Estd. 1962
"A++" Accredited by NAAC (2021)
With CGPA 3.52

SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA
PHONE:EPABX-2609000, www.unishivaji.ac.in, bos@unishivaji.ac.in
शिवाजी विद्यापीठ, कोल्हापूर -४१६००४,महाराष्ट्र
दूरध्वनी-ईपीएबीएक्स -२६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१—२६०९०९४
०२३१—२६०९४८७

Ref.No.SU/BOS/Science/434 **Date: 15/07/2025**

To,

The Principal,
All Concerned Affiliated Colleges/Institutions
Shivaji University, Kolhapur.

Subject: Regarding revised syllabi of B.Sc. Part-II (Sem.III & IV) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0)

Ref: No.SU/BOS/Science/270 & 271 Date: 03/05/2025 Letter.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi, nature of question paper of B.Sc. Part-II (Sem.III & IV) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0).

B.Sc.Part-II (Sem. III & IV) as per NEP-2020 (2.0)			
1.	Botany	8.	Geology
2.	Statistics	9.	Zoology
3.	Mathematics	10.	Chemistry
4.	Microbiology	11.	Electronics
5.	Plant Protection	12.	Industrial Microbiology
6.	B.A./B.A.B.Ed. Geography	13.	Biotechnology(Voc/Opt)
7.	Biotechnology(Entire)		

This syllabus, nature of question and equivalence shall be implemented from the academic year 2025-2026 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in NEP-2020@suk(Online Syllabus)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2025 & March/April 2026. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Dy Registrar
Dr. S. M. Kubal

Encl: As above

for Information and necessary action

Copy to:

1	Dean, Faculty of Science & Technology	6	Appointment Section A & B
2	Director, Board of Examinations and Evaluation	7	I.T.Cell /Computer Centre
3	Chairman, Respective Board of Studies	8	Eligibility Section
4	B.Sc.-M.Sc. Exam Section	9	Affiliation Section (T.1) (T.2)
5	Internal Quality Assurance Cell (IQAC Cell)	10	P.G. Seminar Section

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०२३१—२६०९४८७

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B.Sc.Part-II (Sem. III & IV) as per NEP-2020 (2.0)			
1.	Botany	8.	Geology
2.	Physics	9.	Zoology
3.	Statistics	10.	Chemistry
4.	Mathematics	11.	Electronics
5.	Microbiology	12.	Drug Chemistry
6.	Plant Protection	13.	Industrial Microbiology
7.	Astrophysics and Space Science	14.	Sugar Technology (Entire)

This syllabus, nature of question and equivalence shall be implemented from the academic year 2025-2026 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in NEP-2020@suk(Online Syllabus)

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Yours faithfully,

By Registrar
Dr. S. M. Kubal

Encl: As above

for Information and necessary action

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SHIVAJI UNIVERSITY, KOLHAPUR.

Syllabus

For

B.Sc. Part – II Statistics

SEMESTER III AND IV

AS PER NEP 2020 (2.0)

To be implemented from academic year 2025-26

SHIVAJI UNIVERSITY, KOLHAPUR

NAME OF FACULTY : Science and Technology

PROGRAMME NAME AND CODE : B. Sc.

PART : II (Statistics)

1	YEAR OF IMPLEMENTATION	June 2025
2	PREAMBLE	Not applicable
3	PROGRAMME LEARNING OUTCOMES (PO)	Provided in B. Sc. Part I syllabus
4	COURSE OUTCOMES (CO)	Provided
5	OBJECTIVES PROGRAMME	As per rules
6	DURATION OF THE COURSE	As per rules
7	MEDIUM OF INSTRUCTION	English
8	ELIGIBILITY FOR ADMISSION	B. Sc. I pass or ATPT with Statistics as one of the subject
9	SCHEME OF TEACHING AND EXAMINATION PATTERN (Theory/Practical/Internal)	As per rules
10	EQUIVALENCE OF THE PAPERS	Provided
11	STRUCTURE OF PROGRAMME	Provided
12	STANDARD OF PASSING AND DETERMINATION OF SGPA/CGPA, GRADING AND DECLARATION OF RESULTS	As per rules
13	NATURE OF QUESTION PAPER, DURATION AND SCHEME OF MARKING	As per rules
14	SYLLABUS: COURSE TITLE, CODE, CREDITS, VERTICALS NAME, REFERENCES etc.	Provided

SHIVAJI UNIVERSITY, KOLHAPUR NEP-2020 (2.0) Credit Framework for B. Sc.II Under Faculty of Science and Technology								
SEM (Level)	MAJOR	MINOR	OE	VSC/SEC	AEC/ VEC/ IKS	OJT/ FP/ CEP / CC/ RP	Total Credits	Degree/ Cum. Cr. MEME
SEM III (5.0)	Major V (2) **Continuous Probability Distributions - I** Major VI (2) **Correlation and Regression Analysis** Major P III (2) **Statistics Practical - III**	Minor V (2) **Association and Correlation Analysis** Minor VI (2) **Elementary Probability Distributions** Minor P III (2) **Statistics Practical - III**	OE-3(2) **Basic Statistics Practical-III**	VSC I (2) (P) (Major specific) **Practical on Data Analysis Using R-I** SEC I (2) **Practical on Data Analysis using MS-Excel – I**	AEC I (2) (English)	CC-I (2)	22	UG Diploma 88
SEM IV (5.0)	Major VII (2) **Continuous Probability Distributions - II** Major VIII (2) **Elementary Statistical Inference** Major P IV (2) **Statistics Practical- IV**	Minor VII (2) **Statistical Methods for Quality Control** Minor VIII (2) **Sample Surveys and Testing of Hypothesis** Minor P IV (2) **Statistics Practical- IV**	OE-4(2) **Basic Statistics Practical-IV**	SEC-II (2) **Practical on Data Analysis using MS-Excel – II**	AEC-II (2) (English) VEC-II (2) (Environmental studies)	CEP-I (2)	22	
Credits	8(T)+4(P)=12	8(T)+4(P)=12	2(P)+2(P)=4	4(P)+2(P)=6	2+4=6	2+2=4	44	Exit Option: 4 credits courses

EQUIVALENCE OF THE PAPERS

Old Syllabus		**New Syllabus**	
Semester No. Paper No.	**Title of the Paper**	**Semester No. Paper No.**	**Title of the Paper**
Semester III DSC – C7 STATISTICS -V	Probability Distributions-I	Semester III Major V	Continuous Probability Distributions - I
Semester III DSC – C8 STATISTICS -VI	Statistical Methods-I	Semester III Major VI	Correlation and Regression Analysis
Semester IV DSC – D7 STATISTICS -VII	Probability Distributions-II	Semester IV Major VII	Continuous Probability Distributions - II
Semester IV DSC – D8 STATISTICS -VIII	Statistical Methods-II	Semester IV Major VIII	Elementary Statistical Inference

B. Sc. Part - II: Semester - III
Major V: Continuous Probability Distributions - I
Theory: 30 Hrs. Marks:50 (Credits:02)

Course Outcomes: After successfully completing this course, the students will be able to acquire knowledge of

i. Continuous random variable and find the various measures, probabilities using its probability distribution.
ii. Transformation of univariate continuous random variable.
iii. Some standard continuous probability distributions with real life situations.
iv. The relations among the different distributions.

