GOA UNIVERSITY

Taleigao Plateau, Goa 403 206

REVISED MINUTES

For the 5th Meeting of the

X ACADEMIC COUNCIL

Day & Date

30th and 31st July, 2021

Time

10.30 a.m.

Venue

Online via Google Meet

Minutes of the Fifth Meeting of the X Academic Council

Date: 30.07.2021 and 31.07.2021

Time: 10.30 a.m.

Venue: Online via Google Meet.

A list of members who attended the meeting of Academic Council and those who sought leave of absence is appended.

The Chairperson (Vice-Chancellor) extended a warm welcome to all the members to the Fifth meeting of the X Academic Council, especially to the honorable members who had joined from outside Goa, Prof. (Dr.) Rajpal Singh and Prof. R.C. Kuhad, and thanked them for their participation.

The Chairperson (Vice-Chancellor) observed that some of the honorable members had lost their near and dear ones due to the pandemic, since the last Academic Council meeting. On behalf of the University, conveyed his sincere condolences to them and their families for their loss.

Thereafter, the agenda was taken up for discussion.

D	**DISCCUSSION ITEMS**
D 1	**CONFIRMATION**
D 1.1	**To confirm the minutes of the Fourth meeting of the Academic Council held on 27th and 28th May, 2021.** The Academic Council accepted the following correction suggested by the Members of the Academic Council: **a) D 9.1.2 Misuse of Grant-in-Aid Programme staff and the facilities and there by overburdening the staff stand corrected as:** Professor Anthony Rodrigues, Member briefed the House on the Resolution. After discussion, the Academic Council decided to obtain feedback from the Colleges whether the teachers and the staff from the Grant-in-Aid Programmes were being allotted work of self-financed Programmes. While the Grant-in-Aid Programme teachers/staff may provide mentorship to the Self-Financing Programmes, they should not be involved in Administration or the day-to-day functioning of the Programme. It was also decided to write a letter in this regard to all the Colleges as well as the Directorate of Higher Education. b) **D 3.8 Minutes of Board of Studies in Economics Online Meeting held on 21/05/2021** The matter was referred back to the Board of Studies in Economics to deliberate and decide on the Pre-requisites for the Course - Techniques of Geo-spatial Analysis. The minutes of the Fourth meeting of the Academic Council held on 27th and 28th May, 2021 were confirmed with the above corrections. **(Action: Assistant Registrar-Academic-General)**

	The recommendations of the Committee to be placed before the Academic Council for consideration. **(Action: Assistant Registrar-Academic-PG)**
D 3.17	**Minutes of the Board of Studies of Commerce (UG) meeting held on 20.07.2021.** The Academic Council approved the minutes of the meeting of the Board of Studies in Commerce (UG) held on 20.07.2021, with the following observations: 1. Necessary changes to be carried out with regard to the marks and lectures in the Course Advanced Managerial Economics for the B.Com. Programme. 2. The Sub-Committee recommended by the Board of Studies to prepare the Course Outline for the B.Com. Curriculum was approved. 3. The Syllabus of the Practical Orientation of Commerce and Business (Commerce Lab) (Skill Enhancement Course for Semester III (SEC) B.Com.) was not approved. The matter was referred back to the Board of Studies to have further deliberations to clearly identify the Practical and Theory components of the Practical Course. The Chairperson Board of Studies was requested to place its recommendation before the Standing Committee of Academic Council to be held on 13.08.2021. **(Action: Assistant Registrar-Academic-PG)**
D 3.18	**Meeting of the Board of Studies in Mathematics was held by circulation on 16.07.2021** The Academic Council approved the minutes of the meeting of the Board of Studies in Mathematics held by circulation on 16.07.2021 with the following observations: 1) The word 'Executive' to be dropped from the nomenclature of the Course. 2) Total contact hours of each Module to be specified. **(Action: Assistant Registrar-Academic-PG)**
D 3.19	**Minutes of the Board of Studies in Homoeopathy meeting held on 24.07.2021.** The item was withdrawn with directions to refer them back to the Board of Studies. **(Action: Assistant Registrar-Academic-PG)**
D 3.20	**Minutes of the Board of Studies in Psychology meeting held on 16.07.2021 in online mode.** The Academic Council approved the minutes of the meeting of the Board of Studies in Psychology meeting held on 16.07.2021 in online mode. The Academic Council suggested that marks needed to be allotted for each module in the syllabus for all UG Programmes. The Chairperson of the Boards of Studies to be informed to indicated marks for the modules while framing the syllabus. The Chairperson, Board of Studies was requested to clearly indicate the names of the members who would be working on the Psychology Practicum Handbook /Manual for UG Psychology faculty. The Chairperson was requested to place the Manual for the consideration of the Academic Council once completed. The Academic Council approved the decision of the Board of Studies to have a Laboratory to conduct Practicum for Psychology students in each College. The Joint

X AC- 5
30&31-07-2021

GOA UNIVERSITY
Taleigao Plateau, Goa 403 206

U P D A T E D F I N A L A G E N D A

For the 5th Meeting of the

X ACADEMIC COUNCIL

Day & Date

30th and 31st July, 2021

Time

10.30 a.m.

