

A
Proposed Syllabus

For

B.Sc. \ B.A.

I, II, III, IV, V, VI Semester

COURSE

WITH

STATISTICS

Session 2018-2019 onwards

DR.H.S. GOUR VISHWAVIDYALAYA
(A CENTRAL UNIVERSITY)
SAGAR (M.P.)

Introduction

Statistics Profession

Statistics is used in estimating and assessing various taxation policies and programmes run by central and state governments and to design plans for the welfare of the society. It provides tools and techniques for data analysis and design making and also extends services to researchers relating to humanities, business and other interdisciplinary sciences

B.Sc./B.A.

8. Name of the Programme: B.Sc./B.A.
9. Duration of Programme : The duration of programme is six semesters spread over a period of not less than 90 working days for each semester.
10. Structure of programme : The course (elective and core) of study for B.Sc./B.A., includes the subject, number of hrs. per week devoted to each subject and credits for its theory, practicals as per scheme attached.
11. Medium of instruction: English
12. Each courses of B.Sc./B.A. is mark as a core/compulsory/elective courses etc.
13. Credit allotted: Credit allotted followed through out of scheme of programme

(Total credit: 44)

iii. Core Course: 24

iv. Elective Course: 20

14. Scheme of Examination:

(a) Mid Semester Examination	:	20
(b) Internal Assessment	:	20
(c) End Semester Examination	:	60

Total : 100

R. J. J.
8/6/18
CHAIRMAN
Board of Studies
Deptt. of Maths. & Statistics
Dr. H.S. Gour Vishwavidyalaya
SAGAR (M. P.) INDIA

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SAGAR (M. P.) INDIA

H.S.
8.6.18

M. J.
8/6/18

D. S.

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
(Central University)
Department of Mathematics and Statistics
B.Sc.\ B.A. with Statistics
Academic Session 2018-2019 onwards

B.Sc.\ B.A. with Statistics

Semester	Code	Course Title	Credit	Contact Hours
1	STAT-CC-111	Descriptive Statistics	4	60
	STAT-CC-112	Practical : Descriptive Statistics	2	30
2	STAT-CC-211	Probability and Probability Distributions	4	60
	STAT-CC-212	Practical : Probability and Probability Distributions	2	30
3	STAT-CC-311	Sampling Theory & Distributions	4	60
	STAT-CC-312	Practical Work	2	30
	STAT-SE-311	Portfolio Optimization	2	30
	STAT-SE-312	Mathematical Analysis-I	2	30
4	STAT-CC-411	Statistical Inference	4	60
	STAT-CC-412	Practical Work	2	30
	STAT-SE-411	Mathematical Finance	2	30
	STAT-SE-412	Mathematical Analysis-II	2	30
5	STAT-SE-511	Introduction to Operations Research	2	30
	STAT-SE-512	Calculus-I	2	30
	STAT-EC-511	Financial Statistics	4	60
	STAT-EC-512	Practical Work	2	30
6	STAT-SE-611	Econometrics	2	30
	STAT-SE-612	Calculus-II	2	30
	STAT-EC-611	Design of Experiments	4	60
	STAT-EC-612	Practical Work	2	30

NOTE :-

1. Papers of CODE CC are compulsory in Semesters 1 to 4.
2. Choose any one paper of CODE SE in semesters 3 to 6.
3. Choose both papers of CODE EC in semesters 5 and 6.

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
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B.Sc.\B.A. –I Semester

STAT-CC-111	Descriptive Statistics	4	0	0	4

Mid Sem-20
Internal assessment-20
End Sem-60

UNIT I

Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives. **(12 hours)**

UNIT II

Consistency and independence of data with special reference to attributes. Measures of Central Tendency : mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation. **(12 hours)**

UNIT III

Moments, absolute moments, factorial moments, skewness and kurtosis, Sheppard's corrections. Bivariate data: Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation. **(12 hours)**

UNIT IV

Simple linear regression, principle of least squares and fitting of polynomials and exponential curves. **(12 hours)**

UNIT V

Index Numbers: Definition, construction of index numbers and problems thereof for weighted and unweighted index numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Consumer price index numbers. **(12 hours)**

Suggested Books :

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

Additional Books :

3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
4. Gupta S.C., Kapoor V.K., Fundamental of Mathematical Statistics, S.Chand,
5. Gupta S.C., Kapoor V.K., Fundamental of Applied Statistics, S.Chand and Sons.