Unit-1: **(15 hrs.)**

1.1: Univariate Continuous Distributions:

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. 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. Moment 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).Generation of raw and central moments. Cumulant generating function (c. g. f.): Definition, relations between cumulants and central moments (without proof). Examples.

Transformation of univariate continuous random variable:

Distribution of Y = g(X), where g(.) is monotonic or non-monotonic function by using (i) Jacobian of transformation, (ii) Distribution function and (iii) m. g. f. methods. Examples and problems.

1.2: Some Univariate Continuous Distribution (Uniform, Exponential**)**

Uniform distribution: Definition of Uniform distribution over (a, b), mean, variance, moments, c.d.f., m.g.f. Distribution of: (i) (X– a) / (b–a), ii) (b–X) / (b–a), (iii) Y = F(X), where F(.) is c.d.f. of any continuous r.v. X.

Exponential Distribution: P.d.f. with parameter θ:

$$f(x) = \begin{cases} \theta e^{-\theta x} & ;\ x \geq 0, \theta > 0 \\ 0 & ;\ otherwise \end{cases}$$

c.d.f., m.g.f., c.g.f. Mean, variance and moments using M.g.f., C.V. Cumulants, median, quartiles, lack of memory property, distribution of $-(1/\theta)\log X$ where X~U (0, 1).

Unit-2:

2.1: Some Univariate Continuous Distribution (Gamma, Weibull**)**

Gamma distribution: Gamma distribution with rate parameter 'θ' and shape parameter 'n'.

$$f(x) = \begin{cases} \frac{\theta^n}{\Gamma n} e^{-\theta x} x^{n-1} & ;\ 0 \leq x < \infty, \theta > 0, n > 0 \\ 0 & ;\ otherwise \end{cases}$$

Special case when θ = n = 1. m.g.f., c.g.f., mean, mode, variance, moments, cumulants, β_1, β_2, γ_1 and γ_2 coefficients, additive property, distribution of sum of i.i.d. exponential variates.

Weibull distribution: Weibull distribution with parameters (α, β).

$$f(x) = \begin{cases} \alpha\beta^{\alpha} x^{\alpha-1} e^{-(x\beta)^{\alpha}} ; 0 \leq x < \infty, \alpha > 0, \beta > 0 \\ 0 \qquad\qquad\qquad\qquad ;\ otherwise \end{cases}$$

Mean and variance, coefficient of variation, relation with gamma and exponential distribution. Examples and problems.

2.2: Some Univariate Continuous Distribution (Beta first, Beta second, Laplace**)**

Beta distribution of first kind: Beta distribution of first kind with parameters m and n.

$$f(x) = \begin{cases} \frac{1}{\beta(m,n)} \frac{x^{m-1}}{(1-x)^{n-1}} & ; 0 < x < 1, m, n > 0 \\ 0 & ; otherwise \end{cases}$$

Mean, mode, variance, symmetric when m = n. Uniform distribution as a particular case when m = n = 1, distribution of (1–X).

Beta distribution of second kind: Beta distribution of second kind with parameters m and n.

$$f(x) = \begin{cases} \frac{1}{\beta(m,n)} \frac{x^{m-1}}{(1+x)^{m+n}} & ; 0 \leq x < \infty, m, n > 0 \\ 0 & ; otherwise \end{cases}$$

Mean, mode, variance, relation between beta distribution of first kind and second kind.

Laplace (Double Exponential) Distribution: P.d.f. with parameters μ and θ:

$$f(x) = \begin{cases} \frac{\theta}{2} e^{-\theta|x-\mu|} & ; -\infty < x < \infty, -\infty < \mu < \infty, \theta > 0 \\ 0 & ; otherwise \end{cases}$$

Nature of the probability curve, moment generating function, mean, variance. Laplace distribution as a distribution of the difference of two i.i.d. exponential variates with parameter 'θ'. Examples and problems.

References and Recommended Readings:

1. Parimal Mukhopadhyay: An Introduction to the Theory of Probability. World Scientific Publishing.
2. Hogg R. V. and Criag A.T.: Introduction to Mathematical Statistics (Third edition), Macmillan Publishing, New York.
3. Gupta S. C. & Kapoor V.K.: Fundamentals of Mathematical 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. 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. Walpole R.E. & Mayer R.H.: Probability & Statistics. (Chapter 4, 5, 6, 8, 10) Mac Millan Publishing Co. Inc, New York.

B. Sc. Part - II: Semester - III
Major VI: Correlation and Regression Analysis
Theory: 30 Hrs. Marks:50 (Credits:02)

Course Outcomes: After successfully completing this course, the students will be able to:

i. Study correlation between two variables by using diagrams and graphs.
ii. Study methods and derive formulae to quantify correlation between two or three variables.
iii. Derive linear regression equation of dependent variable on independent variable(s).
iv. Estimate value of dependent variable for given value(s) of independent variable(s).

Unit 1: Bivariate Data Analysis (15 hrs.)

1.1: Correlation Analysis: Bivariate data, Need of analysis of bivariate data, Concept of correlation between two variables, Types of correlation.

Methods of studying correlation:

1) Scatter diagram: Its utility. Covariance: Definition, Effect of change of origin and scale.
2) Karl Pearson's coefficient of correlation (r): Definition, Properties: i) $-1 \leq r \leq 1$, Interpretation for different values of r. ii) Effect of change of origin and scale.
3) Spearman's rank correlation coefficient (R): Definition. Derivation of formula for R in case of observations without ties. Formula of R in case of observations with ties. Illustrative examples.

