VIMALA COLLEGE (AUTONOMOUS)

THRISSUR

(Affiliated to University of Calicut)

B.Sc. DEGREE PROGRAMME

IN

STATISTICS

UNDER CHOICE BASED CREDIT AND SEMESTER SYSTEM

SCHEME, SYLLABUS AND MODEL QUESTION PAPER

2016 ADMISSION ONWARDS

CORE COURSES, COMPLEMENTARY COURSES & OPEN COURSE

CONTENTS

B.Sc. DEGREE PROGRAMME (STATISTICS CORE)
COURSE SRTUCTURE

Semester	Course Code	Course Title	Total hours	Hours /week	Credit
I	VEG1A 01	Common Course I – English	72	4	4
	VEG1A 02	Common Course II – English	90	5	3
	VML1A 01 VHD1A 01 VSK1A 01	Common Course III – Language other than English	72	4	4
	VST1 B01	Core course I Basic statistics and probability	72	4	4
	VMT1C01	Complementary Course I Mathematics	72	4	3
	VME1C01	Complementary Course I Mathematical Economics	72	4	3
		Total	**450**	**25**	**21**
II	VEG2A 03	Common Course IV – English	72	4	4
	VEG2A 04	Common Course V – English	90	5	3
	VML2A 02 VHD2A 02 VCK2A 02	Common Course VI – Language other than English	72	4	4
	VST2 B02	Core Course II Bivariate Random Variables and probability Distributions	72	4	4
	VMT2C02	Complementary Course II Mathematics	72	4	3
	VME2C02	Complementary Course II Mathematical Economics	72	4	3
		Total	**450**	**25**	**21**
III	VEG3A05	Common Course VI – English	90	5	4
	VML3A03 VHD3A 03 VCK3A 03	Common Course VIII - Language other than English	90	5	4
	VST3 B03	Core Course III -Statistical Estimation	90	5	4
	VMT3C03	t Complementary CourseIII Mathematics	90	5	3
	VME3C03	Complementary Course III Mathematical Economics	90	5	3
		Total	**450**	**25**	**18**
	VEG4A06	Common Course IX – English	90	5	4

IV	VML4 A04 VHD4A 04 VCK4A 04	Common Course X - Language other than English	90	5	4
	VST4 B04	Core Course IV –Testing of Hypothesis	90	5	4
	VMT4C04	Complementary Course IV – Mathematics	90	5	3
	VME4C04	Complementary Course IV Mathematical Economics	90	5	3
		Total	**450**	**25**	**18**
V	VST5 B05	Core Course V –Mathematical methods in statistics	90	5	4
	VST5 B06	Core Course VI –Statistical Computing	90	5	4
	VST5 B07	Core Course VII Sample Surveys	90	5	4
	VST5 B08	Core Course VIII Operations research and Statistical Quality control	90	5	4
	VST5D01	Open Course – (*course from other streams*):	36	2	2
	VST5PL1	Core Course IX Practical I	18	1	2
		Project	36	2	
		Total	**450**	**25**	**20**
VI	VST6 B09	Core Course X –Time series and Index numbers	90	5	4
	VST6 B10	Core Course XI – Design of Experiments	90	5	4
	VST6 B11	Core Course XII – Population studies and Actuarial Science	90	5	4
	VST6B12	Core Course XIII Linear Regression Analysis	90	5	4
	VST6 E01 VST6 E02 VST6 E03	Core Course XII – Elective: I Reliability Theory Elective II Elective III	54	3	2
	VST6 PL2	Core Course XIV – Practical II			2
	VST6PR	Project	36	2	2
		Total	**450**	**25**	**22**
		Total Credit			**120**

CREDIT AND MARK DISTRIBUTION IN EACH SEMESTERS

Total Credits: 120; Total Marks: 3450

Semester	*Course*	*Credit*	*Marks*
I	Common course: English	4	100
	Common course: English	3	100
	Common course: Additional Language	4	100
	Core Course I:	4	100
	Complementary course: Mathematics	3	100
	Complementary course: Mathematical Economics	3	100
	Total	**21**	**600**
II	Common course: English	4	100
	Common course: English	3	100
	Common course: Additional Language	4	100
	Core Course II:	4	100
	Complementary course: Mathematics	3	100
	Complementary course: Mathematical Economics	3	100
	Total	**21**	**600**
III	Common course: English	4	100
	Common course: Additional Language	4	100
	Core Course III: Mechanics	4	100
	Complementary course: Mathematics	3	100
	Complementary course: Mathematical Economics	3	100
	Total	**18**	**500**
IV	Common course: English	4	100
	Common course: Additional Language	4	100
	Core Course IV:	4	100
	Complementary course: Mathematics	3	100
	Complementary course: Mathematical Economics	3	100
	Total	**18**	**500**
V	Core Course V:	4	100
	Core Course VI:	4	100
	Core Course VII:	4	100
	Core Course VIII:	4	100
	Core Course IX: Practical 1	2	100
	Open course:	2	50
	Total	**20**	**550**
	Core Course X:	4	100
	Core Course XI:	4	100
	Core Course XII:	4	100

VI	Core Course XIII:	4	100
	Core Course XIV: Practical II	2	100
	Core Course XVI: Project	2	100
	Elective	2	100
	Total	**22**	**700**
	Grand Total	**120**	**3450**

COURSE STRUCTURE STATISTICS(CORE)

Credit Distribution

Semester	*Common course*		*Core course*	*Complementary course*		*Open course*	*Total*
	English	*Additional Language*		*Mathematics*	*Mathematical Economics*		
I	4+3	4	4	3	3	-	21
II	4+3	4	4	3	3	-	21
III	4	4	4	3	3	-	18
IV	4	4	4	3	3	-	18
V	-	-	4+4+4+4+2	-	-	2	20
VI	-	-	4+4+4+4+2+2+2	-	-	-	22
Total	**22**	**16**	**56**	**12**	**12**	**2**	**120**

Mark Distribution and Indirect Grading System

Mark system is followed instead of direct grading for each question. After external and internal evaluations marks are entered in the answer scripts. All other calculations, including grading, will be done by using the software. Indirect Grading System in 7 point scale is followed. Each course is evaluated by assigning marks with a letter grade (A^+, A, B, C, D, E or F) to that course by the method of indirect grading.

Mark Distribution

Sl. No.	*Course*	*Marks*
1	English	600
2	Additional Language	400
3	Core course: Statistics	1600
4	Complementary course I: Mathematics	400
5	Complementary course II: Mathematical Economics	400
6	Open Course	50
	Total Marks	**3450**

Seven point Indirect Grading System

% of Marks	*Grade*	*Interpretation*	*Grade Point Average*	*Range of Grade points*	*Class*
90 and above	A^+	Outstanding	6	5.5 - 6	First Class with distinction
80 to below 90	A	Excellent	5	4.5 – 5.49	
70 to below 80	B	Very good	4	3.5 – 4.49	First Class
60 to below 70	C	Good	3	2.5 – 3.49	
50 to below 60	D	Satisfactory	2	1.5 – 2.49	Second Class
40 to below 50	E	Pass/Adequate	1	0.5 – 1.49	Pass
Below 40	F	Failure	0	0 – 0.49	Fail

An aggregate of E grade with 40% marks (after external and internal put together) is required in each course for a pass and also for awarding a degree. Appearance for Internal Assessment (IA) and End Semester Evaluation (ESEexternal)) are compulsory and no grade shall be awarded to a candidate if she/he is absent for IA/ESE or both.

After the successful completion of a semester, Semester Grade Point Average (SGPA) of a student in that semester is calculated using the formula given below. For the successful completion of a semester, a student should pass all courses. However, a student is permitted to move to the next semester irrespective of SGPA obtained.

The Semester Grade Point Average can be calculated as

$$SGPA = \frac{\text{Sum of the credit points of all courses in a semester}}{\text{Total credits in that semester}}$$

$$ie.,\ SGPA = \frac{C1*G1 + C2*G2 + C3*G3 + \ldots\ldots}{n}$$

where G1, G2, … are grade points of different courses; C1, C2, ... are credits of different courses of the same semester and n is the total credits in that semester.

The Cumulative Grade Point Average (CGPA) of the student is calculated at the end of a programme. The CGPA of a student determines the overall academic level of the student in a programme and is the criterion for ranking the students. CGPA can be calculated by the following formula
The Cumulative Grade Point Average (CGPA) can be calculated as

$$CGPA = \frac{\text{Total credit points obtained in all semesters}}{\text{Total credits}}$$

Core Course Structure
Total Credits: 56 (Internal: 20%; External: 80%)

Semester	Course code	Course title	Hours / week	Total hours	Credits	Marks
I	VST1B01	Basic Statistics and Probability	4	72	4	100
II	VST2B02	Bivariate Random Variable and Probability Distributions	4	72	4	100
III	VST3B03	Statistical Estimation	5	90	4	100
IV	VST4B04	Testing of Hypothesis	5	90	4	100
V	VST5B05	Mathematical Methods in Statistics	5	90	4	100
	VST5B06	Statistical Computing	5	90	4	100
	VST5B07	Sample surveys	5	90	4	100
	VST5B08	Operations Research and Statistical Quality Control	5	90	4	100
	VST5PL1	Practical Paper 1**	1	18	2	100
VI	VST6B 09	Time Series and Index Numbers	5	90	4	100
	VST6B10	Design of Experiments	5	90	4	100
	VST6B 11	Population Studies and Actuarial Science	5	90	4	100
	VST6B12	Linear Regression Analysis	5	90	4	100
	VST6P L2	Practical Paper II**	-	-	2	100
	VST6P R*	Project Work	2	36	2	100
	VST6E0 1	Elective Paper	3	54	2	100
Total					**56**	**1600**

* Project work 2 Hrs/ week in Semesters 5 and 6.

** Practical I and II are of three hours duration will be conducted as theory exams .The numerical questions from the prescribed areas will be asked for external examination. The students have to maintain a practical record book. The valuation of the record work shall be done internally.

CORE COURSE THEORY: EVALUATION SCHEME

The evaluation scheme for each course contains two parts: *viz.*, internal evaluation and external evaluation. Maximum marks from each unit is prescribed in the syllabus.

1. INTERNAL EVALUATION

20% of the total marks in each course are for internal evaluation.

Table 1: Components of Evaluation

Sl. No.	*Components*	*Marks*
1	Attendance	5
2	Test papers: I & II	5 + 5
3	Assignment	2
4	Seminar/ Viva	3
	Total Marks	20

Table 2: Percentage of Attendance and Eligible Marks

% of attendance	*Marks*
Above 90%	5
85-89%	4
80-84%	3
76-79%	2
75%	1

Table 3: Pattern of Test Papers

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
1.5 Hours	One word	4	4	1	4
	Short answer	5	4	2	8
	Paragraph	5	4	3	12
	Problem	4	2	3	6
	Essay	2	1	10	10
				*Total Marks**	40

*90% and above = 5, 80 to below 90% = 4.5, 70 to below 80% = 4, 60 to below 70% = 3.5, 50 to below 60% = 3, 40 to below 50% = 2, 35 to below 40% = 1, below 35% = 0

Table 4 : Internal assessment of the practical paper

Sl. No.	*Components*	*Marks*
1	Test Papers: I & II	5+5
2	Record of the Practical problems done	10
	Total Marks	20

2. EXTERNAL EVALUATION

External evaluation carries 80% marks. University examinations will be conducted at the end of each semester.

Table 1: Pattern of Question Paper

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
	One word or one phrase or true or false	10	10	1	10

3 Hours	Short answer(one or two Sentence)	7	7	2	14
	Paragraph/half page	7	5	4	20
	Problems	7	4	4	16
	Essay	4	2	10	20
				Total Marks	80

CORE COURSE PROJECT: EVALUATION SCHEME

Project evaluation will be conducted at the end of sixth semester.

Project:

1. Project work should be done as an extension of topics in the syllabus.
2. Project work may be done individually or as group of maximum of six students.

Guidelines for doing project

The project work provides the opportunity to study a topic in depth that has been chosen or which has been suggested by the project guide. The students first carryout a literature survey Which will provide the background information necessary for the investigations during the research phase of the project.

- **The written report must be submitted at the end of the project**.

Table 1: Internal Evaluation

Sl. No	*Criteria*	*Marks*
1	Punctuality	5
2	Skill in doing project work/data	5
3	Scheme Organisation of Project Report	5
4	Viva-Voce	5
	Total Marks	20

Table 2: External Evaluation

Project evaluation: Individual presentation is compulsory and individual Log book should be submitted

Sl. No	*Criteria*	*Marks*
1	Preparation of the project report	5
2	Topic, methodology,	25
3	Presentation	25
4	viva	25
	Total	80

OPEN COURSES OFFERED BY STATISTICS DEPARMENT (For students from other streams)

1	ST5 D01	Basic Statistics
2	ST5 D02	Economic Statistics
3	ST5 D03	Quality Control

ELECTIVE COURSES OFFERED BY STATISTICS DEPARMENT (For students from other streams)

1	VST6E01	Reliability Theory
2	VST6E02	Stochastic Modelling
3	VST6E03	Actuarial Science- Probability Models and Risk Theory

Award of Degree

The successful completion of all the courses (common, core, complementary and open courses) prescribed for the B.Sc Statistics programme with E grade (40 %) shall be the minimum requirement for the award of B.Sc Statistics programme degree.

SYLLABUS FOR
B.Sc. STATISTICS-SEMESTER SYSTEM

SEMESTER I : CORE COURSE I
VST1B01: BASIC STATISTICS AND PROBABILITY

Module 1: Population, Sample, Statistical data, Types of data, Methods of data collection, classification and tabulation of data, frequency distribution, descriptive measures of frequency distribution - central tendency, dispersion, skewness and kurtosis.(Concept and brief description only) :**15 hours**

Module 2: Random experiment, Sample space, event, classical definition of probability, statistical regularity, field, sigma field, axiomatic definition of probability and simple properties, addition theorem (two and three events), conditional probability of two events, multiplication theorem, independence of events-pair wise and mutual, Bayes theorem.
25 hours

Module 3: Random variable-discrete and continuous, probability mass function (pmf) and probability density function (pdf)-properties and examples, cumulative Distribution function and its properties, change of variable (univariate case).:**15 hours**

Module 4: Fitting of straight line, parabola, exponential, polynomial, (least square method), correlation-Karl Pearson's Correlation coefficient, Rank Correlation-Spearman's rank correlation co-efficient, Partial Correlation, Multiple Correlation, regression, two regression lines, regression coefficients.:**17 hours**

References

1. V. K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
2. S.C.Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons
3. A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, McGraw Hill

John E Freund, Mathematical Statistics (6^{th} edn), Pearson Edn, NewDelhi

SEMESTER II: CORE COURSE 2.
VST2B02: BIVARIATE RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS

Module 1: Mathematical expectations-definition, raw and central moments (definition and relationships), moment generating function and properties, characteristic function (definition and use only).Moment measures of skewness and kurtosis. **15 hours**

Module 2: Bivariate random variables, joint pmf and joint pdf, marginal and conditional probability, independence of random variables .Expectation of Bivariate random variables-conditional mean and variance, covariance, Karl Pearson Correlation coefficient, independence of random variables based on expectation. **20 hours**

Module 3: Discrete probability distributions- Bernoulli, Binomial, Poisson, Geometric, negative binomial (definition, properties and applications), Uniform (mean, variance and mgf).**25 hours**

Module 4: Continuous probability distributions -Uniform, exponential, gamma, Beta, Normal (definition, properties and applications), Lognormal and Cauchy (Definition only), transformation of bivariate random variables. **12 Hours**

References

1. V. K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
2. S.C.Gupta and V. K. kapoor Fundamentals of Mathematical Statistics, Sultan Chand and Sons
3. A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, McGraw Hill
4. John E Freund, Mathematical Statistics (6^{th} edn), Pearson Edn, NewDelhi

SEMESTER III :CORE COURSE 3.