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
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B.Sc.\ B.A.–I Semester

STAT-CC-112	Practical : Descriptive Statistics	2	0	0	2

Mid Sem - 20

Internal assessment - 20

End Sem [Assessment of performance in experiment:50, Viva : 10] - 60

List of Practical

(30 hours)

1. Graphical representation of data.
2. Problems based on measures of central tendency.
3. Problems based on measures of dispersion.
4. Problems based on combined mean and variance and coefficient of variation.
5. Problems based on moments, skewness and kurtosis.
6. Fitting of polynomials, exponential curves.
7. Karl Pearson correlation coefficient.
8. Correlation coefficient for a bivariate frequency distribution.
9. Lines of regression, angle between lines and estimated values of variables.
10. Spearman rank correlation with and without ties.
11. Partial and multiple correlations.
12. Planes of regression and variances of residuals for given simple correlations.
13. Planes of regression and variances of residuals for raw data.
14. Calculate price and quantity index numbers using simple and weighted average of price relatives.
15. To calculate the Chain Base index numbers.
16. To calculate consumer price index number

Suggested Books :

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I& II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

Additional Books :

1. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
2. Gupta S.C., Kapoor V.K., Fundamental of Mathematical Statistics, S.Chand,
3. Gupta S.C., Kapoor V.K., Fundamental of Applied Statistics, S.Chand and Sons.

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
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B.Sc.\ B.A.–II Semester

STAT-CC-211	Probability and Probability Distributions	4	0	0	4

Mid Sem-20
Internal assessment-20
End Sem-60

UNIT I

Probability: Introduction, random experiments, sample space, events and algebra of events. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes’ theorem and its applications. **(12 hours)**

UNIT II

Random variables: discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., illustrations and properties of random variables, univariate transformations with illustrations. Two dimensional random variables: discrete and continuous type, joint, marginal and conditional p.m.f, p.d.f., and c.d.f. **(12 hours)**

UNIT III

Independence of variables, bivariate transformations with illustrations Mathematical Expectation and Generating Functions: Expectation of single and bivariate random variables and its properties. **(12 hours)**

UNIT IV

Moments and Cumulants, moment generating function, cumulant generating function and characteristic function. Uniqueness and inversion theorems (without proof) along with applications. Conditional expectations. **(12 hours)**

UNIT V

Standard probability distributions: Binomial, Poisson, geometric, negative binomial, hypergeometric, uniform, normal, exponential, Cauchy, beta and gamma along with their properties and limiting/approximation cases. **(12 hours)**

Suggested Books :

1. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund’s Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

Additional Books :

1. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi
2. Gupta S.C., Kapoor V.K., Fundamental of Mathematical Statistics, S.Chand,
3. Gupta S.C., Kapoor V.K., Fundamental of Applied Statistics, S.Chand and Sons.

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B.Sc.\ B.A.–II Semester

STAT-CC-212	Practical : Probability and Probability Distributions	2	0	0	2

Mid Sem - 20

Internal assessment - 20

End Sem [Assessment of performance in experiment:50, Viva : 10] - 60

List of Practical

(30 hours)

1. Fitting of binomial distributions for n and $p = q = \frac{1}{2}$.
2. Fitting of binomial distributions for given n and p .
3. Fitting of binomial distributions after computing mean and variance.
4. Fitting of Poisson distributions for given value of λ .
5. Fitting of Poisson distributions after computing mean.
6. Fitting of negative binomial.
7. Fitting of suitable distribution.
8. Application problems based on binomial distribution.
9. Application problems based on Poisson distribution.
10. Application problems based on negative binomial distribution.
11. Problems based on area property of normal distribution.
12. To find the ordinate for a given area for normal distribution.
13. Application based problems using normal distribution.
14. Fitting of normal distribution when parameters are given.
15. Fitting of normal distribution when parameters are not given.

Suggested Books :

1. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

Additional Books :

1. Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi
2. Gupta S.C., Kapoor V.K., Fundamental of Mathematical Statistics, S.Chand,
3. Gupta S.C., Kapoor V.K., Fundamental of Applied Statistics, S.Chand and Sons.

