

S-29 Nov., 2013 AC after Circulars from Circular No.55 & onwards

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डॉ. बाबासाहेब आंबेडकर मराठवाडा विद्यापीठ, औरंगाबाद

परिपत्रक क्रमांक/एस.यु./विज्ञान/अभ्यासक्रम/७४/२०१४

या परिपत्रकाद्वारे सर्व संबंधितांना सुचित करण्यात येते की, विज्ञान विद्याशाखेने शिफारस केल्यानुसार बी. एस्सी. / एम. एस्सी. प्रथम व द्वितीय वर्षाच्या सुधारित अभ्यासक्रमास आणि बी. एस्सी. प्रथम वर्षाच्या अभ्यासक्रमात किरकोळ बदल करण्यास विद्यापरिषदेच्या वतीने मा. कुलगुरु यांनी, त्यांना प्राप्त असलेल्या विशेष अधिकार महाराष्ट्र विद्यापीठ अधिनियम-१९९४ कलम १४(७) अन्वये मान्यता दिलेली आहे. त्या अनुषंगाने सुधारीत तयार केलेल्या अभ्यासक्रमाची प्रत या परिपत्रकासोबत आपल्या पुढील कार्यवाहीसाठी पाठविण्यात येत आहे.

[1]	B.Sc. Physics	Semester-III & IV,
[2]	B.Sc. Chemistry	Semester-III & IV,
[3]	B.Sc. Botany	Semester-III & IV,
[4]	B.Sc. Zoology with minor changes	Semester-I & II,
[5]	B.Sc. Zoology	Semester-III & IV,
[6]	B.Sc. Fisheries	Semester-III & IV,
[7]	B.Sc. Electronics (Opt.)	Semester-III & IV,
[8]	B.A./B.Sc. Mathematics	Semester-III & IV,
[9]	B.Sc. Computer Science	Semester-I & II,
[10]	B.Sc. Information Technology	Semester-I & II,
[11]	B.C.A.	Semester-I & II,
[12]	B.Sc. Computer Science(Opt.)	Semester-I & II,
[13]	B.Sc. Information Technology(Opt.)	Semester-I & II,
[14]	B.Sc. Computer Application(Opt.)	Semester-I & II,
[15]	B.Sc. Computer Maintenance(Opt.)	Semester-I & II,
[16]	B.Sc. Biotechnology (Progressively)	Semester-I to VI,
[17]	B.Sc. Biotechnology (Opt.) (Progressively)	Semester-I to IV,
[18]	B.Sc. Sericulture Technology	Semester-I & II,
[19]	B.Sc. Networking Multimedia	Semester-III & IV,
[20]	B.Sc. Bioinformatics	Semester-I & II,
[21]	B.Sc. Hardware & Networking	Semester-I & II,
[22]	B.Sc. Animation	Semester-I & II,
[23]	B.Sc. Dairy Science & Technology	Semester-III & IV,
[24]	B.Sc. Biochemistry	Semester-III & IV,
[25]	B.Sc. Analytical Chemistry	Semester-III & IV,
[26]	B.Sc. Textile & Int. Decoration with minor changes	Semester-I & II,
[27]	B.Sc. Textile & Int. Decoration	Semester-III & IV,
[28]	B.Sc. Home Science with minor changes	Semester-I & II,
[29]	B.Sc. Home Science	Semester-III & IV,
[30]	B.Sc. Agro.Chem. & Fertilizers	Semester-III & IV,

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[31]	B.Sc. Geology	Semester-III & IV,
[32]	B.A. Statistics with minor changes	Semester-I & II,
[33]	B.A. Statistics	Semester-III & IV,
[34]	B.Sc. Statistics with minor changes	Semester-I & II,
[35]	B.Sc. Statistics	Semester-III & IV,
[36]	B.Sc. Industrial Chemistry	Semester-III & IV,
[37]	B.Sc. Horticultural	Semester-I & II,
[38]	B.Sc. Dry land Agriculture	Semester-I & II,
[39]	B.Sc. Microbiology	Semester-III & IV,
[40]	M.Sc. Computer Science	Semester-I to IV,
[41]	M.Sc. Information Technology	Semester-I to IV.