1.2: Regression Analysis: Concept of regression, Lines of regression of Y on X (Y=a + bX + ε) and X on Y(X=c + dY + ε). Fitting of lines of regression by the least square method, Regression coefficients b_{xy}, b_{yx} and their interpretations. Properties:

i) $b_{xy} \times b_{yx} = r^2$, ii) $b_{xy} \times b_{yx} \leq 1$, iii) $\frac{b_{xy} + b_{yx}}{2} \geq r$

iv) Effect of change of origin and scale on regression coefficients. v) The point of intersection of two regression lines. vi) An acute angle between the two lines of regression.

Concept of residual, mean residual sum of squares, coefficient of determination. Illustrative examples.

Unit 2: Trivariate Data Analysis: (15 hrs.)

2.1: Multiple Regression Analysis: Concept of trivariate data, visualizing the correlation among the variables using scatter plot matrix, Correlation matrix, Concept of multiple linear regression, Plane of regression, Yule's notation. Obtaining equation of plane of regression of X_1 on X_2 and X_3 by method of least squares, definition of partial regression coefficients and their interpretation. Residual: Definition, properties, mean and variance of residuals, residual plot.

2.2: Multiple and Partial Correlation Analysis: Concept of multiple correlation. Definition and derivation of formula of multiple correlation coefficient ($R_{1.23}$) in case of three variables X_1, X_2 and X_3 (without proof). Concept of partial correlation. Definition and derivation of formula for partial correlation coefficient ($r_{12.3}$) in case of three variables X_1, X_2 and X_3 (without proof). Properties of multiple and partial correlation coefficient:

i) $0 \leq R_{1.23} \leq 1$, ii) $-1 \leq r_{12.3} \leq 1$, iii) $1 - R^2_{1.23} = (1 - r^2_{12})(1 - r^2_{13.2})$ iv) $R_{1.23} > |r_{12}|$, v) $R_{1.23} > |r_{13}|$, vi) $b_{12.3} \times b_{21.3} = r^2_{12.3}$. Examples and problems.

References and Recommended Readings:

1. Parimal Mukhopadhyay: An Introduction to the Theory of Probability. World Scientific Publishing.
2. Hogg R. V. and Criag A.T.: Introduction to Mathematical Statistics (Third edition), Macmillan Publishing, New York.
3. Gupta, S.C. and Kapoor, V.K (2019): Fundamentals of Applied Statistics, S. Chand & Sons, New Delhi.
4. Goon A. M, Gupta M. K., Dasgupta B. (2013) Fundamental of Statistics, Vol. I and II, The World Press Pvt. Ltd. Kolkata.
5. Nabendu Pal and Sahadeb Sarkar (2005): Statistics: Concepts and Applications, Prentice Hall of India Private Limited, New Delhi.

B. Sc. Part - II Semester - III
Major P-III: Statistics Practical- III
Practical: 60 hrs. Marks -50 (Credits: 02)

Pre requisites: Knowledge of the topics in the theory papers.

Course Outcomes: After successfully completing this practical course, the students will be able to:

i. fit and test the goodness of fit of specified distribution for given data.
ii. understand how to obtain random sample from various probability distributions.
iii. get the basic knowledge of bivariate data analysis by visualization, computing correlation coefficient and performing linear regression analysis.
iv. get the knowledge of trivariate data analysis by visualization, multiple and partial correlations and performing linear regression analysis.

List of Practicals:

1. Fitting of Binomial and Poisson distribution and test for goodness of fit.
2. Fitting of Continuous Uniform and Exponential distribution and test for goodness of fit.
3. Model sampling from Binomial and Poisson distribution.
4. Model sampling from Continuous Uniform and Exponential distribution.
5. Visualizing the relation between two variables using scatter plot.
6. Karl Pearson's Correlation Coefficient.
7. Spearman's Rank Correlation Coefficient.
8. Simple Linear regression.
9. Multiple linear regression.
10. Multiple and Partial Correlation Coefficients.

Notes:

a. Students must complete all experiments using MS-Excel.
b. MS-Excel should be used at the time of practical examination for calculation.
c. Student must complete the entire practical to the satisfaction of the teacher concerned.
d. Student must produce laboratory journal along with completion certificate signed by Head of the Department, at the time of practical examination.

Laboratory Requirements:

Laboratory should be well equipped with at least 20 computers along with necessary Software's, at least two printers, sufficient back up facility (UPS/ Inverter/ Generator).

Nature of Practical Question Paper:

a. In the practical question paper, there shall be four questions each of 20 marks, a student has to attempt any two questions.
b. Computations should be completed using MS-Excel and should be demonstrated to examiner. Experiment aim, formulae, results etc. should be written on practical answer paper.
c. 5 marks are reserved for the Journal and 5 marks for the Oral examination.
d. Practical examination is of four hours duration which includes viva (oral) examination and online demonstration.

B. Sc. Part - II: Semester – III
Minor V: Association and Correlation Analysis
Theory: 30 Hrs. Marks: 50 (Credits: 02)

Course Outcomes: After successfully completing this course, the students will be able to:

i. Understand the concept of association and independence between two attributes.
ii. Measure the association between two attributes.
iii. Study correlation between two variables by using scatter diagram.
iv. Quantify correlation between two variables.

Unit 1: Association and Independence of Attributes: (15 hrs.)

1.1 Introduction to dichotomous attributes, Notations, Class, Positive and negative class, Order of class, Ultimate class and class frequencies of attributes, Fundamental set of class frequencies, Interrelationship between class frequencies (Class frequencies in terms of a) Ultimate class frequencies and b) Positive class frequencies), Illustrative examples up to three attributes.

1.2: Concept of association and independence of two attributes A and B. Types of association. Yule's Measures of Association (Q) and Measures of Colligation (Y).

Properties of Q and Y: i) $-1 \leq Q \leq 1$, ii) $-1 \leq Y \leq 1$, iii) $Q = \frac{2Y}{1+Y^2}$, iv) $|Q| \geq |Y|$.

Interpretation for different values of Q. Illustrative examples.

Unit 2: Bivariate Data Analysis: (15 hrs.)

2.1: Introduction to bivariate data. Need of analysis of bivariate data. Concept of correlation between two variables. Types of correlation.

2.2: Methods of studying correlation:

i) Scatter diagram.

ii) Karl Pearson's coefficient of correlation (r): Concept of co-variance and its properties, Definition of Karl Pearson's coefficient of correlation (r),

Properties of r: i) $-1 \leq r \leq 1$, ii) Effect of change of origin and scale on r.

