Hemchandracharya North Gujarat University, Patan
Choice Based Credit System (CBCS)
Syllabus for B.Sc. Semester III (Statistics)
Effective from June, 2013
CC STA- 201
Random Variable and Probability Distribution – I

HOURS: 4 / week   *CREDIT: 4*   *EXAM HRS: 3*

Unit I: Random variable and its probability function (10 L)
Concept of Discrete and continuous Random Variable (R.V.), probability mass function, distribution function and its illustration, concept of joint probability functio n, marginal and conditional probability function. Transformation and its use in deriving distribution of two or more random variables.

Unit II: Mathematical Expectation and related terms (10 L)
 - Expectation of Random Variables, properties o f expectations,
 - Moments, measures of location, variation, skewness and kurtosis
 - Moments in terms of expectations with interrelationship, moment generating function, cumulant generating function their properties and uses.

Unit III: Discrete Probability Distribution – I (10 L)
Bernoulli distribution,
Binomial distribution
Poisson distribution
Hyper geometric distribution
- Derivation, basic properties of these distributions – Mean, Variance, moment generating function and moments, cumulant generating function,
- Applications and examples of these distributions.

Unit IV: Continuous Probability Distribution -I (10 L)
Uniform / Rectangular Distribution
Exponential Distribution
Beta type I and type II distribution
- Derivation, basic properties of these distributions – Mean, Variance, moment generating function and moments, cumulant generating function,
- Applications and examples of these distributions.

Reference Books:
1. Hogg, R.V. and Craig, A.T. (1972): Introduction to Mathematical Statistics, Amerind Publishing Co.
2. Mood, A.M., Greybill, F.A. and Bose, D.C. (1974): Int roduction to the Theory of Statistics, McGraw Hill.
3. Mukhopadhyay, P. (1996): Mathematical Statistics, New Central Book Agency.
4. Rohtagi, V.K. (1967): An Introduction to Probability Theory and Mathematical Statistics,

John Wiley and Sons.

5. Hoel, P.G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.
6. Meyer, P.L. (1970): Introductory Probability and Statistical Applications, Addison Wesley.
7. Gupta, S.C., and Kapoor, V.K. Fundamentals of Mathematical Statistics, S ultan Chand Publications.
8. Goon, A.M., Gupta, M.K. and Das Gupta, B. (1991): Fundamentals of Statistics, Vol. I, WorldPress, Calcutta.
9. A First Course in Probability - Sheldon.M.Ross, (Mc Millian publishing Co.)
10. Introduction to Probability and Statistics for Engineers and Scientists -S.M. Ross (Elsever)

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Hemchandracharya North Gujarat University, Patan
Choice Based Credit System (CBCS)
Syllabus for B.Sc. Semester III (Statistics)
Effective from June, 2013
CC STA- 202
Mathematical Economics and Actuarial Science -I

HOURS: 4 / week   *CREDIT: 4*   *EXAM HRS: 3*

Unit I: Index Numbers (10 L)
- Meaning, uses and Construction of index numbers
- Weighted and un weighted index number,
- Fixed and chain based index numbers
- Different formulas of calculating index numbers – Laspeyre's, Paasche's, Marshall – Edgeworth's Fisher's.
- Reversal tests for index numbers – Time and Factor reversal Tests
- Errors in index numbers
- Cost of living index number – its construction and uses
- Whole sale price index number and its application

Unit II: Demography (10 L)
- **Vital Statistics-**
- Sources of vital statistics in India, functions of vital Statistics, rates and ratios,
- Mortality rates- Crude, Age Specific and Standard Death rates
- Fertility and reproduction rates, Crude birth rates general and specific fertility rates, gross and net reproductive rates.

Unit III: Probability Models and Life Table (10 L)
Utility theory, insurance and utility theory, models for individual claims and their sums, survival function, curate future lifetime, force of mortality.
Life table and its relation with survival function, examples, assumptions for fractional ages, some analytical laws of mortality, select and ultimate tables.
Multiple life functions, joint life and last survivor status, insurance and annuity benefits through multiple life functions, evaluation for special mortality laws

Unit IV: Distribution of Income: (10 L)
- A Review. Distribution patterns and descriptive analysis. Income distribution functions: The Pareto law, Pareto –Levy law, week Pareto law, lognormal distribution (an income distribution),
- Inequality of income, Gini's coefficient
- Lorenz curve mathematically & its deviation for some well-known income distribution function.

Reference Books:
1. Goon, Gupta, Dasgupta : Fundamentals of Statistics, Vol -II, The World Press Pvt.Ltd., Calcutta 1986.
2. Parimal Mukhopadhyay : Applied Statistics, Books and Allied (P) Ltd , Kolkata,2005.

