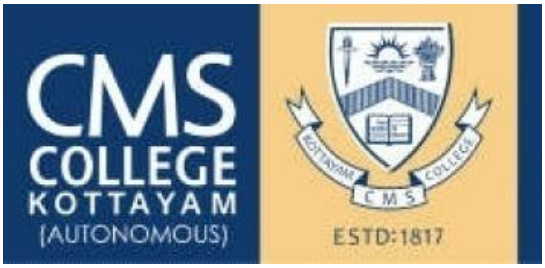

CMS COLLEGE KOTTAYAM

(AUTONOMOUS)

Affiliated to the Mahatma Gandhi University, Kottayam, Kerala

CURRICULUM FOR COMPLEMENTARY COURSE IN STATISTICS

UNDER CHOICE BASED CREDIT SYSTEM 2018
(With effect from 2018)

Approved by the Board of Studies on 26-03-2018

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The Board of Studies of Statistics (Complementary Course), of CMS Colleges takes this opportunity to express our gratitude and deep appreciation to all academicians who had participated in the meeting for the restructuring of the syllabus for the academic year 2018 that was arranged at CMS College, Kottayam.

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Chairman

Board of studies

PREFACE

The complementary course of Statistics taught to the Undergraduate Departments of Mathematics and Physics is designed with the objective of creating a better understanding of Statistics among the future generations which would equip them to be better citizens of tomorrow. The curriculum is framed to equip students to grasp the basic concepts of Statistics and in addition to have a broader vision. A dynamic curriculum accommodates first faced developments in the knowledge of the subject concerned by introducing innovative concepts, multidisciplinary profile and standard education.The course aims to develop critical thinking among the students so as to make them understand the real gap between theoretical components and its actual practice.

Course	Details			
Code	**ST1811201**			
Title	**Descriptive Statistics**			
Degree	**B. Sc**			
Branch(s)	**Mathematics& Physics**			
Year/Semester	**1/I**			
Type	**Complementary**			
Credits	**3**			
Contact hours	Total hours	**72**	Hours /week	**4**

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Define and use the basic terminology of statistics	R,AP	6 PY, 9 MT
2	Analyse and compare different sets of data	An	6 PY 9 MT
3	Classify the data by means of diagrams and graph	AP	6 PY, 9 MT
4	Recall the meanings of statistical terms	R	6 PY, 9 MT
5	Explain the statistical concepts of central tendency, dispersion skewness, Kurtosis & index numbers	U	6 PY, 9 MT
6	Calculate and interpret the various measures of central tendency, dispersion skewness, Kurtosis & index numbers	AP	6 PY, 9 MT

*PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create ,PY –Physics, MT -Maths

Module	Course Description	Hrs	CO.No.
1.0	**DIFFERENT ASPECTS OF DATA, AND ITS COLLECTION**	**20**	
1.1	Introducing Statistics as a science for extracting information from data	2	1
1.2	Concepts of a statistical population and sample.	2	1
1.3	Different types of Bar diagrams	2	3
1.4	Different types of data; primary and secondary ,qualitative and quantitative)	2	2,4
1.5	Collection of data;	2	2,4
1.6	census and sampling methods	2	2,4
1.7	Different types of random samples- simple random sample, systematic, stratified and cluster (description only).	2	2,4
1.8	Classification of Data	2	2
1.9	Frequency distribution	2	3
1.10	Graphical representation of frequency distributions	2	3
2.0	**CENTRAL TENDENCY AND DISPERSION**	**20**	
2.1	Averages- Arithmetic Mean, Median, Mode,	2	5,6
2.2	Geometric Mean, Harmonic Mean and Weighted averages.	2	5,6
2.3	Absolute Measures of dispersion- Range, Quartile Deviation	2	5,6
2.4	Mean Deviation	2	6
2.5	Standard Deviation.	2	6
2.6	Combined mean and standard deviation,	2	6
2.7	Coefficient of variation	2	6
2.8	Relative measures of dispersion	2	6
2.9	Ogives	2	3