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
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B.Sc.\ B.A.–III Semester

STAT-CC-311	Sampling Theory & Distributions	L	T	P	C
		4	0	0	4
		Max. Marks : 100			

Mid Sem-20
Internal assessment-20
End Sem-60

UNIT I

Limit laws: convergence in probability, almost sure convergence, convergence in mean square and convergence in distribution and their inter relations, Chebyshev's inequality, W.L.L.N., S.L.L.N. and their applications, De-Moivre Laplace theorem, Central Limit Theorem (C.L.T.) for i.i.d. variates, applications of C.L.T. and Liapunov Theorem (without proof). **(12 hours)**

UNIT II

Definitions of random sample, parameter and statistic, sampling distribution of a statistic, Sampling distribution of sample mean, Null and alternative hypotheses, level of significance, Type I and Type II errors, their probabilities and critical region. Large sample tests, use of CLT for testing single proportion, difference of two proportions, single mean, difference of two means, standard deviation. Test based on Chi-Square, t & F distributions. **(12 hours)**

UNIT III

Sample surveys, Concept of population and sample, need for sampling, Census and sample surveys. Advantages of sampling, Basic concepts in sampling. Organization aspects of survey sampling. Sample selection and sample size, Sampling error and non-sampling errors. **(12 hours)**

UNIT IV

Some basic sampling methods- Simple Random Sampling (SRS) with and without replacement. Stratified random sampling, proportional and Neyman allocations. Efficiency comparisons. **(12 hours)**

UNIT V

Systematic sampling and its variance, Ratio, product, difference and Regression methods of estimation, their bias and m.s.e. under simple random sampling. **(12 hours)**

Suggested Books :

1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2003): *An Outline of Statistical Theory*, Vol. I, 4th Edn. World Press, Kolkata.
2. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): *An Introduction to Probability and Statistics*. 2ndEdn. (Reprint) John Wiley and Sons.

Additional Books :

1. Hogg, R.V. and Tanis, E.A. (2009): *A Brief Course in Mathematical Statistics*. Pearson Education.
2. Johnson, R.A. and Bhattacharya, G.K. (2001): *Statistics-Principles and Methods*, 4th Edn. John Wiley and Sons.
3. Mood, A.M., Graybill, F.A. and Boes, D.C. (2007): *Introduction to the Theory of Statistics*, 3rd Edn. (Reprint).Tata McGraw-Hill Pub. Co. Ltd.

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B.Sc.\ B.A.–III Semester

STAT-CC-312	Practical Work	L	T	P	C
		0	0	2	2
		Max. Marks : 100			

Mid Sem - 20

Internal assessment - 20

End Sem [Assessment of performance in experiment:50, Viva : 10] - 60

PRACTICAL/LAB. WORK:

List of Practical **(30 hours)**

1. Testing of significance and confidence intervals for single proportion and difference of two proportions
2. Testing of significance and confidence intervals for single mean and difference of two means and paired tests.
3. Testing of significance and confidence intervals for difference of two standard deviations.
4. Exact Sample Tests based on Chi-Square Distribution.
5. Testing if the population variance has a specific value and its confidence intervals.
6. Testing of goodness of fit.
7. Practical on SRS.
8. Practical on Stratified Sampling.
9. . Practical on Systematic Sampling.
10. . Practical on ratio estimator.

Suggested Books :

1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2003): *An Outline of Statistical Theory*, Vol. I, 4th Edn. World Press, Kolkata.
2. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): *An Introduction to Probability and Statistics*. 2ndEdn. (Reprint) John Wiley and Sons.

Additional Books :

1. Hogg, R.V. and Tanis, E.A. (2009): *A Brief Course in Mathematical Statistics*. Pearson Education.
2. Johnson, R.A. and Bhattacharya, G.K. (2001): *Statistics-Principles and Methods*, 4th Edn. John Wiley and Sons.
3. Mood, A.M., Graybill, F.A. and Boes, D.C. (2007): *Introduction to the Theory of Statistics*, 3rd Edn. (Reprint).Tata McGraw-Hill Pub. Co. Ltd.

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B.Sc.\ B.A.–III Semester

STAT- SE-311	Portfolio Optimization	L	T	P	C
		2	0	0	2
		Max. Marks : 100			

Mid Sem-20
Internal assessment-20
End Sem-60

UNIT I

Financial markets. Investment objectives. **(06 hours)**

UNIT II

Measures of return and risk. Types of risks. Portfolio of assets. **(06 hours)**

UNIT III

Expected risk and return of portfolio. Diversification. **(06 hours)**

UNIT IV

Mean-variance portfolio optimization- the Markowitz model and the two-fund theorem, risk-free assets and one fund theorem, efficient frontier. **(06 hours)**

UNIT V

Portfolio performance evaluation measures. **(06 hours)**

Suggested Books :

- 1 F.K. Reilly, Keith C. Brown, *Investment Analysis and Portfolio Management*, 10th Ed., South-Western Publishers, 2011.