Venue
Online via Google Meet

---**NIL**---

Part C.

i. Recommendations regarding preparation and publication of selection of reading material in the subject or group of subjects and the names of the persons recommended for appointment to make the selection:

---**NIL**---

Part D

i) Recommendations regarding general academic requirements in the Departments of University or affiliated colleges:

---**NIL**---

ii) Recommendations of the Academic Audit Committee and status thereof: ---**NIL**---

Part E.

i. Recommendations of the text books for the course of study at undergraduate level:

---**NIL**---

ii. Recommendations of the text books for the course of study at post graduate level:

---**NIL**---

Part F.

Important points for consideration/approval of Academic Council

i) The important points/recommendations of BoS that require consideration/approval of Academic Council (points to be highlighted) as mentioned below
a)
b)

ii) The declaration by the Chairperson that the minutes were readout by the Chairperson at the meeting itself.

Date: 23/07/2021
Place: Goa University

Sd/-
Signature of the Chairperson

Part G. The Remarks of the Dean of the Faculty

i) The minutes are in order
ii) The minutes may be placed before the Academic Council with remarks if any.
iii) May be recommended for approval of Academic Council.
iv) Special remarks if any.

Unit IV of Advanced Managerial Economics should be of 18 hours.

Date: 26/07/2021
Place: Goa Business School

Sd/-
Signature of the Dean

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D 3.18	**Meeting of the Board of Studies in Mathematics was held by circulation on 16th July 2021**

Part A

(I) Recommendations regarding courses of study in the subject or group of subjects at the undergraduate level:

Nil

(II) Recommendations regarding courses or group of subjects at postgraduate level:

BOS discussed about PG Diploma in Applied Statistics programme to be introduced at Govt. College of Sanquelim (Syllabus submitted by the college is attached as **AnnexureI**)**(Refer page no 232)**

All members were of the opinion that the syllabus of the course DASC 01 Foundation Mathematics should be changed and the paper should be named as Basic Mathematics. The revised syllabus for this paper as suggested by the members is attached at **AnnexureII**. **(Refer page no 239)**

Part B:

(I) Scheme of the Examinations at Undergraduate Level:

Nil

(II) Panel of examiners for different examinations at Undergraduate Level:

Nil

(III) Scheme of the examinations at post-graduate level:

Nil

(IV) Panel of examiners for different examinations at post-graduate Level:

Nil

Part C

(I) Recommendations regarding preparation and publication and selection of Anthologies in any subject or group of subjects and the names of person recommended for appointment to make the selection:

Nil

Part D

(I) Recommendations regarding general academic requirements in the Departments of University or affiliated colleges:

Nil

II) Recommendation of Academic Audit committee and status thereof

No recommendations

Part E

(I) Recommendations of text books for the course for study at the Undergraduate level:

Nil

(II) Recommendations of text books for the courses of study at the post Graduate level:

Nil

Part F

Important points for consideration/approval of Academic Council:

PG Diploma in Applied Statistics Programme at Govt. College of Saquelim is approved by BoS in Mathematics with minor changes.

The declaration by the Chairman, that the minutes were read out by the Chairman at the meeting itself.

	Sd/- Signature of Chairman Date: 16th July 2021 Place: Goa University **Part G: The remarks of the Dean of the Faculty.** (I) The minutes are in order. (II) The minutes may be placed before the Academic Council with remarks if any. (III) May be recommended for approval of Academic Council (IV) Special remarks if any: Nil Sd/- Signature of the Dean Date: 16-07-2021 Place: Goa University **(Back to Index)**
D 3.19	**Minutes of the Board of Studies in Homoeopathy meeting held on 24/07/2021.** **Part – A** i) Recommendations regarding courses of study in the subject or group of subjects at the undergraduate level. **:** **N.A.** ii) Recommendations regarding courses of study in the subject or group of subjects at the postgraduate level. **:** **N.A.** **Part – B** Scheme of examinations at undergraduate level. **: Annexurel (Refer page no 248)** i) **(Scheme of Examination existing & proposed attached)** ii) Panel of examiners for different examinations at the under-graduate level.**:** **(Sealed envelope)** iii) Scheme of examinations at post-graduate level. **:** **N.A.** iv) Panel of examiners for different examinations at the post-graduate level **:** **N.A.** **Part – C** Recommendations regarding preparation and publication of selection of reading material in the subject or group of subjects and the names of the persons recommended for appointment to make the selection. : **No recommendations** **Part – D** Recommendations regarding general academic requirements in the departments of University or affiliated colleges. **: No recommendations** **Part – E** i) Recommendations of text books for the course of study at under-graduate level **:**

D 3.18 Meeting of the Board of Studies in Mathematics was held by circulation on 16th July 2021

AnnexureI

Post Graduate Department and Research Centre in Economics Government College of Arts, Science and Commerce, Sanquelim-Goa

Executive Post Graduate Diploma in Applied Statistics

1. Introduction

As per the instructions of the Government of Goa, the Post Graduate Department and Research Centre in Economics of Government College of Arts, Science and Commerce, Sanquelim-Goa proposes to introduce an **Executive Post Graduate Diploma in Applied Statistics Programme.** This proposal is approved by the **Directorate of Higher Education, Government of Goa.** The

P.G. Diploma in Applied Statistics will cater to the needs of the working professionals serving in Government and Non-Government Organisations. The programme will be based on the **OA-28 relating to Common Ordinance governing (a) the Post Graduate Diploma Programme in specialized fields/areas/subjects offered at the Post-Graduate teaching Departments and at affiliated colleges/recognized institutions of Goa University (Effective from 16th May, 2019).** The Programme is expected to commence from September 2021.