Interpretation for different values of r.

iii) Spearman's rank correlation coefficient (R): Definition. Derivation of formula for R in case of observations without ties. Formula of R in case of observations with ties.

Illustrative examples.

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B. Sc. Part - II: Semester - III

Minor VI: Elementary Probability Distributions

Theory: 30 Hrs. Marks: 50 (Credits: 02)

Course Outcomes: After successfully completing this course, the students will be able to acquire knowledge of

i. Continuous random variable and the various measures using its probability distribution.
ii. Uniform and Exponential distributions with real life situations.
iii. Normal distribution with real life situations.
iv. Sampling distributions of a statistic: Chi-Square, t and F distribution.

Unit-1: **(15 hrs.)**

1.1:Basics of univariate continuous distributions:

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. 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, moment 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), examples.

Transformation of univariate continuous random variable:

Distribution of Y = g(X), where g(.) is monotonic or non-monotonic function by using (i) Jacobian of transformation, (ii) Distribution function and (iii) m. g. f. methods. Examples and problems.

1.2: Uniform and Exponential distribution:

Uniform distribution: Definition of Uniform distribution over (a, b), mean, variance, c.d.f., m.g.f. Distribution of: (i) (X– a) / (b–a), (ii) Y = F(X), where F(.) is c.d.f. of any continuous r.v. X. Nature of the probability curve.

Exponential Distribution: P.d.f. with parameter θ:

$$f(x) = \begin{cases} \theta e^{-\theta x} & ; x \geq 0, \theta > 0 \\ 0 & ; otherwise \end{cases}$$

c.d.f., m.g.f., mean, variance, C.V., median, memoryless property, distribution of $-(1/\theta)\log X$ where X~U (0, 1). Nature of the probability curve.

Unit-2: **(15 hrs.)**

2.1: Normal distribution: Normal distribution with parameters μ and σ^2, Definition of standard normal distribution, properties of normal curve, m.g.f., mean, variance, median, mode, of normal distribution.

2.2: Exact Sampling Distributions:

Chi-Square distribution: Definition of Chi-square variate, p.d.f. of Chi-square variate (without proof), mean, variance. Nature of the probability curve.

Student's t-distribution: Definition of Student's t-variate, p.d.f. of t-variate (without proof), mean, variance. Nature of the probability curve.

Snedecor's F-distribution: Definition of F-variate, p.d.f. of F-variate (without proof), mean, variance. Nature of the probability curve.

Interrelation between t, F and Chi-square (without proof).

References and Recommended Readings:

1. Parimal Mukhopadhyay: An Introduction to the Theory of Probability. World Scientific Publishing.
2. Hogg R. V. and Criag A.T.: Introduction to Mathematical Statistics (Third edition), Macmillan Publishing, New York.
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6. Walpole R.E. & Mayer R.H.: Probability & Statistics. (Chapter 4, 5, 6, 8, 10) Mac Millan Publishing Co. Inc, New York.

B. Sc. Part – II: Semester – III
Minor P-III: Statistics Practical – III
Practical: 60 Hrs. Marks: 50 (Credits: 02)

Course Outcomes: After successful completion of this practical course, the student will be able to:

i. Understand and compute class frequencies for dichotomous attributes and analyze association and independence between attributes.
ii. Analyze the relationship between two variables using scatter diagrams and compute correlation using Karl Pearson's and Spearman's methods.
iii. Apply and interpret continuous probability distributions such as exponential and normal distributions in practical contexts.
iv. Fit uniform and exponential distributions to data and perform model sampling to simulate random phenomena.

LIST OF PRACTICALS:

1. Attributes – I (Class frequencies).
2. Attributes – II (Association and independence)
3. Scatter plot and Spearman's Rank correlation coefficient.
4. Karl Pearson's correlation coefficient.
5. Fitting of continuous uniform distribution.
6. Fitting of exponential distribution.
7. Model sampling from continuous uniform distribution.
8. Model sampling from exponential distribution.
9. Applications of exponential distribution.
10. Applications of normal distribution.

Notes:

a. Students should complete all experiments using MS-Excel or Scientific calculators.
b. Student must complete the entire practical to the satisfaction of the teacher concerned.
c. Student must produce laboratory journal along with completion certificate signed by Head of the Department, at the time of practical examination.

Laboratory Requirements:

Laboratory should be well equipped with at least 20 computers/ Calculators along with necessary Software's, at least two printers, sufficient back up facility (UPS/ Inverter/ Generator).

Nature of Practical Question Paper:

a. In the practical question paper, there shall be four questions of 20 marks each; a student has to attempt any two of them.
b. Practical examination is of four hours duration which includes viva (oral) examination and online demonstration.
c. 5 marks are reserved for the Journal and 5 marks for the Oral examination.

B. Sc. Part – II: Semester – III
OE–III (P): Basic Statistics Practical-III
Practical: 60 Hrs. Marks: 50 (Credits: 02)

Course Outcomes: After successfully completing this practical course, the students will be able to:

i. Construct and interpret boxplots to analyze data distribution and detect outliers.
ii. Apply systematic sampling methods for efficient data collection.
iii. Compute and interpret moments, skewness, and kurtosis for statistical analysis.
iv. Utilize $\bar{X}$, R, p, and c charts for process monitoring and quality control.

List of Practicals:

1. Boxplot.
2. Systematic sampling.
3. Moments, skewness, and kurtosis (Ungrouped data).
4. Moments, skewness, and kurtosis (Grouped data).
5. Application of $\bar{X}$ chart.
6. Application of R chart.
7. Application of p chart.
8. Application of c chart.
9. Case study: equivalent to two practicals.

Notes:

a. Student must complete the entire practical to the satisfaction of the teacher concerned.
b. Student must produce laboratory journal along with completion certificate signed by Head of the Department, at the time of practical examination.

Laboratory Requirements:
Laboratory should be well equipped with at least 20 computers along with necessary Software's, at least two printers, sufficient back up facility (UPS/ Inverter/ Generator).

Nature of Practical Question Paper:

a. In the practical question paper, there shall be four questions each of 16 marks, a student has to attempt any two questions.
b. Computations should be completed using Calculators/ MS-Excel and should be demonstrated to examiner. Experiment aim, formulae, results etc. should be written on practical answer paper.
c. 8 marks are reserved for Case Study, 5 marks are reserved for the Journal and 5 marks for the Oral examination.
d. Practical examination is of four hours duration which includes viva (oral) examination and online demonstration.

