion - Range, Standard Deviation with relative measures– Simple problems.	13
III	Population and samples – Selection of sample – Random sampling and non-random sampling – Statistical Inference - Standard error – Type I Error and Type II Error – Test of Hypothesis - Basic concepts: Types of tests; Z, T, F-test and Chi-square test of significance.	13
IV	Correlation - Definition, Types of Correlation – Karl Pearson’s correlation coefficients, Spearman’s Rank Correlation coefficients. Regression - Concept, Definitions – Simple and multiple regression equations – fitting of regression equation, Simple Problems.	13
V	Quality control charts – Introduction, process control, control charts, and control limits and specification limits, product control – Types of control charts: \bar{X} and R chart – P, c and np chart – Simple problems.	13
References	<ul style="list-style-type: none"> • Krishnanswamy,O.R, Methodology of Research in Social science, Himalaya Publishing House, Bombay, 2002. • Verma B.L, Shukla G.D and Srivastava.R.N, Biostatistics – Perspectives in Health Care; Research and Practice, New Delhi: CBS Publishers & Distributors, 1993. • Veer Bala Rastogi, Biostatistics, Medtech publication, (3rd revised Edition), 2017. • Qazi Shoeb Ahmad, Viseme Ismail, Biostatistics, University Science press, new Delhi, (1st Edition), 2008. • Siegel, Sideny, Non-Parametric Statistics for Behavioral Sciences, New Delhi: MCGraw Hill, 2006. 	
Text Books	<ul style="list-style-type: none"> • Gupta. C.B, An Introduction to Statistical Methods, New Delhi: Vikas Publishers, (23rd Ed), 2004. 	

	<ul style="list-style-type: none"> • Gupta. S.P, Statistical Methods, New Delhi: Sultan Chand, 2017. • Goon, A.M., M. K. Gupta and B. Das Gupta, Fundamentals of Statistics- Vol. II, World Press, Ltd, Kolkata. 2016. • Hogg. R.T. and A.T. Craig. A.T, Introduction to mathematical Statistics, (7thEd), 2012. • Rangaswamy, A Textbook of Agricultural Statistics, (3rd Ed), New Age International Publishers, New Delhi, 2020.
Websites	<ul style="list-style-type: none"> • https://www.biostat.washington.edu/about/biostatistics • https://www.agrimoon.com/wp-content/uploads/Statistics.pdf • https://fac.ksu.edu.sa/sites/default/files/stat_-book_introduction_to_statistics.pdf
Course Outcomes	<p>On completion of the course, students should be able to do</p> <p>C01: Solve problems using appropriate statistical measures</p> <p>C02: Create and interpret visual representation of statistical data</p> <p>C03: Acquire knowledge on different types of error and tests</p> <p>C04: Learn about correlation and Regression and their applications</p> <p>C05: Prepare different quality control charts such as \bar{X}, R, P, np and c chart.</p>

PANEL OF EXAMINERS

**CENTRE FOR APPLIED RESEARCH
COURSE: PG PROGRAMMES**

**RESEARCH MYTHOLOGY & IPR/ RESEARCH METHODS
RESEARCH METHODS AND STATISTICS/BUSINESS RESEARCH**

PANEL OF EXAMINERS

SL. NO	FACULTY DETAILS
1.	Dr. G. YAMUNA Associate Professor Department of Economics Sri G.V.G.Visalakshi College for Women S.V.Mills (P.o), Udumal Pet Thiruppur District. Mobile: 9843023387 E-mail: gyamuna1965@gmail.com
2.	Dr. A. THOMAS WILLIAM Associate Professor Department of Rural Development Science Arul Anandar College (Autonomous) Karumathur, Madurai – 625514. Mobile: 9443883894 E-mail: williamsrvt@gmail.com
3.	Dr. M. RAJESWARI Assistant Professor Department of Economics Annamalai University Annamalai Nagar – 608002. Mobile: 9443986960 E-mail: saran_raji@yahoo.co.in
4.	Dr. RAVISHANKAR Associate professor, Department of Population Studies Annamalai University, Annamalali Nagar. Mobile: 9443278441 E-mail: akravisankar.pop@gmail.com
5.	Dr. G. VEDANTHADESIKAN Director, Centre for Rural Development, Annamalai University, Annamalainagar – 608 002 Mobile: 9443538760 E-mail: drgrdesikan@gmail.com

**CENTRE FOR APPLIED RESEARCH
COURSE: P.G PROGRAMMES**

**APPLIED STATISTICS/ STATISTICS
PANEL OF EXAMINERS**

SL. NO	FACULTY DETAILS
1.	Dr. P. ARUMUGAM Professor Department of Statistics Manonmaniam Sundaranar University, Tirunelveli - 627 012, Mobile: 9042759438 E-mail: sixface@gmail.com
2.	Dr. G. EZHUMALAI Senior Statistician and Research Consultant Mahatma Gandhi Medical college & Research Institute Pondicherry. Mobile: 9444325567 E-mail: senthilkumarbalan@gmail.com
3.	Dr .V. PRAKASH Associate Professor of Statistics Department of Statistics Presidency College (Autonomous) Chennai – 05. Mobile: 9381730350, 9445986350. E-mail: venu.prakas@gmail.com
4.	Dr. C. NANTHAKUMAR Associate Professor of Statistics & Head Salem Sowdeswari College, Salem – 636010 Mobile: 9443496217
5.	Dr. T. EDWIN PRABAKARAN Associate Professor of Statistics Department of Statistics Loyola College, Chennai – 600034. Mobile: 9444926016. E-mail: teprabakaran@yahoo.com

**CENTRE FOR APPLIED RESEARCH
COURSE: PG PROGRAMME**

BIO-STATISTICS

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**CENTRE FOR APPLIED RESEARCH
MBA PROGRAMME (NEW)**

COURSE: QUANTITATIVE TECHNIQUES

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**CENTRE FOR APPLIED RESEARCH
COURSE: U.G PROGRAMMES**

ELEMENTS OF RESEARCH METHODS

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**CENTRE FOR APPLIED RESEARCH
UG PROGRAMME – B.Sc MICRO BIOLOGY**

COURSE: ALLIED BIO-STATISTICS – Paper I & II

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**CENTRE FOR APPLIED RESEARCH
COURSE: UG PROGRAMME**

STATISTICAL METHODS/ INTRODUCTION TO STATISTICS

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