VST3B03: STATISTICAL ESTIMATION

Module 1: Limit Theorems: Chebyshev's inequality, Convergence in probability(definition and example only), weak law of large numbers (iid case), Bernoulli law of large numbers.Central limit theorem (Llindberg – Levy iid case). **15 hours**

Module 2: Sampling distributions: Parameter, Statistic, standard error, Sampling from normal distribution: distribution of sample mean, sample variance, chi-square, students t distribution, and F distribution (definition, property and relationships only) :**20 hours**

Module 3: Estimation of Parameter: Point Estimation. Desirable properties of a good estimator, unbiasedness, consistency, sufficiency, Fisher Neyman factorization theorem(Statement and application only), efficiency, Cramer Rao inequality. **25 hours**

Module 4: Methods of Estimation; method of maximum likelihood, method of moments, method of least squares. **15 hours.**

Module 5; Interval Estimation; Large sample confidence interval for mean, equality of means, equality of proportions. Derivation of exact confidence intervals for means , variance and ratio of variances based on Normal,t,chi square distribution; **15 hours**

References

1. V. K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
2. S.C.Gupta and V. K. Kapoor. Fundamentals of Mathematical Statistics, Sultan Chand and Sons
3. A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, McGraw Hill
4. John E Freund, Mathematical Statistics (6^{th} edn), Pearson Edn, NewDelhi

SEMESTER IV: CORE COURSE 4.

VST4B04: TESTING OF HYPOTHESIS

Module 1: Testing of Hypotheses; concept of testing hypotheses, simple and composite hypotheses, null and alternative hypotheses, type I and type II errors, critical region, level of significance, power of test. p – value. Most powerful tests, Uniformly most powerful test ,Neyman Pearson Lemma .**20 hours**

Module 2: Large sample tests concerning mean, equality of means, proportions, equality of proportions. Small sample tests based on t distribution for mean, equality of means and paired t test: **30 hours**

Module 3: Tests based on F distribution. Tests based on chi square distribution for variance, goodness of fit and for independence of attributes .Test for correlation coefficients. **20 hours.**

Module 4: Non parametric tests. advantages, disadvantages ,Kolmogrov Smirnov test, one sample and two sample sign tests,run test. Wilcoxon signed rank test, median test, Mann Whitney test. **20 hours**

References

1. V. K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
2. S.C.Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons
3. A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, McGraw Hill
4. John E Freund, Mathematical Statistics (6^{th} edn), Pearson Edn, NewDelhi

SEMESTER V: CORE COURSE 5.

VST5B05: MATHEMATICAL METHODS IN STATISTICS

Module 1: Real Number system: Mathematical induction, order properties of real number, Bernoulli, Cauchy, triangle inequality, absolute value, Completeness property-suprema & infima, Archimedian property, Density theorem, nested interval property. **20 hours**

Module 2: Sequences: Limit, limit theorems, Squeeze theorem, convergence of sequence, root test and ratio test, monotone convergence theorem, subsequence and Bolzano-Weierstrass theorem, Cauchy criterion, limits of functions, limit theorems of functions, **25 hours**

Module 3: Continuous functions: Definition, Boundedness theorem, Maximum-minimum theorem, Location of roots theorem, Intermediate value theorem, uniform continuity, Differentiation, Interior extremum theorem, Rolle's theorem, Mean value theorem, Taylor's theorem. **25 hours**

Module 4: Riemann Integration: Definition, Integrability criteria, integrability of continuous and monotone functions, properties of integrals, first and second fundamental theorems on integral calculus. **20 hours**

Books of references

1. Malik S.C. and Savitha Arora, Real Analysis, New Age International
2. Robert G Bartle, Real Analysis, Wiely
3. Shanti Narayanan, Elements of Real Analysis

SEMESTER V :CORE COURSE 6.

VST5B06: STATISTICAL COMPUTING

Module 1: Introduction to R: R as a calculator, statistical software and a programming language, R preliminaries, getting help, data inputting methods(direct and importing from other spread sheet

applications like Excel), data accessing, and indexing, Graphics in R, built in functions, saving, storing and retrieving work. **20 Hours**

Module 2: Descriptive statistics:, diagrammatic representation of univariate and bivariate data (box plots, stem and leaf diagrams, bar plots, pie diagram, scatter plots), measures of central tendency (mean, median and mode), partition values, measures of dispersion (range, standard deviation, mean deviation and inter quartile range), summaries of a numerical data, skewness and kurtosis, random sampling with and without replacement. **25 Hours**

Module 3: Probability Distributions: R as a set of statistical tables- cumulative distribution, probability density function, quantile function, and simulate from the distribution, plotting probability curves for standard distributions. **20 Hours**

Module 4: Statistical Inference: classical tests: One- and two-sample tests, z-test, t-test,F-test, chi-square test of independence and goodness of fit, interval estimation for mean, difference of mean and variance, tests for normality (shapiro-wilks test, wilcoxon's test and q-q plot), Anova(one- way and two-way), correlation and regression analysis(bivariate and multivariate data), polynomial regression .**25 Hours**

References:

1. Michale J. Crawley, THE R BOOK, John Wiley & Sons, England (2009)
2. Sudha G. Purohit et.al., Statistics Using R, Narosa Publishing House, , India(2008)
3. John Verzani, simple R-Using R for Introductory Statistics, (http:// www.math.csi.cuny.edu/Statistics/R/SimpleR/Simple.)
4. W. N. Venables, D. M. Smith and the R Core Team, An Introduction to R , Notes on R: A Programming Environment for Data Analysis and Graphics, Version 2.15.2 (2012-10-26) (http://www.r-project.org)

SEMESTER V: CORE COURSE 7.

VST5B07: SAMPLE SURVEYS

Module 1: Census and Sampling, principal steps in sample survey-probability sampling, judgment sampling, organization and execution of large sample surveys, sampling and non-sampling errors, preparation of questionnaire. **20 hours**

Module 2: Simple random sampling with and without replacement- methods of collecting simple random samples, unbiased estimate of the population mean and population total-their variances and estimate of these variances-simple random sampling for proportions **:25 hours**

Module 3: Stratified random sampling: estimation of population mean and total, proportional and Neymann allocation of sample sizes-cost function-optimum allocation considering cost-comparison with simple random sampling. **20 hours**

Module 4: Systematic Sampling & Cluster sampling : Linear and circular systematic sampling, comparison with simple random sampling. Cluster sampling: Clusters with equal sizes-estimation of the population mean and total, comparison with simple random sampling**. 25 hours**

Books for references

1. Murthy M N, Sampling theory and methods, Statistical Publishing society, Calcutta
2. Daroja Singh and F S Chaudhary, Theory and Analysis of Sample Survey Designs, Wiely Estrn Limitted
3. Cochran W.G, Sampling Techniques, Wiely Estern

SEMESTER V: CORE COURSE 8.

VST5B08: OPERATIONS RESEARCH AND STATISTICAL QUALITY CONTROL

Module 1: Transportation and assignment problems, North-west corner rules, row column and least cost method-Vogel's approximation method, Assignment problem, Hungarian algorithm of solution. **20 hours**

Module 2: Sequencing Models: Sequencing problems- assumptions in sequencing problems – processing n jobs through one machine - processing n jobs through two machines - processing n jobs through three machines.**20 hours**

Module 3: General theory of control charts, causes of variations in quality, control limits, sub-grouping, summary of out-of-control criteria, charts of attributes, np chart, p chart, c chart, Charts of variables: X bar chart, R Chart and sigma chart, Revised control charts, applications and advantages.**25 hours**

Module 4: Principles of acceptance sampling-problems and lot acceptance, stipulation of good and bad lots-producer' and consumer' risk, simple and double sampling plans, their OC functions, concepts of AQL, LTPD,AOQL, Average amount of inspection and ASN function

25 hours

Books for references

1. Gupta and Manmohan, Linear programming, Sulthan Chand and sons
2. Hardley G, Linear programming, Addison-Wesley
3. Taha, Operations Research, Macmillan,
4. V.K.Kapoor, Operations Research, Sultan Chand and Sons
5. S.C.Gupta and V.K.Kapoor Fundamentals of Applied Statistics, Sultan Chand and Sons

SEMESTER V: CORE COURSE 9.

VST5PL1: PRACTICAL 1.

Topics for practical 1

Numerical questions from the following topics of the syllabi are to be asked for external examination of this paper. The questions are to be evenly chosen from these topics.

The students have to maintain a practical record. The numerical examples of the following topics are to be done by the students of the fifth semester class under the supervision of the teachers and to be recorded in the record book. The valuation of the record shall be done internally

1. Small sample test
2. Large sample test
3. Construction of confidence intervals
4. Operations Research (L.P.P, T.P, A.P)
5. Construction of Control charts
6. Sample surveys

SEMESTER VI : CORE COURSE 10.

VST6B09: TIME SERIES AND INDEX NUMBERS

Module 1: Time series analysis: Economic time series, different components, illustrations, additive and multiplicative models, determination of trends, growth curves, analysis of seasonal fluctuations, construction of seasonal indices**. 25** hours

Module 2: Index numbers: Meaning and definition-uses and types-problems in the construction of index numbers-simple aggregate and weighted aggregate index numbers. Test for consistency of index numbers-factor reversal , time reversal and unit test, Chain base index numbers-Base shifting-splicing and deflating of index numbers. Consumer price index numbers-family budget enquiry-limitations of index numbers. **30** hours

Module 3: Research methodology: Meaning of research- objectives, Types of research – criteria of good research – research design, sampling design- steps in sampling design –criteria of selecting a sampling procedure- Measurement and Scaling techniques- data collection- statistical tools for analysis- Interpretation and report writing – Layout of the research project (concepts only).**15 hours**

Books for references

1. SC Gupta and V K Kapoor, Fundamentals of applied statistics, Sulthan chand and sons
2. Goon A M Gupta M K and Das Gupta, Fundamentals of Statistics Vol II, The World press, Calcutta
3. Box G E P and Jenkins G M, Time series analysis, Holden Day
4. C.R. Kothari , Research methodology – methods and techniques.

SEMESTER VI: CORE COURSE 11.

VST6B10: DESIGNS OF EXPERIMENTS

Module 1: Linear estimation, estimability of parametric functions and BLUE-Gauss-Markov theorem-Linear Hypothesis**.25 hours**

Module 2: Analysis of variance, one way and two way classification (with single observation per cell), Analysis of covariance with a single observation per cell.**25 hours**

Module 3: Principles of design-randomization-replication-local control, Completely randomized design, Randomized block design-Latin square design. Missing plot technique-comparison of efficiency.**25 hours**

Module 4: Basic concepts of factorial experiments, 2^3 factorial experiments, Duncan's multiple range test.**15 hours**

Books for references

1. S.C. Gupta and V K Kapoor, Fundamentals of applied Statistics, Sulthan Chand and Sons
2. Federer, Experimental Designs
3. M N Das and N Giri, Design of Experiments, New Age international,
4. DD Joshy, linear Estimation and Design of Experiments, Wiley Eastern
5. Montgomeri, Design of Experiments

SEMESTER VI : CORE COURSE 12

VST6B11: POPULATION STUDIES AND ACTUARIAL SCIENCE

Module 1: Sources of vital statistics in India-functions of vital statistics, Rates and ratios-mortality rates-crude, age specific and standard death rates-fertility and reproduction rates-crude birth rates-general and specific fertility rates-gross and net reproduction rates.**20 hours**

Module 2: Life Tables-complete life tables and its characteristics-Abridged life tables and its characteristics, principle methods of construction of abridged life tables-Reed Merrel's method

40 hours

Module 3: Fundamentals of insurance: Insurance defined meaning of loss, peril, hazard and proximate cause in insurance, Costs and benefits of insurance to society-branches of insurance. Insurable loss exposures-feature of loss that is deal of insurance, Construction of Mortality table-computation of premium of life insurance for fixed duration and for the whole life.**30 hours**

Books for reference

1. S.C. Gupta and V K Kapoor, Fundamentals of applied Statistics, Sulthan Chand and Sons
2. Benjamin B, Health and Vital Statistics, Allen and Unwin
3. Mark S Dorfman, Introduction to Risk Management and Insurance, Prentice Hall
4. C.D.Daykin, T. Pentikainen et al, Practical Risk Theory of Acturies, Chapman and Hill

SEMESTER VI : CORE COURSE 13.

VST6B12: REGRESSION ANALYSIS

Module 1: Least Square estimation: Gauss-Markoff Setup, Normal equations and least square Method of estimation, properties of estimator, variance of estimator, Estimation of variance.

25 hours

Module 2: Linear Regression: Simple linear regression model, least square estimation of parameters, Hypothesis testing of slope and intercept, co-efficient of determination.**20 hours**

Module 3: Multiple Regression: Model, estimation of model parameters, test for significance of regression, regression co-efficient, co-efficient of determination, use of ANOVA.**25 hours**

Module 4: Polynomial and logistic regression: Models and method of estimation, logistic regression-binary-model and estimates.**20hours**

References

1. D C. Montegomerry, E A Peak and G G Vining, Introduction to Linear regression analysis, Wiley 2003

SEMESTER VI :CORE COURSE 14.

VST6PL2: PRACTICAL 2

Topics for practical 2

Numerical questions from the following topics of the syllabi are to be asked for external examination of this paper. The questions are to be evenly chosen from these topics.

The students have to maintain a practical record. The numerical examples of the following topics are to be done by the students of the sixth semester class under the supervision of the teachers and to be recorded in the record book. The valuation of the record shall be done internally

1. Design of Experiments
2. Time series

3. Index numbers
4. Regression Analysis (Linear and Multiple regression)

SEMESTER VI : CORE COURSE 15

VST6PR: PROJECT

The following guidelines may be followed for project work.

1. The project is offered in the fifth and sixth semester of the degree course and the duration of the project may spread over the complete year.
2. A project may be undertaken by a group of students, the maximum number in a group shall not exceed 5. However the project report shall be submitted by each student.
3. There shall be a teacher from the department to supervise the project and the synopsis of the project should be approved by that teacher. The head of the department shall arrange teachers for supervision of the project work.
4. As far as possible, topics for the project may be selected from the applied branches of statistics, so that there is enough scope for applying and demonstrating statistical skills learnt in the degree course.

SEMESTER VI : CORE COURSE 16

ELECTIVE COURSES

COURSR 1: VST6E01: RELIABILITY THEORY

Module 1: Structural properties of coherent Systems: System of components-series and parallel structure with example-dual structure function-coherent structure-preservation of coherent system in terms of paths and cuts-representation of bridge structure-times to failure-relative importance of components-modules of coherent systems.**20 hours**

Module 2: Reliability of Coherent systems: Reliability of a system of independent components-some basic properties of system reliability-computing exact system reliability-inclusion exclusion method-reliability importance of components. **20 hours**

Module 3: Parametric distributions in reliability: A notion of ageing (IFR and DFR only) with examples-exponential distribution-Poisson distribution. **14 hours**

Books for references

1. R E Barlow and F Proschan (1975) Statistical Theory of Reliability and life testing, Holt Rinhert, Winston
2. N Ravi Chandran, Reliability Theory, Wiley Eastern

ELECTIVE COURSE:2

VST6E02: PROBABILITY MODELS AND RISK THEORY

Module 1: Individual risk model for a short time: Model for individual claim random variables-sums of independent random variables-Approximation for the distribution of sum-Application to insurance.**10 hours**

Module 2: Collective risk models for a single period: The distribution of aggregate claims-selection of basic distributions-properties of compound Poisson distribution-approximation to the distributions of aggregate claims.**15 hours**
Module 3: Collective risk models over an extended period: Claims process-The adjustment coefficients-Discrete time model-the first surplus below the initial level-The maximal aggregate loss.**15 hours**
Module 4: Application of risk theory: Claim amount distributions approximating the individual model-stop-loss re-insurance-the effect of reinsurance on the probability of ruin.**14 hours**

Books for reference
1. Institute of Actuaries, Act Ed. Study Materials
2. McCutcheon, JJ, Scott William (1986): An introduction to Mathematics of Finance
3. Butcher M V, Nesbit, Cecil (1971) Mathematics of Compound Interest, Ulrich's book
4. Neil, Alistair, Heinemann (1977) Life contingencies
5. Bowers, Newton Let et al (1997) Actuarial mathematics, society of Actuaries, 2nd

ELECTIVE COURSE: 3
VST6E03: STOCHASTIC MODELLING
Module 1: Concept of mathematical modeling, definition, natural testing a informal mathematical representations. **10 hours**
Module 2: Concept of stochastic process, probability generating functions, convolution generating function of sum of independent random variables, Definition of a stochastic process, classification, Markov chain, transition probabilities, Chapmann and Kolmogrov equations, transition probability matrices, examples and computation. **30 hours**
Module 3: First passage probabilities, classification of states, recurrent, transient and ergodic states, stationary distribution, mean ergodic. **14 hours**

Books for reference
1. V K Rohatgi, An introduction to probability theory and mathematical statistics, Wiley eastern
2. S M Ross, An Introduction to Probability Theory and Stochastic Models
3. V K Rohadgi Statistical Inference, Wiley Eastern

OPEN COURSE

OPEN COURSE STRUCTURE

(FOR STUDENTS OTHER THAN B.Sc. Statistics)
Total Credits: 2 (Internal 20%; External 80%)

Semester	Code	Course Title	Hours/week	Total Hours	Marks
V	VST5D01	Basic Statistics	2	36	50
	VST5D02	Economic Statistics			
	VST5D03	:Quality Control			

OPEN COURSE: EVALUATION SCHEME

The evaluation scheme contains two parts: *viz.*, internal evaluation and external evaluation.
Maximum marks from each unit are prescribed in the syllabus.

