STATISTICS: COMPLEMENTARY SYLLABUS FOR B.Sc. (MATHEMATICS MAIN)
CBCSSUG 2019 (2019 admission onwards)

1 STA 1C 01 INTRODUCTORY STATISTICS
2 STA 2C 02 PROBABILITY THEORY
3 STA 3C 03 PROBABILITY DISTRIBUTIONS AND SAMPLING THEORY
4 STA 4C 04 STATISTICAL INFERENCE AND QUALITY CONTROL

I. INTRODUCTORY STATISTICS
(CODE: STA1C01)

Module 1: *Official statistics*: The Statistical system in India: The Central and State Government organizations, functions of the Central Statistical Office (CSO), National Sample Survey Organization (NSSO) and the Department of Economics and Statistics.

7 hours

Module 2: *Introduction to Statistics*: Nature of Statistics, Uses of Statistics, Statistics in relation to other disciplines, Abuses of Statistics. Concept of primary and secondary data. Designing a questionnaire and a schedule. Concepts of statistical population and sample from a population, quantitative and qualitative data, Nominal, ordinal and time series data, discrete and continuous data. Presentation of data by table and by diagrams, frequency distributions by histogram and frequency polygon, cumulative frequency distributions (inclusive and exclusive methods) and ogives. Measures of central tendency (mean, median, mode, geometric mean and harmonic mean) with simple applications. Absolute and relative measures of dispersion (range, quartile deviation, mean deviation and standard deviation) with simple applications. Co-efficient of variation, Box Plot. Importance of moments, central and non-central moments, and their interrelationships. Measures of skewness based on quartiles and moments; kurtosis based on moments.

30 hours

Module 3: *Correlation and Regression:* Scatter Plot, Simple correlation, Simple regression, two regression lines, regression coefficients. Fitting of straight line, parabola, exponential, polynomial (least square method).

15 hours

Module 4: *Time series*: Introduction and examples of time series from various fields, Components of times series, Additive and Multiplicative models. Trend: Estimation

of trend by free hand curve method, method of semi averages, method of moving averages and fitting various mathematical curves. Seasonal Component: Estimation of seasonal component by Method of simple averages, Ratio to Trend. *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.

20 hours

References:

1. S.C. Gupta and V.K. Kapoor. *Fundamentals of Mathematical Statistics*, Sultan Chand
& Sons, New Delhi
2. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I
& II, 8th Edn. The World Press, Kolkata.
3. Mukhopadhyay P. (2011): Applied Statistics, 2nded. Revised reprint, Books and Allied
4. Hoel P.G. *Introduction to mathematical statistics*, Asia Publishing house.
5. Chatfield.C. *The Analysis of Time Series: An Introduction*, Chapman & Hall
6. *Guide to current Indian Official Statistics*, Central Statistical Office, GOI, New Delhi.
7. www.mospi.gov.in
8. www.ecostat.kerala.gov.in

SEMESTER II

STA 2C 02- PROBABILITY THEORY

Contact Hours per week: 4

Number of credits: 3

Number of Contact Hours: 72

Course Evaluation: External 60 Marks+ Internal 15 Marks

Duration of Exam: 2 Hours

II. PROBABILITY THEORY
(CODE: STA2C02)

Module 1: *Introduction to Probability:* Random experiment, Sample space, events, classical definition of probability, statistical regularity, field, sigma field, axiomatic definition of probability and simple properties, addition theorem (two and three events), conditional probability of two events, multiplication theorem, independence of events-pair wise and mutual, Bayes theorem and its applications.

25 hour

Module 2: *Random variable*s: Discrete and continuous, probability mass function (pmf) and probability density function (pdf)-properties and examples, Cumulative distribution function and its properties, change of variables (univariate case only)

12 hours

Module 3: *Mathematical expectations (univaraite):* Definition, raw and central moments(definition and relationships), moment generation function and properties,characteristic function (definition and use only), Skewness and kurtosis using moments

15 hours

Module 4: *Bivariate random variables*: Joint pmf and joint pdf, marginal and conditional probability, independence of random variables, function of random variable. BivariateExpectations, conditional mean and variance, covariance, Karl Pearson Correlation coefficient, independence of random variables based on expectation.

20 hours

References :

1. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2nd Edn. (Reprint) John Wiley and Sons.

2. S.C.Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, Sultan Chand
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.

