"Education for Knowledge, Science and Culture"

-Shikshanmaharshi Dr.Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE (AUTONOMOUS), KOLHAPUR

Department of Statistics

B. Sc. II

Semester III & IV

CBCS syllabus to be implemented from June 2022 Onwards

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Department of Statistics

B.Sc. II Semester III and IV, CBCS

Semester	Paper No.	Course Code	Course Title	No. of Credits
III	V	DSC - 1004 C1	Probability Distributions I	02
	VI	DSC - 1004 C2	Statistical Methods	02
IV	VII	DSC - 1004 D1	Probability Distributions II	02
	VIII	DSC - 1004 D2	Introduction to Reliability Theory & Testing of Hypothesis	02
	Practical II	--	--	02
	Practical III	--	--	02

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B. Sc. Part – II CBCS Syllabus with effect from June 2022
STATISTICS - DSC - 1004 C1
Semester: III

Paper V: Probability Distributions-I Theory: 36 Hours

Course Outcomes: At the end of the course students will be able to:

CO1. Compute descriptive statistics, moments, skewness, kurtosis, m.g.f. and c.g.f for continuous univariate distributions.

CO2.Compute various statistical measures for continuous bivariate distributions.

CO3.Understand transformation of continuous univariate and bivariate random variable.

CO4.Understand various continuous probability distributions and their applications in different fields.

Unit I: Continuous Univariate & Bivariate Distributions: (18 Hours)

Continuous Univariate Distributions:

1.1 Definition of the continuous sample space with illustrations, definition of continuous random variable (r.v.), probability density function (p.d.f.), cumulative distribution function (c.d.f.) and its properties.

1.2 Expectation of r.v., expectation of function of r.v., mean, median, mode, quartiles, variance, harmonic mean, raw and central moments, skewness and kurtosis, examples.

1.3 Moments generating function (m.g.f.): definition and properties (i) Standardization property $M_X(0) = 1$, (ii) Effect of change of origin and scale, (iii) Uniqueness property of m.g.f., if exists, (statement only). Raw and central moments using m.g.f.

1.4 Cumulant generating function (c.g.f.): definition, Cumulants, Properties of c.g.f. and relations between cumulants and central moments (up to order four).

1.5 Transformation of univariate continuous r.v.: Distribution of Y=g(X), where g is monotonic or non-monotonic functions using, (i) Jacobian method (ii) Distribution function and (iii) M.g.f. method. and examples.

Continuous Bivariate Distributions:

1.6 Definition of bivariate continuous random variable (X, Y), Joint p.d.f., c.d.f with properties, marginal and conditional distribution, independence of random variables, evaluation of probabilities of various regions bounded by straight lines.

1.7 Expectation of function of r.v.s, means, variances, covariance, correlation coefficient, conditional expectation, conditional variance, regression as conditional expectation if it is linear function of other variable and conditional variance, proof of

i) $E(X \pm Y) = E(X) \pm E(Y)$ ii) $E[E(X/Y)] = E(X)$.

1.8 If X and Y are independent r.v.s. then proof of

i) $E(XY) = E(X)\,E(Y)$, ii) $M_{X+Y}(t) = M_X(t).\,M_Y(t)$.

1.9 Transformation of continuous bivariate random variables: Distribution of bivariate random variables using Jacobin method and examples

Unit 2: Uniform, Exponential & Normal Distribution: (18 Hours)

2.1 Uniform distribution: Definition, p.d.f., nature of curve, c.d.f., m.g.f., mean, variance, moments. Distribution of (i) (X-a) / (b- a), ii) (b-X) / (b-a), where X follows U (a, b). (iii) Y = F(x) where F(x) is c.d.f. of any continuous r.v. and examples.

2.2 Exponential distribution: Definition, p.d.f with rate parameter θ, nature of curve, c.d.f., mean, variance, m.g.f., c.g.f., C.V., moments, Cumulants, median, quartiles, lack of memory property, distribution of - (1/ θ) log (X), where X~U (0, 1) and examples.

2.3 Normal distribution: Definition, properties of normal curve, nature of curve, m.g.f., c.g.f., mean, variance, median, mode, mean deviation about mean, moments, cumulants, measures of skewness and kurtosis, Definition of standard normal distribution, distribution of linear combination of independent normal variates and examples.

2.4 Real life situations of Uniform, Exponential and Normal distributions.

Recommended Books:

1. Gupta S. C. &Kapoor V.K.: Fundamentals of Mathematical Statistics. Sultan Chand & sons, New Delhi.
2. K.C. Bhuyan Probability distribution Theory and Statistical Inference New Central book agency.