B. Sc. Part - II: Semester - III
VSC-I (P): Practical on Data Analysis Using R -I
Practical: 60 Hrs. Marks: 50 (Credits: 02)

Course Outcomes:
After successfully completing this practical course, the students will be able to:

i. Understand and apply basic data types and operators in R for statistical computing.
ii. Perform data manipulation in R.
iii. Utilize R functions for descriptive statistics and data visualization.
iv. Import, export and analyze data using frequency tables and graphical representations.

List of Practicals:

1. Variables and Basic Data types in R
2. Creating vectors, matrix (up to 3X3), array
3. Arithmetic operations in R for matrix
4. Creating data frames using R

5. Central tendency (A.M., G.M., H.M., Median, Mode, Quantiles) using R (using built up function)
6. Dispersion (Range, Q.D., S.D., Variance) using R (using built up function)
7. Correlation and regression analysis using R (using built up function)
8. Import and Export data files.
9. Diagrammatic and graphical presentation using R –I (Histogram, Simple bar, Subdivided bar)
10. Diagrammatic and graphical presentation using R –II (Pie chart, Frequency curve, Frequency polygon, Box plot)

Notes:

a. Students must complete all experiments using software R.
b. Software R should be used at the time of practical examination for calculation.
c. Student must complete the entire practical to the satisfaction of the teacher concerned.
d. Student must produce laboratory journal along with completion certificate signed by Head of the Department, at the time of practical examination.

Laboratory Requirements:

Laboratory should be well equipped with at least 20 computers along with necessary Software's, at least two printers, sufficient back up facility (UPS/ Inverter/ Generator).

Nature of Practical Question Paper:

a. In the practical question paper, there shall be four questions each of 20 marks, a student has to attempt any two questions.
b. Computations should be completed using software R and should be demonstrated to examiner. Experiment aim, formulae, results etc. should be written on practical answer paper.
c. 5 marks are reserved for the Journal and 5 marks for the Oral examination.
d. Practical examination is of four hours duration which includes viva (oral) examination and online demonstration.

B. Sc. Part – II: Semester - III
SEC-I (P) : Practical on Data Analysis using MS-Excel – I
Practical: 60 Hrs. Marks – 50 (Credits: 02)

Course Outcomes: After successfully completing this practical course, the students will be able to:

i. Create, format, and manipulate spreadsheets using MS-Excel, demonstrating proficiency in tasks such as data entry, cell formatting, and basic formula usage.
ii. Efficiently manipulate the data in MS-Excel using use basic tools like find and replace, sort and filter.
iii. Visualize the data using MS-Excel.
iv. Develop a deep understanding of Excel formulas and functions in MS-Excel, enabling them to perform mathematical, trigonometric, statistical, date and time operations.

List of Practicals:

1) Use of MS-Excel as a calculator.
2) Visualizing Data using MS-Excel.
3) Visualizing distribution of data using MS-Excel.
4) Using Mathematical and Trigonometric functions in MS-Excel.
5) Graphical functions using MS-Excel and curve fitting to data.
6) Using Statistical functions in MS-Excel.
7) Using Find and replace, Sort and filter tools in MS-Excel.
8) Working with Date and Time data using MS-Excel.
9) Case Study: equivalent to two practicals.

Notes:

a) Students must complete all experiments using MS-EXCEL.
b) Case study – In case study, students are expected to analyze real data sets (primary or secondary) using statistical techniques / tools which they have learnt.
c) MS-EXCEL should be used at the time of practical examination for calculation.
d) Student must complete the entire practical to the satisfaction of the teacher concerned.
e) Student must produce laboratory journal along with completion certificate signed by Head of the Department, at the time of practical examination.

Laboratory Requirements: Laboratory should be well equipped with at least 20 computers along with necessary softwares, at least two printers, sufficient back up facility (UPS/ Inverter/ Generator).

Nature of Practical Question Paper:

a) In the practical question paper there shall be four questions each of 16 marks, a student has to attempt any two questions.
b) Computations should be completed using MS-EXCEL and should be demonstrated to examiner. Aim of the experiment, Formulae, Results etc. should be written on practical answer paper.
c) 8 marks are reserved for Case Study, 5 marks are reserved for the Journal and 5 marks for the Oral examination.
d) Practical examination is of four hours duration which includes viva (oral) examination and online demonstration.

B. Sc. Part - II: Semester - IV
Major VII: Continuous Probability Distributions - II
Theory: 30 Hrs. Marks:50 (Credits:02)

Course Outcomes: After successfully completing this course, the students will be able to:

i. Study Normal distribution with real life situations.
ii. Establish the relationships among different distributions.
iii. Study continuous bivariate r.vs. and probability distributions of their transformations.
iv. Understand the concept of sampling distribution of a statistic.
v. Derive sampling distributions of a statistic: Chi-Square, t and F distributions.

Unit-1: (15 hrs.)

1.1 : Normal distribution: Normal distribution with parameters μ and σ^2, Definition of standard normal distribution, properties of normal curve, m.g.f., c.g.f., mean, variance, median, mode, mean deviation, moments, cumulants, measures of skewness and kurtosis of normal distribution, distribution of linear combination of normal variates. Distribution of X^2, where X~N(0,1).

1.2 : Continuous Bivariate Distributions: Definition of bivariate continuous r. v. (X, Y), Joint p.d.f., c.d.f. with properties, marginal and conditional distribution, independence of r.vs., evaluation of probabilities of various regions bounded by straight lines. Expectation of function of r.vs., means, variances, covariance, correlation coefficient, conditional expectation, regression as conditional expectation if it is linear function of other variable and conditional variance. Examples.

Proof of results: (i) $E(X\pm Y) = E(X)\pm E(Y)$, (ii) $E[E(X/Y)]= E(X)$.

(iii) $E(XY) = E(X)\times E(Y)$, if X and Y are independent

(iv) $M_{X+Y}(t) = M_X(t)\times M_Y(t)$, if X and Y are independent

Unit-2: (15 hrs.)

2.1 : Transformation of continuous bivariate random variables: Distribution of transformation of bivariate r.v.s by using method of jacobian of transformation. Obtaining probability distribution of (X+Y), X/Y and X/(X+Y) where X and Y are independent Gamma variates with identical scale parameters. Examples and problems.