2.10	Box plot.	2	3
3.0	**Moments, Skewness and Kurtosis**	**15**	
3.1	Raw moments,	3	5,6
3.2	central moments	3	5,6
3.3	Inter relations between raw moments and central moments	3	5
3.4	Skewness- Pearson's measures of skewness	3	6
3.5	Bowley's and moment measures of skewness		6
3.6	Kurtosis- percentile and moment measure of kurtosis ,	3	6
4.0	**INDEX NUMBERS**	**17**	
4.1	Definition of Index Numbers and Price Index Numbers	1	4
4.2	Price Index Numbers as Simple (A. M.,G. M, H.M and Aggregate Methods)	4	6
4.3	Weighted averages (A. M.)of price.	2	6
4.4	Laspeyer's, Paasche's and Fisher's Index Numbers.	4	6
4.5	Time-Reversal and Factor-Reversal tests.	3	5
4.6	Cost of living index numbers-family budget and aggregate expenditure methods	3	6

Text Books for Reference

1. Goon, A. M.,Gupta M. K. and Dasgupta,B(1986).Fundamentals of Statistics,Volume1, world press, Kolkota
2. Gupta, S. C. and Kapoor, V. K.(2002). Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand and Sons.
3. Gupta, S. C. and Kapoor, V. K.(2007).Fundamentals of applied StatisticsSultanChandand Sons.
4. R.S.N. Pillai, Bagavathi(2010). STATISTICS- Theory and Practice, S.Chand publications.

Course	Details			
Code	**ST1812203**			
Title	**Probability Theory**			
Degree	**B.Sc**			
Branch(s)	**Mathematics& Physics**			
Year/Semester	**2**			
Type	**Complementary**			
Credits	**3**			
Contact hours	Total hours	**72**	Hours /week	**4**

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Define the basic rules of probability	U	6 PY, 9 MT
2	Solve the problems in probability	AP	6 PY, 9 MT
3	Explain the concepts of random variables	U	6 PY, 9 MT
4	Differentiate the ideas between discrete and continuous random variables	An	6 PY, 9 MT
5	Draw the scatter diagram and Regression equations	R	6 PY, 9 MT
6	Calculate the correlation and regression coefficient	AP	6 PY, 9 MT
7	Identify the regression lines	An	6 PY, 9 MT

*PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create ,PY –Physics, MT -Maths

Module	Course Description	Hrs	CO.No.
1.0	**PROBABILITY**	20	
1.1	Random experiments and two types of sample spaces	2	1
1.2	Events, Laws of events	2	1
1.3	Complement, union and intersection of events and their meaning.	2	1
1.4	Mutually exclusive, equally likely and Independent events.	2	1

1.5	Classical approach to probability	2	2
1.6	Frequency and Axiomatic approaches to probability.	2	2
1.7	Theorems -Addition theorem (up to 3 events)	2	2
1.8	Conditional probability. Multiplication theorem (up to 3 events). Independence of events..	2	2
1.9	Bayes' theorem	2	2
1.10	(problems based on the above topics)	2	2
2.0	**PROBABILITY DISTRIBUTION OF UNIVARIATE RANDOM VARIABLES**	**17**	
2.1	Concept of random variables. discrete and continuous random variables.	3	3
2.2	Probability mass and density functions, and cumulative distribution functions.	3	3
2.3	Evaluation of conditional probabilities.	3	4
2.4	Evaluation of unconditional probabilities.	3	4
2.5	Change of variables (discrete)	2	3
2.6	Methods of Jacobian and cumulative distribution function (one variable case)	3	4
3.0	**PROBABILITY DISTRIBUTION OF BIVARIATE RANDOM VARIABLES**	**15**	
3.1	Concept of a two-component random vector	2	3
3.2	Bivariate probability mass and density functions	4	3,4
3.3	Marginal and conditional distributions	4	3,4
3.4	Independence of Bivariate random variables.	5	3,4
4.0	**CORRELATION AND REGRESSION**	**20**	
4.1	Bivariate data types of correlation. scatter diagram.	2	5
4.2	Karl Pearson's product- moment correlation coefficients	2	6
4.3	Spearman's rank correlation coefficients.	2	6
4.4	Invariance of correlation coefficient under linear transformation	2	6
4.5	fitting of polynomial equations of degree one	2	7
4.6	fitting of polynomial equations of degree two	2	7
4.7	fitting of exponential curve	2	7
4.8	Two type of regression equations	2	5,6
4.9	Identification of regression equations.	2	7
4.10	correlation coefficient and regression equations of two way table	2	6