Reference Books:

1. Goon, A.M., Gupta M.K. and Dasgupta B: Fundamentals of Statistics Vol. I and Vol. II World Press, Calcutta.
2. Gupta S. C. &Kapoor V.K.: Fundamentals of Mathematical Statistics. Sultan Chand & sons, New Delhi.
3. Hogg R.V. and Criag A.T.: Introduction to Mathematical Statistics (Third edition), Macmillan Publishing, New York.
4. K.C. Bhuyan: Probability distribution Theory and Statistical Inference New Central book agency.
5. Mood A.M., Graybill F.A.: Introduction to theory of Statistics. (Chapter II, IV, V, VII) and Boes D.C. Tata, McGraw Hill, New Delhi. (Third Edition)
6. Parimal Mukhopadhyay: An Introduction to the Theory of Probability. World Scientific Publishing.
7. V. K. Rohatgi, A.K. Md. Ehsanes Saleh: An introduction to Probability and Statistics, Wiley series in probability and Statistics second edition.
8. Walpole R.E. & Mayer R.H.: Probability & Statistics. (Chapter 4, 5, 6, 8, 10) MacMillan Publishing Co. Inc, New York

STATISTICS - DSC - 1004 C2

Paper VI: Statistical Methods (Theory 36 Hours)

Course Outcomes: At the end of the course students will be able to:

CO1.Understand the concept of Multiple Linear Regression, residual.
CO2. Understand the concept of multiple correlation and partial correlation.
CO3.Compute simple, weighted index numbers and cost of living index number.
CO4.Understand the basics of official Statistics.

Unit I: Multiple linear Regression, Multiple and Partial Correlation (for trivariate data only): (18 Hours)

Multiple Linear Regression (for trivariate data only):

1.1 Concept of multiple linear regression, plane of regression, Yule's notation, correlation matrix.

1.2 Fitting of regression plane by method of least squares, definition of partial regression coefficients and their interpretation.

1.3 Residual: definition, order of residual, properties, derivation of mean and variance,

1.4 Covariance between residuals.

Multiple and Partial Correlation (for trivariate data only):

1.5 Concept of multiple correlations.

1.6 Definition of multiple correlation coefficient $R_{i.jk}$, derivation of multiple correlation coefficient.

1.7 Properties of multiple correlation coefficient;
Interpretation of $R_{i.jk}=1$, $R_{i.jk}=0$,

1.8 Coefficient of multiple determination $R^2_{1.23}$.

1.9 Concept of partial correlation. Definition of partial correlation coefficient $r_{ij.k}$, derivation of $r_{ij.k,}$,properties of partial correlation coefficient and examples.

Unit II: Index Number & Official Statistics (18 Hours)

Index Numbers:

2.1 Meaning and utility of index numbers, problems in construction of index numbers.

2.2 Types of index numbers: price, quantity and value.

2.3 Unweighted and weighted index numbers using (i)aggregate method, (ii) average of price or quantity relative method (A.M. or G.M. is to be used as an average)

2.4 Index numbers using; Laspeyre's, Paasche's and Fisher's formula.

2.5 Properties of Fishers index number.

2.6 Tests of index numbers: unit test, time reversal test, factor reversal test.

2.7 Cost of living index number: definition, construction by using (i) Family Budget method (ii) Aggregate expenditure method.

2.8 Shifting of base, splicing and purchasing power of money.

Official Statistics:

2.9 National and International official statistical system
Official Statistics: (a) Need, Uses, Users, Reliability, Relevance, Limitations, Transparency, its visibility (b) Compilation, Collection, Processing, Analysis and Dissemination, Agencies Involved, Methods.

2.10 National Statistical Organization: Vision and Mission, NSSO and CSO; roles and responsibilities; Important activities, Publications etc.

Recommended Books:

1. Gupta S. C. & Kapoor V.K.: Fundamental of Applied Statistics. Sultan Chand & sons, New Delhi.
2. S. C. Gupta: Fundamentals of Statistics, Himalaya Publishing House, seventh revised & enlarged edition.