1.1 The Objectives of the Programme

1. To provide opportunities for continuing education and skill formation for human resource development required in different sectors of employment.
2. To acquaint the learners with the application of statistical tools in the analysis of data.
3. To provide the knowledge and hands-on training in selected areas of statistics
4. To equip learners with the skills of using appropriate software for statistical applications in various fields.
5. To help the learners in career progression.

1.2 Programme Outcomes

On successful competition of the Programme, the candidate will be able to:

- Apply various types of sampling methods to data collection.
- Create and interpret frequency tables.
- Display data graphically and interpret graphs.
- Recognize, describe, and calculate the measures suitable to the data sets.
- Use basic statistical tools to apply for a given research problem.
- Process and manage voluminous data using Statistical software.
- Make predictions and decisions based on data analysis.

2. Programme Structure and Details

2.1 The programme will consist of 32 credits comprising of 7 core courses of 4 credits each (five theory courses and two Practical courses) and two elective courses 2 credits each.

Core Courses (Theory): (5x4) = 20 credits

Core Course (Practicals): (2x4) = 8 credits

Optional Courses (Theory): (2x2) = 4 credits

2.2 Course Details

Sr. No.	Code	Course Title	Credits
		Semester I	
		Core Courses	
1.	DASC 01	Foundation Mathematics	4
2.	DASC 02	Descriptive Statistics	4
3.	DASC 03	Probability Theory	4
4.	DASC 04	Practical I: Basic Statistics	4
Semester II			
		Core Courses	
5.	DASC 05	Statistical Inference	4
6.	DASC 06	Statistical Techniques	4
7.	DASC 07	Practical II	4
		Elective Courses (Any two)	
8.	DASE 08(1)	Time Series Analysis	2
9.	DASE 08(2)	Demography	2
10.	DASE 08(3)	Econometrics	4
11.	DASE 08(4)	Any other Course of relevance	4

3. Duration of the programme

The duration of the Diploma Programme shall be of two semesters (one year).

4. Eligibility for admission

(ii) To be eligible for admission to the programme leading to the award of Post Graduate Diploma the candidate must have passed the Bachelor's Degree examination of Goa University or an equivalent examination of any other recognized University.

(ii) The candidate has to be an employee of a Government or a Non-Government Organisation.

5. Evaluation

Assessment of the performance of the students in a Course shall be based on the examination at the end of each semester. The examination shall consist of either a comprehensive written test or a comprehensive laboratory examination, depending on whether it is a theory Course or laboratory / practical Course.

The written examination and the practical examination carrying 100 marks (4 Credits) shall be of three hours duration and 50 marks (2 Credits) will be of two hours duration.

6. Syllabus

SEMESTER I

CORE COURSES

DASC 01 FOUNDATION MATHEMATICS 4 CREDITS

Module 1: The Real Numbers

The Real Number System; Mathematical Induction; The Real Line.

Module 2: Set Theory

Sets, Set operations, Finite and Infinite Sets, Non-denumerable sets, Cartesian Product, Relations, Functions, Ordered Sets, Linear Point Sets.

Module 3: Functions & Limits

Metric Spaces, Open & closed sets, Neighbourhood and point of accumulation, sequence, Cauchy sequence, limit of a function, continuity.

Module 4: Vectors and Matrices

Vectors, Vector Spaces, Linear Dependence, Basis. Elementary operations with Matrices, Equivalence, Determinants, Inverse of Matrix, Rank of a Matrix, Cramer's Rule. Input-Output technique.

Module 5: Differentiation

Rules of differentiation: Total derivatives and Partial derivatives. Maxima and minima, points of inflexion.

Module 6: Integration

Reimann integral, Fundamental Theorem of the calculus, Techniques of integration and Definite integrals.

References

1. Apostol (1973), Mathematical Analysis.
2. Courant, R. and F. John (1965), Introduction to Calculus and Analysis (Volumes I & II), Interscience Publishers. http://www.astrosen.unam.mx/~aceves/Metodos/ebooks/courant_john1.pdf
3. Jim Hefferon, Linear Algebra, Fourth edition.
4. Thomas Bending (2007), Foundation Mathematics and Statistics, Cengage Learning.

DASC 02 DESCRIPTIVE STATISTICS 4 CREDITS

Module 1: Analysis of Quantitative Data

Types of data; Collection and summarization of univariate and bivariate data including graphical methods; Measures of Central Tendency; Measures of Dispersion; Moments; Skewness and Kurtosis; Bivariate and multivariate normal distributions.

Module 2: Bivariate continuous distributions, conditional and marginal distributions.

Fitting of Curves; Correlation Coefficient; Rank Correlation; Intra-Class Correlation; Discriminant and Cluster analysis; Principal component analysis.

Module 3: Regression and Multiple Correlations

Linear Regression; Plane of Regression; Multiple Correlation; Partial Correlation.

Module 4: Theory of Attributes

Classification of Attributes; Independence of Attributes; Association of Attributes; Association of Attributes for r x s Contingency Table.

References

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002), Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.