REFERENCES

1. Gupta S. C. and Kapoor V. K.(2002). Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand and Sons.
2. Hogg R. V., Mckean J. W., and Craig A. T.(2014) Introduction to Mathematical Statistics, 6th edition, Pearson Education Inc.
3. R.S.N. Pillai, Bagavathi(2010). STATISTICS- Theory and Practice, S.Chand publications.
4. Medhi J.(2006). Statistical Methods, 2nd edition, New Age International Publishes.
5. Miller, I. and Miller, M.(2014). Mathematical Statistics, 8th edition, Pearson Education Inc.
6. Mood, A. M., Graybill, F.A. and Bose, F.A.(1974).Introduction to Theory of Statistics, Oxford and IBH publishers.
7. Ross, S.(2003). A first comes in probability Pearson, Education Publishers, Delhi

Course	Details			
Code	**ST1813204**			
Title	**Probability Distributions**			
Degree	**B.Sc**			
Branch(s)	**Mathematics& Physics**			
Year/Semester	**3**			
Type	**Complementary**			
Credits	**4**			
Contact hours	Total hours	**90**	Hours /week	**5**

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Explain the concept of mathematical expectation	U	6 PY, 9 MT
2	Illustrate the different aspects of mathematical expectation	AP	6 PY, 9 MT
3	Discuss the discrete and continuous probability distribution	U	6 PY, 9 MT
4	Solve the problems related to discrete and continuous probability distribution	AP	6 PY, 9 MT
5	Describe the Chebychev's inequality, Weak Law of Large Numbers and Bernoulli's Law of Large Numbers	U	6 PY, 9 MT
6	Explain Central Limit Theorem	U	6 PY, 9 MT
7	Identify the different sampling distributions	An	6 PY, 9 MT

*PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create ,PY –Physics, MT -Maths

Module	Course Description	Hrs	CO.No.
1.0	**MATHEMATICAL EXPECTATION**	**20**	
1.1	Expectation of random variables and their functions.	3	1
1.2	Definition of - Raw moments, central moments and their interrelation,	4	1
1.3	A.M, G.M, H.M, S.D, M.D., covariance	4	2
1.4	Pearson's correlation coefficient in terms of expectation.	2	2
1.5	MGF and characteristic function and simple properties.	4	2
1.6	Moments from mgf.	3	2
2.0	**STANDARD PROBABILITY DISTRIBUTIONS**	**25**	
2.1	Uniform(discrete/continuous)- mean, variance, mgf	2	3,4
2.2	Bernoulli (mean, variance, mgf)	2	3,4
2.3	binomial (mean, variance, mgf)	4	3,4
2.4	Poisson (mean, variance, mgf)	4	3,4
2.5	Geometric, exponential (mean, variance, mgf, lack of memory property)	4	3,4
2.6	gamma- one and two parameter(s)(mean, variance, mgf)	3	3,4
2.7	beta(type I and type II) (mean, variance, mgf)	2	3
2.8	Normal distribution with all properties	4	3,4
3.0	**LAW OF LARGE NUMBERS AND CENTRAL LIMIT THEOREM**	20	
3.1	Chebychev's inequality (With problems)	6	5
3.2	Weak Law of Large Numbers	4	5
3.3	Bernoulli's Law of Large	4	5
3.4	Central Limit Theorem (Lindberg- Levy form with proof)	6	6
4.0	**SAMPLING DISTRIBUTIONS**	**25**	
4.1	Concept of sampling and sampling distributions	2	7
4.2	Concept of, Statistic(s) and standard error(s).	2	7
4.3	Mean and variance of sample mean when sampling is from a finite population.	3	7
4.4	Chi-square distributions	4	7

4.5	Student's t distribution	4	7
4.6	Snedecor's F distribution	4	7
4.7	statistics following the above distributions.	3	7
4.8	Relation among Normal, Chi-square, t and F distributions	3	7

Text Books for Reference

1. Goon A. M., Gupta M. K., and Dasgupta B.(2005). Fundamentals of Statistics, Vol. II, 8th edition, World Press, Kolkatta.
2. Gupta S. C. and Kapoor V. K.(2002). Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand and Sons.
3. Hogg R. V., Mckean J. W., and Craig A. T.(2014). Introduction to Mathematical Statistics, 6th edition, Pearson Education Inc.
4. R.S.N. Pillai, Bagavathi(2010). STATISTICS- Theory and Practice, S.Chand publications.
5. Miller, I. and Miller, M.(2014). Mathematical Statistics, 8th edition, Pearson Education Inc.
6. Medhi J.(2006). Statistical Methods, 2nd edition, New Age International Publishes.