Reference Books:

1. CSO. National Accounts Statistics- Sources and Health.
2. Datt R., Sundaram, K. P. M. (2016) Indian Economy, (Sultan Chand & company)
3. Goon, A.M., Gupta M.K. and Dasgupta B: Fundamentals of Statistics Vol. I and Vol. II World Press, Calcutta.
4. Gupta S. C. & Kapoor V.K.: Fundamentals of Applied Statistics. Sultan Chand & sons, New Delhi.
5. Parimal Mukhopadhyaya: An Introduction to the Theory of Probability. World Scientific Publishing.
6. S. C. Gupta: Fundamentals of Statistics, Himalaya Publishing House, seventh revised & enlarged edition.
7. Sen, A. (1997). Poverty and Inequality.

STATISTICS - DSC - 1004 D1
Semester: IV
Paper VII: Probability Distributions-II Theory 36 Hours

Course Outcomes: At the end of the course students will be able to:

CO1.Understand various continuous probability distributions and their applications in different fields.
CO2. Know the relation between various probability distributions.
CO3.Learn basics of R- software
CO4.Learn data analysis using R- software.

Unit I: Gamma, Beta and Exact Sampling Distributions. (18 Hours)

1.1 Gamma distribution: Gamma distribution with rate parameter θ and shape parameter n, special case $\theta = 1$, $n = 1$, m.g.f., c.g.f., mean, variance, mode, moments, cumulants, skewness and kurtosis, additive property, distribution of sum of i.i.d. exponential variates, distribution of X^2 if $X \sim N(0, 1)$ and examples.

1.2 Beta distribution of first kind: Beta distribution of first kind with parameters m and n. mean, variance, H.M., mode, distribution is symmetric when $m = n$, Uniform distribution as a particular case when $m = n = 1$, distribution of (1-X) and examples.

1.3 Beta distribution of second kind: Beta distribution of second kind with parameters m and n. mean, variance, H.M., mode, relation between beta distribution of first kind and second kind, distribution of X+Y, X/Y and X/(X+Y) where X and Y are independent gamma variates and examples.

1.4 Chi-Square distribution: Definition, p.d.f. of chi square distribution with n degrees of freedom, nature of curve, mean, variance, moments, m.g.f., c.g.f., mode, skewness and kurtosis, additive property and examples.

1.5 Student's t- distribution: Definition, p.d.f. with n degrees of freedom, nature of curve, mean, variance, mode, moments, skewness and kurtosis and examples.

1.6 Snedecor's F distribution: Definition, p.d.f., nature of curve, mean, variance and mode. reciprocal property. interrelation between t, F and χ^2 variates (without proof) and

examples.

Unit II: Statistics using R **(18 Hours)**

2.1 Installation and introduction to R, History and features of R, data input / output variables in R: Numeric, character, logical and complex

2.2 Class (), Object identification: is.na, is.numeric, is.character, is.matrix, is.vector, is.null, is.factor ,as.functions

2.3 Creation of vector using commands: combine, scan, seq, rep, edit, sort, length, which, order

2.4 Operations on data: Assignment operators in R, leftwards assignments (<- <<-, =) rightwards assignments (->, ->>, =)

2.5 Listing and deleting the objects: matrix, data.frame, cbind, rbind ,converting objects.

2.6 Arithmetic and simple functions: sum, prod, sort,

2.7 Matrix computation: addition, multiplication, determenant, inverse, rank.

2.8 Import and export data: read.table, read.csv, file.choose, write.table, write.csv.

2.9 Data Visualization:

-Diagrammatic representation: simple bar diagram, sub-divided bar diagram, multiple bar diagram.

-Graphical representation: Scatter plot, histogram, frequency polygon, ogive curve.

2.10 Control structure: for loop, while loop, if else statement, break statement, switch case.

2.11 Installation of packages.

2.12 Exploratory data analysis: mean, variance, quantiles, pdf, cdf, correlation, summary, aggregate function, functions from apply family.

2.13 Plots to check normality: Box plot, Q- Q plot.

Recommended Books:

1. Parimal Mukhopadhyay: An Introduction to the Theory of Probability. World Scientific Publishing.

2.Sudha G. Purohit, Sharad D Gore, Shailaja R. Deshmukh, Statistics using R, Second Edition

Reference Books:

1. Crawley, M. J. (2006): Statistics - An introduction using R. John Wiley, London 32.
2. Gupta S. C. & Kapoor V.K.: Fundamentals of Mathematical Statistics. Sultan Chand & sons, New Delhi ,Twelfths edition..
3. Gupta S. C. & Kapoor V.K.: Fundamentals of Applied Statistics. Sultan Chand & sons, New Delhi.
4. Goon, A.M., Gupta M.K. and Dasgupta B: Fundamentals of Statistics Vol. I and Vol. II World Press, Calcutta.
5. Jared P. Lander, R for everyone advanced analytics and graphics, second edition.
6. Mood A.M., Graybill F.A.: Introduction to theory of Statistics. (Chapter II, IV, V, VII) and Boes D.C. Tata, McGraw Hill, New Delhi. (Third Edition)
7. Parimal Mukhopadhyay: An Introduction to the Theory of Probability. World Scientific Publishing.