हा सुधारीत व नवीन तयार केलेल्या अभ्यासक्रमाचा आराखडा शैक्षणिक वर्ष २०१४-१५ करिता मर्यादित असेल व विद्यापरिषदेच्या अंतिम मान्यतेनंतर हे परिपत्रक नियमित ठेवण्याबाबत या कार्यालयाद्वारे नवीन परिपत्रक पारीत करण्यात येईल. तसेच सुधारीत व नवीन तयार केलेल्या अभ्यासक्रमाची प्रत विद्यापीठाच्या संकेतस्थळावर उपलब्ध आहे.

करिता, या परिपत्रकाची सर्व संबंधितांनी नोंद घ्यावी.

विद्यापीठ प्रांगण,
औरंगाबाद-४३१ ००४.
संदर्भ क्र.एस.यु./सा.शा./सबवि /२०१३-१४/
६५९९-७०२
दिनांक :- २७-०५-२०१४.

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संचालक,
महाविद्यालये व विद्यापीठ
विकास मंडळ.

या परिपत्रकाची एक प्रत :-

- १) मा. परीक्षा नियंत्रक, परीक्षा विभाग,
 - २) मा. प्राचार्य, सर्व संलग्नीत महाविद्यालये,
 - ३) संचालक, युनिक यांना विनंती करण्यात येते की, सदरील अभ्यासक्रम विद्यापीठाच्या संकेतस्थळावर उपलब्ध करुण देण्यात यावेत.
 - ४) संचालक, ई-सुविधा केंद्र, विद्यापीठ परिसर,
 - ५) जनसंपर्क अधिकारी, मुख्य प्रशासकीय इमारत,
 - ६) कक्ष अधिकारी, पात्रता विभाग, मुख्य प्रशासकीय इमारत,
 - ७) कक्ष अधिकारी, बी.ए. / बी.एस.सी./ बी.सी.एस./एम.एस.सी. विभाग, परीक्षा भवन,
 - ८) अभिलेख विभाग, मुख्य प्रशासकीय इमारती मागे,
- डॉ. बाबासाहेब आंबेडकर मराठवाडा विद्यापीठ, औरंगाबाद.

Revised Syllabus of
B.Sc. Second Year
Sem. III & IV
Statistics [Optional]
effect for the academic year 2014-2015

Proposed in the meeting of 21/2/11
Submitted on 4/3/14.

Dr. Babasaheb Ambedkar
Marathwada University, Aurangabad

Syllabus at the
S.Y. B.Sc. in Statistics *-(optional)*
With effect from the academic year 2014-2015

SYLLABII OF B.Sc. II-YEAR
STATISTICS
Semester III & IV

Semester	Paper No.	Title Of The Paper	No. of Lectures per week	Marks Univ.
III Theory	201	Statistical Methods- I	03	50
	202	Sampling Techniques	03	50
IV Theory	203	Statistical Methods- II	03	50
	204	Applied Statistics	03	50
Annual Practical	205	Practicals based on 201 & 203	03	100
Annual Practical	206	Practicals based on 202 & 204	03	100