2.2 : Exact Sampling Distributions:

Chi-Square distribution: Definition of Chi-square r.v., derivation of p.d.f. of Chi-square r.v. with n degrees of freedom by using m.g.f., Mean, variance, mode, moments, c.g.f., cumulants, skewness and kurtosis of Chi-square distribution. Additive property. Sampling distribution of $\overline{X}$ and S^2 when sample is drawn from normal population and their independence (Statement only).

Student's t-distribution: Definition of Student's t-variate. Derivation of p.d.f. of t-variate, mean, mode, variance, moments, skewness and kurtosis of t-distribution.

Snedecor's F-distribution: Definition of F-variate, Derivation of p.d.f. of F-variate, mean, variance and mode of F-distribution. Distribution of 1/F. Interrelation between t, F and Chi-square (without proof).

References and Recommended Readings:

1. Trivedi R.S.: Probability and Statistics with Reliability and Computer Science Application, Prentice–Hall of India Pvt. Ltd., New Delhi.
2. Parimal Mukhopadhyay: An Introduction to the Theory of Probability. World Scientific

Publishing.
3. Hogg R.V. and Criag A.T.: Introduction to Mathematical Statistics (Third edition), Mac-Millan Publishing, New York.
4. Goon A.M., Gupta M.K. and Dasgupta B.: Fundamentals of Statistics Vol. I and Vol. II World Press, Calcutta.
5. Gupta S.C.& Kapoor V.K.: Fundamentals of Mathematical Statistics. Sultan Chand & sons, New Delhi.
6. Gupta S. C. & Kapoor V.K.: Applied Statistics. Sultan Chand & sons, New Delhi.
7. Mood A.M., Graybill F.A. and Boes D.C.: Introduction to theory of Statistics. Tata, Mc-Graw Hill, New Delhi.(Third Edition)
8. Walpole R.E. & Mayer R.H.: Probability & Statistics. Mac-Millan Publishing Co. Inc, New York.

B. Sc. Part – II: Semester – IV
Major VIII: Elementary Statistical Inference
Theory: 30 Hrs. Marks-50 (Credits:02)

Course Outcomes: After successfully completing this course, the students will be able to acquire knowledge of

i. The concept of point estimation.
ii. Various Properties of good estimator
iii. The concept of testing of hypothesis.
iv. Using Appropriate small sample tests and large sample tests.

Unit-1: Point Estimation: **(15 hrs.)**

1.1: Introduction: Notion of a parameter, parameter space, definition of statistic, general problem of estimation. Definition of an estimator and its Standard Error (SE), distinction between estimator and estimate.

1.2: Properties of estimator:

A) *Unbiasedness*: Unbiased and biased estimator, positive and negative bias, examples of unbiased and biased estimators. Proof of the following results:

a) Two distinct unbiased estimators of $\phi(\theta)$ give rise to infinitely many unbiased estimators of $\phi(\theta)$.
b) If T is an unbiased estimator of θ then $\phi(T)$ is an unbiased estimator of $\phi(\theta)$ provided $\phi(.)$ is a linear function.
c) Sample variance is a biased estimator of the population variance.
d) Sample mean square is an unbiased estimator of variance.

Illustrations of unbiased estimator for parametric functions. Examples.

B) *Efficiency*: Relative efficiency of estimators. Examples.

1.3: Method of moments estimation (MME) with examples

Unit-2: Testing of Hypothesis: **(15 hrs.)**

2.1 : Introduction, hypothesis, simple and composite hypothesis, null and alternative hypothesis, one and two sided hypotheses, test of hypothesis, test statistic, critical region, critical value, type I and type II errors, size of a test, level of significance, power of a test.

2.2 : Large Sample Tests:

A) Tests for means: i) Tests for single population mean; H_0: $\mu=\mu_0$
ii) Tests for equality of two population means; H_0: $\mu_1=\mu_2$

B) Tests for proportion: i) Tests for single population proportion; H_0: $p = p_0$
ii) Tests for equality of two population proportions; H_0: $p_1= p_2$

2.3 : Small Sample Tests:

A) t-tests: test for means: i) H_0: $\mu = \mu_0$, ii) H_0: $\mu_1 = \mu_2$, (when $\sigma_1^2 = \sigma_2^2$), iii) Paired t-test.

B) χ^2 - test: i) Tests for single population variance H_0: $\sigma^2 = \sigma_0^2$ (Mean known and unknown),
ii) Test for goodness of fit of given probability distribution.
iii)Test for independence of attributes when data is in the form of: a) $m \times n$ contingency table and b) 2×2 contingency table.

Yate's corrections for continuity.

C) F–test: Test for equality of two population variances; H_0: $\sigma_1^2 = \sigma_2^2$

References and Recommended Readings:

1) Kale B. K. : A first course in Parametric Inference
2) Rohatgi V. K.: Statistical Inference
3)Rohatgi V. K. : An introduction to Probability Theory and Mathematical Statistics
4) Dudewicz C. J. and Mishtra S. N. : Modern Mathematical Statistcs
5) Cassela G. and Berger R. L. Statistical Inference
6) Snedecor G.W. and Cochoran W. G.: "Statistical Methods", Lowa State University Press.
7) Mayer, P. L. : Introductory Probability and Statistical Applications, Addision Weseley Pub. Comp. London.
8) Kulkarni, M. B. Ghatpande, S. B. and Gore, S. D. :"Common Statistical Tests" Satyajeet Prakashan, Pune –11029.
9) Gupta, S. P. :"Statistical Methods", Sultan Chand and Sons, 23, Daryaganj, New Delhi.
10) A. Santhakumaran: Fundamentals of Testing of Statistical Hypothesis
11) Parimal Mukhopadhyay: "Mathematical Statistics", New Central Book Agency, Pvt. Ltd. Calcutta.

B. Sc. Part – II: Semester - IV
Major-P-IV: Statistics Practical - IV
Practical: 60 Hrs. Marks -50 (Credits: 02)

Course Outcomes: After successfully completing this practical course, the students will be able to:

i. know applications of some standard continuous probability distributions.
ii. understand how to obtain random sample from normal distribution.
iii. fit normal distribution and test the goodness of fit for given data.
iv. test various hypothesis about parameters of specified distribution for given data.