8. Sudha G. Purohit, Sharad D Gore, Shailaja R. Deshmukh, Statistics using R, Second Edition
9. Walpole R.E. & Mayer R.H.: Probability & Statistics. (Chapter 4, 5, 6, 8, 10) MacMillan Publishing Co. Inc, New York

STATISTICS - DSC - 1004 D2

Paper VIII: Introduction to Reliability Theory & Testing of Hypothesis

(Theory 36 Hours)

Course Outcomes: At the end of the course students will be able to:

CO1. Understand the basic concepts of reliability and ageing properties.
CO2. Recognize the basic concepts of testing of hypothesis.
CO3. Distinguish between large and small sample tests.
CO4. Apply small and large sample tests in real life examples.

Unit I: Reliability Theory **(18 Hours)**

1.1 Binary Systems: Block diagrams, definition of binary coherent structure and illustrations. Coherent system of at most three components, (a) Series system (b) Parallel system (c) 2 out of 3 component system, cut vector, cut set, path vector, path set, Minimal cut, minimal path representation of system.

1.2 Reliability of binary System: reliability of above systems h(p) when components are independent and identically distributed with common probability p of operating.

1.3 Ageing Properties: hazard rate, hazard function, survival function, Concept of distributions with increasing and decreasing failure rate (IFR, DFR). Relationship between survival function and hazard function, density function and hazard rate, derivations o f results:

1) Hazard rate of a series system when components having independent lifetimes
2) Life time of series system of independent components with independent IFR

1.4 Applications of reliability using exponential distribution.

Unit II: Testing of Hypothesis **(18 Hours)**

2.1 Notion of Population, Sample, Parameter, Statistic, Sampling distribution of Statistic, hypothesis, Simple and composite hypothesis, Null and alternative hypothesis, One and two tailed test, Critical region, type I and type II errors, level of significance, p-value., power of test.

2.2 Large Sample Tests:

i) General procedure of testing of hypothesis

ii) Test for means: Testing population mean H_0: $\mu=\mu_0$ and testing equality of two population means H_0:$\mu_1 = \mu_2$.

iii) Test for proportion: Testing population proportion H_0: $P=P_0$ and testing equality of two population proportions H_0:$P_1 = P_2$.

iv) Testing population correlation coefficient H_0: $\rho=\rho_0$ and testing equality of two population correlation coefficients H_0:$\rho_1 = \rho_2$ by Fisher's Z transformation.

2.3 Small Sample Tests:

i) Definition of student's t variate, t test for testing H_0: $\mu=\mu_0$, H_0:$\mu_1 = \mu_2$, paired t test and test for population correlation coefficient H_0: $\rho=0$.

ii) **Chi square tests:**

a) Testing population variance H_0: $\sigma^2 = \sigma_0^2$.
b) Test for goodness of fit.

c) Test for independent of attributes

i) m×n contingency table

ii)2×2 contingency table

iii) Yate's correction for continuity

iv) McNemar's test

iii) F test for testing equality of two population variances H_0: $\sigma_1^2 = \sigma_2^2$

Recommended Books:

1. Gupta S. C. & Kapoor V.K.: Fundamentals of Mathematical Statistics. Sultan Chand & sons, New Delhi, Twelfths edition.
2. Sheldon Ross: Stochastic Process, Wiley series in probability and mathematical statistics Second edition

References

1. 1.Barlow R. E. and Proschan Frank: Statistical Theory of Reliability and Life Testing. Holt Rinebart and Winston Inc., New Yark.
2. Gupta S. C. & Kapoor V.K.: Fundamentals of Mathematical Statistics. Sultan Chand & sons, New Delhi, Twelfths edition.
3. Sheldon Ross: Stochastic Process, Wiley series in probability and mathematical statistics Second edition
4. Sinha S. K.: Reliability and Life Testing, Second Edition, Wiley Eastern Publishers, New Delhi.
5. Trivedi R. S.: Probability and Statistics with Reliability and Computer Science Application, Prentice – Hall of India Pvt. Ltd., New Delhi.