Additional Books :

1. H.M. Markowitz, *Mean-Variance Analysis in Portfolio Choice and Capital Markets*, Blackwell, New York, 1987.
2. D.G. Luenberger, *Investment Science*, 2nd Ed., Oxford University Press, 2013.

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B.Sc.\ B.A.–III Semester

STAT-SE-312	Mathematical Analysis-I	L	T	P	C
		2	0	0	2
		Max. Marks : 100			

Mid Sem-20
Internal assessment-20
End Sem-60

UNIT-I

Real Analysis: Representation of real numbers as points on the line and the set of real numbers as complete ordered field. Bounded and unbounded sets. **(06 hours)**

UNIT-II

Neighborhoods and limit points. Superimum and infimum, derived sets, open and closed sets, sequences and their convergence. **(06 hours)**

UNIT-III

limits of some special sequences such as r power n , $(1 + 1/n)^n$ and $n^{1/n}$ and Cauchy's general principle of convergence, Cauchy's first theorem on limits. **(06 hours)**

UNIT-IV

Monotonic sequences, limit superior and limit inferior of a bounded sequence. Infinite series, positive termed series and their convergence, Comparison test. **(06 hours)**

UNIT-V

D'Alembert's ratio test, Cauchy's n th root test, Raabe's test. Gauss test, Cauchy's condensation test and integral test (Statements and Examples only). Absolute convergence of series, Leibnitz's test. **(06 hours)**

Suggested Books :

1. Malik S.C. and Savita Arora: Mathematical Analysis, Second Edition, Wiley Eastern Limited, New Age International Limited, New Delhi, 1994.

Additional Books :

2. Somasundram D. and Chaudhary B.: A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1987.
3. Gupta S.L. and Nisha Rani: Principles of Real Analysis, Vikas Publ. House Pvt. Ltd., New Delhi, 1995.

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 B.Sc.\ B.A.–IV Semester

STAT-CC-411	Statistical Inference	L	T	P	C
		4	0	0	4
		Max. Marks : 100			

Mid Sem-20
Internal assessment-20
End Sem-60

UNIT I

Estimation: Concepts of estimation, unbiasedness, sufficiency, consistency and efficiency. Factorization theorem. Complete statistic, Minimum variance unbiased estimator (MVUE), Rao-Blackwell theorem and its applications. Cramer-Rao inequality. **(12 hours)**

UNIT II

Methods of Estimation, method of maximum likelihood estimation with properties, interval estimation, confidence limits for normal distribution case, basic idea of Bayes estimators. **(12 hours)**

UNIT III

Principles of test of significance: Null and alternative hypotheses (simple and composite), Type-I and Type-II errors, critical region, level of significance, size and power, best critical region, most powerful test, uniformly most powerful test, Neyman Pearson Lemma (statement and applications to construct most powerful test). **(12 hours)**

UNIT IV

Sequential Analysis: Sequential probability ratio test (SPRT) for simple v/s simple hypotheses. Fundamental relations among α , β , A and B, determination of A and B in practice. **(12 hours)**

UNIT V

Wald's fundamental identity and the derivation of operating characteristics (OC) and average sample number (ASN) functions, examples based on normal, Poisson, binomial and exponential distributions. **(12 hours)**

Suggested Books :

1. Goon A.M., Gupta M.K.: Das Gupta.B. (2005), Fundamentals of Statistics, Vol. I, World Press, Calcutta.
2. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2nd Edn. (Reprint) John Wiley and Sons.

Additional Books :

1. Miller, I. and Miller, M. (2002) : John E. Freund's Mathematical Statistics (6th addition, low price edition), Prentice Hall of India.
2. Dudewicz, E. J., and Mishra, S. N. (1988): Modern Mathematical Statistics. John Wiley & Sons.
3. Mood A.M, Graybill F.A. and Boes D.C.: Introduction to the Theory of Statistics, McGraw Hill.
4. Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1997) Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.
5. Snedecor G.W and Cochran W.G.(1967) Statistical Methods. Iowa State University Press.

