SHIVAJI UNIVERSITY, KOLHAPUR.

B. Sc. Part II: Semester-III: STATISTICS

Syllabus to be implemented from June, 2014.

Paper-V: Probability Distributions-I

Unit-1:Discrete Distributions: Poisson, Geometric and Negative Binomial Distribution (10)

1.1: Definition of random variable (defined on countably infinite sample space)

1.2: Poisson Distribution: Definition of Poisson with parameter λ . Mean, variance**,** probability generating function (p.g.f.). Recurrence relation for successive Probabilities, Additive property of Poisson distribution. Poisson distribution as a limiting case of Binomial distribution, examples.

1.3: Geometric Distribution: Definition of Geometric with parameter p. Mean, Variance, distribution function, p.g.f., Lack of memory property, examples.

1.3: Negative Binomial Distribution: Definition of Negative Binomial with parameters (k, p), Geometric distribution is a particular case of Negative Binomial distribution, Mean, Variance, p.g.f., Recurrence relation for successive probabilities, examples.

Unit-2: Continuous Univariate Distributions: (12)

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

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

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

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

2.5 Examples.

Unit-3: Continuous Bivariate Distributions: (15)

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

3.2: Expectation of function of r.v.^{s} means, variances, covariance, correlation coefficient, conditional expectation, regression as conditional expectation if it is linear function of other variable and conditional variance, proof of i) $E(X \pm Y) = E(X) \pm E(Y)$, ii) $E[E(X/Y)] = E(X)$.

3.3: If X and Y are independent r.v.s. then (i) $E(XY) = E(X)E(Y)$, (ii) $M_{x+y}(t) = M_x(t) M_y(t)$

3.4: Examples.

Unit-4: Transformations of continuous r.v.: (08)

4.1: Transformation of univariate continuous r.v.: Distribution of $Y=g(X)$, where g is monotonic or non-monotonic functions using (i) Jacobian of transformation, (ii) Distribution function and (iii) m.g.f. methods.

4.2: Transformation of continuous bivariate r.v.^{s} : Distribution of bivariate r.v.s. using Jacobin of transformation.

4.3: Examples and problems.

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B. Sc. Part II: Semester-III: STATISTICS

Syllabus to beimplemented from June, 2014.

Paper VI: Statistical Methods-I

Unit 1: Time Series: (08)

1.1: Meaning and need of time series analysis, components of times (i) Secular trend (ii) Seasonal Variation (iii) Cyclical Variation (iv) Irregular Variation, Additive and Multiplicative model, utility of time series.

1.2: Measurement of trend: (i) Moving averages method (ii) Progressive average method (iii) Least square method. (iv) Measurement of seasonal indices by simple average method.

Unit 2: Statistical Quality Control: (12)

2.1: Meaning and purpose of S.Q.C., Process control, Product control, chance causes, assignable causes, Shewhart's control chart- construction & working, lack of control situation.

2.2: Control charts for variables - control chart for mean, control chart for range, construction and working of mean & range charts for unknown standards, revised control limits.

2.3: Control charts for Attributes – Defects, defectives, fraction defective, control chart for fraction defective (p-chart) for fixed sample size and unknown standards, construction and working of chart. Control charts for number of defects (C-chart), for unknown standards, construction and working of C-chart.

Unit-3: Demography (12)

3.1: Introduction and need of vital statistics

3.2: Mortality rates: Crude death rate (CDR), Specific Death Rate (SDR), Standardized Death Rate (STDR).

3.3: Fertility Rates: Crude Birth Rate (CBR), Age Specific Fertility Rate (ASFR), General Fertility Rate (GFR), Total Fertility Rate (TFR).

3.4: Reproduction Rate: Gross Reproduction rate (GRR), Net Reproduction Rate (NRR).

Unit-4: Index Numbers: (13)

4.1: Meaning and utility of index numbers, problems in construction of index numbers.

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

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

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

4.5: Tests of index numbers: unit test, time reversal test and factor reversal tests.

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

4.7: Shifting of base and purchasing power of money.

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SHIVAJI UNIVERSITY, KOLHAPUR.
B. Sc. Part II: Semester-IV: STATISTICS
Structure of the Course to be implemented from June, 2014.

Paper-VII: Probability Distributions-II

Unit-1: Uniform and Exponential Distribution: (10)

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

1.2: Exponential distribution: p.d.f. (one parameter),

$$f(x) = \theta e^{-\theta x}, x \geq 0, \theta > 0$$
$$= 0 \quad , o.w$$

c.d.f., m.g.f., c.g.f., mean, variance, C.V., moments, Cumulants, median, quartiles, lack of memory property, distribution of – (1/ θ) logX where X~U (0, 1).

Unit-2: Gamma and Beta Distributions: (13)

2.1:Gamma distribution: Gamma distribution with scale parameter θ and shape parameter n, special case θ = 1, n =1, m.g.f., c.g.f., mean, mode, variance, moments, cumulants, $\beta_1, \beta_2, \gamma_1$ and γ_2 coefficients, additive property: distribution of sum of i.i.d. exponential variates.