1. INTERNAL EVALUATION

20% of the total marks are for internal evaluation. The colleges shall send only the marks obtained for internal examination to the university.

Table 1: Components of Evaluation

Sl. No.	*Components*	*Marks*
1	Attendance	2.5
2	Test papers: I & II	2.5 + 2.5
3	Assignment / Viva	2.5
	Total Marks	10

Table 2: Percentage of Attendance and Eligible Marks

% of attendance	*Marks*
Above 90%	2.5
85-89%	2
80-84%	1.5
76-79%	1
75%	0.5

Table 3: Pattern of Test Papers (Internal)

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
1 Hour	One word	4	4	1	4
	Short answer	2	1	2	2
	Paragraph	4	2	3	6
	Essay	2	1	8	8
				Total Marks	20

*Marks: 80% and above = 2.5, 60 to below 80% = 2, 50 to below 60% = 1.5, 40 to below 50% = 1, 35 to below 40% = 0.5, below 35% = 0.

2. EXTERNAL EVALUATION

External evaluation carries 80% marks. Examination will be conducted at the end of 5th semester.

Table 1: Pattern of Question Paper

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
2 Hours	One word/One Phrase/True or false	6	6	1	6
	Short answer- one or two sentence	5	5	2	10
	Paragraph- half page	6	4	4	16
	Essay- within two pages	3	1	8	8
				Total Marks	40

OPEN COURSES :

VST5D01: BASIC STATISTICS

Module 1: Elements of Sample Survey: Census and Sampling, advantages, principal step in sample survey-sampling and non-sampling errors

15 hours

Module 2: Measures of Central tendency: Mean, median and mode and their empirical relationships, weighted arithmetic mean-Dispersion: absolute and relative measures, standard deviation and coefficient of variation.

15 hours

Module 3: Fundamental characteristics of bivariate data: univariate and bivariate data, scatter diagram, curve fitting, principle of least squares, fitting of straight line. Simple correlation, Pearson's correlation coefficient, limit of correlation coefficient

19 hours

Module 4: Basic probability: Random experiment, sample space, event, algebra of events, Statistical regularity, frequency definition, classical definition and axiomatic definition of probability-addition theorem,

20 hours

References

1. V. K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

2. S.C.Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons
3. A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, McGraw Hill
4. John E Freund, Mathematical Statistics (6^{th} edn), Pearson Edn, NewDelhi

VST5D02: ECONOMIC STATISTICS

Module 1: Time series analysis: Economic time series, different components, illustrations, additive and multiplicative models, determination of trends, analysis of seasonal fluctuations, construction of seasonal indices 24 hours

Module 2: Index numbers: Meaning and definition-uses and types-problems in the construction of index numbers-simple aggregate and weighted aggregate index numbers. Test for consistency of index numbers-factor reversal and time reversal - limitations of index numbers. 30 hours

Books for references

1. S C Gupta and V K Kapoor, Fundamentals of Applied Statistics, Sulthan Chands and sons
2. Goon A M, Gupta M K and Das Gupta, Fundamentals of Statistics Vol II, The World Press, Calcutta

VST5D03: QUALITY CONTROL

Module 1: General theory of control charts, causes of variations in quality, control limits, summary of out-of-control criteria, charts of attributes - np chart, p chart, c chart, Charts of variables: X bar chart and R Chart, applications and advantages 30 hours

Module 2: Principles of acceptance sampling-problems of lot acceptance, stipulation of good and bad lots-producer' and consumer' risk, simple and double sampling plans, their OC functions, concepts of AQL, LTPD,AOQL, Average amount of inspection and ASN function 24 hours

References

1. Grant E L, Statistical quality control, McGraw Hill
2. Duncan A J, Quality Control and Industrial Statistics, Taraporewala and sons
3. Montegomery D C, Introduction to Statistical Quality Control, John Wiley and sons

COMPLEMENTARY COURSE-STATISTICS:

COURSE STRUCTURE

Total Credits: 12 (Internal: 20%; External: 80%)

Semester	Course code	Course Title	Hrs/week	Total Hrs	Credit	Marks
I	VST1C01	Basic Statistics and Probability	4	72	3	100
II	VST2C02	Probability Distributions	4	72	3	100
III	VST3C03	Statistical Inference	5	90	3	100
IV	VST4C04	Applied Statistics	5	90	3	100
				Total	**12**	**400**

COMPLEMENTARY

COURSE THEORY: EVALUATION SCHEME

The evaluation scheme for each course contains two parts: *viz.*, internal evaluation and external evaluation. Maximum marks from each unit is prescribed in the syllabus.

1. INTERNAL EVALUATION

20% of the total marks in each course are for internal evaluation.

Table 1: Components of Evaluation

Sl. No.	*Components*	*Marks*
1	Attendance	5
2	Test papers: I & II	5 + 5
3	Assignment	2
4	Seminar/ Viva	3
	Total Marks	20

Table 2: Percentage of Attendance and Eligible Marks

% of attendance	*Marks*
Above 90%	5
85-89%	4
80-84%	3
76-79%	2
75%	1

Table 3: Pattern of Test Papers

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
1.5 Hours	One word	4	4	1	4
	Short answer	5	4	2	8
	Paragraph	5	4	3	12
	Problem	4	2	3	6
	Essay	2	1	10	10
				*Total Marks**	40

*90% and above = 5, 80 to below 90% = 4.5, 70 to below 80% = 4, 60 to below 70% = 3.5, 50 to below 60% = 3, 40 to below 50% = 2, 35 to below 40% = 1, below 35% = 0

2. EXTERNAL EVALUATION

External evaluation carries 80% marks. University examinations will be conducted at the end of each semester.

Table 1: Pattern of Question Papers

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
3 Hours	One word/one phrase/true or false	10	10	1	10
	Short answer-one or two sentences	7	7	2	14
	Short essay/ problems	5	3	4	12
	Paragraph/Half page/ problems	6	4	6	24
	Essay/ Problems	4	2	10	20
				Total Marks	80

COMPLEMENTARY COURSE I:
VST1C01: BASIC STATISTICS AND PROBABILITY

Module 1: Population, sample, , measures of central tendency-arithmetic mean, weighted arithmetic mean, geometric mean, harmonic mean, median, mode, partition values-quartile, percentile, measures of deviations-variance, standard deviation, mean deviation about mean, quartile deviation, co-efficient of variation.**20 hours**

Module 2: Fitting of straight line, parabola, exponential, polynomial, (least square method), correlation, regression, two regression lines, regression coefficients,properties- .rank correlation, partial and multiple correlation (3 variables).**15 hours**

Module 3: Random experiment, Sample space, event, classical definition of probability, statistical regularity, relative frequency definition, field, sigma field, axiomatic definition of probability and simple properties, concept of probability measure, addition theorem (two and three events), conditional probability of two events, multiplication theorem, independence of events(pair wise and mutual), Bayes theorem. –numerical problems.**25 hour**

Module 4: Random variable-discrete and continuous, probability mass function (pmf) and probability density function (pdf)-properties and examples, cumulative Distribution function and its properties, change of variable (univariate case**). 12 hours**

References

1. V. K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

2. S.C.Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chan and Sons
3. A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, McGraw Hill
4. John E Freund, Mathematical Statistics (6^{th} edn), Pearson Edn, NewDelhi

COMPLEMENTARY COURSE II-
VST2C02: PROBABILITY DISTRIBUTIONS

Module 1: Mathematical expectations (univariate): Definition, raw and central moments (definition and relationships), moment generating function and properties, characteristic function (definition and use only), Skewness and kurtosis (using moments)
15 hours
Module 2: Bivariate random variable: joint pmf and joint pdf, marginal and conditional probability, independence of random variables, function of random variable. Bivariate Expectations, conditional mean and variance, covariance, Karl Pearson Correlation coefficient, independence of random variables based on expectation.
15 hours
Module 3: Standard distributions: Discrete type-Bernoulli, Binomial, Poisson, Geometric, negative binomial (definition, properties and applications), Uniform (mean, variance and mgf), Continuous type-Uniform, exponential, gamma, Beta, Normal (definition, properties and applications), Lognormal, Pareto and Cauchy (Definition only) **30 hours**
Module 4: Chebyshev's inequality, variables, Convergence in probability weak law of large numbers (iid case), Bernoulli law of large numbers, example only), Central limit theorem (Lindberg Levy-iid case) **12 hours**
References

1. V. K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
2. S.C.Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons
3. A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, McGraw Hill
4. John E Freund, Mathematical Statistics (6^{th} edn), Pearson Edn, NewDelhi

COMPLEMENTARY COURSE III.
VST3C03: STATISTICAL INFERENCE

Module 1: Sampling distributions: Statistic, Sampling distribution of a statistic, Standard error, Sampling from normal distribution, distribution of sample mean, sample variance;, chi-square distribution, t distribution, and F distribution (definition, derivations and relationships only).
25 hours
Module 2: Theory of Estimation: Point Estimation, desirable properties of a good estimator, unbiasedness, consistency, sufficiency, Fisher Neyman factorization theorem, efficiency.Methods of Estimation:- Method of maximum likelihood, method of moments.
20 hours
Module 3: Interval Estimation: Interval estimates of mean, difference of means, variance, proportions

and difference of proportions. Derivation of exact confidence intervals for means, variance and ratio of variances based on normal, t, chi square and F distributions: **15 hours**

Module 4: Testing of Hypotheses: concept of testing hypotheses, simple and composite hypotheses, null and alternative hypotheses, type I and II errors, critical region, level of significance and power of a test. Neyman Pearson approach: Large sample tests concerning mean equality of means, proportions, equality of proportions, Small sample tests based on t distribution for mean, equality of means and paired t test. Tests based on F distribution for ratio of variances. Tests based on Chi square distribution for variance, goodness of fit and for independence of attributes: **30 hours**

References

1. V. K. Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
2.S.C.Gupta and V. K. Kapoor Fundamentals of Mathematical Statistics, Sultan Chand and Sons
3.A.M. Mood, F.A. Graybill and D C Bose, Introduction to Theory of Statistics, McGraw Hill
4.John E Freund, Mathematical Statistics (6^{th} edn), Pearson Edn, NewDelhi

COMPLEMENTARY COURSE IV:
VST4C04: APPLIED STATISTICS

Module 1:Census and Sampling, Principal steps in a sample survey, different types of sampling, Organisation and execution of large scale sample surveys, errors in sampling (Sampling and nonsampling errors) preparation of questionnaire, simple random sampling with and without replacement, Systematic,stratified and cluster sampling (concept only).**20 hours**

Module 2:Analysis of variance; one way, two way classifications. Null hypothesis, total, between and within sum of squares. Assumptions-ANOVA table.**15 hours**

Module 3: Time series :Components of time series-additive and multiplicative models, measurement of trend, moving averages, seasonal indices-simple average-ratio to moving average.

Index numbers: meaning and definition-uses and types- problems in the construction of index numbers- different types of simple and weighted index numbers. Test for an ideal index number- time and factor reversal test. **30 hours**

Module 4:Statistical Quality Control: Concept of statistical quality control, assignable causes and chance causes, process control. Construction of control charts, 3sigma limits. Control chart for variables-Mean chart and Range chart. Control chart for attributes- pchart, d or np chart and c chart.

25 hours

References

1. A.C. Chiang & K. Wainwright : Fundamentals of Mathematical Economics, 4^{th} ed., McGraw Hill.
2. R.G.D. Allen : Mathematical Economics, ELBS.
3. Taro Yamane: Mathematics for Economits, 2^{nd} ed., PHI.
4. P.K. Gupta & ManMohan : Linear Programming and Theory of Games.
5. Srinath Baruah : Basic Mathematics and its Applications in Economics, Macmillan.
6. Akinson : Distribution and Inequality Measures, TMH.

COMPLEMENTARY COURSE-

MATHEMATICAL ECONOMICS:

COURSE STRUCTURE

Total Credits: 12 (Internal: 20%; External: 80%)

Semester	Course code	Course Title	Hrs/week	Total Hrs	Credit	Marks
I	VME1C01	Mathematical Economics	4	72	3	100
II	VME2C02	Mathematical Economics	4	72	3	100
III	VME3C03	Mathematical Economics	5	90	3	100
IV	VME4C04	Mathematical Economics	5	90	3	100
				Total	**12**	**400**

COMPLEMENTARY COURSE THEORY: EVALUATION SCHEME

The evaluation scheme for each course contains two parts: *viz.*, internal evaluation and external evaluation. Maximum marks from each unit is prescribed in the syllabus.

1. INTERNAL EVALUATION

20% of the total marks in each course are for internal evaluation.

Table 1: Components of Evaluation

Sl. No.	*Components*	*Marks*
1	Attendance	5
2	Test papers: I & II	5 + 5
3	Assignment	2
4	Seminar/ Viva	3
	Total Marks	20

Table 2: Percentage of Attendance and Eligible Marks

% of attendance	*Marks*
Above 90%	5
85-89%	4
80-84%	3
76-79%	2
75%	1

Table 3: Pattern of Test Papers

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
1.5 Hours	One word	4	4	1	4
	Short answer	5	4	2	8
	Paragraph	5	4	3	12

	Problem	4	2	3	6
	Essay	2	1	10	10
				*Total Marks**	40

*90% and above = 5, 80 to below 90% = 4.5, 70 to below 80% = 4, 60 to below 70% = 3.5, 50 to below 60% = 3, 40 to below 50% = 2, 35 to below 40% = 1, below 35% = 0

2. EXTERNAL EVALUATION

External evaluation carries 80% marks. University examinations will be conducted at the end of each semester.

Table 1: Pattern of Question Papers

Duration	*Pattern*	*Total number of questions*	*Number of questions to be answered*	*Marks for each question*	*Marks*
3 Hours	One word/one phrase/true or false	10	10	1	10
	Short answer-one or two sentences	7	7	2	14
	Short essay/ problems	5	3	4	12
	Paragraph/Half page/ problems	6	4	6	24
	Essay/ Problems	4	2	10	20
				Total Marks	80

MATHEMATICAL ECONOMICS -COMPLEMENTARY COURSE

FIRST SEMESTER

VME1C01: MATHEMATICAL ECONOMICS

Module I : Demand and Supply Analysis (20 hrs)

Utility and demand – the meaning of demand and quantity demanded – the law of demand – demand curve – market demand curve – reasons for the law of demand – slope of a demand curve – shifts in demand – demand function and demand curve – the meaning of supply – supply function – law of supply – slope of a supply curve– shifts in supply – market equilibrium – price elasticity of demand – measurement of price elasticity – arc elasticity of demand – cross elasticity of demand. (relevant sections chapters 5 and 7 of Text 1).

Module II : Cost and Revenue Functions (15 hrs)

Cost function: Average and marginal costs, Short run and long run costs, Shapes of average cost curves in the short run and long run and its explanation, Revenue function, Marginal revenue (MR) and Average Revenue (AR) functions, Relation between MR, AR and Elasticity of demand. (relevant sections of chapter 19 & 21 of text 1).