2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
4. D. Freedman, R. Pisani and R. Purves, **Statistics**, Norton & Company.

DASC 03 PROBABILITY THEORY 4 CREDITS

Module 1: Basic Concepts in Probability

Introduction to Probability; Different Approaches to Probability Theory; Laws of Probability; Bayes Theorem.

Module 2: Random Variables and Expectation

Random Variables; Bivariate Discrete Random Variables; Bivariate Continuous Random Variables; Mathematical Expectation.

Module 3: Discrete Probability Distributions

Binomial Distribution; Poisson Distribution; Discrete Uniform and Hypergeometric Distributions; Geometric and Negative Binomial Distributions.

Module 4: Continuous Probability Distributions

Normal Distribution; Area Property of Normal Distribution; Continuous Uniform and Exponential Distributions; Gamma and Beta Distributions.

References

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002), Fundamentals of Statistics, Vol. I, 8th Edn. The World Press, Kolkata.
2. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
3. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
4. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi.

DASC 04 PRACTICAL I: BASIC STATISTICS 4 CREDITS

Introduction to MS Excel; Classification and Tabulation of Data; Diagrammatic Presentation of Data Graphical Presentation of Data; Graphical Presentation of Time Series Data; Measures of Central Tendency; Measures of Dispersion Moments, Skewness and Kurtosis; Correlation Analysis; One Sample Tests; Two Sample Tests; Analysis of Variance; Design of Experiments. Finding probabilities: Binomial & Poisson.

SEMESTER II

CORE COURSES

DASC 05 STATISTICAL INFERENCE 4 CREDITS

Module I: Sampling Distributions

Introduction to Sampling Distribution; Sampling Distributions of Statistics; Standard Sampling Distributions-I; Standard Sampling Distributions-II.

Module II: Estimation

Introduction to Estimation; Point Estimation; Interval Estimation for One Population; Interval Estimation for Two Populations.

Module III: Testing of Hypothesis

Concepts of Testing of Hypothesis; Large Sample Tests; Small Sample Tests; Chi-Square and F-Tests

Module IV: Non-parametric Tests

One-Sample Tests; Two-Sample Tests; k-Sample Tests; Analysis of Frequencies.

References

1. Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1997) Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.
2. Dudewicz, E. J., and Mishra, S. N. (1988): Modern Mathematical Statistics. John Wiley & Sons.
3. Goon A.M., Gupta M.K.: Das Gupta B. (2005), Fundamentals of Statistics, Vol. I, World Press, Calcutta.
4. Miller, I. and Miller, M. (2002), E. Freund's Mathematical Statistics (6^{th} addition, low price edition), Prentice Hall of India.
5. Mood A.M, Graybill F.A. and Boes D.C, Introduction to the Theory of Statistics, McGraw Hill.
6. Rohatgi V. K. and Saleh, A.K. Md. E. (2009), An Introduction to Probability and Statistics. 2ndEdn. (Reprint) John Wiley and Sons.

DASC 06 STATISTICAL TECHNIQUES 4 CREDITS

Module I: Sampling Designs

Introduction to Sample Surveys; Simple Random Sampling; Stratified Random Sampling; Some Other Sampling Schemes.

Module II: Analysis of Variance

Introduction to Analysis of Variance; One-way Analysis of Variance; Two-way Analysis of Variance; Two-way Analysis of Variance with m Observations per Cell.

Module III: Design of Experiments

Completely Randomised Design; Randomised Block Design; Latin Square Design; Factorial Experiments.

Module IV: Random Numbers Generation and Simulation Techniques

Random Number Generation for Discrete Variables; Random Number Generation for Continuous Variables; Simulation Techniques; Applications of Simulation.

References

1. Gentle J.E. (1998), Random Number Generation and Monte Carlo Methods, Spriner-Verlag, New York.
2. Robert C.P. and Casella G. (1999), Monte Carlo Statistical Methods, Springer-Verlag, New York.
3. Good P.I. (1999), Resampling Methods: A Practical Guide to Data Analysis, Birkhauser, Boston.
4. Davison and Hinkley (1997), Bootstrap Methods and their Application, Camb. Univ. Press, Cambridge.
5. P McCullagh and J.A. Nelder (1989), Generalized Linear Models, 2nd Ed, Chapman and Hall.
6. Wu, C. F. J. And Hamada, M. (2009), Experiments, Analysis, and Parameter Design Optimization

(Second edition), John Wiley.
7. Renchner, A. C. And Schaalje, G. B. (2008). Linear Models in Statistics (Second edition), John Wiley and Sons.

DASC 07 PRACTICAL II - USING LATEST STATISTICAL SOFTWARE 4 CREDITS

Introduction to the latest software like R, SAS, and SPSS with hands-on training on computers.

Control Charts for Mean; Control Charts for Mean using Range; Control Charts for Mean using Standard Deviation; Control Charts for Range; Control Charts for Standard Deviation; Simple Linear Regression; Multiple Linear Regression; Regression with Dummy Variable; Variable Selection Methods; Estimation of Trend by Curve Fitting; Smoothing or Filtering the Time Series; Seasonal Component Analysis.
Distribution of Quadratic forms; Simple Linear Regression; Multiple Regression; Tests for Hypothesis; Analysis of Variance of a one way classified data; Analysis of Variance of a two way classified data with one observation per cell; Analysis of Covariance of a one way classified data; Analysis of Covariance of a two way classified data.