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
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B.Sc./ B.A.–IV Semester

STAT-CC-412	Practical Work	L	T	P	C
		0	0	2	2
		Max. Marks : 100			

Mid Sem - 20

Internal assessment - 20

End Sem [Assessment of performance in experiment:50, Viva : 10] - 60

PRACTICAL/LAB. WORK:

List of Practical

(30 hours)

1. Unbiased estimators (including unbiased but absurd estimators)
2. Consistent estimators, efficient estimators and relative efficiency of estimators.
3. Cramer-Rao inequality and MVB estimators
4. Sufficient Estimators – Factorization Theorem, Rao-Blackwell theorem, Complete Sufficient estimators
5. Lehman-Scheffe theorem and UMVUE
6. Maximum Likelihood Estimation
7. Asymptotic distribution of maximum likelihood estimators
8. Estimation by the method of moments, minimum Chi-square
9. Type I and Type II errors
10. Most powerful critical region (NP Lemma)
11. Uniformly most powerful critical region
12. Unbiased critical region
13. Power curves
14. Likelihood ratio tests for simple null hypothesis against simple alternative hypothesis
15. Likelihood ratio tests for simple null hypothesis against composite alternative hypothesis
16. Asymptotic properties of LR tests
17. SPRT procedure
18. OC function and OC curve
19. ASN function and ASN curve

Suggested Books :

1. Goon A.M., Gupta M.K.: Das Gupta.B. (2005), Fundamentals of Statistics, Vol. I, World Press, Calcutta.
2. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2nd Edn. (Reprint) John Wiley and Sons.

Additional Books :

1. Miller, I. and Miller, M. (2002) : John E. Freund's Mathematical Statistics (6th addition, low price edition), Prentice Hall of India.
2. Dudewicz, E. J., and Mishra, S. N. (1988): Modern Mathematical Statistics. John Wiley & Sons.
3. Mood A.M, Graybill F.A. and Boes D.C.: Introduction to the Theory of Statistics, McGraw Hill.
4. Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1997) Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.
5. Snedecor G.W and Cochran W.G.(1967) Statistical Methods. Iowa State University Press.

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 B.Sc.\ B.A.–IV Semester

STAT- SE -411	Mathematical Finance	L	T	P	C
		2	0	0	2
		Max. Marks : 100			

Mid Sem-20
Internal assessment-20
End Sem-60

Unit – I:

Basic principles: Comparison, arbitrage and risk aversion, Interest (simple and compound, discrete and continuous). **(06 hours)**

Unit – II:

Time value of money, inflation, net present value, internal rate of return (calculation by bisection and Newton-Raphson methods). **(06 hours)**

Unit – III:

Comparison of NPV and IRR. Bonds, bond prices and yields. Floating-rate bonds, immunization **(06 hours)**

Unit – IV:

Asset return, short selling, portfolio return, (brief introduction to expectation, variance, covariance and correlation). **(06 hours)**

Unit –V:

Random returns, portfolio mean return and variance, diversification, portfolio diagram, feasible set, Markowitz model (review of Lagrange multipliers for 1 and 2 constraints). **(06 hours)**

Suggested Book :

1. David G. Luenberger, *Investment Science*, Oxford University Press, Delhi, 1998.

Additional Books :

1. John C. Hull, *Options, Futures and Other Derivatives*, 6th Ed., Prentice-Hall India, Indian reprint, 2006.
2. Sheldon Ross, *An Elementary Introduction to Mathematical Finance*, 2nd Ed., Cambridge University Press, USA, 2003.

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B.Sc.\ B.A.–IV Semester

STAT-SE-412	Mathematical Analysis-II	L	T	P	C
		2	0	0	2
		Max. Marks : 100			

Mid Sem-20
Internal assessment-20
End Sem-60

UNIT-I

Review of limit, continuity and differentiability, uniform Continuity and boundedness of a function. Rolle’s Mean Value theorem. **(06 hours)**

UNIT-II

Lagrange’s Mean Value theorem, Taylor’s theorem with lagrange’s and Cauchy’s form of remainder(without proof). **(06 hours)**

UNIT-III

Taylor’s and Maclaurin’s series expansions of $\sin x$, $\cos x$, $\log(1+x)$, $\exp x$, $(1+x)^n$. **(06 hours)**

UNIT-IV

Numerical Analysis: Factorial, finite differences and interpolation. Operators, E and divided difference. Bisection method and Newton-Raphson method. **(06 hours)**

UNIT-V

Newton’s forward, backward and divided differences interpolation formulae. Lagrange’s interpolation formulae. Central differences, Gauss and Stirling interpolation formulae. **(06 hours)**

Suggested Books :

1.Malik S.C. and Savita Arora: Mathematical Analysis, Second Edition, Wiley Eastern Limited, New Age International Limited, New Delhi, 1994.

Additional Books :

1. Somasundram D. and Chaudhary B.: A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1987.
2. Gupta S.L. and Nisha Rani: Principles of Real Analysis, Vikas Publ. House Pvt. Ltd., New Delhi, 1995.