Course	Details			
Code	**ST1814206**			
Title	**Statistical Inference**			
Degree	**B.Sc**			
Branch(s)	**Mathematics& Physics**			
Year/Semester	**4**			
Type	**Complementary**			
Credits	**4**			
Author(s) ID				
Vetter(s) ID				
Contact hours	Total hours	**90**	Hours /week	**5**

CO No.	***Expected Course Outcomes*** *Upon completion of this course, the students will be able to*:	Cognitive Level	PSO No.
1	Explain the concept of estimation of parameters	U	6 PY, 9 MT
2	Calculate the problems related to point estimation and interval estimation	AP	6 PY, 9 MT
3	Explain the concepts of Testing of Hypotheses, (Large Sample Tests small sample test)	U	6 PY, 9 MT
4	Solve the problems related to Testing of Hypotheses, (Large Sample Tests small sample test)	AP	6 PY, 9 MT
5	Hypothesize various advanced statistical techniques for modelling and exploring practical situations.	C	6 PY, 9 MT

*PSO-Program Specific outcome; CO-Course Outcome;
Cognitive Level: R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create ,PY –Physics, MT -Maths

Module	Course Description	Hrs	CO.No.
1.0	**POINT ESTIMATION**	**25**	
1.1	Concepts of Estimation, Estimators and Estimates.	2	1
1.2	Point estimation	3	1
1.3	Interval estimation.	3	1
1.4	Properties of good estimators; unbiasednes	4	1
1.5	Efficiency	4	1,2
1.6	Consistency	4	1,2
1.7	Sufficiency	4	1,2
1.8	Factorization theorem (statement).	1	1,2
2.0	**METHODS OF ESTIMATION AND INTERVAL ESTIMATION**	**20**	
2.1	Method of moments	2	2
2.2	Method of maximum likelihood	4	1,2
2.3	Method of minimum variance.	4	1,2
2.4	Cramer-Rao inequality (statement only)	1	1
2.5	confidence intervals for mean,	3	1,2
2.6	confidence intervals for variance	3	1,2
2.7	confidence intervals for proportions	3	1,2
3.0	**TESTING OF HYPOTHESES, LARGE SAMPLE TESTS**	**25**	
3.1	Statistical hypotheses, null and alternate hypotheses	2	3
3.2	Simple and composite hypotheses,	1	3
3.3	Type-I and type-II errors	1	3
3.4	Critical Region. Size and power of a test, p-value (with problems)	5	3,4
3.5	Neyman-Pearson approach.	2	3
3.6	Large sample tests - z-tests for means,	2	3,4
3.7	z-tests for difference of means,	2	3,4
3.8	z-tests for proportion	2	3,4
3.9	z-tests for difference of proportion	2	3,4
3.10	Chi-square tests for independence, homogeneity.	6	3,4
4.0	**SMALL SAMPLE TESTS**	**20**	
4.1	Normal tests for mean, (when o known)	1	3,4

4.2	Normal tests for difference of means and (when o known)	2	3,4
4.3	Normal tests for proportion (when o known)	2	3,4
4.4	t-tests for means (when o unknown),	2	3,4
4.5	t-tests for difference of means (when o unknown),	2	3,4
4.6	paired t-test	2	3,4
4.7	test for proportion(binomial),	2	3,4
4.8	chi-square test	2	3, 4
4.9	F-test for ratio of variances. (derivation not required).	2	5
4.10	Tests for correlation and regression	3	3,4

Text Books for Reference

1. Goon A. M., Gupta M. K., and Dasgupta B.(2005). Fundamentals of Statistics, Vol. 8th edition, World Press, Kolkatta.
2. Gupta S. C. and Kapoor V. K.(2002). Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand and Sons.
3. Hogg R. V., Mckean J. W., and Craig A. T.(2014). Introduction to Mathematical Statistics, 6th edition, Pearson Education Inc.
4. R.S.N. Pillai, Bagavathi(2010). STATISTICS- Theory and Practice, S.Chand publications.
5. Miller, I. and Miller, M.(2014). Mathematical Statistics, 8th edition, Pearson EducationInc.
6. Medhi J.(2006). Statistical Methods, 2nd edition, New Age International Publishes.