3. Bowers N.L., Jr. H.S. Gerber, Hickan J.C.,Jons D.A., Nesbitt C.J.: Actuarial Mathematics, The Society of Actuaries, 1997.
4. Lecture Notes on Statistics in Insurance: An Introduction, Dr. Mrs. S.R.Deshmukh.
5. N.L. Bowers, H.U.Gerber, H.C. Hickman, D.A. Jones and C.J. Nesbitt, (1986).
6. Actuarial Mathematics, Society of Actuaries, Ithaca, Illinois, U.S.A. Second Edition (1997) (i) Unit 3 Chapters: 1,2,3,8,9,11, (ii) Unit 4 - Chapters: 4,5,6,7,13,14
7. Life Contingencies, Spurgeon E.T (1972), Cambridge University Press.
8. Life Contingencies, Neill, A. (1977), Heineman.
9. J.M. Henderson & R.E.Quandt : Microeconomic Theory - Mathematical Approach (1980).
10. Peter Lambert : The Distribution & Redistributi on of Income.
11. N.C. Kakwani : Income Inequality and Poverty : Methods of Estimation and Policy Applications.
12. P.A. Samuelson and W.D. Nordheus : Economics (1998).

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Hemchandracharya North Gujarat University,Patan
Choice Based Credit System (CBCS)
Syllabus for B.Sc. Semester III (Statistics)
Effective from June, 2013
STA- 203
Statistics Practical Based on CC STA-201 and CC STA-202

HOURS: 6 / week   *CREDIT: 2.5*   *EXAM HRS: 3*

(A) Manual Practical
1. Generation of random sample from binomial and fitting of Binomial distribution.
2. Generation of random sample from Poisson and fitting of Poisson distribution.
3. Generation of random sample from exponential and fitting of exponential distribution.
4. Generation of random sample from beta I and beta II distribution.
5. Construction of index numbers. Reversal test for index numbers.
6. Construction of cost of living index numbers.
7. Calculation of mortality rates.
8. Calculation of Fertility rates and reproduction rates.
9. Construction of life tables.
10. Lorenz curve, Gini's coefficients and Pareto Law.

(B) Practical Using MS Excel
1. Generation of random sample from binomial and fitting of Binomial distribution.
2. Generation of random sample from Poisson and fitting of Po isson distribution.
3. Generation of random sample from exponential and fitting of exponential distribution.
4. Generation of random sample from beta I and beta II distribution.
5. Construction of index numbers. Reversal test for index numbers.
6. Construction of cost of living index numbers.
7. Calculation of mortality rates.
8. Calculation of Fertility rates and reproduction rates.
9. Construction of life tables.
10. Lorenz curve, Gini's coefficients and Pareto Law.

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Hemchandracharya North Gujarat University, Patan
Choice Based Credit System (CBCS)
Syllabus for B.Sc. Semester IV (Statistics)
Effective from June, 2013
CC STA- 204
Random variable and Probability Distribution -II

HOURS: 4 / week   CREDIT: 4   EXAM HRS: 3

Unit 1: **Characteristics Function and some inequalities (10 L)**
- Characteristic Function and its properties.
- Inversion theorem with proof, use of inversion theorem in deriving different discrete and
  continuous distributions.
- $P[g(X) \geq k] \leq E[g(X)]/k$, k>0.
- Jensen's Inequality
- Inequalities using Jensen's inequalities
  (i) $E(X^2) \geq [E(X)]^2$, (ii) $E(|X|) \leq [E|X|^p]^{1/p}$, (iii) $[E(|X|^s)]^{1/s} \geq [E(|X|^r)]^{1/r}$, 0<r < s.
- Boole's Inequality and Bonferroni's inequalities

Unit 2: **Continuous Probability Distribution – II (10 L)**
          Gamma Distribution
          Normal Distribution
          Weibull Distribution
- Derivation, basic properties of these distributions – Mean, Variance, moment generating
  function and moments, cumulant generating function,
- Applications and examples of these distributions.

Unit 3: **Bivariate Discrete Distribution (10 L)**
- Concept of Joint Distribution, joint mass function.
- Bivariate distribution, Marginal and conditional distribu tion
- Independence of Random variables.
- concept of conditional expectation and conditional variance
- moments and product moment, Karl Pearson's Coefficient of correlation

Unit 4: **Markov Chain and its applications (10 L)**
- Definition of Markov chain,
- Classification of states and chains (communicate, reducible and irreducible states and
  chains)
- Transition probability and Chapman Kolmogorov equation.
- Applications of Markov chain

Reference Books:
1. Hogg, R.V. and Craig, A.T. (1972): Introduction to Mathematical Statistics, Amerind Pub.
   Co.
2. Mood, A.M., Greybill, F.A. and Bose, D.C. (1974): Introduction to the Theory of
   Statistics, McGraw Hill.
3. Mukhopadhyay, P. (1996): Mathematical Statistics, New Central Book Agency.