ELECTIVE COURSES

DASE 08 (1) DEMOGRAPHY 2 CREDITS

Module I: Scope and importance of demography

Module II: Data sources and their limitations: Population census, Vital registration, Population register, Demographic and Health surveys, other sources.
Module III: Evaluation and adjustment of census and survey data on age-sex distribution.

Growth of Human Population: Rate of natural increase; Arithmetic, Geometric and Exponential growths.
Module IV: International statistical classification of diseases, injuries and causes of death. Measures based on diseases (i.e., morbidity), death (i.e., mortality) and birth (i.e., fertility) statistics including measures such as Gross and Net reproduction rates, Mean length of generation, and Census measures of fertility.
Module V: Life Tables: Definition, simple construction and applications. Concept of Migration.

References

1. H.S. Shryock and J. S. Siegel (1976) The Methods and Materials of Demography (Studies in Population).
2. K. Srinivasan (1998) Basic Demographic Techniques and Applications, Sage.
3. R. Ramkumar (2018), Technical Demography, New Age International, Second edition.

DASE 08 (2) TIME SERIES ANALYSIS 2 CREDITS

Module I: Exploratory Analysis of Time Series

Graphical display; classical decomposition model – trend, seasonal and cyclical components.

Module II: Stationary Stochastic Time Series

Weak and strong stationarity; AR, MA and ARMA models; Box-Jenkin's correlogram analysis – ACF and PACF; diagnostic tests.

Module III: Non-Stationary Time Series: ARIMA model; deterministic and stochastic trends; unit root tests – DF and ADF tests.

Module IV: Forecasting based on ARIMA/ARMA model; Introductory VAR Analysis.

References

1. Brockwell, P. and R.A. Davis (2002): Introduction to Time Series and Forecasting, 2nd edition, Springer- Verlag.
2. Chatfield, C. (1996): Analysis of Time Series, 5th edition, Chapman & Hall.
3. Mills, T.C. (1990): Time Series Techniques for Economists, Cambridge University Press.
4. Mills, T.C. (1999): The Econometric Modelling of Financial Time Series, 2nd edition, Cambridge University Press.

DASE 08 (3) ECONOMETRICS 2 CREDITS

Module I: Classical Linear Regression Model: Assumptions; OLS method of estimation; tests of hypotheses; use of dummy variables in regression.

Module II: Problems of Heteroscedasticity and Autocorrelation: GLS method of estimation; tests for heteroscedasticity and autocorrelation.

Module III: Multicollinearity: Nature of the problem and its consequences; econometric solutions.

Module IV: Introductory Analysis of Panel Data.

References

1. Brooks Chris (2002), Introductory Econometrics for Finance, Cambridge University Press.
2. Johnston, J. and J. DiNardo (1997), Econometrics Methods, 4th edition, McGraw-Hill.
3. Kmenta, J. (1990), Elements of Econometrics, 2nd edition, Macmillan.
4. Maddala, G.S. (2001), Introduction to Econometrics, John Wiley.

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AnnexureII

COURSE DETAILS

Effective from Academic Year: 2021-22

Sr. No.	Code	Course Title	Credits	Total Contact Hours
Semester I				
		Core Courses		
1.	DASC 01	Basic Mathematics	4	48
1.	DASC 02	Descriptive Statistics	4	48
2.	DASC 03	Probability Theory	4	48
3.	DASC 04	Practical I: Basic Statistics	4	48
Semester II				
		Core Courses		
4.	DASC 05	Statistical Inference	4	48
5.	DASC 06	Statistical Techniques	4	48
6.	DASC 07	Practical II	4	48
		Elective Courses (Any two)		
7.	DASE 08(1)	Time Series Analysis	2	24
8.	DASE 08(2)	Demography	2	24
9.	DASE 08(3)	Econometrics	4	48
10.	DASE 08(4)	Any other Course of relevance	4	48

Duration of the programme

The duration of the Diploma Programme shall be of two semesters (one year) with Week End and Evening Classes.

SYLLABUS

SEMESTER I

CORE COURSES

COURSE CODE: DASC: 01 **TITLE OF THE COURSE: BASIC MATHEMATICS**

NUMBER OF CREDITS: 4 **TOTAL CONTACT HOURS: 48**

Course Objective: To introduce the elementary mathematical concepts and tools which are useful in understanding the numerical and derivations in the remaining courses of the programme.

Course Outcomes: On successful competition of the Course, the candidate will be able to have basic idea related to the use of real numbers, Sets, functions and limits, matrices, differentiation and integration which are useful for the programme.

Course Content

Module 1: Set theory

Types of sets, Operation on sets, Distributive properties and Demorgans laws, Venn diagrams, Number of elements in a set, Applications of sets.

Module 2: Matrices and Determinants

Types of matrices, Elementary operations on matrices, Determinant of a matrix, Cramer's rule, Solution of linear equations using matrices and determinants, Consistency of linear equations. (No theorems and proofs).

Module 3: Functions and Limits

Cartesian coordinate system, ordered pairs, Cartesian product, Relations, Functions, Types of functions, Limit of a function, Concept of continuity.