Module III : Theory of Consumer Behaviour (15 hrs)

Cardinal utility analysis – the Law of diminishing marginal utility – the Law of equi-marginal utility – Indifference curves – Ordinal utility – Indifference map – Marginal rate of substitution – Properties of indifference curves. (relevant sections of chapters 9 and 11 of Text 1).

Module IV : Economic Applications of Derivatives (22 hrs)

Economic Applications of Derivatives. Marginal, average and total concepts optimizing economic functions - Functions of several variables and partial derivatives, Rules of partial differentiation,Total differential and derivatives, Second order partial derivatives, Optimization of multivariable functions, Constrained optimization with Lagrangen multipliers, Significance of the Lagrange multiplier, Optimization and constrained optimization of multivariable functions in Economics .
(chapter 4 – Sections 4.7 and 4.8; chapter 5 and chapter 6 sections 6. 1 to 6.6 – of text 2).

Text books:

1. H.L. Ahuja : Principles of Micro Economics, 15th Revised Edition, S. Chand
2. Edward T. Dowling: Introduction to Mathematical Economics, Schaum's Outline Series, Third edition, TMH.

References

1. R.G.D. Allen : Mathematical Analysis for Economists, Macmillan, ELBS.
2. Edward T. Dowling : Introduction to Mathematical Economics, Third edition, Schaum's Outline Series, TMH.
3. Henderson & Quandt : Microeconomic Theory: A Mathematical Approach, 3rd Ed.TMH
4. Taro Yamane : Mathematics for Economists: An elementary survey. Second Edition, PHI.
5. Srinath Baruah : Basic Mathematics and its Application in Economics, Macmillan.

SECOND SEMESTER

VME2C02: MATHEMATICAL ECONOMICS

Module I : Inequalities in Income (10 hrs)

Analysis of Income and allied distributions – Pareto distribution, fitting of Pareto distribution. Inequalities in income, Causes of inequalities, Measures to reduce inequality; Measurement of inequality of income – Lorenz curve, Gini ratio.

(Chapter 47 of Text 1)

Module II : Linear Programming (22 hrs)

Mathematical Expression for Economic problems, Graphic solutions, The Extreme point theorem, Slack and surplus variables, Simpler Algorithm – Maximization – Minimization, Marginal values and Shadow pricing, The dual statement of dual theorems, Solving the primal through the dual.

(chapters 13, 14, 15 of text 2)

Module III : Game theory (20 hrs)

Meaning, characteristics, definition of various terms, two-person's zero sum game – pay off matrix, maxin strategy, minimax strategy, saddle point, mixed strategy, Dominance solution through graphic method – linear programming solution to two-persons zero sum game – limitation of game theory.

(chapter 14 of text 3)

Module IV : Input Output Analysis (20 hrs)

Introduction – assumptions – technological coefficient matrix – closed and open input output model – coefficient matrix and open model – The Hawkins – Simon conditions – Solutions for two industries – Determination of equilibrium of prices – Coefficient matrix and closed model – The Leontief production function – limitation of input-output analysis.

(chapter 19 – sections 19.1 to 19.7, 19.9, 19.11, 19.13).

Text books:

1. M.L. Jhingan: Micro Economic Theory, 6th ed., Vrinda Publications.
2. Edward T. Dowling: Introduction to Mathematics, Economics, Second edition, Schaum's Outline, McGraw Hill.
3. Kothari : Quantitative Techniques, Third edition, Vikas Pub. House, Chapter 14.
4. Mehta-Madnani : Mathematics for Economists, Revised ed., S. Chand.

References

1. A.C. Chiang & K. Wainwright : Fundamentals of Mathematical Economics, 4th ed., McGraw Hill.
2. R.G.D. Allen : Mathematical Economics, ELBS.
3. Taro Yamane: Mathematics for Economits, 2nd ed., PHI.
4. P.K. Gupta & ManMohan : Linear Programming and Theory of Games.
5. Srinath Baruah : Basic Mathematics and its Applications in Economics, Macmillan.
6. Akinson : Distribution and Inequality Measures, TMH.

THIRD SEMESTER

VME3C03: MATHEMATICAL ECONOMICS

Module I : Differential and Difference Equations (25 hrs)

Differential equations: Definitions and concepts. First order linear differential equations. Exact differential equations – integrating factors. Separation of variables. Economic applications – Use of differential equations in economics. Difference equations: definitions and concepts. First order linear difference equations. Economic applications – the Cobweb model, the Harrod model.

(Chapters 16 and 17 of Text 1)

Module II : The Production function (20 hrs)

Meaning and nature of production functions. The law of variable proportions – isoquants marginal rate of technical substitution (MRTs). Producer's equilibrium. Expression path. The elasticity of substitution. Ridge lines and economic region of production.

(Chapter 14 Section 14.1 to 14.9 of Text 2)

Module III : (20 hrs)

Euler's Theorem (Statement only). Euler's Theorem and Homogeneous production function. Cobb Douglas Production function. Properties. Economic significance – Limitations. CES production function – Properties – Advantages – Limitations – Returns to scale – Cobweb Theorem. (Chapter 14, Section 14.10 to 14.13 of Text 2).
Optimization of Cobb Douglas production functions – Optimization of constant elasticity of production function. (Chapter 6; Sections 6.9 and 6.10 of Text 1).

Module IV : Investment Decisions and Analysis of Risk (25 hrs)

Nature of investment decisions; Appraisal necessary; Needed information; Appraisal techniques; Payback method; Average Rate of Return (ARR) method;
Net Present Value (NPV) Method; Internal Rate of Return (IRR) Method; Net Terminal Value Method; Profitability Index (P.I); Analysis of Risk / Uncertainty; The Risk Concept; Risk and Uncertainty Situations; Measurement of Risk in Precise Terms; Incorporating Risk in Investment decisions; Risk-adjusted discount rate (RAD) approach; Certainty-Equivalent Approach; Probability Distribution Approach (The Hillier Models); Decision Trees Approach;
(Chapter 16 of Text 3).

Text book:

1. Edward T. Dowling : Introduction to Mathematical Economics, Third edition, TMH.
2. S.P. Singh, A.K. Parashar & H.P. Singh : Econometrics and Mathematical Economics, S. Chand.
3. C.R. Kothari : An Introduction to Operations Research, Third edition, Vikas Publishing House.

References

1. A.C. Chiang & K. Wainwright : Fundamentals of Mathematical Economics, 4th ed., McGraw Hill.
2. Taro Yamane: Mathematics for Economics, 2nd ed., PHI.
3. Srinath Baruah : Basic Mathematics and its Applications in Economics, Macmillan.

FOURTH SEMESTER

VME4C04: MATHEMATICAL ECONOMICS

Module I (20 hrs)

Introduction to Econometrics – The nature of regression analysis – Two variable regression analysis (pages 1 to 59 of the text).

Module II (25 hrs)

Two variable regression model (Section 3.1 to 3.9 of the text pages 60-103).

Module III (25 hrs)

Classical normal linear regression model – two variable regression – Internal Estimation and Hypothesis testing (Sections 4.1 to 4.5 and 5.1 to 5.13 of the text).

Module IV (20 hrs)

Extensions of the two variable linear regression model (Sections 6.1 to 6.10 of the text).

Text book: Damodar N. Gujarati & Sangeetha : Basic Econometrics, 4th ed., TMH Indian Reprint, 2008.

References

1. S.P. Singh, A.K. Parashar and H.P. Singh : Econometrics and Mathematical Economics, S. Chand.

Model Question Paper
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
FIRST SEMESTER B.Sc DEGREE EXAMINATION
(CBCSS-UG)
Core Course-STATISTICS
VST1B01: BASIC STATISTICS AND PROBABILITY

Time:3 Hours **Maximum Marks: 80**

Part A

Answer all questions in one word. Each question carries 1 mark.

1. The set of all possible outcomes of a random experiment is.....
2. The geometric mean of regression coefficients.....
3. Data originally collected for an investigation are known as.....
4. Second quartile is same as.....
5. If A and B are disjoint events P(A∩B) is .....

Write True/ False.

6. For a negatively skewed distribution the relation between mean, median and mode is mean = median = mode.
7. If the covariance between two variables is positive the variables would change in opposite directions.
8. A table based on secondary data must always indicate the source of data.
9. Median is a partition value.
10. Probability can never take negative values. (10 x 1 = 10 marks)

Part B

Answer all questions in one sentence each. Each one carries 2 marks.

11. Distinguish between classification and tabulation.
12. Define a continuous random variable
13. What is co-efficient of variation?
14. Define Karl Pearson's Coefficient of correlation.
15. What are partition values?
16. Distinguish between correlation and regression.
17. What are the properties of probability distribution function.

(7x2=14marks)

Part C

Answer any 3 questions.Each one carries 4 marks.

18. Establish the relationship among AM , GM ,and HM.
19. A and B are independent events and if P(A) =1/3 = P(B), what is P(AUB)?
20. Define conditional probability and independence. State the probability conditions for which three events A,B,C are mutually independent.
21. Find the mean and variance of the first n natural numbers.
22. Examine whether the following is a distribution function :

$$F(x) = \begin{cases} 0 & : \ x < 0 \\ x & : \ 0 \leq x < 1 \\ 1 & : \ x \geq 1. \end{cases}$$

Also find its probability density function. (3x4 =12marks)

Part D

Answer any 4 questions. Each one carries 6 marks

23. Derive the formula for Spearman's rank correlation coefficient.
24. State and prove addition and multiplication theorem of probability for two events.
25. If P(A) = x , P(B) = y and P(AB) = z , find the probabilities of $P(A \cup B^{I})$ and $P(A^{I} \cup B)$.
26. If X has pdf f(x) = e^{-x} , x ≥ 0, find the pdf of y = e^{-x} .
27. An integer is chosen at random from the first 100 integers. An event A is said to happen if the chosen integer is divisible by 3 or 5. Write down the sample space and the event A.
28. The two regression lines are 3x + 12y - 10 = 0 and 3y + 9x - 46 = 0. Find
    (a) The means of X and Y.
    (b) The correlation coefficient.
    (c) The variance of y given that variance of x is 9. (4 x6 =24marks)

Part E

Answer any 2 questions.Each one carries 10 marks.

29. (a) what is a measure of dispersion?
    (b) Compare Mean deviation and standard deviation as measure of dispersion and show that mean deviation is minimum when takes about the median.
    (d) The scores of two teams in a match are given below. Find which team is more consistent in their play

Team A :	22	24	19	21	17
Team B :	18	20	18	15	19

30. Explain the principle of least squares. Describe how will you use it to fit a parabola of second degree?
31. In chest X-rays tests, it is found that the probability of detection when a person has actually T.B. is 0.95 and probability of diagnosing incorrectly as having T.B. is 0.002. In a certain city 0.1% of the adult population is suspected to be suffering from T.B. If an adult is selected at random and diagnosed as having T.B. on the basis of X-ray test, what is the probability of his actually having T.B.?
32. Determine the constant k such that the function given below will be a pdf.

    f(x) = 0 for x < 0 or x > 3
    = x for $0 \leq x \leq \frac{1}{2}$
    = k for $\frac{1}{2} \leq x \leq 3$

    Also find its distribution function. (2 x 10 = 20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SECOND SEMESTER B.Sc DEGREE EXAMINATION

(CBCSS-UG)

Core Course-STATISTICS

VST2B02: BIVARIATE RANDOM VARIABLE AND PROBABILITY DISTRIBUTIONS

Time:3 Hours **Maximum Marks: 80**

Part A

Answer all questions in one word.
Each question carries 1 mark

1. If X is a random variable with variance 5, then V(2X+5) = …….
2. If the covariance between X and Y is zero it mean that X and Y are……..
3. The number of customers reaching a bank counter in 20 minutes time follows ……
4. Mean of Cauchy distribution is……
5. If X and Y are two independent random variables, then f(X,Y) = ……..

Write true or false

6. Expectation of a random variable always exists.
7. Covariance between two independent random variables is zero.
8. Normal distribution is a skewed distribution.
9. Mean of the uniform distribution defined on (-a , a) is $a^2/3$.
10. The variance of a poison distribution with mean 2 is 4.

(10 x1=10 Marks)

Part B

Answer all questions in one sentence each. Each one carries 2 marks

11. Write down the relation between raw moments and central moments.
12. Define Negative binomial distribution.
13. Derive Mgf of Rectangular distribution.
14. Show that $V(a X + b) = a^2 V(X)$.
15. What are the properties of joint distribution function?
16. If $X_1, X_2, \ldots\ldots, X_n$ are n independent random variables, then $M_{\sum_{i=1}^{n} X_i}(t) = \prod_{i=1}^{n} M_{X_i}(t)$.
17. Define Pareto distribution.

(7 X2 =14 Marks)

Part C

Answer any 3 questions. Each one carries 4 marks.

18. Define mathematical expectation of a discrete random variable .Let X be a discrete random variable taking the values 0!, 1!, 2!, ……. With probabilities, $P(X = x!) = \frac{e^{-1}}{x!}$. Examine whether E(X) exists.
19. State and prove multiplication theorem of mathematical expectation.
20. Derive the Mgf of Normal distribution.
21. Two random variables X and Y have joint pdf

$f(x,y) = k(x^2 + y^2)$,$0 < x < 2$, $1 < y < 4$
$= 0$ else where

Find k.

22. For the rectangular distribution, $f(x) = \frac{1}{2a}$, $-a < x < a$, Show that $\mu_{2r} = \frac{a^{2r}}{2r+1}$ (3 X4 =12 Marks)

Part D

Answer any 4 questions. Each one carries 6 marks.

23. If X is a normal variate with mean 20 and standard deviation 5. Find the probability that $16 \leq X \leq 22$
24. State and prove Normal distribution as a limiting form of Binomial distribution.
25. State and prove Schwartz inequality.
26. X and Y are independent normal variates with means 6, 7 and variance 9, 16 respectively, determine λ such that $P(2X + Y \leq \lambda) = P(4X - 3Y \leq 4\lambda)$.
27. The joint probability distribution of X and Y is given by the following table

Y \ X	0	3	9
2	1/8	1/24	1/12
4	1/4	1/4	0
6	1/8	1/24	1/12

1) Find Cov(X,Y)
2) Are X and Y independent?

28. State and prove properties of Mgf.

(4 X6 =24 Marks)

Part E

Answer any 2 questions. Each one carries 10 marks.

29. If X and Y have the joint pdf given by $f(x,y) = \frac{x+y}{21}$, x = 1, 2, 3 ; y = 1, 2. Obtain
    1) the correlation coefficient ρ_{xy}
    2) E(X/Y=2) and V(X/Y=2).

30. Fit a Binomial distribution to the following data.

No. of female mice	0	1	2	3	4
Frequency	8	32	34	24	5

31. Define Exponential distribution and obtain its Mgf. Also explain the lack of memory property of Exponential distribution.
32. Derive mean deviation about mean of Normal distribution.

(2 x10 =20Marks)

Model Question Paper
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
THIRD SEMESTER B.Sc DEGREE EXAMINATION
(CBCSS-UG)
Core Course-STATISTICS
VST3B03: STATISTICAL ESTIMATION

Time:3 Hours **Maximum Marks: 80**

Part A

Answer all questions in one word. Each question carries 1 mark.

1. The square of any standard normal variate follows……
2. A value of an estimator is called……
3. The Confidence interval is also called ……...
4. Bernolli's law of large numbers is a particular case of …….
5. Standard deviation of the sampling distribution of an estimator is called ……..

Write true or false

6. Unbiased estimators are always consistent.
7. The range of variation of F distribution is -∞ to∞
8. In CLT, the mean and variance of the random variables are equal.
9. The mean of the t distribution is zero.
10. To determine the confidence interval for the variance of a Normal distribution, chi square distribution is used. (10 x1 =10marks)

Part B

Answer all questions in one sentence each. Each one carries 2 marks.

11. Define F distribution.
12. State the Chebyshev's inequality.
13. Give the 95% confidence interval for the mean of a Normal distribution N(μ,σ) when σ is known.
14. Define unbiased of an estimator.
15. Distinguish between parameter and statistic.
16. Define confidence coefficient.
17. Define Chi square distribution. (7 x2= 14marks)

Part C

Answer any 3 questions.Each one carries 4 marks.