2.2: Beta distribution of first kind: Beta distribution of first kind with parameters m & n. mean, mode, variance, symmetric when m = n, Uniform distribution as a particular case when m = n = 1, distribution of (1-X).

2.3: Beta distribution of second kind: Beta distribution of second kind with parameters m & n. mean, mode, variance, relation between beta distribution of first kind and second kind, distribution of X+Y, X/Y and X/(X+Y) where X and Y are independent gamma variate.

Unit-3: Normal distribution: (10)

Normal distribution with parameters μ & 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 & kurtosis, distribution of linear combination of variates. Distribution of X^2 if X~N (0, 1).

Unit-4: ExactSampling Distributions: (12)

4.1: Chi-Square distribution: Definition of chi square, derivation of p.d.f. of chi square distribution with n degrees of freedom using m.g.f.. c.g.f., mean, variance, moments, cumulants, mode, skewness and kurtosis, additive property.

4.2: Student's t- distribution: Definition of student's t variate. Derivation of p.d.f., mean, mode, variance, moments, $\beta_1, \beta_2, \gamma_1$ and γ_2 coefficients.

4.3: Snedecor's F distribution: Definition of F variate, derivation of p.d.f., mean, variance and mode. Distribution of 1/F. Inter relation between t, F and χ^2 (Without Proof).

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SHIVAJI UNIVERSITY, KOLHAPUR.

B. Sc. Part II: Semester-IV: STATISTICS

Syllabus to beimplemented from June, 2014.

Paper VIII: Statistical Methods-II

Unit-1: Chebychev's Inequality: (05)

1.1: Chebycheve's inequality for discrete and continuous distributions.
1.2: Examples

Unit-2: Reliability Theory: (15)

2.1: Binary Systems: Block diagrams, definition of binary coherent structure and illustrations. Coherent system of component at most three, (a) Series, (b) Parallel, (c) 2 out of 3: Minimal cut, minimal path representation of system.
2.2: Reliability of binary System: reliability of above systems h (p), when components are independent and identically distributed with common probability p of operating.
2.3: Ageing Properties: definitions: Hazard rate, hazard function, survival function, Concept of distributions with increasing and decreasing failure rate (IFR, DFR). Relationship between survival function and hazard function, density function and hazard rate, derivations of results (1) Hazard rate of a series system of components having independent life times is summation of component hazard rates.(2) Life time of series system of independent components with independent IFR life times is IFR,
2.4: Examples on exponential distribution.

Unit3: Testingof Hypothesis - I:(13)

3.1: Notion of Population, Sample, Parameter, Statistic, Sampling distribution of Statistic, hypothesis, Simple and composite hypothesis, Null and alternative hypothesis, type I and type II errors, Critical region, level of significance, p-value. one and two tailed test, power of test.
3.2. Large Sample Tests:
General procedure of testing of hypothesis.
a) Tests for means: i) testing of population mean; H_0: $\mu = \mu_0$
ii) testing equality of population means; H_0: $\mu_1 = \mu_2$
b) Tests for Proportion: i) testing of population Proportion; H_0: $P = P_0$
ii) testing equality of population Proportion; H_0:$P_1 = P_2$
c) test for population correlation: i) H_0: $\rho = \rho_0$ ii) H_0: $\rho_1 = \rho_2$ (by Z-transformation)

Unit4: Testingof Hypothesis - II: (12)

4.1. Definition of Fisher's t- variate
t- test: a) test for means: i) H_0: $\mu = \mu_0$,
ii) H_0: $\mu_1 = \mu_2$, ($\sigma_1 = \sigma_2$)
iii) Paired t- test
4.3. χ^2 – test: i) test for population variance H_0: $\sigma = \sigma_0$,
ii) test for goodness of fit
iii) test for independence of attributes;
a) m x n contingency table
b) 2 x 2 contingency table, Yate's correction for continuity.
4.3. F – test: test for equality of two population variances H_0: $\sigma_1 = \sigma_2$

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SHIVAJI UNIVERSITY, KOLHAPUR.
B. Sc. Part II: STATISTICS
Syllabusto be implemented from June, 2014
Practical Course at B. Sc. Part- II

Objectives:

By the end of course students are expected to:

i. Compute probabilities of standard probability distributions.
ii. Compute the expected frequency and test the goodness of fit.
iii. Drawing random sample from standard probability distribution and sketch of the p.m.f./ p.d.f. for given parameters.
iv. Compute the index numbers.
v. Construction of control charts.
vi. Study the applications of Poisson, geometric and negative binomial distributions.
vi. Interpretation of results.