Module 4: Differentiation

Definition of derivative of a function, Standard forms for differentiation, Derivatives of functions (algebraic, exponential and logarithmic only). Rules for differentiation, Applications of differentiation in commerce and economics, Concept of partial derivatives.

Module 5: Integration

Meaning of integration, Standard forms, Methods of finding integrals of algebraic, exponential and logarithmic expressions, Definite integration, Application of integration in science, commerce and economics, Area under a curve (No theorems and proofs).

Pedagogy:

- Traditional Chalk board Classes.
- Online / Power-point presentations & Videos
- Assignments and presentations

References

1. Shanti Narayan (2009) A Textbook of Matrices, S. Chand & Co, New Delhi
2. Mittal P. K, Mathematics for Degree Students (2010), S. Chand & Co. Mumbai
3. Chitale S.G & Joshi N, A New Approach to mathematical Techniques, Sheth Publishers, Mumbai
4. Shanti Narayan, Differential Calculus, S. Chand & Co. New Delhi

COURSE CODE: DASC: 02 TITLE OF THE COURSE: DESCRIPTIVE STATISTICS

NUMBER OF CREDITS: 4 TOTAL CONTACT HOURS: 48

Course Objective: To learner should be able to understand:

- the properties of a distribution and to analyse and compare two or more distributions.
- the statistical relationship and quantitative measures of relationship between two variables for determining the strength of relationship.
- the average relationship between two variables in terms of regression analysis and the multiple and partial correlation.
- the characteristics and analysis of qualitative data.

Course Outcomes: On successful competition of the Course, the candidate will learn to apply quantitative and qualitative techniques of statistics in the analysis of data.

Module 1: Analysis of Quantitative Data

Types of data; Collection and summarization of univariate and bivariate data including graphical methods; Measures of Central Tendency; Measures of Dispersion; Moments; Skewness and Kurtosis; Bivariate and multivariate normal distributions.

Module 2: Bivariate continuous distributions, conditional and marginal distributions.

Fitting of Curves; Correlation Coefficient; Rank Correlation; Intra-Class Correlation; Discriminant and Cluster analysis; Principal component analysis.

Module 3: Regression and Multiple Correlations

Linear Regression; Plane of Regression; Multiple Correlation; Partial Correlation.

Module 4: Theory of Attributes
Classification of Attributes; Independence of Attributes; Association of Attributes; Association of Attributes for r x s Contingency Table.

Pedagogy:
- Traditional Chalk board Classes.
- Online / Power-point presentations & Videos
- Lab exercises
- Assignments and presentations

References
1. Goon A.M., Gupta M.K. and Dasgupta B. (2002), Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
4. D. Freedman, R. Pisani and R. Purves, **Statistics**, Norton & Company.

COURSE CODE: DASC: 03 TITLE OF THE COURSE: PROBABILITY THEORY
NUMBER OF CREDITS: 4 TOTAL CONTACT HOURS: 48

Course Objective: To introduce the concepts, approaches and laws of probability and to familiarise with the useful aspects of Random experiments and computation of probabilities; Probability and distribution functions for Univariate and Bivariate random variables for discrete and continuous cases; Mathematical expectation, Standard continuous distributions.

Course Outcomes: On successful competition of the Course, the candidate will understand to make predictions based on data analysis.

Course Content
Module 1: Basic Concepts in Probability
Introduction to Probability; Different Approaches to Probability Theory; Laws of Probability; Bayes Theorem.

Module 2: Random Variables and Expectation
Random Variables; Bivariate Discrete Random Variables; Bivariate Continuous Random Variables; Mathematical Expectation.

Module 3: Discrete Probability Distributions
Binomial Distribution; Poisson Distribution; Discrete Uniform and Hypergeometric Distributions; Geometric and Negative Binomial Distributions.

Module 4: Continuous Probability Distributions
Normal Distribution; Area Property of Normal Distribution; Continuous Uniform and Exponential Distributions; Gamma and Beta Distributions.

Pedagogy:

- Traditional Chalk board Classes.
- Online / Power-point presentations & Videos
- Lab exercises
- Assignments and presentations

References

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002), Fundamentals of Statistics, Vol. I, 8th Edn. The World Press, Kolkata.
2. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
3. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
4. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi.

COURSE CODE: DASC:04 TITLE OF THE COURSE: PRACTICAL I- BASIC STATISTICS

NUMBER OF CREDITS: 4 TOTAL CONTACT HOURS: 48

Course Objective: To acquaint with the use of MS Excel for graphical representation of data and use of various statistical techniques for processing of data.

Course Outcomes: On successful competition of the Course, the candidate will be able to use MS Excel to display data graphically and use the statistical tool suitable to the data sets.

Course Content

Introduction to MS Excel; Classification and Tabulation of Data; Diagrammatic Presentation of Data. Graphical Presentation of Data; Graphical Presentation of Time Series Data; Measures of Central Tendency; Measures of Dispersion Moments, Skewness and Kurtosis; Correlation Analysis; One Sample Tests; Two Sample Tests; Analysis of Variance; Design of Experiments. Finding probabilities: Binomial & Poisson.