For Theory paper: = 45 Lectures per paper, per semester

For Practical Papers: = 45 Lectures per paper, per semester

STATISTICAL METHODS- I

PAPER 201

- Unit I: Standard Univariate Continuous Distributions.** (15 Lectures)
- Uniform Distribution :-**
- 1.1 Definition mean, variance.
 - 1.2 Symmetry, c.d.f.
 - 1.3 Sketch of p.d.f. Distribution of $\frac{x-a}{b-a}$, $\frac{b-x}{b-a}$
- Normal Distribution :-**
- 1.4 Definition, mean, variance.
 - 1.5 Chief characteristics
 - 1.6 M.G.F. C.G.F. central moments, Cumulants $\beta_1, \beta_2, \gamma_1, \gamma_2$.
 - 1.7 median, mode.
 - 1.8 Additive property, probability distribution of Standard normal Variate .
 - 1.9 probability distribution of \bar{x} the mean of i.i.d. $N(\mu, \sigma^2)$ random variables.
 - 1.10 Area property, Central limit theorem (Statement only).
- Unit II: Standard Continuous Distributions(Continued)** (15 Lectures)
- Exponential Distribution :-**
- 2.1 Definition
 - 2.2 Nature of p.d.f. & curve.
 - 2.3 Mean, variance, M.G.F, C.G.F.
 - 2.4 Lack of memory property, median.
 - 2.5 Distribution of $\min(x, y)$ with x, y i.i.d. exponential random variables.
- Gamma distribution :-**
- 2.6 Definition, M.G.F, C.G.F.
 - 2.7 Moments, cumulants, $\beta_1, \beta_2, \gamma_1, \gamma_2$.
 - 2.8 Mode, additive property.
 - 2.9 Distribution of sum of n i.i.d. exponential variables.
 - 2.10 Relation between distribution function of Poisson and gamma variates.
 - 2.11 Recurrence relation between moments
- Unit III: Point Estimation.** (15 Lectures)
- 3.1 Characteristics of a good estimator. Viz. Consistency, Unbiasedness, Efficiency, and Sufficiency.
 - 3.2 Standard results on the above Characteristics.
 - 3.3 Problems on the above Characteristics.
 - 3.4 Likelihood function, Cramer rao Inequality (Statement) maximum Likelihood estimator and its properties.
 - 3.5 Methods of Estimation: Method of Maximum Likelihood and Method of Moments.
 - 3.6 Large Sample test for Single mean, difference of means.
 - 3.7 Large Sample test for Single proportion and difference of proportions.

SAMPLING TECHNIQUES PAPER 202

Unit I

Basics of Sampling : (15 Lectures)

- 1.1 Introduction to theory of sampling
- 1.2 Fundamental Definitions :Sample (n),population(N), Sample mean, sample variance , sample size, sample mean square.
- 1.3 Some more definitions :
Sampling unit , sampling frame, parameter, statistic, sampling distribution, standard error, utility of standard error, estimator, unbiased estimator.
- 1.4 principal steps in sample survey.
- 1.5 Principles of sample survey. Principle of statistical regularity, principle of validity & principle of optimization.
- 1.6 Sampling & complete enumeration, and their merits & demerits.
- 1.7 Probability and Non probability sampling.
- 1.8 Sampling and non sampling errors.
- 1.9 Estimation of sample size.

Unit II

Basic sampling Methods. Simple random sampling. (15 Lectures)

- 1.10 Introduction to SRS & SRSWOR Proof of $p(\bar{E}_r) = \frac{1}{N} = p(\bar{E}_1)$
Where \bar{E}_r is the event that the specified unit is not selected in anyone of the previous (r-1) draws and then selected at the r^{th} draw. Proof of, in SRS each of Nc_n samples have equal probability of being selected & is $p = \frac{1}{Nc_n}$.
- 2.2 Methods of selection of simple random sample. Lottery method, Mechanical randomization or Random numbers method.
- 2.3 Theorems on unbiasedness of sample mean and sample mean square.
- 2.4 Variance of sample mean in SRSWOR, standard error of mean & its Estimate, sampling fraction $\frac{n}{N}$ & finite population correction (fpc) (1-f)
- 2.5 Merits & limitations of SRS
- 2.6 Variance of sample mean in SRSWR & comparison with variance of sample mean in SRSWOR.
- 2.7 Simple random sampling of Attributes Notations & terminology
- 2.8 Theorems on unbiasedness and variance of sample proportion
- 2.9 Size of simple random sample for specified precision.

Unit III

Basic sampling methods (continued) (15 Lectures)

- 3.1 Introduction and need of stratified sampling, Advantages of stratified random sampling.
- 3.2 Notations & terminology in stratified random sampling, Mean of stratified random sample \bar{Y}_s
- 3.3 Theorems on unbiasedness of \bar{Y}_s and variance of \bar{Y}_s
- 3.4 Proportional allocation of sample size & variance of \bar{Y}_s in proportional allocation.
- 3.5 Optimum allocation of sample size. Linear cost function.
Proof of "Variance of \bar{Y}_s is minimum for fixed total size of the sample (n) if n_i are proportional to $N_i S_i$, where n_i are stratum sample size, N_i stratum population size & S_i are population mean square
Square for i_{th} stratum, $i = 1, 2, \dots, k$ is number of strata.
- 3.6 Variance of \bar{Y}_s for optimum allocation .
- 3.7 Comparison of precisions of simple random sampling, proportional & optimum allocation.
- 3.8 Systematic random sampling, introduction, Linear & circular systematic sampling, merits limitations of systematic sampling.
- 3.9 \bar{Y}_{ss} , mean of systematic sample unbiasedness of \bar{Y}_{ss} & Variance of \bar{Y}_{ss} .