Note:

i. Computer printout is to be attached to the journal.
ii. Observation table and/or calculations using statistical formulae should be done by MS- EXCEL and verify by using library functions.
iii. Student must complete the entire practical to the satisfaction of the teacher concerned.
iv. Student must produce the laboratory journal along with the completion certificate signed by Head of Department, at the time of practical examination.
v. There will be case study. A report on the same has to be submitted by every student along with the journal.

B.Sc . II Statistics Practical **Marks -100 (Credit 4)**

Course Outcomes: At the end of the course students are expected to be able to:

CO1. Compute probabilities of standard probability distributions, expected frequencies and test the goodness of fit.

CO2. Understand how to obtain random sample from standard probability distribution.

CO3. Construct various control charts.

CO4. Understand the applications and Sketch of various discrete and continuous distributions

Practical II:

1. Fitting of Discrete Uniform and Binomial distribution.
2. Fitting of Hypergeometric and Poisson distribution.
3. Fitting of Geometric and Negative Binomial distribution.
4. Model sampling from Discrete Uniform and Binomial distribution.
5. Model sampling from Hypergeometric and Poisson distribution.
6. Model sampling from Geometric and Negative Binomial distribution.
7. Fitting of Continuous Uniform distribution and Exponential distribution
8. Fitting of Normal distribution.
9. Model sampling from Continuous Uniform and Exponential distribution
10. Model sampling from Normal distribution using: (i) Normal table and (ii) Box-Muller transformation.
11. Application of Exponential & Normal distribution.
12. Data input/output and data manipulation using R-Software.
13. Diagrammatic representation of data using R-Software. (Simple plot, Bar plot, Subdivided Bar Diagram, Multiple Bar Diagram, Pie Chart)
14. Diagrammatic and graphical representation of data using R-Software. (Histogram, frequency polygon, Scatter Diagram, Ogive Curves)
15. Measures of central tendency, dispersion and correlation using R-Software.
16. Plotting of pmf and cdfs of various discrete distributions using R – Software
17. Plotting of pdf and cdfs of various continuous distributions using R – Software
18. Applications of Binomial, Poisson, Exponential and Normal distribution using R.

Practical III:

1. Fitting of straight lines, second degree curves.
2. Fitting of exponential and power curves
3. Index Numbers-I. (computations of index numbers)
4. Index Numbers-II (tests of adequacy, Shifting of base, cost of living index number.)
5. Multiple Regression (For trivariate data)
6. Multiple and Partial Correlation (For trivariate data)
7. Large sample tests for means.
8. Large sample tests for proportions.
9. Tests for population correlation coefficients. (Using Fisher's Z transformation.)
10. Tests based on Chi square distribution. (Test for population variance, Test for goodness of fit.)
11. Tests for independence.
12. Tests based on t distribution ($\mu = \mu_0$, $\mu_1 = \mu_2$.; paired t test)
13. Test based on F distribution: $\sigma^2{}_1 = \sigma^2{}_2$
14. Reliability I
15. Reliability II
16. Fitting of Straight line / Parabola / Exponential curves using MS-EXCEL.
17. Sketch of p.m.f.s of various discrete distributions for various parameters using MS-EXCEL. (Binomial, Poisson, Geometric & Negative Binomial Distributions.)
18. Sketch of p.d.f.s of various continuous distributions for various parameters using MS-EXCEL. (Exponential, Gamma, Beta First and Second Kind, Normal Distributions.)

SEC 1 (Credit 2)

Introduction to MS-Excel

Course Outcomes: At the end of the course, students should be able to

1. Use excels for entering and manipulating data.
2. Use advanced techniques for report visualizations.
3. Handle huge amount of data.

Introduction:

Spreadsheet as a worksheet, creating (data entry), editing, copy-paste, copy-paste special, cell referencing, saving and printing spreadsheets, Securing & Protecting spreadsheets.

Home Tab Groups:

Clipboard: Cut/copy/paste
Font: Face, color, size, style (b, i, u), border, shading
Alignment: Horizontal, vertical, wrap text, merge cells
Number format in detail
Cells: Insert rows and columns
Editing: Autosum, sort/filter, find/select/replace
Tables, Illustrations (Pictures/Shapes), Charts & Graphs

Page Layout Tab Groups: Page Setup –Margins/Orientations/Size
Functions & formulae
Data: Import data using csv/web/table range, refresh data, filtering data, text to columns, remove duplicates, data validation, ifelse function
View: workbook view, show, freeze panes
Simple built-in functions: Count, counta, countblank, countif, countifs, sum, devsq, frequency, max, maxa, min, mina, mode, upper, lower, proper, exp, abs, log, round,

SEC 2 (Credit 2)

Advance MS- Excel

Course Outcomes: At the end of the course, students should be able to

1. Apply advanced formulas to lay data in readiness for analysis
2. Understand various statistical methodologies of summarizing data
3. Share workbooks with others.