Pedagogy:

- Lab demonstration and exercises using MS Excel
- Online / Power-point presentations & Videos
- Assignments and presentations

SEMESTER II

CORE COURSES

COURSE CODE: DASC: 05 TITLE OF THE COURSE: STATISTICAL INFERENCE

NUMBER OF CREDITS: 4 TOTAL CONTACT HOURS: 48

Course Objective: Learning basic concepts and methodologies of sampling distributions with their applications, estimation theory, parametric and non-parametric testing of hypothesis and to draw inferences about the population on the basis of samples by using appropriate statistical techniques.

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Course Outcomes: Successful competition of the Course will enable the learner to apply appropriate statistical techniques to draw inferences about the population on the basis of samples.

Course Content

Module I: Sampling Distributions

Introduction to Sampling Distribution; Sampling Distributions of Statistics; Standard Sampling Distributions-I; Standard Sampling Distributions-II.

Module II: Estimation

Introduction to Estimation; Point Estimation; Interval Estimation for One Population; Interval Estimation for Two Populations.

Module III: Testing of Hypothesis

Concepts of Testing of Hypothesis; Large Sample Tests; Small Sample Tests; Chi-Square and F-Tests

Module IV: Non-parametric Tests

One-Sample Tests; Two-Sample Tests; k-Sample Tests; Analysis of Frequencies.

Pedagogy:

- Traditional Chalk board Classes.
- Online / Power-point presentations & Videos
- Lab exercises
- Assignments and presentations

References

1. Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1997) Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.
2. Dudewicz, E. J., and Mishra, S. N. (1988): Modern Mathematical Statistics. John Wiley & Sons.
3. Goon A.M., Gupta M.K.: Das Gupta B. (2005), Fundamentals of Statistics, Vol. I, World Press, Calcutta.
4. Miller, I. and Miller, M. (2002), E. Freund's Mathematical Statistics (6^{th} addition, low price edition), Prentice Hall of India.
5. Mood A.M, Graybill F.A. and Boes D.C, Introduction to the Theory of Statistics, McGraw Hill.
6. Rohatgi V. K. and Saleh, A.K. Md. E. (2009), An Introduction to Probability and Statistics. 2ndEdn. (Reprint) John Wiley and Sons.

COURSE CODE: DASC: 06 TITLE OF THE COURSE: STATISTICAL TECHNIQUES

NUMBER OF CREDITS: 4 TOTAL CONTACT HOURS: 48

Course Objective: To acquaint the learners with the statistical techniques useful for Sample surveys and their analysis, ANOVA, design of experiments and some useful methods of generation of random numbers and applications of simulation techniques.

Course Outcomes: Successful competition of the Course will help the learner to prepare appropriate sampling design and use suitable statistical techniques for sample data.

Course Content

Module I: Sampling Designs

Introduction to Sample Surveys; Simple Random Sampling; Stratified Random Sampling; Some Other Sampling Schemes.

Module II: Analysis of Variance

Introduction to Analysis of Variance; One-way Analysis of Variance; Two-way Analysis of Variance; Two-way Analysis of Variance with m Observations per Cell.

Module III: Design of Experiments

Completely Randomised Design; Randomised Block Design; Latin Square Design; Factorial Experiments.

Module IV: Random Numbers Generation and Simulation Techniques

Random Number Generation for Discrete Variables; Random Number Generation for Continuous Variables; Simulation Techniques; Applications of Simulation.

Pedagogy:

- Traditional Chalk board Classes.
- Online / Power-point presentations & Videos
- Lab exercises
- Assignments and presentations

References

1. Gentle J.E. (1998), Random Number Generation and Monte Carlo Methods, Spriner-Verlag, New York.
2. Robert C.P. and Casella G. (1999), Monte Carlo Statistical Methods, Springer-Verlag, New York.
3. Good P.I. (1999), Resampling Methods: A Practical Guide to Data Analysis, Birkhauser, Boston.
4. Davison and Hinkley (1997), Bootstrap Methods and their Application, Camb. Univ. Press, Cambridge.
5. P McCullagh and J.A. Nelder (1989), Generalized Linear Models, 2nd Ed, Chapman and Hall.
6. Wu, C. F. J. And Hamada, M. (2009), Experiments, Analysis, and Parameter Design Optimization (Second edition), John Wiley.
7. Renchner, A. C. And Schaalje, G. B. (2008). Linear Models in Statistics (Second edition), John Wiley and Sons.

COURSE CODE: DASC: 07 **TITLE OF THE COURSE: PRACTICAL II USING LATEST STATISTICAL SOFTWARE**

NUMBER OF CREDITS: 4 **TOTAL CONTACT HOURS: 48**

Course Objective: To introduce and acquaint the learner with the use of latest statistical software for processing and managing voluminous data.

Course Outcomes: On successful competition of the Course, the candidate will process and manage voluminous data by using the latest statistical software.

Course Content

Introduction to the latest software like R, SAS, and SPSS with hands-on training on computers.

Control Charts for Mean; Control Charts for Mean using Range; Control Charts for Mean using Standard Deviation; Control Charts for Range; Control Charts for Standard Deviation; Simple Linear Regression; Multiple Linear Regression; Regression with Dummy Variable; Variable Selection Methods; Estimation of Trend by Curve Fitting; Smoothing or Filtering the Time Series; Seasonal Component Analysis.

Distribution of Quadratic forms; Simple Linear Regression; Multiple Regression; Tests for Hypothesis; Analysis of Variance of a one way classified data; Analysis of Variance of a two way classified data with one observation per cell; Analysis of Covariance of a one way classified data; Analysis of Covariance of a two way classified data.