List of Practicals:

1. Fitting of Normal distribution and testing goodness of fit.
2. Model sampling from Normal distribution.
3. Checking normality through Normal probability plot.
4. Applications of Normal distribution.
5. Practical on basic Terminologies with respect to Testing of Hypothesis.
6. Large sample test for population means.
7. Large sample test for population proportion.
8. Test based on t distribution.
9. Test based on chi-square distribution.
10. Test based on F distribution.

Notes:

a. Students must complete all experiments using MS-Excel.
b. MS-Excel should be used at the time of practical examination for calculation.
c. Student must complete the entire practical to the satisfaction of the teacher concerned.
d. Student must produce laboratory journal along with completion certificate signed by Head of the Department, at the time of practical examination.

Laboratory Requirements:

Laboratory should be well equipped with at least 20 computers along with necessary Software's, at least two printers, sufficient back up facility (UPS/ Inverter/ Generator).

Nature of Practical Question Paper:

a. In the practical question paper, there shall be four questions each of 20 marks, a student has to attempt any two questions.
b. Computations should be completed using MS-Excel and should be demonstrated to examiner. Experiment aim, formulae, results etc. should be written on practical answer paper.
c. 5 marks are reserved for the Journal and 5 marks for the Oral examination.
d. Practical examination is of four hours duration which includes viva (oral) examination and online demonstration.

B. Sc. Part - II: Semester - IV
Minor VII: Statistical Methods for Quality Control
Theory: 30 Hrs. Marks: 50 (Credits:02)

Course Outcomes: After successful completion of this course, the students will be able to acquire knowledge of

i) Concepts of quality, quality control, statistical quality control and the need of statistical quality control
ii) Process control and product control.
iii) Concept of control chart and different types of variable and attribute control charts.
iv) Single and double sampling plans with their implementation.

Unit-1: Quality Control for Variables: (15 hrs.)

1.1: Quality Management:

Meaning and dimensions of quality, magnificent tools of quality: Histogram, Check sheet, Pareto diagram, cause and effect diagram, scatter diagram, control chart, flow chart,

1.2: Control Chart for Variables:

Historical review of quality control, meaning and purpose of S.Q.C., process control, product control, chance causes, assignable causes, advantages and limitations of S.Q.C. Steps in construction of Shewhart's control chart and its interpretations. Concepts of control limits, warning limits and tolerance limits. Steps in construction of mean chart, range chart and their interpretation. Revised control limits.

Unit 2: Quality Control for Attributes: (15 hrs.)

2.1: Control Chart for Attributes:

Definition of defects, defectives, fraction defective, Steps in construction of p-chart, np-chart and their interpretations. Steps in construction of c-chart and their interpretations.

2.2: Product Control:

Sampling Inspection plans for attribute: Concept of AQL, LTPD, Consumer's and producer's risks, AOQ, AOQL, OC, ASN and ATI. Description of single and double sampling plans. State the formulae of the above constant for single and double sampling plans and problems. Concept of Six Sigma limits. Six sigma participants and hierarchy.

References and Recommended Readings:

1. Burr Irving, W. (2018). Statistical Quality Control Methods. Taylor & Francis.
2. Gupta Bhisham C. and Walker H. Fred (2007). Statistical Quality Control for the Six Sigma Green Belt. ASQ Quality Press.
3. Montgomery, D. C. and Johnson, L. A. (2012). Statistical Quality Control: A Modern Introduction. John Wiley and Sons, Inc.
4. Oakland, J. (2007). Statistical Process Control, Butterworth
5. Schilling, Edward G. and Neubauer, Dean V. (2009). Acceptance Sampling in Quality Control. Chapman and Hall/CRC

B. Sc. Part – II: Semester – IV
Minor VIII: Sample Surveys and Testing of Hypothesis
Theory: 30 Hrs. Marks-50 (Credits: 02)

Course Outcomes: After successfully completing this course, the students will be able to acquire knowledge of

i. Design and implement effective sampling strategies.
ii. Sampling plans in real-world data collection.
iii. The concept of testing of hypothesis.
iv. Applying appropriate small sample tests and large sample tests.

Unit-1: Role of Sample Surveys in Research **(15 hrs.)**

1.1 : Concepts of population and sample. Census method and sampling method, advantages of sampling method over census method, sampling units, sampling frame, random sampling and non-random sampling. Sampling and non-sampling errors with illustrations.

1.2 : Objectives of a sample survey.

1.3 : Designing a questionnaire, characteristics of a good questionnaire (Questions with codes & scores are to be discussed).

1.4 : Planning, execution and analysis of a sample survey, practical problems at each of these stages.

1.5 : Study of some surveys illustrating the above ideas, rounds conducted by National Sample Survey Organization.

1.6 : Definitions: Parameter, Statistic, Sampling distribution of Statistic, standard error.

Unit-2: Testing of Hypothesis: **(15 hrs.)**

2.1 : Hypothesis, simple and composite hypothesis, null and alternative hypothesis, one and two-sided hypothesis, test of hypothesis, test statistic, critical region, critical value, type I and type II errors, size of a test, level of significance, p-value, power of a test.

2.2 : Large Sample Tests:

D) Tests for means: i) Tests for single population mean; H_0: $\mu=\mu_0$ (variance known)
ii) Tests for equality of two population means; H_0: $\mu_1=\mu_2$ (variance known)

E) Tests for proportion: i) Tests for single population proportion; H_0: $P = P_0$
ii) Tests for equality of two population proportions; H_0: $P_1= P_2$

2.3 : Small Sample Tests:

A) t-tests: Test for means: i) H_0:$\mu=\mu_0$ (variance unknown)
ii) H_0:$\mu_1=\mu_2$, (unknown and equal variances),
iii) Paired t-test.

B) χ^2 - test: i) Tests for single population variance H_0: $\sigma^2 = \sigma_0^2$ (mean known and unknown),
ii) Test for goodness of fit of given probability distribution.
iii) Test for independence of attributes when data is in the form of
a) m × n contingency table and b) 2 × 2 contingency table.
Yate's corrections for continuity.

C) F–test: Test for equality of two population variances; H_0: $\sigma_1^2 = \sigma_2^2$ (mean known and unknown)

References and Recommended Readings:

1. Kulkarni, M. B. Ghatpande, S. B. and Gore, S. D. :"Common Statistical Tests" Satyajeet Prakashan, Pune –11029.
2. Gupta, S. P. :"Statistical Methods", Sultan Chand and Sons, 23, Daryaganj, New Delhi 110002.
3. A. Santhakumaran: Fundamentals of Testing of Statistical Hypothesis
4. Parimal Mukhopadhyay: "Mathematical Statistics", New Central Book Agency, Pvt. Ltd. Calcutta.
5. Snedecor G.W. and Cochoran W. G.: "Statistical Methods", Lowa State University Press.
6. Mukhopadhyay P (2008): Theory and methods of survey sampling. Prentice-Hall of India, New Delhi.
7. Raghunath Arnab (2017): Survey Sampling Theory and Applications, Academic Press, Elsevier.