Practical – II

1. Fitting of Discrete Uniform distribution.
2. Fitting of Binomial distribution.
3. Fitting of Hypergeometric distribution.
4. Fitting of Poisson distribution.
5. Fitting of Geometric distribution.
6. Fitting of Negative Binomial distribution.
7. Model sampling from Discrete Uniform distribution.
8. Model sampling from Binomial distribution.
9. Model sampling from Hypergeometric distribution.
10. Model sampling from Poisson distribution.
11. Model sampling from Geometric distribution.
12. Model sampling from Negative Binomial distribution
13. Fitting of Continuous Uniform distribution
14. Fitting of Exponential distribution
15. Fitting of Normal distribution.
16. Model sampling from Continuous Uniform and Exponential distribution
17. Model sampling from Normal distribution using: (i) Normal table and
(ii) Box-Muller transformation.
18. Application of Exponential & Normal distribution.
19. Fitting of binomial, Poisson & Negative Binomial distribution using MS-EXCEL.
20. Fitting of Exponential & Normal distribution using MS-EXCEL.

Notes: 1. For fitting of all distributions, test of goodness of fit is necessary.

2. For model sampling from all distributions, inverse c.d.f. transformation method has to be used. Expected to draw the sketch of the p.m.f. / p.d.f. for given parameters.

Practical - III

1. Applications of Poisson distribution.
2. Applications of geometric and negative binomial distributions.
3. Fitting of straight lines, second degree curves.
4. Fitting of exponential and power curves of type $Y = a.b^X$, $Y = aX^b$ and $Y = ae^{bX}$
5. Time Series. (Trend by Progressive averages, Moving average &least square methods.)
6. Construction of R and $\overline{X}$ charts.
7. Construction of P and C charts.
8. Index Numbers-I. (computations of index numbers) and)
9. Index Numbers-II (tests of adequacy, Shifting of base, cost of living index number.)
10. Demography I (Mortality rates).

11. Demography II (Fertility and Reproduction rates).
12. Large sample tests for means.
13. Large sample tests for proportions.
14. Tests for population correlation coefficients. (Using Fisher's Z transformation.)
15. Tests based on Chi square distribution.(Test for population variance, Test for goodness of fit.)
16. Tests for independence.
17. Tests based on t distribution ($\mu = \mu_0$, $\mu_1 = \mu_2$; paired t test)
18. Tests based on F distribution. ($\sigma_1 = \sigma_2$,)
19. Fitting of Straight line / Parabola / Exponential curves using MS-EXCEL.
20. Sketch of gamma and beta distributions for various parameters using MS-EXCEL.

Note:

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

Laboratory requirements:

Laboratory should be well equipped with sufficient number of electronic calculators and computers along with necessary software, printers and UPS.

Nature of Theory question Paper of B. Sc. Part–II, Semester-III and IV

Paper – V, VI, VII and VIII

Common Nature of Question Paper as per Science Faculty.

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

a) Each practical paper is of 50 marks, containing four questions each of 20 marks and students has to solve any two questions. In only one of four questions there shall be a sub question of about 10 marks based on MS-EXCL.

b) Evaluation of MS-EXCL based question will be on line and should be demonstrated by the student to the examiner.

c) 5 marks are reserved for journal and 5 marks are for oral for practical paper-II examination.

d) 5 marks are reserved for journal and 5 marks are on study tour report / Case study for practical paper-III examination.

e) Practical examination is of 4 hour duration which includes viva examination and online demonstration.

f) There should be two subject experts at the time of Practical examination.

References:

1. Barlow R. E. and Proschan Frank: Statistical Theory of Reliability and Life Testing. Holt Rinebart and Winston Inc., New Yark.
2. Sinha S. K.: Reliability and Life Testing, Second Edition, Wiley Eastern Publishers, New Delhi.
3. Trivedi R. S.: Probability and Statistics with Reliability and Computer Science Application, Prentice – Hall of India Pvt. Ltd., New Delhi.
4. ParimalMukhopadhyaya: An Introduction to the Theory of Probability. World Scientific Publishing.

5. Hogg R.V. and Criag A.T.: Introduction to Mathematical Statistics (Third edition), Macmillan Publishing, New York.
6. Gupta S. C. &Kapoor V.K.: Fundamentals of Mathematical Statistics. Sultan Chand & sons, New Delhi.
7. Gupta S. C. &Kapoor V.K.: Applied Statistics. Sultan Chand & sons, New Delhi.
8. 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)
9. Walpole R.E. & Mayer R.H.: Probability & Statistics. (Chapter 4, 5, 6, 8, 10) MacMillan Publishing Co. Inc, New York
10. Goon, A.M., Gupta M.K. and Dasgupta B: Fundamentals of Statistics Vol. I and Vol. II World Press, Calcutta.
11.Gupta S.P: Statistical Methods, Sultan Chand and Sons, New Delhi.
12. Srivastav D.S: A Text book of Demography. Speigelman: Demography.
13. Snedecor G.W. and Cochoran W. G. Statistical Methods.Lowa State University Press.
14. Waikar and Lev: Elementary Statistical Methods.

Equivalence

Old Paper	New Paper
Paper-V: Continuous Probability Distributions-I Paper-VI: Bivariate Discrete Distributions and Multiple Regression Analysis	Paper-V: Probability Distributions-I Paper VI: Statistical Methods-I
Paper VII: Continuous Probability Distributions-II Paper VIII: Statistical Methods	Paper-VII: Probability Distributions-II Paper VIII: Statistical Methods-II

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