Pedagogy:

- Lab demonstration and exercises using MS Excel

- Online / Power-point presentations & Videos
- Assignments and presentations

ELECTIVE COURSES

COURSE CODE: DASE 08 (1) **TITLE OF THE COURSE: DEMOGRAPHY**

NUMBER OF CREDITS: 2 **TOTAL CONTACT HOURS: 24**

Course Objective: To provide knowledge about the different concepts of demography, sources of data, evaluation and adjustment of data.
Course Outcomes: **The learner will be acquainted with the knowledge of different concepts of demography, sources of data and describe demographic measurements, evaluate and adjust data.**

Course Content
Module I: Scope and importance of demography
Module II: Data sources and their limitations: Population census, Vital registration, Population register, Demographic and Health surveys, other sources.
Module III: Evaluation and adjustment of census and survey data on age-sex distribution.
Growth of Human Population: Rate of natural increase; Arithmetic, Geometric and Exponential growths.
Module IV: International statistical classification of diseases, injuries and causes of death. Measures based on diseases (i.e., morbidity), death (i.e., mortality) and birth (i.e., fertility) statistics including measures such as Gross and Net reproduction rates, Mean length of generation, and Census measures of fertility.
Module V: Life Tables: Definition, simple construction and applications. Concept of Migration.

Pedagogy:
- Traditional Chalk board Classes.
- Online / Power-point presentations & Videos
- Assignments and presentations

References
1. H.S. Shryock and J. S. Siegel (1976) The Methods and Materials of Demography (Studies in Population).
2. K. Srinivasan (1998) Basic Demographic Techniques and Applications, Sage.
3. R. Ramkumar (2018), Technical Demography, New Age International, Second edition.

DASE 08 (2) **2 CREDITS**

COURSE CODE: DASE 08 (2) **TITLE OF THE COURSE: TIME SERIES ANALYSIS**

NUMBER OF CREDITS: 2 **TOTAL CONTACT HOURS: 24**

Course Objective: To introduce learner to time series methods and the applications of these methods to different types of data.

Course Outcomes: Upon successful completion, students will have the knowledge and skills to:

- Apply the concept of stationarity to the analysis of time series data
- Run and interpret time-series models and regression models for time series;
- Use the Box-Jenkins approach to model and forecast time-series data empirically;
- Use appropriate models to analyse time series data;
- Utilise fundamental research skills in applied time series analysis; and
- Use software packages for analysing time series data.

Course Content

Module I- Exploratory Analysis of Time Series: Graphical display; classical decomposition model – trend, seasonal and cyclical components.

Module II- Stationary Stochastic Time Series: Weak and strong stationarity; Auto Regressive (AR), Moving Average (MA) and Auto Regressive Moving Average, (ARMA) models; Box-Jenkin's correlogram analysis – Auto Correlation Function (ACF) and Partial Correlation Function (PACF); diagnostic tests.

Module III- Non-Stationary Time Series**: Auto-Regressive Integrated Moving Average (ARIMA) model; deterministic and stochastic trends; unit root tests – DF and ADF tests.**

Module IV- Forecasting based on ARIMA/ARMA model; Introductory Vector Autoregression (VAR) Analysis.

Pedagogy:

- Traditional Chalk board Classes.
- Online / Power-point presentations & Videos
- Lab exercises
- Assignments and presentations

References

1. Brockwell, P. and R.A. Davis (2002): Introduction to Time Series and Forecasting, 2nd edition, Springer- Verlag.
2. Chatfield, C. (1996): Analysis of Time Series, 5th edition, Chapman & Hall.
3. Mills, T.C. (1990): Time Series Techniques for Economists, Cambridge University Press.
4. Mills, T.C. (1999): The Econometric Modelling of Financial Time Series, 2nd edition, Cambridge University Press.

COURSE CODE: DASE 08 (3) **TITLE OF THE COURSE: ECONOMETRICS**

NUMBER OF CREDITS: 2 **TOTAL CONTACT HOURS: 24**

Course Objective: To provide learners with the knowledge and skills of basic applied econometrics to enable them to understand and to conduct basic econometrics analyses.

Course Outcomes: Upon successful completion, learners will be able to understand, evaluate and analyse economic data; interpret statistical evidence from economic data.

Course Content

Module I: Classical Linear Regression Model: Assumptions; OLS method of estimation; tests of hypotheses; use of dummy variables in regression.

Module II: Problems of Heteroscedasticity and Autocorrelation: GLS method of estimation; tests for heteroscedasticity and autocorrelation.

Module III: Multicollinearity: Nature of the problem and its consequences; econometric solutions.

Module IV: Introductory Analysis of Panel Data.

Pedagogy:

- Traditional Chalk board Classes.
- Online / Power-point presentations & Videos
- Lab exercises
- Assignments and presentations

References

1. Brooks Chris (2002), Introductory Econometrics for Finance, Cambridge University Press.
2. Johnston, J. and J. DiNardo (1997), Econometrics Methods, 4th edition, McGraw-Hill.
3. Kmenta, J. (1990), Elements of Econometrics, 2nd edition, Macmillan.
4. Maddala, G.S. (2001), Introduction to Econometrics, John Wiley.

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