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
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Department of Mathematics and Statistics
B.Sc.\ B.A.–V Semester

STAT-SE-511	Introduction to Operations Research	L	T	P	C
		2	0	0	2
		Max. Marks : 100			

Mid Sem-20
Internal assessment-20
End Sem-60

UNIT I

Introduction to Operations Research, phases of O.R., model building, various types of O.R.problems. **(06 hours)**

UNIT II

Linear Programming Problem, Mathematical formulation of the L.P.P, graphical solutions of a L.P.P. **(06 hours)**

UNIT III

Optimum solution to a L.P.P: Simplex method, concept of artificial variables and Charne’s big M-technique. Graphically identifying special cases of L.P.P. Concept of duality in L.P.P. **(06 hours)**

UNIT IV

Transportation Problem: Initial solution by North West corner rule, Least cost method and Vogel’s approximation method (VAM), MODI’s method to find the optimal solution. **(06 hours)**

UNIT V

Assignment problem: Hungarian method to find optimal assignment. **(06 hours)**

Suggested Books :

1. Taha, H. A. (2007): Operations Research: An Introduction, 8th Edition, Prentice Hall of India.

Additional Books :

1. SwarupKanti, Gupta, P.K. and Manmohan (2007): Operations Research, 13th Edition, Sultan Chand and Sons.
2. Ravindran, A, Phillips, D.T., Solberg,J.J.(2005): Operations Research- Principles and Practice, John Wiley & Sons.

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 B.Sc.\ B.A.–V Semester

STAT-SE-512	CALCULUS -I	L	T	P	C
		2	0	0	2
		Max. Marks : 100			

Mid Sem-20
Internal assessment-20
End Sem-60

Unit – I:

Limits of function, continuous functions, properties of continuous functions, partial differentiation and total differentiation. **(06 hours)**

Unit – II:

Indeterminate forms: L-Hospital's rule, Leibnitz rule for successive differentiation. Euler's theorem on homogeneous functions. **(06 hours)**

Unit – III:

Maxima and minima of functions of one and two variables, constrained optimization techniques (with Lagrange multiplier) along with some problems. **(06 hours)**

Unit – IV:

Jacobian. concavity and convexity , points of inflexion of function, singular points. **(06 hours)**

Unit – V:

Formation and solution of a partial differential equations. Equations easily integrable. Linear partial differential equations of first order. **(06 hours)**

Suggested Books :

1. Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad (14TH Edition - 1997).

Additional Books :

1. Zafar Ahsan: Differential Equations and their Applications, Prentice-Hall of India Pvt. Ltd., New Delhi (2ndEdition -2004).
2. Piskunov, N: Differential and Integral Calculus, Peace Publishers, Moscow.

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA, SAGAR
(Central University)
Department of Mathematics and Statistics
B.Sc.\ B.A.–VI Semester

STAT-SE-611	Econometrics	L	T	P	C
		2	0	0	2
		Max. Marks : 100			

Mid Sem-20
Internal assessment-20
End Sem-60

UNIT- I

Introduction: Objective behind building econometric models, nature of econometrics, model building, role of econometrics, structural and reduced forms. General linear model(GLM). Estimation under linear restrictions. **(06 hours)**

UNIT-II

Multicollinearity: Introduction and concepts, detection of multicollinearity, consequences, tests and solutions of multicollinearity, specification error. **(06 hours)**

UNIT- III

Generalized least squares estimation, Aitken estimators. Autocorrelation: concept, consequences of autocorrelated disturbances, detection and solution of autocorrelation. **(06 hours)**

UNIT- IV

Heteroscedastic disturbances: Concepts and efficiency of Aitken estimator with OLS estimator under heteroscedasticity. Consequences of heteroscedasticity. **(06 hours)**

UNIT- V

Tests and solutions of heteroscedasticity. Autoregressive and Lag models, Dummy variables, Qualitative data. **(06 hours)**

Suggested Books :

1. Gujarati, D. and Sangeetha, S. (2007): Basic Econometrics, 4th Edition, McGraw Hill Companies.
2. Johnston, J. (1972): Econometric Methods, 2nd Edition, McGraw Hill International.

Additional Books :

1. Koutsoyiannis, A. (2004): Theory of Econometrics, 2nd Edition, Palgrave Macmillan Limited,
2. Maddala, G.S. and Lahiri, K. (2009): Introduction to Econometrics, 4th Edition, John Wiley & Sons.