18. Explain point estimation and interval estimation.
19. What are the properties of maximum likelihood estimators?
20. Show that the sample mean $\bar{x}$ is an unbiased estimator of $\frac{1}{\theta}$for the distribution
    f(x,θ) =$\theta(1-\theta)^{x-1}$,x = 1,2, ……..., $0<\theta<1$
21. Derive the 95% confidence interval of the variance of a Normal distribution.

22. A random variable X has mean 50 and variance 100. Use Chebyshev's inequality to obtain approximate bounds for (1) P(I X- 50I ≥ 15) & (2) P(I X – 50I < 20) (3 x4 =12 marks)

. **Part D**

Answer any 4 questions.Each one carries 6 marks

23. Show that $t_n$is consistent for θ if E(t_n) → θ and variance V(t_n) → 0 as n → ∞.
24. Derive mean and variance of χ^2 distribution.
25. For a sample of 10 observations $\bar{x}_1$ = 6 and $n_1{S_1}^2$ = 0.64. For another sample of 10 observations $\bar{x}_2$ = 5.7 and $n_2{S_2}^2$ = 0.24. Assuming that the two samples come from Normal populations with the Same variance σ^2 (unknown), prepare 95% confidence interval for $(\mu_1 - \mu_2)$
26. State and prove weak law of large numbers.
27. Describe the desirable properties of a good estimator.
28. If X_1 and X_2 are independent χ^2 random variables each with one degree of freedom. Find λ such that P(X_1 +X_2>λ) = ½.

(4 x6=24marks)

Part E

Answer any 2 questions. Each one carries 10 marks.

29. Derive χ^2 distribution.
30. Derive Confidence interval for two population means when
    1) σ_1, σ_2Known
    2) σ_1, σ_2Unknown and n_1, n_2 small
31. What is a Maximum likelihood estimator? Find the Maximum likelihood estimator of Poisson parameter λ of Poisson distribution.
32. 1) Derive confidence interval for the difference of proportions of two Binomial populations.
    2) Show that for distribution

    f(x,θ) =$\theta e^{-\theta x}$, $0 \le x \le \infty$, $\theta > 0$

    The 95% confidence interval for θ for large samples is given by $\theta = \frac{1 \pm \frac{1.96}{\sqrt{n}}}{\bar{x}}$

(10 x1 =10 marks)

Model Question Paper
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
FOURTH SEMESTER B.Sc DEGREE EXAMINATION
(CBCSS-UG)
Core Course-STATISTICS
VST4B04: TESTING OF HYPOTHESIS

Time: 3 hours **Maximum: 80 marks**

Part A

Answer all questions in one word. Each question carries 1 mark.

1. Level of significance is the probability of …….
2. Equality of two population variances can be tested by ……..
3. The critical value of one sided left tailed Z test, for α =0.05 is ……..
4. The degree of freedom forχ^2 while dealing with a contingency table of order 2×2 is ……
5. The test used to check the randomness of the collected set of symbols is……..

Write true or false

6. There cannot be two acceptance regions in any testing problem.
7. A test based on the outcome of tossing of a coin is a parametric test.
8. The rejection region in F test lies on right tail.
9. In the case of sign test, the test statistic follows a binomial distribution.
10. While applying χ^2 test, all the expected cell frequencies must be less than 5.

(10 x1 = 10marks)

Part B

Answer all questions in one sentence. Each one carries 2 marks.

11. Define power of a test
12. Distinguish between large sample and small sample test.
13. Define uniformly most powerful test.
14. What are the assumptions on t test?
15. What is Yate's correction?
16. Give the formula of F statistic.
17. Define type II error (7x2 = 14 marks)

Part C

Answer any 3 questions. Each one carries 4 marks.

18. Distinguish between parametric test and non-parametric test.
19. Explain the test procedure for testing the mean of a normal population whose variance is unknown.
20. What are the uses of t test?
21. Distinguish between simple and composite hypothesis. Give one example each.
22. If X≥ 1 is the critical region for testing H_0 :θ= 2 against H_1 :θ=1 on the basis of a single observation from $f(x,\theta) = \theta e^{-\theta x}$, $x \geq 0$, obtain the probabilities of type I and type II errors.

(3 x 4 = 12 marks)

Part D

Answer any 4 questions. Each one carries 6 marks.

23. State and prove Neymann Pearson lemma.
24. Explain the large sample test for testing the equality of proportions.
25. A population follows the distribution with pdf f(x,θ) $= \theta x^{\theta-1}$, $0 < x < 1$ and 0 elsewhere.To test

    H_0 :θ= 1 against H_1 :θ=2. A random sample of size 2, X_1, X_2 was used. Critical region was defined

    by the equality $\frac{3}{4x_1} \leq x_2$. Find the significance level and power of the test.
26. Explain Kolmogrovsmirnov test.
27. The following are samples from two independent normal populations. Test the hypothesis that they

    have the same mean assuming that the variances are equal by taking the level of significance as 5%

    Sample 1: 14 18 12 9 16 24 20 21 19 17

    Sample 2: 20 24 18 16 26 25 18
28. Explain the paired t test for testing the equality of means of two populations.

(4 x6 = 24marks)

Part E

Answer any 2 questions.
Each one carries 10 marks.

29. In a certain experiment to compare two types of pig foods A & B. The following results of increase in

    Weights were observed

Pig No.	1	2	3	4	5	6	7	8
Food A	49	53	51	52	47	50	52	53
Food B	52	55	52	53	50	54	54	53

    1) Assuming that the two samples of pigs are independent. Can we conclude that food B is better than food A.
    2) Also examine the case when the same sets of pigs were used in both cases.
30. 1) Explain the χ^2 test of goodness of fit.
    2) Fit a Poisson distribution to the following data and test the goodness of fit.

x	0	1	2	3	4	5	6
f	275	72	30	7	5	2	1

31. 1) Define Best critical region.
    2) Let $x_1, x_2, \ldots\ldots, x_n$ is a random sample from N(θ, σ) where σ is known. Obtain the best critical Region of size α for testing H_0: $\theta = \theta_0$ against H_1: $\theta = \theta_1$where θ_0&θ_1 are specified values.
32. What is Fishers Z transformation? Also explain application of Fishers Z transformation.

(2 x10 = 20marks)

Model Question Paper
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
FIFTH SEMESTER B.Sc DEGREE EXAMINATION
(CBCSS-UG)
Core Course-STATISTICS
VST5B05 - MATHEMATICAL METHODS

Time:3 Hours **Maximum Marks: 80**

Part A

Answer all questions. Each question carries 1 mark

Fill in the blanks

1. The set N of natural numbers is an ---------- set.
2. The sum and product of two rational numbers are ----------numbers.
3. The $\lim_{x\to 0} x sin\frac{1}{x} =$ ----------
4. Uniform continuity of a function implies ----------
5. Let f be bounded integrable function then $\lim_{n}\{U(p,f) - L(p,f)\}$ =----------

Write True/ False.

6. A bounded sequence is always convergent.
7. The function $f(x) = \frac{1}{x}$ is uniformly continuous on $[1,2]$
8. If f is integrable on $[a,b]$then 2f is integrable in $[a,b]$
9. No smallest positive real number can exist.
10. Least upper bound of a bounded set need not be an element of the set.

(10 x1 =10marks)

Part B

Answer all questions in one sentence questions.
Each one carries 2 marks.

11. Define limit of a sequence.
12. Define a rational number.
13. Describe supermom.
14. Define Rieman integral
15. Define continuity of a function
16. What is triangle inequality ?
17. What is mean by the absolute value of x (7×2 = 14marks)

Part C

Answer any 3 questions.
Each one carries 4 marks

18. What is principle of mathematical induction?
19. Show that there does not exist a rational number r such that $r^2 = 2$
20. What are the order properties of R
21. Prove the arithmetic geometric mean inequality for a, b

22. Show that a convergent sequence is bounded.

(3×4 = 12marks)

Part D

Answer any 4 questions.
Each one carries 6 marks

23. Show that if a and b are in R and $a < b$ then $< \frac{a+b}{2} < b$.
24. State and prove Bernoulli's inequality.
25. State and prove density theorem.
26. If $I_n = [a_n, b_n]$ $n \in N$ is a nested sequence of closed and bounded intervals, then there exists a number $\xi \in$ R such that $\xi \in I_n$ for all $n \in N$
27. Show that the limit point of a convergent sequence is unique.
28. Show that a continuous function is R integrable.

(4×6 = 24marks)

Part E

Answer any 2 questions.
Each one carries 10 marks.

29. State and prove Rolle's theorem.
30. State and prove the first fundamental theorem of integral calculus.
31. Establish D'Alembertz's ratio test.
32. State and prove intermediate value theorem.

(2×10 = 20marks)

Model Question Paper
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
FIFTH SEMESTER B.Sc DEGREE EXAMINATION
(CBCSS-UG)
Core Course-STATISTICS
VST5B06: STATISTICAL COMPUTING

Time:3 Hours **Maximum Marks: 80**

Part A

Answer all questions in one word. Each question carries 1 mark.

1. R is a system for statistical analysis and graphics created by …. and ….
2. …. is the function in R for number of elements in x.
3. In base graphics system, which function is used to add elements to a plot?
4. Which function in R language is used to find out whether the means of 2 groups are equal to each other or not?
5. In R how missing values are represented**?**

Write True or False

6. R is open source software and is available freely.
7. hist(x) is the graphical function for histogram of the frequencies of x
8. save (x, file="x.Rdata") is the command used to store R objects in a file.
9. Correlations is produced by cor() and covariance is produced by cov() function.
10. rcmdr command is used to start the R commander GUI.

(10x1=10marks)

Part B

Answer all questions in one sentence questions. Each one carries 2 marks.

11. What are the different methods of inputing data in R?
12. What is vector indexing?
13. What are the different methods of accessing elements of a vector or matrix?
14. Distinguish c(), cbind() and rbind()
15. Write down a function in R to count even numbers in a set of n observations.
16. Explain how the command >rnorm(100) executes.
17. Explain the general form of `Plot' command in R.

(7x2 = 14marks)

Part C

Answer any 3 questions. Each one carries 4 marks

18. How can you draw Scatter plot in R?
19. What do you meant by Box plot? How can you draw box-plot in R?
20. Describe the `if else' command in R.
21. What are the different types of operators in R?

22. Give an example of ANOVA using R. (3x4 = 12marks)

Part D

Answer any 4 questions.
Each one carries 6 marks.

23. List out some of the advantages of R programming language.
24. Explain Data objects in R with examples.
25. Explain procedures of calling data set from other format (.xls, .csv or .txt) to R with suitable examples. When will you use read.table() function.
26. Write your own function to calculate mean, median and mode of a set of observations given below

    12,32,41,11,12,25,43,18,16,9,21,13,12,28,35,25,34,21,15,28
27. Explain how the following command executes:

    >mean(rnorm(100))

    >mean(abs(rnorm(100)))

    >hist(rnorm(100))
28. Explain about data import in R language.

(4x6 = 24marks)

Part E

Answer any 2 questions.
Each one carries 10 marks.

29. Following is the frequency distribution of daily emission (in tons) of sulphur dioxide from an industrial plant.

Mid point	6.95	10.95	14.95	18.95	22.95	26.95	30.95
Frequency	3	10	14	25	17	9	2

Write the R code to find the three quartiles, skewness and kurtosis of the data

30. Using R functions, write a program to generate random sample of size 100 from a normal population with mean 10, variance 4 and then construct a frequency distribution, P-P plot and Q-Q plot of the generated sample.
31. Explain what is t-tests in R?
32. What are the applications of chi square test? Explain with an example in R.

(2x10 = 20marks)

Model Question Paper
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
FIFTH SEMESTER B.Sc DEGREE EXAMINATION
(CBCSS-UG)
Core Course-STATISTICS
VST5B07 - SAMPLE SURVEYS

Time: 3 hours **Max. Marks: 80**

Part A

Answer all questions in one word. Each question carries 1 mark.

1. The procedure of dividing the population into strata and then drawing a random sample from each one of the strata is called ----------
2. In simple random sampling the probability of selecting any unit at the first draw is --------
3. In circular systematic sampling the number of samples of size n that can be drawn from a population of size N is ----------
4. Consider a population of six units with values 1,2,3,4,5,6. The mean of sample mean is ----------
5. A method of sampling in which only the first unit is selected at random, the rest being selected automatically according to a predetermined pattern is called ----------
6. A sample of n units is selected from a population. The standard error of sample mean in the usual notation is equal to ----------
7. What is sampling fraction?
8. The total number of samples of size n=2 from a population od size N=6 by srswor is ----
9. Errors other than sampling errors such as those arising through non- response, incompleteness and inaccuracy of returns are termed as ----------
10. For the purpose of selecting a sample, it is necessary that the population to be sampled can be subdivided into a finite number of distinct and identifiable units called --------

(10x1=10marks)

Part B

Answer all questions in one sentence questions. Each one carries 2 marks

11. Explain cluster sampling
12. What are the advantages of simple random sampling?
13. Define finite population correction.
14. Explain circular systematic sampling.
15. Define standard error?
16. Distinguish between primary data and secondary data.
17. Define stratified random sampling.

(7x2 = 14marks)

Part C

Answer any 3 questions. Each one carries 4 marks

18. Discuss proportional allocation in stratified sampling.
19. Distinguish between complete enumeration and sampling.
20. Explain any one method of selecting a simple random sample.
21. What are the advantages of systematic sampling
22. What is the standard error of the estimate of population mean in simple random sample with replacement.

(3x4 = 12marks)

Part D

Answer any 4 questions. Each one carries 6 marks

23. Distinguish between primary data and secondary data.
24. Compare systematic sampling with simple random sampling
25. What do you mean by non- sampling errors? Explain the various sources of non- sampling error.
26. In stratified sampling, compare the variance of the estimator of population mean under proportional allocation and Neyman allocation.
27. Describe the procedure of selecting cluster sampling. Obtain an unbiased estimate of population mean.
28. Explain probability sampling and non- probability sampling with the help of examples.

(4x6 =marks)

Part E

Answer any 2 questions. Each one carries 10 marks.

29. If the population consists of a linear trend , then prove that
    Var($\overline{y_{st}}$) $\leq$ Var ($\overline{y_{sys}}$) $\leq$ Var ($\overline{y_{ran}}$)
30. Consider a population of 6 units with values 1,2,3,4,5,6. Write down all possible samples of size 2 (without replacement) from this population and verify that sample mean is an unbiased estimate of the population mean.also calculate the sampling variance.
31. Propose an estimator for the population mean based on cluster sampling. Find its variance. Find the relative efficiency of cluster sampling with the simple random sampling.
32. What are the principle steps in a sample survey. Explain?

(2x10 = 20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

Core Course-Statistics

VST5B08: OPERATIONS RESEARCH AND STATISTICAL QUALITY CONTROL

Time: 3 hours **Maximum Marks: 80**

Part A

Answer all questions.Each question carries 1 mark.

1. The transportation problem is balanced if.....
2. In an assignment problem involving 4 workers and 3 jobs, total number of assignments possible are...
3. Variations in the items produced in a factory may be due to ....
4. Trial control limit for the $\bar{X}$ chart with usual notations are ....
5. Who developed acceptance sampling as an alternative to 100 inspection?

Write True or False

6. The methods used to solve an assignment problem is North West Corner method.
7. Variations due to assignable causes in the product occurs due to defective raw materials.
8. Control chart for non-conformities is a control chart for attributes .
9. The OC curve gives proportion of good lots.
10. The acceptance sampling plan is used for identifying good lots. (10x1 = 10marks)

Part B

Answer all questions in one sentence each. Each question carries 2 marks.

11. Explain degeneracy in transportation problem.
12. Distinguish between transportation problem and assignment problem.
13. Define Sequencing problems.
14. What is an OC curve? What is its utility in product control?
15. What is meant by quality of a product?
16. What are the control limits for R chart?
17. What is meant by specification limits and control limits? Does a process in statistical control ensure that the product will meet within specification? (7x2 = 14 marks)

Part C

Answer any 3 questions.Each question carries 4 marks.