4. Rohtagi, V.K. (1967): An Introduction to Probability Theory and Mathematical Statistics, John Wiley and Sons.
5. Hoel, P.G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.
6. Meyer, P.L. (1970): Introductory Probability and Statistical Applications, Addison Wesley.
7. Gupta, S.C., and Kapoor, V.K. Fundamentals of Mathematical Statistics, Sultan Chand publications.
8. Goon, A.M., Gupta, M.K. and Das Gupta, B. (1991): Fundamentals of Statistics, Vo l.I, WorldPress, Calcutta.
9. A First Course in Probability - Sheldon.M.Ross, (Mc Millian publishing Co.)
10. Introduction to Probability and Statistics for Engineers and Scientists- S.M. Ross (Elsever)
11. A First course in Probability - T.K. Chandra & D.Chatterjee (Narosa Publishing House)
12. Mathematical Statistics (VI Edition) - John E. Freund

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Hemchandracharya North Gujarat University,Patan
Choice Based Credit System (CBCS)
Syllabus for B.Sc. Semester IV (Statistics)
Effective from June, 2013
CC STA- 205
Statistical Tests, Official Statistics and Sampling

HOURS: 4 / week   *CREDIT: 4*   *EXAM HRS: 3*

Unit 1: Large Sample Tests (10 L)
- Concept and elementary idea of statistical hypothesis, simple and composite hypothe sis, null and alternative hypothesis, level of significance, degree of freedom
- Test of normality and Z – test to test the significance of mean based on a large sample, to test the significance of two difference of two means based on large sample
- Test of Proportions - to test the significance of single proportion based on a large sample, to test the significance of difference between two proportions based on large sample
- Fisher's Information and its use to test the significance of coefficient of cor relation

Unit 2: Correlation and regression in three variables (10 L)
- Concept of Yule's notation, Plane of regression for three variables
- Residue and its properties
- Multiple and partial correlation coefficients and their inter relationships
- example

Unit 3: Official Statistics – (10 L)
Indian Census Operations, Origin and functions,
Role of Indian Census operation in planning and development processes,
Origin and functions of -National Sample Survey Organisation (NSSO),
Central Statistical Organisation (CSO), Indian Statistical Institute (ISI),
Indian Council for Medical Researches (ICMR) etc.,
Role of these institutions in the planning and development processes.

Unit 4: Census and Sampling – (10 L)
- Concept of Survey and complete enumeration, difference between survey and census,
  importance of survey
- Principal steps in sample survey.
- Types of sampling: Probability sampling, Judgment sampling, Mixed sampling, Sampling
- non sampling errors.

Reference Books:
1. Goon A.M., Gupta M.K. & Dasgupta B. (1994): An Outline of Statistical Theory (Vol -1), World Press
2. Johnson, N.I. & Kotz S. (1970): Distributions in Statistics, John Wiley
3. Ross S.M. (1972): Introduction to Probability Models, Academic Press
4. Mood A.M., Graybill F. & Boes D.C. (1974): An Introduction to the Theory of Statistics (3rd ed),McGraw Hill

5. Hogg R.V. & Craig A.T. (1978): Introduction to Mathematical Statistics
6. Rohatgi V.K. (1984): An Introduction to Probability Th eory & Mathematical Statistics, John Wiley.
7. Stuart G & Ord J.K. (1991): Advanced Theory of Statistics (Vol 2), Charles Griffin
8. Bhattacharya GK & Johnson R. A. (1977): Concepts & Methods of Statistics, John Wiley
9. Sampling Theory and Methods - Murthy.M.N (Statistical Probability Society , Calcutta)
10. Sampling Techniques -Cochran.W.G (Wiley Eastern Ltd)
11. Theory and Analysis of Sample survey - D.Singh and F.S.Chaudhary (John Wiley and Sons)
12. Fundamentals of Statistics (Vol II) - Goon, Gupta & Das Gupta (Sulthan Chand & Sons)
13. Theory and Methods of Survey Sampling. Prentice Hall. Mukhopadhyay, P. (1998)
14. C.S.O. (1984) : Statistical System in India
15. Yule G.U. & Kendall M.G. (1953): An Introductio n to the Theory of Statistics, C.Griffin
16. Kendall M.G. & Stuart A. (1966): Advanced Theory of Statistics (Vol 3), C.Griffin
17. Croxton F.E., Cowden D.J. & Klein (1969): Applied General Statistics, Prentice Hall
18. Mukhopadhyay P. (1999): Applied St atistics

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STA- 206
Statistics Practical Based on CC STA-204, CC STA-205

HOURS: 6 / week   *CREDIT: 2.5*   *EXAM HRS: 3*

(A) Manual Practical
1. Generation of random sample from normal distribution.
2. Fitting of normal distribution.
3. Generation of random sample from gamma distribution
4. Fitting of gamma distribution.
5. Drawing a random sample from Weibull distribution.
6. Large sample tests for testing single mean, difference between two means
7. Large sample tests for testing single proportion, difference between two proportions.
8. Testing significance of the correlation coefficient $\rho = \rho_0$
9. Problems based on bivariate distributions (conditional, marginal and Karl Pearson's Correlation using product moment).
10. Problems based on Markov chains

(B) Practical Using MS Excel
1. Generation of random sample from normal distribution.
2. Fitting of normal distribution.
3. Generation of random sample from gamma distribution
4. Fitting of gamma distribution.
5. Drawing a random sample from Weibull distribution.
6. Large sample tests for testing single mean, difference between two means
7. Large sample tests for testing single proportion, difference between two proportions.
8. Testing significance of the correlation coefficient $\rho = \rho_0$
9. Problems based on bivariate distributions (conditional, marginal and Karl Pearson's Correlation using product moment).
10. Problems based on Markov chains

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