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STAT-SE-612	CALCULUS-II	L	T	P	C
		2	0	0	2
		Max. Marks : 100			

Mid Sem-20
Internal assessment-20
End Sem-60

UNIT I

Differential Equations: Exact differential equations, integrating factors, change of variables, Total differential equations. **(06 hours)**

UNIT II

Differential equations of first order and first degree, Differential equations of first order but not of first degree. **(06 hours)**

UNIT III

Equations solvable for x, y, q, Equations of the first degree in x and y, Clairaut's equations. **(06 hours)**

UNIT IV

Higher Order Differential Equations : Linear differential equations of order n, Homogeneous and non-homogeneous linear differential equations of order n with constant coefficients. **(06 hours)**

UNIT V

Different forms of particular integrals, Linear differential equations with non-constant coefficients, Reduction of order method. **(06 hours)**

Suggested Books :

1. Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad (14Th Edition - 1997).

Additional Books :

1. Zafar Ahsan: Differential Equations and their Applications, Prentice-Hall of India Pvt. Ltd., New Delhi (2ndEdition -2004).
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B.Sc.\ B.A.–V Semester

STAT-EC-511	Financial Statistics	L	T	P	C
		4	0	0	4
		Max. Marks : 100			

Mid Sem-20
Internal assessment-20
End Sem-60

UNIT I

Probability review: Real valued random variables, expectation and variance, skewness and kurtosis, conditional probabilities and expectations. Discrete Stochastic Processes, Binomial processes, General random walks, Geometric random walks, Binomial models with state dependent increments. **(12 hours)**

UNIT II

Tools Needed For Option Pricing: Wiener process, stochastic integration, and stochastic differential equations. Introduction to derivatives: Forward contracts, spot price, forward price, future price. Call and put options, zero-coupon bonds and discount bonds. **(12 hours)**

UNIT III

Pricing Derivatives: Arbitrage relations and perfect financial markets, pricing futures, put-call parity for European options, relationship between strike price and option price. Stochastic Models in Finance: Discrete time process- binomial model with period one. **(12 hours)**

UNIT IV

Stochastic Models in Finance: Continuous time process- geometric Brownian motion. Ito's lemma, Black-Scholes differential equation, Black-Scholes formula for European options, Hedging portfolios: Delta, Gamma and Theta hedging. **(12 hours)**

UNIT V

Binomial Model for European options: Cox-Ross-Rubinstein approach to option pricing. Discrete dividends. **(12 hours)**

Suggested Book :

1. Franke, J., Hardle, W.K. And Hafner, C.M. (2011): Statistics of Financial Markets: An Introduction, 3rd Edition, Springer Publications.

Additional Books :

1. Stanley L. S. (2012): A Course on Statistics for Finance, Chapman and Hall/CRC.

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B.Sc.\ B.A.–V Semester

STAT-EC-512	Practical Work	L	T	P	C
		0	0	2	2
		Max. Marks : 100			

Mid Sem - 20
Internal assessment - 20
End Sem [Assessment of performance in experiment:50, Viva : 10] - 60

PRACTICAL / LAB WORK (Using spreadsheet/ R)

List of Practical

(30 hours)

1. To verify “no arbitrage” principle
2. To verify relationship between spot price, forward price, future price
3. To price future contracts
4. To verify put-call parity for European options
5. To construct binomial trees and to evaluate options using these trees
6. To price options using black – Scholes formula
7. To hedge portfolios using delta and gamma hedging
8. To hedge portfolios theta hedging
9. Pricing of call options using binomial model
10. Computation of dividends on call options as a percentage of stock price.
11. Computation of dividends on call options as a fixed amount of money.
12. Pricing of put options using binomial model
13. Call-put parity for options following binomial models.
14. Effect of dividends on put options.

Suggested Books :

1. Franke, J., Hardle, W.K. And Hafner, C.M. (2011): Statistics of Financial Markets: An Introduction, 3rdEdition, Springer Publications.

Additional Books :

1. Stanley L. S. (2012): A Course on Statistics for Finance, Chapman and Hall/CRC.

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B.Sc./ B.A.–VI Semester

STAT-EC-611	Design of Experiments	L	T	P	C
		4	0	0	4
		Max. Marks : 100			

Mid Sem-20
Internal assessment-20
End Sem-60

UNIT I

Experimental designs: Role, historical perspective, terminology, experimental error, basic principles, uniformity trials, fertility, size and shape of plots and blocks. Basic designs: **(12 hours)**

UNIT II

Completely Randomized Design (CRD), Randomized Block Design (RBD). RBD with missing plot analysis, advantages and disadvantages. **(12 hours)**

UNIT III

Latin Square Design (LSD) – layout, model and statistical analysis, relative efficiency, missing observations. **(12 hours)**

UNIT IV

Factorial experiments: advantages, notations and concepts, 2^2 , 2^3 , factorial experiments, design and analysis. **(12 hours)**

UNIT V

Total and Partial confounding for 2^3 experiments, construction of such experiments only. **(12 hours)**

Suggested Books :

1. Cochran, W.G. and Cox, G.M. (1959): Experimental Design. Asia Publishing House.
2. Das, M.N. and Giri, N.C. (1986): Design and Analysis of Experiments. Wiley Eastern Ltd.