18. Explain any two methods of finding the initial basic feasible solution of transportation problem.
19. What are the assumptions in sequencing problems?
20. (a) How do you construct a control chart to control the proportion defectives based on a given data?
    (b) Write a short note on modified control chart.
21. Distinguish between defect and defective. How do you calculate control limits for a C

chart?

22. Define (i) Consumers risk ; (ii) LTPD; (iii) AOQL. (3x4 = 12marks)

Part D

Answer any 4 questions.Each question carries 6 marks.

23. Explain briefly the ollowing: (a)
    MODI method
    (b) Loops in transportation problem
24. Give three different examples of sequencing problems from your daily life. Explain the process of solving sequencing problem.
25. How will you process n johs through one machine.
26. Define single sampling plan. Write any two advantages of double sampling plan over single sampling plan.
27. What do you understand by acceptance sampling procedure? State its uses.
28. Define the terms: (a)
    Producer's risk.
    (b) AQL. (c)
    ATI.

(4x6 = 24marks)

Part E

Answer any 2 questions.
Each question carries 10 marks.

29. Solve the following transportation problem by Vogels approximation method:-\

Origin	Destination				Availability
	1	2	3	4	
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Requirement	200	225	275	250	

30. There are seven jobs, each of which has to go through the machines A and B in the order AB. Processing times in hours are given as

Job	:	1	2	3	4	5	6	7
Machine A:		3	12	15	6	10	11	9
Machine B:		8	10	10	6	12	1	3

    Determine a sequence of these jobs that will minimize the total elapsed time T. Also find T and idle time for machine A nad B.
31. How will you process n jobs through three machines? Discuss.
32. Explain the construction and working of X and R chart.

(2x10 = 20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR
FIFTH SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

Open Course-Statistics

VST5D01: BASIC TATISTICS

Time: 2 hours **Maximum Marks: 40**

Part A

Answer all questions in one word.Each question carries 1 mark.

1. As sample size increases ..... decreases.
2. Which average is known as businessmen's average ?
3. AM for two numbers is 10 and GM is 8. Then the numbers are...
4. For finding the least square estimate we solve ..... equations.
5. For an inverse association the correlation coefficient lies between...

(5x1 = 5marks)

Part B

Answer all questions in one sentence each.
Each question carries 2 marks.

6. What do you mean by sampling error.
7. Distinguish between Probability sampling and Non-probability sampling.
8. Write down the sample for the experiment of tossing of three coins.
9. State multiplication theorem. What happens when events are independent.
10. Give classical definition of probability, by clearly stating the underlying assumptions.

(5x2 = 10marks)

Part C

Answer any 3 questions.
Each question carries 5 marks.

11. A population consists of values 2, 6 , 9, 10, 8. Draw all possible simple random samples without replacement of size 2. Calculate the sample mean for each sample. Do their average coincide with the population mean.
12. Given below is a frequency table :

Variable :	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency :	10	20	-	40	-	25	15

    Given that median is 35 and total frequency is 170. Find the missing frequencies
13. Explain the concept of rank correlation. When is it used?
14. Explain the axiomatic definition of probability.
15. Give the principle of least squares. How do you fit a straight line using this principle?

(3x5 = 15marks)

Part D

Answer any 1 question. Each question carries 10 marks.

16. Discuss the various measures of dispersion.
17. For the following data, find the correlation coefficient:

    X : 48 35 17 23 47

    Y : 45 20 40 25 45
18. Outline the procedure involved in a Census survey and a Sample survey.

(1x10 = 10 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

Core Course-Statistics

VST6B09 - TIME SERIES AND INDEX NUMBERS

Time: 3 hours **Maximum Marks: 80**

Part A

Answer all questions.Each question carries 1 mark

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1. Which is the best method for measuring seasonal variations?
2. Name the component of a time series which is associated with fire in a factory.
3. Index numbers are special type of .....
4. For consumer price index price quotations are collected from....
5. .... is the process of grouping of related facts into classes on the basis of certain com- mon characteristics.

Write True or False

6. Simple average method is used to calculate trend values.
7. Semi - average method is used to compute seasonal indices.
8. Factor reversal test permits the interchange of price and quantity.
9. Fishers index number is the A.M of Laspeyres and Paasches index numbers.
10. Biased error does not decrease when the sample size increases. (10x1 = 10marks)

Part B

Answer all questions in one sentence each.
Each question carries 2 marks.

11. Define time series.
12. What are the components of a time series?
13. Write down the additive model of a time series.
14. Which are the different kinds of index numbers?
15. Define quantity index number.
16. What do you mean by Research?
17. Distinguish between research methods and research methodology. (7x2 = 14 marks)

Part C

Answer any 3 questions.Each question carries 4 marks.

18. Define moving average.
19. Index numbers are called Economic Barometers Why?
20. Explain time reversal test and factor reversal test?
21. What are the important objectives of the research?
22. What are the important features of research design? (3x4 = 12marks)

Part D

Answer any 4 questions. Each question carries 6 marks.

23. Distinguish between seasonal variations and cyclic variations.
24. Explain semi average method. In what way it is better than freehand method?
25. How do you construct consumer price index numbers?
26. Define a sample design? Explain the steps in sampling design?
27. What are the stages of research design?
28. What are the frequently used scaling techniques?

(4x6 = 24marks)

Part E

Answer any 2 questions.Each question carries 10 marks.

29. Explain ratio to trend method.
30. What are the problems involved in the construction of an index number?
31. Describe the moving average method for determining trend in a time series.
32. Explain the significance of a research report and narrate the various steps involved in writing such a report.

(2x10 = 20marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SIXTH SEMESTER B.Sc DEGREE EXAMINATION

(CBCSS-UG)

Core Course-STATISTICS

VST6B10: DESIGNS OF EXPERIMENTS

Time: 3 hours **Max. Marks: 80**

Part A

Answer all questions in one word. Each question carries 1 mark

1. The experimental error is controlled through the principle of ----------
2. The number of experimental units in a Latin square design having 5 treatments is -------
3. A completely randomised design is also known as ----------
4. The degrees of freedom associated to the error term in RBD having 3 blocks and 5 treatments is ----------
5. The missing observations in an RBD is obtained by minimising ----------
6. Replication influences ------- causes
7. Latin square design controls ---------- variation
8. Precision of the experiment is inversely proportional to---------
9. The critical difference between treatments means follow------- distribution.
10. Fertility contour map is associated to ---------- (10x1=10marks)

Part B

Answer all questions in one sentence questions.

Each one carries 2 marks

11. State the necessary and sufficient condition for estimability of parametric function.
12. What is meant by LSD?
13. What are factorial experiments?
14. What do you mean by experimental unit?
15. Write the expression for two missing observation in RBD.
16. What is a Linear hypothesis?
17. State any two disadvantages of CRD?

(7x2 = 14marks)

Part C

Answer any 3 questions. Each one carries 4 marks.

18. Distinguish between assignable causes and chance causes?
19. Give two factors A and B , each at two levels, what is the simple effect of A at first level of B?
20. Give the layout of randomised block design?
21. What is the use of missing plot technique?
22. What is analysis of covariance?

(3x4 = 12marks)

Part D

Answer any 4 questions.Each one carries 6 marks

23. Explain the basic principles of experimental design
24. Describe Duncan's multiple range test.
25. Give the complete statistical analysis of CRD
26. Discuss the advantages and disadvantages of RBD
27. Explain what is meant by main effects and interaction effects in factorial experiment?
28. Derive the estimation of missing value in LSD

(4x6 = 24marks)

Part E

Answer any 2 questions. Each one carries 10 marks

29. State and prove Gauss- Markov theorem
30. Derive the ANOVA table for RBD
31. Give the expressions for the total effect, the main effect, sum of squares due to an effect and the standard error of an effect for a 2^3 experiment.
32. Three Processes A, B and C are tested to see whether their outputs are equivalent. The following data is got.

A	10	12	13	11	10	14	15	13
B	9	11	10	12	13			
C	11	10	15	12	13			

Carry out analysis of variance and state your conclusions.

(2x10 = 20marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SIXTH SEMESTER B.Sc DEGREE EXAMINATION

(CBCSS-UG)

Core Course-STATISTICS

VST6B11: POPULATION STUDIES AND ACTURIAL SCIENCE

Time: 3 hours **Max. Marks: 80**

Part A

Answer all questions. Each carries one mark

1. In a life table L_x column refers to…….
2. Uncertainty of loss is known as……
3. ……is defined as the number of deaths in a year per 1000 average population in the year
4. Replacement level of fertility is said to have been reached when the value of NRR is equal to……
5. Life table is generally known as…….
6. If the covered peril is death, the contract is called……
7. In which year 1st synchronous census in India was conducted?
8. Name the largest growing general insurance segment in India.
9. ……..is a condition that increases the frequency of loss
10. Probability of happening something unlikely event is known as……

Part B

Answer all questions. Each carries 2 marks

11. Define premium
12. Define risk
13. Define life table. Give formula for calculating ${}_nq_x$ in Reed Merrell's method of life table construction
14. Define insurable loss.
15. Explain the difference between complete and abridged life table
16. Define insurance
17. Crude death rate is not a good indicator for mortality comparisons. Why? (7x2= marks)

Part C

Answer any three questions. Each carries 4 marks

18. Discuss benefits of insurance to society
19. Difference between life insurance and general insurance
20. What are the assumptions of life table
21. Explain the source of vital statistics
22. Define Total Fertility Rate (TFR). Give its advantages

(3x4=12 marks)

Part D

Answer any four questions. Each question carries six marks

23. Define i) Crude Death Rate ii) Specific Death Rate iii) Standardized Death Rate
24. Distinguish between Gross and Net Reproduction Rates
25. Compute the crude and standardized death rates of the two populations A and B regarding A as standard population, from the following data:

Age group		A		B
(Years)	Population	Deaths	Population	Deaths
Under 10	20000	600	12000	372
10-20	12000	240	30000	660
20-40	50000	1250	62000	1612
40-60	30000	1050	15000	325
Above 60	10000	500	3000	180

26. Write short notes on the following

1. Costs and benefits of insurance to the society
2. Computation of premium of life insurance

27. Explain the different characteristics of an insurance
28. Describe the computation of premium of life insurance for fixed duration using mortality table.

(4x6=24marks)

Part E

Answer any two questions. Each question carries ten marks

29. Explain the chief characteristics of an ideally insurable loss exposure
30. Given the following table for l_x, the number of rabbits living at age x,

X:	0	1	2	3	4	5	6
L_x:	100	90	80	75	60	30	0

X, Y, Z are three rabbits of age 1, 2 and 3 years respectively. Find the probability that

i) At least one of them will be alive for one year more,
ii) X, Y, Z will be alive for two years time
iii) One of the three is alive in two years
iv) All will be dead in two years time

31. Explain the different types of life tables with its uses
32. Explain the branches of insurance

(2x10=20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SIXTH SEMESTER B.Sc DEGREE EXAMINATION

(CBCSS-UG)

Core Course-STATISTICS

VST6B12: REGRESSION ANALYSIS

Time: 3 hours **Max. Marks: 80**

Part A

Answer all questions. Each carries one mark

1. Simple linear regression model is given by the relation y_i=…….
2. In least squares regression, which of the following is not a required assumption about the error term ε?
   a. The expected value of the error term is one.
   b. The variance of the error term is the same for all values of x.
   c. The values of the error term are independent.
   d. The error term is normally distributed.
3. The unbiased estimate of the variance of the residual term $\in_i$ is ……
4. The term regression was introduced by…….
5. The slope of the line of regression $y_i = \beta_1 + \beta_2 x_i + \in_i$ is
6. In estimating PRF and SRF we try to
   Minimize the sum of the residuals
   Minimize the square of residuals
   Minimize the parameters
   Minimize the estimated conditional mean of Y
7. The classical normal linear regression model assumes that each u_i is distributed normally with variance as…..
   a) 0 b) 1 c) -1 d) $\sigma_2^{2`}$
8. State true or false:
   a. E(y/X_i) $= \beta_1 + \beta_2^2 X_i$ is an example of a regression linear in parameters
9. Assuming the u's follow normal distributions, the classical regression linear model becomes…..
10. A regression model having no explicit intercept term is called…….

(10x1=10 marks)

Part B

Answer all questions.Each carries 2 marks

11. State statistical properties of OLS estimator
12. State the Ordinary Least Squares (OLS) estimation criterion
13. Define polynomial regression
14. Define logistic regression
15. Write any four assumptions of CLRM model

16. The uses of ANOVA in regression
17. Define the coefficient of determination

(7x2=14 marks)

Part C

Answer any three questions.Each carries 4 marks

18. Derive the OLS normal equations from the OLS estimation criterion.
19. Difference between two variable regression and multiple regression analysis
20. Explain analysis of residuals
21. Explain the hypothesis testing of slope in linear regression model
22. Explain test of significance of regression (3x4=12 marks)

Part D

Answer any four questions.

Each question carries six marks

22. The following data indicate the gain in reading speed versus the number of weeks in the program of 10 students in a speed reading program
    a. No. of weeks: 2 3 8 11 4 5 9 7 5 7
    b. Speed gain: 21 42 102 130 52 57 105 85 62 90
    c. Plot a scatter diagram to see if a linear relationship indicated
23. Explain multiple linear regression
24. Verify that $SS_R=\frac{S_{xx}S_{yy}-S_{xY}^2}{S_{xx}}$
25. What are the properties of regression coefficients
26. Test the hypothesis that $\beta = 0$ for the following data
    a. X: 3 8 10 13
    b. Y: 7 8 6 7
    c. Use the 5% level of significance
27. Explain the various types of regressions

(4x6=24marks)

Part E

Answer any two questions.Each question carries ten marks

28. Obtain the least square estimates of the regression parameters
29. Fit a first degree polynomial to the following data
    a. X: 1 2 3 4 5 6
    b. Y: 20.6 30.8 55 71.4 97.3 131.8
30. Explain logistic regression models for binary output data
31. The following data relate x, the moisture of a wet mix of a certain product, to Y, the density of the finished product
    a. X: 5 6 7 10 12 15 18 20
    b. Y:7.4 9.3 10.6 15.4 18.1 22.2 24.1 24.8

(2x10=20 marks)

Model Question Paper
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
FIFTH SEMESTER B.Sc DEGREE EXAMINATION
(CBCSS-UG)
Core Course-STATISTICS
VST5PL1 PRACTICAL I

Time:3 Hours **Maximum Marks: 80**

Answer any 4 questions. Each question carries 20 marks.
Use of scientific calculator and statistical tables are permitted.

1 Two samples are drawn from two normal populations. Based on the data test whether the two populations have (i) same means. (ii) same variances.

Sample 1: 10 , 12, 9 ,14 , 8 , 22, 20 , 18, 4 8

Sample 2: 11 , 8 , 4 , 17 , 19 , 20 , 16 , 18 , 5, 17

2 (a) A die is thrown 9000 times and a throw of 4 or 5 is observed 3240 times. Test whether the die is unbiased.

(b) A machine puts out 16 imperfect articles in a sample of 500. After the machine was overhauled it puts out 3 imperfect articles in a batch of 100. Has the machine improved in its performance.

3 (a) A random sample of size 10 from a normal population with standard deviation 5 gave the following observations.

65, 72, 71, 85, 73, 76, 67, 70, 74, 76

Calculate 95% confidence interval for the population mean.

(b) In a large city A, 20% of a random sample of 900 children had defective eye-sight. In another large city B, 15% of 1600 had the same defect. Obtain 95% confidence interval for the difference in the population proportions.

4 (a) A correlation coefficient of 0.15 is derived from a random sample of 600 pairs of observations. Using this data, can we conclude that the population correlation coefficient is insignificant at 5% level of significance?

(b)Consider a population of 5 units with values 10,12,13,16,20 .Write down all possible simple random samples(Without replacement)of size 2 and verify that sample mean is an unbiased estimate of the population mean. Also calculate the variance of the sample mean and verify that it agrees with the formula.

5 (a) Use simplex method to

$Maximize\ Z = x_1 + 3x_2$ Subject to the following constraints

$3x_1 + 6x_2 \leq 8$

$5x_1 + 2x_2 \leq 10$

$x_1 , x_2 \geq 0$

b) Find the optimum basic feasible solution for the following transportation problem.