SEMESTER - IV
STATISTICAL METHODS – II
PAPER 203

Unit I- Chi-Square Distribution

(15 Lectures)

- 1.1. Definition and p.d.f. of Chi-Square distribution.
- 1.2. M.g.f. and c.g.f. mean, variance and other moments of Chi-Square distribution.
- 1.3. Additive property of Chi-Square distribution.
- 1.4. Theorems on independent Chi-Square variates.
- 1.5. Limiting form of Chi-Square distribution.
- 1.6. Applications of Chi-Square distribution.
- 1.7. Testing independence of attributes (2X2 and rXs contingency tables)
- 1.8. Chi-Square test for population variance and its confidence interval.
- 1.9. Chi- Square test for testing goodness of fit.

Unit –II , Student's 't' distribution

(15 Lectures)

- 2.1 Definition and p.d.f. of 't' distribution.
- 2.2 M.g.f.of 't' distribution.
- 2.3 Mean ,variance and other moments of 't' distribution.
- 2.4 Limiting form of 't' distribution.
- 2.5 't' test for single mean and confidence interval for mean.
- 2.6 't' test for difference between means (independent samples)
- 2.7 Paired 't' test (dependent samples).

Unit –III , F,Z and Sampling distribution of statistic

(15 Lectures)

- 3.1 Definition of F- statistic, its p.d.f., mean and variance.
 - 3.2 Distribution of I/F. Relation between t & F& chi square
 - 3.3 F- test for testing difference between population variances.
 - 3.4 Fisher's Z Distribution
 - 3.5 M.G.F of Z distribution
 - 3.6 Fisher's Z transformations.
 - 3.7 Applications of Fisher's Z transformations
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APPLIED STATISTICS

PAPER 204

Unit I

Multiple & partial correlations & multiple regression. (trivariate only) 15 Lectures

- 1.1. Concept of multiple & partial correlation, Multiple regression.
- 1.2. Yule's notations, Plane of regression. Fitting of plane of regression by using principle of least squares. Estimation of regression coefficients
- 1.3. Residuals and properties of residuals. Variance of residual
- 1.4. Derivation of formula for multiple correlation.
- 1.5. Properties of multiple correlation.
- 1.6. Derivation of formula for partial correlation & properties of partial correlation.
- 1.7. Multiple correlation in terms of total & partial correlations.
- 1.8. Coefficient of multiple & partial determination.

Unit II

Time series analysis.

15 Lectures

- 2.1 Definition & introduction to time series data.
- 2.2 Components of time series data.
- 2.3 Analysis of time series. Mathematical models for the analysis Additive, multiplicative & mixed models.
- 2.4 Uses of time series analysis
- 2.5 Measurement of trend. Graphical method. Method of semi averages & method of moving averages .procedure, merits & limitations of all methods.
- 2.6 Curve fitting by principle of least squares Straight line, Second degree parabola. Power & exponential curves.
- 2.7 Estimation of trend by method of least squares. Merits & limitations of the method.
- 2.8 Measurement of seasonal variation by method of simple averages, procedure, merits & limitations.

Unit III

Index numbers.

15 Lectures

- 3.1 Introduction to Index numbers & their uses.
 - 3.2 Problems involved in the construction of index numbers.
 - 3.3 Notations, Unweighted indices & weighted indices.
 - 3.4 Laspeyre's, Paasche's, Fisher's & Marshall Edgeworth index number for Prices & quantities. Value index number.
 - 3.5 Upward & downward bias.
 - 3.6 Unweighted & weighted averages of price relatives based on arithmetic & geometric mean.
 - 3.7 Chain base index number(CBI) conversion of CBI into fixed base index number (FBI) & vice versa.
 - 3.8 Criteria of a good index number. Mathematical tests : Unit test, Time reversal test. (TRT), Factor reversal test (FRT), Circular test.
 - 3.9 Problems on index numbers. Relationship among index numbers.
 - 3.10 Construction of Cost of living index number and it's uses.
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PRACTICALS BASED ON PAPER 202 and 204
PAPER 206