Additional Books :

1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): Fundamentals of Statistics. Vol.II, 8thEdn. World Press, Kolkata.
2. Kempthorne, O. (1965): The Design and Analysis of Experiments. John Wiley.
3. Montgomery, D. C. (2008): Design and Analysis of Experiments, John Wiley.

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B.Sc.\ B.A.–VI Semester

STAT-EC-612	Practical Work	L	T	P	C
		0	0	2	2
		Max. Marks : 100			

Mid Sem - 20

Internal assessment - 20

End Sem [Assessment of performance in experiment:50, Viva : 10] - 60

PRACTICAL / LAB. WORK

List of Practical

(30 hours)

1. Analysis of a CRD
2. Analysis of an RBD
3. Analysis of an LSD
4. Analysis of an RBD with one missing observation
5. Analysis of an LSD with one missing observation
6. Intra Block analysis of a BIBD
7. Analysis of 2² and 2³ factorial in CRD and RBD
8. Analysis of 2² and 2³ factorial in LSD
9. Analysis of a completely confounded two level factorial design in 2 blocks
10. Analysis of a completely confounded two level factorial design in 4 blocks
11. Analysis of a partially confounded two level factorial design
12. Analysis of a single replicate of a 2ⁿ design
13. Analysis of a fraction of 2ⁿ factorial design

Suggested Books :

1. Cochran, W.G. and Cox, G.M. (1959): Experimental Design. Asia Publishing House.
2. Das, M.N. and Giri, N.C. (1986): Design and Analysis of Experiments. Wiley Eastern Ltd.

Additional Books :

1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): Fundamentals of Statistics. Vol.II, 8thEdn. World Press, Kolkata.
2. Kempthorne, O. (1965): The Design and Analysis of Experiments. John Wiley.
3. Montgomery, D. C. (2008): Design and Analysis of Experiments, John Wiley.

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Department of Mathematics and Statistics

Academic Session 2016-2019 onwards

Summary of Under Graduate Courses in Statistics

Course Name	Paper Code	Title of Paper	Credit	Course Coordinator
B. Sc. Sem-I	STAT CC 111	Descriptive Statistics		Prof. D.Shukla & Prof. R.K.Gangele
B. Sc. Sem-II	STAT CC 211	Probability and Probability Distributions		Prof. D.Shukla & Prof. R.K.Gangele
B. Sc. Sem-III	STAT CC 311	Sampling Theory & Distributions	6	Prof. D.Shukla & Prof. R.K.Gangele
B. Sc. Sem-III	STAT SE 311	Portfolio Optimization	2	Prof. R.K.Gangele
B. Sc. Sem-III	STAT SE 312	Mathematical Analysis-I	2	Dr. M.K.Yadav
B. Sc. Sem-IV	STAT CC 411	Statistical Inference	6	Prof. D.Shukla & Prof. R.K.Gangele
B. Sc. Sem-IV	STAT SE 411	Mathematical Finance	2	Prof. R.K.Gangele
B. Sc. Sem- IV	STAT SE 412	Mathematical Analysis-II	2	Dr. K. Shrivastava & Dr. M.K.Yadav
B. Sc. Sem- V	STAT SE 511	Introduction to Operations Research	2	Prof. D.Shukla
B. Sc. Sem- V	STAT SE 512	Calculus -I	2	Dr. K. Shrivastava & Dr. M.K.Yadav
B. Sc. Sem-V	STAT EC 511	Financial Statistics	6	Prof. R.K.Gangele & Dr. M.K.Yadav
B. Sc. Sem- VI	STAT SE 611	Econometrics	2	Prof. R.K.Gangele
B. Sc. Sem- VI	STAT SE 612	Calculus -II	2	Dr. K. Shrivastava & Dr. M.K.Yadav
B. Sc. Sem- VI	STAT EC 611	Design of Experiments	6	Prof. D.Shukla