Origin/Destination	D_1	D_2	D_3	D_4	Availability
O_1	2	3	11	7	6
O_2	1	0	6	1	1
O_3	5	8	15	9	10
Requirement	7	5	3	2	17

6 (a) Twenty bottles are selected at random and the number of defects were as given below.

4 ;5 ;7 ;3 ;3 ;5 ;6 ;2 ;4 ;8 ;3;5 ;4 ;3 ;4 ;5 ;3 ;7 ;6 13

Construct an appropriate control chart and comment on the state of control.

(b) Prepare $\bar{X}$ chart using the following results obtained from sample of size 5 each.

Sample number	1	2	3	4	5
Average	2.5	2.6	2.7	2.7	2.4
Range	0.2	0.2	0.3	0.4	0.3

(4x20=80marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SIXTH SEMESTER B.Sc DEGREE EXAMINATION

(CBCSS-UG)

Core Course-STATISTICS

VST6PL2- PRACTICAL II

Time: 3 hours **Max. Marks: 80**

Answer any 4 questions. Each question carries 20 marks.
Use of scientific calculator and statistical table permitted.

1. (a).Three Processes A, B and C are tested to see whether their outputs are equivalent. The following data is got.

A	10	12	13	11	10	14	15	13
B	9	11	10	12	13			
C	11	10	15	12	13			

Carry out analysis of variance and state your conclusions.

(b). In the table given below are the yields of 6 varieties in a 4 replicate experiment for which one value is missing. Estimate the missing value.

Blocks	Treatments					
	I	II	III	IV	V	VI
1	18.5	15.7	16.2	14.1	13.0	13.6
2	11.7	-	12.9	14.4	16.9	12.5
3	15.4	16.6	15.5	20.3	18.4	21.5
4	16.5	18.6	12.7	15.7	16.5	18.0

2. (a).Calculate Seasonal indices for the following quarterly data.

Year	Quarter I	Quarter II	Quarter III	Quarter IV
2001	30	81	62	119
2002	33	104	86	171
2003	42	133	99	221
2004	56	172	129	335
2005	67	201	136	302

(b). Apply the method of least squares to obtain the trend line from the following data and also predict the sales for the year 2015:

Year	2010	2011	2012	2013	2014
Sales	320	335	350	390	435

(a). Calculate Laspeyere's , Paasche's, Fisher's Index number of prices for the following data.

Commodities	Base Year		Current Year	
	Price	Quantity	Price	Quantity
A	10	12	12	15
B	7	15	5	20
C	5	24	9	20
D	16	5	14	5

(b).Use the data verify whether Fisher's Index number satisfy the Time Reversal Test.

Commodities	2000		2008	
	Price	Quantity	Price	Quantity
A	10	4	12	5
B	8	3	10	4
C	5	8	5	7
D	12	2	12	3

3. (a). From a sample of 16 pairs of observations (X_i ,Y_i) following equations were calculated.
$\sum Y_i = 64, \sum X_i = 96, \sum Xi^2 = 657, \sum Yi^2 = 526, \sum Xi\ Yi = 492$.
Obtain the Ordinary Least Square (OLS) estimators for the regression line Y on X .
(b). In a correlation study , the following results were obtained: $r_{xy} = 0.8$

	X	Y
Mean	6.5	6
S.D	2.5	3.5

Find two regression equations.

4. (a The following are the figures of defectives in 22 lots each containing 2000 rubbe belts:
425, 430, 216, 341, 225, 322, 280, 306, 337, 305, 356, 402, 216, 264, 126, 409, 193, 326, 280, 389, 451, 420.
Draw control chart for fraction defective and comment on the state of control of the Process
(b). During an examination of equal lengths of cloth, the following is the number of defects observed: 2, 3, 4, 0, 5, 6, 7, 4, 3, 2. Draw appropriate control chart and give your comments.

5. (a). The price quotations of four different commodities for 2005 and 2010 are given below. Calculate the index number for 2010 with 2005 as base by using
(i) the simple average of price relatives and
(ii) weighted average of price relatives.

Commodities	Weights	Price(in Rs)	
		2005	2010
A	5	10	13
B	7	12	14
C	6	20	30
D	2	10	18

(b). Compute the trend values by finding three-yearly moving averages for the following time series.

Year	2000	2001	2002	2003	2004	2005	2006
Population (in millions)	412	438	446	454	470	483	490

(4x20=80marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FIRST SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

COMPLEMENTAY COURSE- STATISTICS

VST1C01: BASIC STATISTICS AND PROBABILITY

Time: 3 hours **Maximum Marks: 80**

Part A

Answer all questions in one word. Each question carries 1 mark

1. The geometric mean of regression coefficients……
2. Second quartile is same as……
3. The set of all possible outcomes of a random experiment is……..
4. If A and B are disjoint events P(A∩B) IS…….
5. What is the probability of drawing a black queen from a well shuffled deck of cards?

Write true or false

6. Median is a partition value.
7. Standard deviation is not affected by the change of scale.
8. Zero correlation means absence of any relation between variables.
9. Mutually exclusive events are independent
10. Probability can never take negative values.

(10x1=10marks)

Part B

Answer all questions in one sentence each. Each one carries 2 marks

11. What is coefficient of variation
12. Define a continuous random variable
13. What are the properties of probability distribution functions?
14. Distinguish between population and sample.
15. What are partition values?
16. Distinguish between correlation and regression.
17. If P(x) = x/9, for X = 1, 3, 5, find P(X=3 or 5).

(7x2=14 marks)

Part C

Answer any 3 questions
Each one carries 4 marks

18. Establish the relationship among A.M., G.M. and H.M.
19. Find the mean and variance of the first n natural numbers.
20. Why there are two regression lines? Explain

21. Define conditional probability and independence. State the probability conditions for which three events A, B, C are mutually independent

22. A and B are independent events and if P(A) = 1/3 = P(B), what is P(A∪B)?

(3x4=12marks)

Part D

Answer any 4 questions. Each one carries 6 marks

23. Briefly explain the construction of a histogram with an example.

24. Derive the formula for Spearman's rank correlation coefficient.

25. If P(A)=x, P(B)=y and P(AB)=z, find the probabilities of P(A∪ B') and P(A' ∪B).

26. If X has pdf f(x) = e^{-x}, x ≥ 0, find the pdf of y = e^{-x}.

27. 27. An integer is chosen at random from the first 100 integers. An event A is said to happen if
. the chosen integer is divisible by 3 or 5. Write down the sample space and the event A.

28. The two regression lines are 3x + 12y − 10 = 0 and 3y + 9x − 46 = 0. Find
(a) the means of X and Y.
(b) the correlation coefficient. (4x6=24marks)

Part E

Answer any 2 questions. Each one carries 10 marks

29. (a)What is a measure of dispersion?.
(b) Compare Mean deviation and standard deviation as measure of dispersion and show that mean deviation is minimum when taken about the median.
(c) The scores of two teams in a match are given below. Find which team is more consistent in their play
Team A: 32 38 39 47 48 50 62
Team B: 31 34 48 40 48 53 55

30. Explain the principle of least squares. Describe how an exponential curve of the form $y = ab^x$ can be fitted.

31. In chest X-rays tests, it is found that the probability of detection when a person has actually T. B. is 0.95 and probability of diagnosing incorrectly as having T. B. is 0.002. In a certain city 0.1% of the adult population is suspected to be suffering from T.B. If an adult is selected at random and diagnosed as having T. B. on the basis of X-ray test, what is the probability of his actually having T. B.?

32. Determine the constant k such that the function given below will be a pdf.
f(x) = 0 for x < 0 or x > 3
= x for 0 ≤ x ≤ 1/2
= k for 1/2 ≤ x ≤ 3
Also find its distribution function.

(2x10=20marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SECOND SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

COMPLEMENTAY COURSE- STATISTICS

VST2C02: PROBABILITY DISTRIBUTIONS

Time: 3 hours **Maximum Marks: 80**

Part A

Answer all questions in one word. Each question carries 1 mark

Name the following.

1. The distribution which is used to model life length
2. A discrete distribution which lacks memory
3. The normal distribution with zero mean and unit variance

Fill up the blanks.

4. $E(X - k)2$ is a minimum when k = …….
5. The skewness of a binomial distribution will be 0 if P = ……
6. For a normal distribution the measure of kurtosis is …….
7. Any function of the population values is known as ……

Write true or false.

8. $Cov(X, Y) = 0 \rightarrow X$ and Y are independent.
9. Moment generating function of a random variable always exists
10. Central limit theorem can be applied only for gamma distribution.

(10x1=10marks)

Part B

Answer all questions in one sentence each. Each one carries 2 marks.

11. Define a gamma variable.
12. State the Bernoulli law of large numbers.
13. What do you mean by convergence in distribution?
14. Distinguish between a parameter and a statistic
15. For a binomial distribution mean is 10 and variance is 5. Write down its probability mass function. What is its second raw moment?
16. Give the definition of Cauchy distribution.
17. Give the statement of the Lindberg- Levy form of the central limit theorem.

(7x2=14marks)

Part C

Answer any 3 questions. Each one carries 4 marks

18. Find the mean and variance of discrete uniform distribution on the first n natural numbers.
19. If the first four raw moments of a r.v.are 1,2,3 and 4 respectively, find the values of the first four moments about the mean.
20. Two random variables X and Y have the following joint probability density function:

$$f(x, y) = 2 - x - y \quad \text{if } 0 < x < 1,\ 0 < y < 1$$

= 0 elsewhere.

Find the marginal p.d.f.s and examine whether X and Y are independent.

21. Show that, with usual notation E[E(X/Y)] = E(X).

22. Find the moment generating function of the random variable whose moments are $\mu_r{}' = (r+1)!\,2^r$.

(3x4=12marks)

Part D

Answer any 4 questions. Each one carries 6 marks

23. The wages of 1000 workers are normally distributed with mean Rs.250 and variance Rs.70. . What is the lowest wage of 100 highest paid workers?

24. Define mathematical expectation of a discrete random variable .Let X be a discrete random variable

taking the values 0!, 1!, 2!, ……. With probabilities, P(X = x!) = $\frac{e^{-1}}{x!}$. Examine whether E(X) exists.

25. Stating the necessary conditions show that Binomial distribution tends to Poison distribution.

26. Determine the size of the sample to be taken from a population with S.D.10, if the sample . . mean differing from the population mean by more than 2, is less than 0.2.

27. X is normally distributed with mean 12 and standard deviation 4. Find out the probability of . . the following.

i) $X \geq 20$

(ii) $X \leq 20$

(iii) $0 \leq X \leq 12$

(iv) Also find x' when $P(X \geq x') = 0.24$.

28. State the weak law of large numbers. $\{X_k\}$, k = 1, 2, ... is a sequence of independent random . variables, each taking the values -1, 0, 1. Given that $P(X_k = 1) = P(X_k = -1) = 1/k$ and $P(X_k = 0) = 1 - 2/k$ examine whether the law of large numbers holds for this sequence.

(4x6= 24marks)

Part E

Answer any 2 questions. Each one carries 10 marks

29. (i) Explain skewness and kurtosis.

(ii) If X follows the rectangular distribution with p.d.f. f(x) = $\frac{1}{2\theta}, -\theta \leq x \leq \theta$ derive the first four moments and the coefficient of skewness and kurtosis.

30. If X and Y have the joint pdf given by

f(x,y) =$\frac{x+y}{21}$, x = 1, 2, 3 ; y = 1, 2. Obtain

1) the correlation coefficient ρ_{xy}

2) E(X/Y=2) and V(X/Y=2).

31. Define the following distributions and give their properties. Mention any one application of each.

(i) Poisson

(ii) Lognormal

(iii) Beta

(iv) Pareto

32. (i) State and prove Chebyshev's inequality.

(ii) Let X be a random variable with p.d.f. f(x) = $\frac{1}{2\sqrt{3}}, -\sqrt{3} < x < \sqrt{3}$.

Find P($|x| \geq \frac{3}{2}$) using Chebyshev's inequality and compare it with the exact probability.

(2x10= 20marks)

MODEL QUESTION PAPER
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
THIRD SEMESTER B.Sc. DEGREE EXAMINATION
(CBCSS-UG)
COMPLEMENTAY COURSE- STATISTICS
VST3C03: STATISTICAL INFERENCE

Time: 3 hours **MaximumMarks: 80**

Part A

Answer all questions in one word.Each question carries 1 mark.

1. Standard deviation of the sampling distribution of an estimator is called.....
2. The square of any standard normal variate follows .... distribution.
3. Reject H_0 when H_0 is true is called ....
4. If $X_1, X_2, ...X_n$ is a random sample from a population $p^x(1-p)^{n-x}$ for x=0,1 and $0 < p < 1$ the sufficient statistic for p is .....
5. The range of F-variate is .....

Write True or False

6. The mean of the chi-square distribution with n degrees of freedom is 2n.
7. Fisher Neymann factorization criterion is used to obtain an estimator which is consis- tent.
8. Consistent estimators are not necessarily unbiased.
9. If X follows N(0,1) and Y follows a chi-square with n degrees of freedom then $\frac{\sqrt{n}x}{\sqrt{y}}$ distributed as t distribution with n-1 degrees of freedom
10. The number of independent observations in a set of observations is known as degrees of freedom.

(10x1 = 10marks)

Part B

Answer all questions in one sentence each.Each question carries 2 marks.

11. Define a t- statistic.
12. Define the term parameter.
13. Give an example of a consistent estimator which is not unbiased.
14. State Fisher Neymann factorization theorem.
15. What are the properties of MLE?
16. Define Type I and Type II error.
17. Define power of a test. (7x2 = 14marks)

Part C

Answer any 3 questions.Each question carries 4 marks.

18. Distinguish between point estimation and interval estimation.
19. Examine Sufficiency of X^2 for σ^2 in the $N(0,\sigma^2)$ distribution.
20. Explain method of moments.
21. A sample of 400 items are taken from a population whose standard deviation is 1.5.

The mean of the sample is 2.5. Calculate the 95% confidence limits of the population mean.

22. Distinguish between (i) simple and composite hypothesis and (ii) Null and alternate hypothesis.

(3x4 = 12marks)

Part D

Answer any 4 questions.Each question carries 6 marks.

23. Describe the desirable properties of a good estimator.
24. Examine whether sample variance is an unbiased estimate of population variance if the samples are drawn from $N(\mu, \sigma)$.
25. Show that t_n is consistent for θ if $E(t_n) \rightarrow \theta$ and $V(t_n) \rightarrow 0$ an $n \rightarrow \infty$.
26. Construct the confidence interval for difference of two population means.
27. Briefly outline the Neymann -Pearson theory of testing a simple null hypothesis against a simple alternate hypothesis.
28. Explain the large sample test for testing equality of two population means.

(4x6 =24 marks)

Part E

Answer any 2 questions. Each question carries 10 marks.

29. If $X_1, X_2, \ldots X_n$ is a random sample from a normal population with mean μ and variance σ^2, Obtain the distribution of sample mean and variance.
30. a) Explain maximum likelihood method of estimation.
    b) Let $X_1, X_2, \ldots X_n$ is a random sample from a normal population with mean μ and variance σ^2, Obtain the MLE's of μ and σ^2.
31. a) Explain the construction of confidence interval for σ^2 in $N(\mu, \sigma^2)$.
    b) In a random sample of 100 students selected from a college 15 students are smokers. Obtain a 95% confidence interval for the proportion of smokers in the college.
32. Discuss briefly the different applications of chi-square as a test statistic.

(2x10= 20marks)

MODEL QUESTION PAPER

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

COMPLEMENTAY COURSE- STATISTICS

VST4C04: APPLIED STATISTICS

Time: 3 hours **Maximum Marks: 80**

Part A

Answer all questions in one word.Each question carries 1 mark.

1. The procedure of dividing the population into strata and then drawing a random sample from each one of the strata is called....
2. The long term regular movement in a time series is called ....
3. One or more points outside the control limit indicates that .....
4. Control limits for mean with usual notations are....
5. The statistics used to testing the hypothesis in the case of one way classification is .....

Write True or False

6. Semi - average method is used to compute seasonal indices.
7. Fishers index number is the A.M of Laspeyres and Paasches index numbers.
8. Control chart consist of three control lines.
9. The error degrees of freedom for two way ANOVA with r rows and c columns is rc - 1.
10. The technique of Analysis of variance was first devised by Karl Pearson.