- 1) SRSWOR : Drawing samples of size 'n' from a population of size 'N' and verification of results (a) $E(\bar{y}_n) = \bar{y}_N$, (b) $E(s^2) = S^2$ and
Verify $V(\bar{y}_n) = (1 - f) \frac{S^2}{n}$ for SRSWOR.
 - 3) SRSWR : Drawing samples of size 'n' from a population of size 'N' and verification of Results (a) $E(\bar{y}_n) = \bar{y}_N$, (b) $E(s^2) = \sigma^2$ and
Verify $V(\bar{y}_n) = \left(\frac{N-1}{Nn}\right) S^2$ for SRSWR.
 - 5) Estimation of Sample size in SRS
 - 6) Sampling proportions: Verification of results (a) $E(p) = P$, (b) $V(p) = PQ/n$.
 - 7) Using stratum data, estimation of $V(\bar{y}_c)$ and quantify gain due to stratification.
 - 8) Determination of stratum sample sizes under Proportional and Optimum allocations and Comparison of precision with SRSWOR.
 - 9) Systematic Sampling : Drawing systematic samples of size 'n' and comparison of precision With SRS.
 - 10) Computation of partial and multiple correlation coefficients. (Tri-variate case only).
 - 11) Obtaining plane of regression.
 - 12) Measurement of trend by Method of 3-yearly and 4- yearly moving averages.
 - 13) Measurement of trend by Least Squares Method- (St.line, Power curve and Exponential curve).
 - 14) Measurement of Seasonal variations by Simple averages method.
 - 15) Computation of unweighted indices by Simple Aggregative method and Average of Link relatives method.
 - 16) Computation of weighted indices by Laspeyre's, Paasche's and Fisher's formulae.
 - 17) Verification of tests of adequacy for index numbers given by Laspeyre, Paasche, Fisher, & Marshall-Edgeworth's formulae.
 - 18) Construction of Cost of living index number.
 - 19) Construction of Chain Base index numbers, Conversion between C.B.I. and F.B.I.
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Books recommended

1. Goon A.M, Gupta M.k, Das Gupta B(1991): Fundamentals of Statistics, Vol World Press, Calcutta.
2. Hodges J.K and Lehman EL(1964); Basic Concept of Probability and Statics, Hidden Day,
3. Mood A.M, Graybill F.A, and Boes D.C(1974): Introduction to the Theory of Statistics, McGraw Hill
4. Gupta and Kapoor : Fundamentals of Mathematical Statistics, Sultan and Chand pub.
5. Bhat B.R., Sriventatranama T, and Rao Madava K.S(1997): Statistics A Beginner's Text. Vol II New International(P) Ltd.
6. Rohatgi V.k(1967): An introduction to Probability Theory and Mathematical Statics, John Wiley and Sons.
7. Snedecor G.w, and Coohran W.G.,(1967): Statisticql Iowa State University.
8. Murthy M.N(1967) sampling Theory and Methods, Statistical Publishing Society, Calcutta.
9. Sampath S. (2000): Sampling Theory and Methods, Narosa Publishing House.
10. Sukhalme B.V.(1964): Sample Survey methods and its Applications, Indian Society of Agricultural Statistics.
11. Gupta and Kapoor Fundamentals of Applied Statistics; S.Chand Pub.
12. Goon A.M., M.K, Gupta and b.daS Gupta: Fundamentals of Statistics. Vd II:(World Press Calcutta).
13. Des Rej(2000) Sample Survey Theory, Naros Publising House.
14. Cromon F.E and Cowdon D.J(1969): Applied General Statistics Prectice Hall of India.
15. Goon A.M, Gupta M.K, Das Gupta B. (1986): Fundamentals of Statistics, Vol.II World Press, Calcutta.
16. Gupta and Kapoor
17. : Fundamentals of Applied Statistics .S.Chand. Gupta S.P, Statistical method .S Chand
18. S.C.Shrivastava, Sangya Shrivastava, Anmol Prakashan Pvt.Ltd, New Delhi
19. Asthana and Shrivastva: Applied Statistics of India (Cjaotany Pub)
20. Gupta and Mukhopadhyay P.P.() Applied Statistics, Central Book Agency.