B. Sc. Part – II: Semester – IV
Minor P-IV: Statistics Practical – IV
Practical: 60 Hrs. Marks: 50 (Credits: 02)

Course Outcomes: After successful completion of this practical course, the student will be able to:

i. Construct and interpret control charts for variables and attributes to monitor and improve quality in industrial processes.
ii. Design and evaluate single and double sampling plans for effective quality control and decision-making in acceptance sampling.
iii. Apply the concepts of hypothesis testing, including test statistics, errors, power, and decision rules.
iv. Perform and interpret statistical tests for testing various parameters and independence of attributes.

LIST OF PRACTICALS:

1. Control charts for variables (R and $\bar{X}$ charts)
2. Control charts for attributes (np, p, c-charts)
3. Single sampling plan
4. Double sampling plan
5. Testing of hypothesis: Test Statistic, Type I error, Type II error, Power, Acceptance and Rejection region.
6. Large sample tests: Test of population mean (One and Two sample).
7. Large sample tests: Test for population proportion (One and Two sample).
8. Test based on t distribution.
9. Test based on Chi-square distribution.
10. Test based on F distribution.

Notes:

a. Students should complete all experiments using MS-Excel or Scientific calculators.
b. Student must complete the entire practical to the satisfaction of the teacher concerned.
c. Student must produce laboratory journal along with completion certificate signed by Head of the Department, at the time of practical examination.

Laboratory Requirements:

Laboratory should be well equipped with at least 20 computers/ Calculators along with necessary Software's, at least two printers, sufficient back up facility (UPS/ Inverter/ Generator).

Nature of Practical Question Paper:

a. In the practical question paper, there shall be four questions of 20 marks each; a student has to attempt any two of them.
b. Practical examination is of four hours duration which includes viva (oral) examination and online demonstration.
c. 5 marks are reserved for the Journal and 5 marks for the Oral examination.

B. Sc. Part – II: Semester – IV
OE–IV (P) : Basic Statistics Practical-IV
Practical: 60 Hrs. Marks: 50 (Credits: 02)

Course Outcomes: After successfully completing this practical course, the students will be able to:

i. Analyze time series data using statistical techniques to identify trends and seasonal variations.
ii. Compute and interpret mortality, fertility, and reproduction rates to understand demographic changes.
iii. Calculate and compare Laspeyres, Paasche's, and Fisher's index numbers for economic and statistical analysis.
iv. Apply statistical methods in a case study by integrating at least two practicals to solve real-world problems.

List of Practicals:

1. Analysis of time series data-I.
2. Analysis of time series data-II.
3. Demography-I (Measurement of Mortality rates)
4. Demography-II (Measurement of Fertility rates).
5. Demography-III (Measurement of Reproduction rates).
6. Computation of Index Numbers I (Laspeyres index number)
7. Computation of Index Numbers II (Paasche's index number)
8. Computation of Index Numbers III (Fisher's index number)
9. Case study: Equivalent to two practical.

Notes:

a. Student must complete the entire practical to the satisfaction of the teacher concerned.
b. Student must produce laboratory journal along with completion certificate signed by Head of the Department, at the time of practical examination.

Laboratory Requirements:

Laboratory should be well equipped with at least 20 computers along with necessary Software's, at least two printers, sufficient back up facility (UPS/ Inverter/ Generator).

Nature of Practical Question Paper:

a. In the practical question paper, there shall be four questions each of 16 marks, a student has to attempt any two questions.
b. Computations should be completed using Calculators/ MS-Excel and should be demonstrated to examiner. Experiment aim, formulae, results etc. should be written on practical answer paper.
c. 8 marks are reserved for Case Study, 5 marks are reserved for the Journal and 5 marks for the Oral examination.
d. Practical examination is of four hours duration which includes viva (oral) examination and online demonstration.

B. Sc. Part – II: Semester - IV
SEC II (P): PRACTICAL ON DATA ANALYSIS USING MS-EXCEL – II
Practical: 60 Hrs. Marks – 50 (Credits: 02)

Course Outcomes: After successfully completing this practical course, the students will be able to:

i. Efficiently organize and manage real life datasets within MS-Excel workbooks
ii. Visualize and analyze data using Pivot table tool and data analysis tool pack in MS-Excel
iii. Develop a deep understanding of formulas and functions in MS-Excel, enabling them to perform various statistical, logical, lookup and reference, text operations
iv. Automate the tasks using MS-Excel Macros

List of Practicals:

1) Data Entry in MS-Excel
2) Data manipulation, validation, consolidation and formatting using MS-Excel
3) Summarizing and visualizing data using Pivot table and Pivot chart in MS-Excel
4) Statistical data analysis using Data Analysis Tool Pack in MS-Excel
5) Probabilities and Inverse Probabilities using MS-Excel
6) Using Logical, Lookup and reference, Financial and Database functions in MS-Excel
7) Working with Text data using MS-Excel
8) Recording MS-Excel Macros
9) Case Study: Equivalent to two practical.

Notes:

a) Case study – In case study, students are expected to analyze real data sets (primary or secondary) using statistical techniques / tools which they have learnt.
b) MS-EXCEL should be used at the time of practical examination for calculation.
c) Student must complete the entire practical to the satisfaction of the teacher concerned.
d) Student must produce laboratory journal along with completion certificate signed by Head of the Department, at the time of practical examination.

Laboratory Requirements: Laboratory should be well equipped with at least 20 computers along with necessary software, at least two printers, sufficient back up facility (UPS/ Inverter/ Generator).

Nature of Practical Question Paper:

a) In the practical question paper, there shall be four questions each of 16 marks, a student has to attempt any two questions.
b) Computations should be completed experiments using MS-EXCEL and should be demonstrated to examiner. Aim of the experiment, Formulae, Results etc. should be written on practical answer paper.

c) 8 marks are reserved for case study, 5 marks are reserved for the journal and 5 marks for the oral examination.
d) Practical examination is of four hours duration which includes viva (oral) examination and online demonstration.

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