(10x1 = 10marks)

Part B

Answer all questions in one sentence each.Each question carries 2 marks.

11. Distinguish between census and sampling.
12. What is one way classification of ANOVA?
13. What are the components of time series?
14. What are simple index numbers?
15. What is meant by quality of a product?
16. Define secular trend of a time series.
17. What are chance causes? (7x2 = 14marks)

Part C

Answer any 3 questions.Each question carries 4 marks.

18. Distinguish between sampling and non sampling errors.
19. What are the assumptions of ANOVA techniques.
20. What are the uses of index numbers.
21. Define moving average?
22. What are process control and product control?

(3x4 = 12marks)

Part D

Answer any 4 questions.Each question carries 6 marks.

23. Explain principle steps in a sample survey.
24. What are the different types of sampling? Explain
25. A plastic manufacturer tests the tensile strength of different types of polythene material. A sample of three measurements is taken for each material type and data in pounds per square inch are as follows:
    Type I : 200 215 218
    Type II : 260 255 277
    Type III : 245 248 272
    Determine if the mean tensile strength of the three different types of material differ significantly.
26. Explain the various methods of determining trend in a time series.
27. Calculate ideal index from the following information. 1. Sum of the products of base year quantity to base years price = 440
    2. Sum of the products of base year price to current year quantity = 420
    3. Sum of the products of current year price to current year quantities = 680
    4. Sum of the products of current year price to base year quantities = 720.
28. Construct a control chart for the mean and the range for the data in which samples of 5 are take.
    19 36 42 51 60 18 42 42 19 36 42 51
    24 54 51 74 60 20 65 45 34 50 50 74
    80 69 57 75 72 27 75 68 70 69 58 75
    81 77 59 78 95 42 78 72 81 81 59 78
    81 84 78 132 138 60 87 90 81 84 78 60
    Comment whether the production seems to be under control.

(4x6 = 24marks)

Part E

Answer any 2 questions.Each question carries 10 marks.

29. Explain organisation and execution of large scale sample surveys.
30. Distinguish between one way and two way classification models and explain the procedure followed for carrying out analysis of variance

(2x10= 20marks)

Model Question Paper
VIMALA COLLEGE (AUTONOMOUS), THRISSUR
FIRST SEMESTER B.Sc. DEGREE EXAMINATION
(CBCSS-UG)
COMPLEMENTAY COURSE- MATHEMATICAL ECONOMICS
VME1C01: MATHEMATICAL ECONOMICS

Time: 3 hours **Maximum Marks: 80**

Part A

Answer all questions in one word. Each question carries 1 mark

1. The law of demand expresses the functional relationship between price and ……....
2. If price of a commodity rises, its demand will ……
3. The amount of satisfaction which a person derives from consuming a commodity is……
4. Economic profit= Total Revenue-…….
5. If the cost function is $9q^2+11q+15$, then the fixed cost is…….
6. Average Revenue=…….
7. A consumer reaches equilibrium when marginal utility is equal to.....
8. At saturation point MU of a commodity is ……
9. If the total revenue is $TR = 75Q - 4Q^2$ then the marginal revenue is MR = ……..
10. Given the implicit function $7x^2 - y = 0$ then the derivative $\frac{dx}{dy}$ =

(10x1=10marks)

Part B

Answer all questions in one sentence each. Each one carries 2 marks.

11 Define equilibrium price of a good.
12 Write any four important factors determining the supply of a commodity
13 Distinguish between Economic cost and accounting cost
14 Define the term short run in connection with the production of a commodity
15 Distinguish between Cardinal utility and Ordinal utility.
16 Find the total differential of $Z = 5x^3 - 12xy - 6y^5$
17 Given the demand function $P = 30 - 2Q$ find the marginal revenue function and the marginal revenue when Q= 4

(7x2 = 14marks)

Part C

Answer any 3 questions. Each one carries 4 marks.

18 Suppose a market consists of three consumers A, B and C whose individual demand functions are as given

A: P = 35 - 0.5 Q_A

B: P = 50 - 0.25Q_B

C: P = 40 - 2Q_C

Find out the market demand function for the commodity

19 Explain shift in supply.

20 Prove that the marginal cost of production is equal to the reciprocal of the marginal product of the variable factor multiplied by the price of the variable factor.

21 Given $f(x) = x^3 - 18x^2 + 96x - 80$ find the critical values and determine relative maximum or minimum

22 Mention any four limitations of Marshal's cardinal utility analysis

(4x3 = 12marks)

Part D

Answer any 4 questions. Each one carries 6 marks.

23 Find the partial derivatives of $z = 3x^2 + 22xy + 5y^2$

24 Explain the relation between average and marginal cost curves.

25 Difference between economic cost and accounting cost.

26 Explain the law of diminishing marginal utility.

27 Relationship between average cost and marginal cost.

28 Suppose Q= 20-2P, where Q is output and P is price. Find the Marginal Revenue Function.

(4x6 = 24marks)

Part E

Answer any 2 questions.
Each one carries 10 marks.

29 1) Explain price elasticity of demand

2) Price of a good falls from Rs. 10 to Rs. 8 per unit. The quantity demanded increases . from 80 units to 100 units. Find the price elasticity of demand.

30 Given below the short run total cost function.

$TC = 100 + 50Q - 12Q^2 + Q^3$, where TC is the total cost and Q is level of output

i) Determine Total Variable Cost Function

ii) Average variable cost function

iii) Marginal cost function

31 Explain in detail – Marginal rate of substitution.

32 Optimize the function $f(x) = 26x - 3x^2 + 5xy - 6y^2 + 12y$ subject to $3x + y = 170$

(2x10 = 20marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

SECOND SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

COMPLEMENTAY COURSE- MATHEMATICAL ECONOMICS

VME2C02: MATHEMATICAL ECONOMICS

Time: Three Hours **Maximum Marks: 80**

Part A

Answer all questions.
Each carries one mark

1. ……..prevents legal evasion of inheritance tax and is an important source of revenue for the government
2. The Gini coefficient measures the degree of inequality along the scale from…….to ……
3. In an LPP the function which is required to be maximized or minimized is called……
4. The dual of a dual problem is the……
5. The "less than or equal to" type inequality in a constrain of a LPP can be converted to equality by introducing……..variables
6. A game is said to be fair if its value is……
7. Total pattern of choices employed by a player in a game is called……..
8. Maximize Z=$x_1^2 + x_2^2$ subject to $x_1 - x_2$=3 and $x_2 \leq 2$ is a…….
    a) Linear programming problem
    b) Quadratic programming problem
    c) Transportation problem
    d) Assignment problem
9. In input output analysis the technical coefficients are defined by G_{ij}=……
10. The open input-output model in matrix notation is given by…….

(10x1=10 marks)

Part B

Answer all questions.
Each carries 2 marks

11. Define two person zero sum game
12. Write the merits of the Gini coefficient
13. Explain any two causes of income inequality
14. Find the saddle point of the game for the pay off matrix is: $\begin{bmatrix} 1 & 7 & 3 & 4 \\ 5 & 6 & 4 & 5 \\ 7 & 2 & 0 & 3 \end{bmatrix}$

15. Define value of a game
16. Write any four limitations of input output analysis
17. Write the rules of dominance in game theory

(7x2=14 Marks)

Part C

Answer any three questions.
Each carries 4 marks

18. Solve graphically
    Minimize $Z=20x_1+10x_2$
    Subject to $x_1+2x_2 \leq 40$

    $3x_1+x_2 \geq 30$
    $4x_1+3x_2 \geq 60$
    And $x_1, x_2 \geq 0$
19. Explain graphic method in game theory
20. Write the advantages of input-output analysis. What is the Hawkins Simon conditions
21. 'Existence of noncompeting groups is another cause of inequality of income'. Explain
22. Write short note on mixed strategy

(3x4=12 Marks)

Part D

Answer any four questions.
Each question carries six marks

23. Explain how the Lorenz curve can be used to measure the inequality of incomes
24. Mr. X requires 10, 12 and12 units of chemicals A, B and C for his garden. One jar of liquid product contains 5, 2 and one units of A, B and C respectively. A dry product contains 1, 2 and 4 units of A, B and C per carton. The liquid product cost Rs. 30 per jar and the dry product cost Rs. 20 per carton. Formulate into an LPP to minimize cost
25. Explain the meaning of input-output analysis
26. Use the principle of dominance to reduce the following payoff matrix

		Player B		
		B1	B2	B3
Player A	A1	1	2	-1
	A2	3	1	2
	A3	-1	3	2

27. If $A=\begin{bmatrix}0.10 & 0.50\\ 0.20 & 0.25\end{bmatrix}$ and $D=\begin{bmatrix}300\\ 100\end{bmatrix}$. Find the gross output of the two sectors

28. Write the dual of:

Minimize $Z= x_1-3x_2+2x_3$

Subject to $3x_1-x_2+2x_3\leq 7$

$-2x_1+4x_2\leq 12$

$-4\ x_1+3x_2+8x_3=10$

$x_1, x_2, x_3\geq 0$

(4x6=24marks)

Part E

Answer any two questions.

Each question carries ten marks

29. Use dual simplex method to solve

Minimize $Z = x_1+x_2$

Subject to $x_1+2x_2\geq 12$

$5x_1+6x_2\geq 48$

And $x_1, x_2\geq 0$

30. Determine the optimum strategies and the value of the game from the following pay off matrix:

$$\begin{array}{c} \\ X \end{array}\begin{array}{c} \begin{array}{ccccc} Y & & & & \end{array} \\ \begin{bmatrix} 6 & 3 & -1 & 0 & -3 \\ 3 & 2 & -4 & 2 & -1 \end{bmatrix} \end{array}$$

31. Given the following input coefficient matrix and final demand. Determine the output of each sector

$$A=\begin{bmatrix} 0.1 & 0.3 & 0.1 \\ 0 & 0.2 & 0.2 \\ 0 & 0 & 0.3 \end{bmatrix}$$

32. Write down the applications and advantages of Linear programming problem

(2x10=20 marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR

THIRD SEMESTER B.Sc. DEGREE EXAMINATION

(CBCSS-UG)

COMPLEMENTAY COURSE- MATHEMATICAL ECONOMICS

VME3C03: MATHEMATICAL ECONOMICS

Time: 3 hours Maximum Marks: 80

Part A

Answer all questions in one word. Each question carries 1 mark.

1. The first order differential equation M dy +N dt =0 is called.....
2. When the total product becomes maximum, then the marginal product of the factor will be.....
3. If the production function is linear homogenous, then the elasticity of substitution is.....
4. Equal product curves are also known as.....
5. If the production function becomes linear homogenous then the production operates under.....

Write true or false

6. Production not only depends upon the quantity of inputs but also upon the technique of production.
7. The iso-cost line is tangent to the iso -product curve.
8. When the percentage change in output is the same as percentage change in the inputs, it is known as law of increasing returns.
9. The order of a differential equation is the order of the highest derivative in the equation.
10. If the different iso-product curves are lying at equal distance then there will be increasing return to scale.

(10x1=10marks)

Part B

Answer all questions in one sentence each. Each one carries 2 marks.

11. Define elasticity of substitution.
12. What is average productivity and marginal productivity?
13. What is CES production function?
14. Check whether the differential equation (6yt +9 y^2) dy +(3y^2+ 8t)dt = 0 is exact or not.
15. Define MRTS.
16. Define differential equation.
17. Specify the order and degree of the differential equation

$\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3 = 12x$

(7x2 = 14marks)

Part C

Answer any 3 questions.Each one carries 4 marks.

18. What are the assumptions of Euler's theorem?
19. Explain the law of variable proportion.
20. prove that Euler's theorem is applicable only in the case of homogeneous production.
21. Solve the differential equation $\frac{dy}{dt} + 3y = 6t$, $y(0) = 1/3$
22. Explain the lagged income determination model.

(3x4 = 12marks)

Part D

Answer any 4 questions.
Each one carries 6 marks

23. What are the advantages and limitations of CES Production function?
24. Prove that in Cobb-Douglas production function $P = A L^{\alpha} K^{\beta} u$, α and β the elasticity's of production with respect to labour and capital respectively.
25. Solve the differential equation $(6yt + 9y^2)dy + (3y^2+8t)\, dt = 0$
26. Find the expansion path expressed in terms of its total expenditure on its inputs if the given production function is $P = 12 \log A+30 \log B$ and the input prices $P_A = 2$ and $P_B = 5$.
27. Explain
    1) stage of increasing average returns
    2) stage of diminishing average returns
    3) Stage of absolute diminishing returns
28. Prove that marginal product is always equal to the average product when average product is maximum.

(4x6 = 24marks)

Part E

Answer any 2 questions
Each one carries 10 marks

29. Write down the properties of CES production function (with proof)
30. What is producer's equilibrium? Derive the producer's equilibrium through tangency condition.
31. If the profit rate (price of capital) remains unaltered, the ratio of amount of capital employed per unit of labour shifts from 10:10 to 12:11, given that rise in wages is 25%. Determine elasticity of substitution.
32. Find the elasticity of substitution for the Cobb-Douglas production function:
    $P = A L^{\alpha} K^{\beta} u$ where $\alpha+\beta = 1$

(2x10 = 20marks)

Model Question Paper

VIMALA COLLEGE (AUTONOMOUS), THRISSUR
FOURTH SEMESTER B.Sc. DEGREE EXAMINATION
(CBCSS-UG)
COMPLEMENTAY COURSE- MATHEMATICAL ECONOMICS
VME4C04: MATHEMATICAL ECONOMICS

Time: 3 hours **Maximum Marks: 80**

Part A

Answer all questions in one word.
Each question carries 1 mark.

1. The value of the marginal propensity to consume is ----------
2. A bivariate regression analysis is one with ----------
3. The classical normal linear regression model assumes that each u_i is distributed normally with variance as ----------
4. For the standardized variable, value of the mean is ----------
5. Write the general form of Keynesian consumption function.
6. The method of ordinary least squares is attributed to ----------
7. State True or False . " Coefficient of correlation lies between -1 and + 1.
8. In the ------ model both the regressand and the regressor are expression in the logarithmic form.
9. A regression model having no explicit intercept term is called -------
10. Price of gold collected daily is an example of -------- data.

(10x1=10marks)

Part B

Answer all questions in one sentence questions.
Each one carries 2 marks.

11. What do you mean by linear regression model?
12. Explain the least square principle?
13. Define standard error of an estimate.
14. Define null hypothesis and alternative hypothesis.
15. Define population regression curve.
16. State and prove Gauss- Makov theorem
17. Define P value.

(7x2 = 14 marks)

Part C

Answer any 3 questions.
Each one carries 4 marks.

18. What are the properties of a standardized variable?.
19. Define population regression curve
20. Distinguish between linearly in variables and linearity in parameters.
21. Explain the term regression through origin
22. Explain normal probability plot.

(3x4 = 12marks)

Part D

Answer any 4 questions
Each one carries 6 marks

23. Explain the methodology of Econometrics with the help of an example?
24. Explain the concept and uses of regression. Specify PRF and SRF with an example?
25. Define correlation coefficient ' r'. Also discuss the properties of ' r'.
26. Explain the Jarque – Bera (JB) test of normality.
27. State the statistical properties of OLS estimators?
28. Explain ratio scale and interval scale.

(4x6 = 24marks)

Part E

Answer any 2 questions
Each one carries 10 marks

29. Explain (i). The Lin- Log model (ii). The Log- Lin model (iii). Reciprocal models.
30. You are given the following data based on 10 pairs of observation of Y on X

$$\sum Y_i = 1110, \quad \sum Y_i^2 = 1{,}33{,}300, \quad \sum X_i = 1680, \quad \sum X_i^2 = 3{,}15{,}400 \quad \sum X_i Y_i = 2{,}04{,}200$$

Assuming the assumption of CLRM obtain (1). β_1 and β_2 (2).se (Standard error) of this estimate.

31. Explain the concept of coefficient of determination and give different expressions for its computation.
32. Explain the following:-
    (i). Testing of hypothesis
    (ii). Level of significance
    (iii). Confidence interval approach

(2x10 = 20marks)