Advanced tools: Lookup functions, pivot table and pivote charts, Add-Ins, data analysis tool pack
Descriptive statistics: avedev, average, averagea, averageif, averageifs, confidence, correl (pearson), frequency, geomean, growth, harmean, intercept, median, mode, percentile, percentrank, permut, mdeterm, prob, quartile, rank, skew, slope, small, standardize, stdev, stdeva, stdevp, stdevpa, styx (std. error of regression estimate), trend, trimmean, var, vara, varp, varpa, standardize.
Density and distribution functions: betadist, binomdist, chidist, expondist, fdist, gammadist, hypgeomdist, negbinomdist, normdist, normsdist, poisson, tdist.
Inverse quantiles: betainv, chiinv, finv, gammainv, norminv, normsinv, tinv.
Statistical tools: descriptives correlation, covariance, descriptive statistics, exponential smoothing, f-test two-sample for variances, histogram, estimating trend and seasonality, moving average, random number generation form different distributions, rank and percentile, regression, sampling, t-test, z-test

Note: There will be 100 marks multiple choice exam for SEC at the end of semester II

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New course structure to be implemented w.e.f. June 2022

For B.Sc./BCA/B.Sc. Computer science (Entire)

Sr. No.	**Internal Examination DSC Course**				Total (a+b+c+d)	Conversion of 70 marks in **Total (I) (e)**	**SEE (Semester End Examination) DSC Course**		**Total (II)(f+g) = h**	**Total (I and II)** (e+h) = **i**
	DSC-III (Two tests each of 10 marks) (a)	DSC - IV (Two tests each of 10 marks) (b)	Home assignment DSC III (c)	Home assignment DSC IV (d)			DSC-III(f)	DSC-IV (g)		
1	20	20	15	15	70	**30**	35	35	**70**	**100**

Nature of Internal and SEE (Semester End Examination) Examination

1) For internal examination, there shall be two tests (online/offline) of ten marks and one home assignment of 20 marks for each paper per semester.
2) For internal examination there shall be conversion of 70 marks in 30 marks and for passing 11 marks is required out of 30.
3) For SEE (Semester End Examination), there shall be two papers (DSC III and DSC IV) of each DSC course per semester, each of 35 marks.
4) There shall be combined passing for SEE (Semester End Examination) of DSC-III and DSC -IV i.e 25 marks is required out of 70.
5) There shall be separate passing is mandatory for both internal and SEE (Semester End Examination).

Practical Examination B.Sc.II (as per BoS guidelines)

Nature of Practical Question Paper of B. Sc. Part – II.

a) Each practical paper is of 50 marks, containing four questions each of 20 marks and students have to solve any two questions.
b) Evaluation of MS-EXCEL and R programming-based questions will be on line and should be demonstrated by the student to the examiner.
c) 5 marks are reserved for journal and 5 marks are reserved for oral in practical paper-II examination.
d) 5 marks are reserved for journal and 5 marks are reserved for study tour report / Case study in practical paper - III examination.
e) Practical examination is of 4 hours duration which includes oral as well as online demonstration.
f) There should be two subject experts at the time of practical examination.

Nature of Question Paper (Except English)

Time: 2 hours **Total Marks: (35)**

Instructions: (1) **All** questions are **compulsory**.
(2) Figures to the **right** indicate **full** marks.
(3) Draw **neat**, labeled diagrams **wherever** necessary. (Paper setter may add or delete any instruction if required)

Q.1. A) Select correct alternative. (05)

(i) .....
a) b) c) d)
(ii) .....
a) b) c) d)
(iii) .....
a) b) c) d)
(iv) .....
a) b) c) d)
(v) .....
a) b) c) d)

B) Fill in the blanks **(02)**

i) .....
ii) .....

Q. 2. Attempt any two (16)

(i)
(ii)
(iii)

Q.3. Attempt any three (12)

(i)
(ii)
(iii)
(iv)
(v)

VIVEKANAND COLLEGE ESTD JUNE 1964 KOLHAPUR - 416003

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Department of Statistics
Vivekanand College, Kolhapur
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