4. John E Freund, *Mathematical Statistics*, Pearson Edn, New Delhi

5. Hoel P.G. *Introduction to mathematical statistics*, Asia Publishing house.

SEMESTER III

STA 3C 03- PROBABILITY DISTRIBUTIONS AND SAMPLING THEORY

Contact Hours per week: 4

Number of credits: 3

Number of Contact Hours: 90

Course Evaluation: External 60 Marks+ Internal 15 Marks

Duration of Exam: 2 Hours

III. PROBABILITY DISTRIBUTIONS AND SAMPLING THEORY.
(CODE:STA3C03)

Module 1: *Standard distributions:* Discrete type-Bernoulli, Binomial, Poisson, Geometric,Negative Binomial (definition only), Uniform (mean, variance and mgf). Continuous type-Uniform, exponential and Normal (definition, properties and applications);Gamma (mean, variance, mgf); Lognormal, Beta, Pareto and Cauchy (Definition only)

30 hours

Module 2: *Limit theorems:* Chebyshev's inequality, Sequence of random variables, parameter and Statistic, Sample mean and variance, Convergence in probability (definition and exampleonly), weak law of large numbers (iid case), Bernoulli law of large numbers, Convergencein distribution (definition and examples only), Central limit theorem (Lindberg levy-iid case)

25 hours

Module 3: Sampling methods: Simple random sampling with and without replacement, systematic sampling (Concept only), stratified sampling (Concept only), Cluster sampling(Concept only)

10 hours

Module 4: Sampling distributions: Statistic, Standard error, Sampling from normal distribution, distribution of sample mean, sample variance, chi-square distribution, t distribution, and F distribution (definition, derivations and relationships only).

25 hours

References:

1. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2nd Edn. (Reprint) John Wiley and Sons.

2. S.C.Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, Sultan Chand
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.

4. John E Freund, *Mathematical Statistics*, Pearson Edn, NewDelhi

5. Cochran W.G. (1984):Sampling Techniques(3rd Ed.), Wiley Eastern.

SEMESTER IV

STA 4C 04 - STATISTICAL INFERENCE AND QUALITY CONTROL

Contact Hours per week: 4

Number of credits: 3

Number of Contact Hours: 90

Course Evaluation: External 60 Marks+ Internal 15 Marks

Duration of Exam: 2 Hours

IV: STATISTICAL INFERENCE AND QUALITY CONTROL.
(CODE: STA4C04)

Module 1: *Estimation theory*: Parametric space, sample space, point estimation. Nayman Factorization criteria, Requirements of good estimator: Unbiasedness, Consistency, Efficiency, Sufficiency and completeness. Minimum variance unbiased (MVU) estimators. Cramer-Rao inequality (definition only). Minimum Variance Bound (MVB) estimators. Methods of estimation: Maximum likelihood estimation and Moment estimation methods (Detailed discussion with problems); Properties of maximum likelihood estimators (without proof); Least squares and minimum variance (concepts only). Interval estimation: Confidence interval (CI);CI for mean and variance of Normal distribution; Confidence interval for binomial proportion and population correlation coefficient when population is normal.

30 hours

Module 2: *Testing of Hypothesis*: Level of significance, Null and Alternative hypotheses, simple and composite hypothesis ,Types of Errors, Critical Region, Level of Significance, Power and p-values. Most powerful tests, Neyman-Pearson Lemma (without proof), Uniformly Most powerful tests. Large sample tests: Test for single mean, equality of two means, Test for single proportion, equality of two proportions. Small sample tests: t-test for single mean, unpaired and paired t-test. Chi-square test for equality of variances, goodness of fit, test of independence and association of attributes. Testing means of several populations: One Way ANOVA, Two Way ANOVA (assumptions, hypothesis, ANOVA table and problems)

35 hours

Module 3: *Non-parametric methods*: Advantages and drawbacks; Test for randomness, Median test, Sign test, Mann-Whiteny U test and Wilcoxon test; Kruskal Wallis test (Concept only)

10 hours

Module 4: *Quality Control:* General theory of control charts, causes of variations in quality, control limits, sub-grouping, summary of out-of-control criteria. Charts of variables - X bar chart, R Chart and sigma chart. Charts of attributes – c-charts, p-chart and np-chart.(Concepts and problems).

15 hours

References:

1. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2nd Edn. (Reprint) John Wiley and Sons.

2. Gupta, S.P. *Statistical Methods*. Sultan Chand and Sons: New Delhi.
3. S.C.Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, Sultan Chand and
Sons
4. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rdEdn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
5. John E Freund, *Mathematical Statistics*, Pearson Edn, NewDelhi
6. Grant E L, *Statistical quality control*, McGraw Hill
7. Montogomery, D. C. (2009): Introduction to Statistical Quality Control, 6th Edition,
Wiley India Pvt. Ltd.