BAGALKOT UNIVERSITY

Mudhol Road, Jamkhandi – 587301 Dist: Bagalkote

PROGRAM /COURSE STRUCTURE AND SYLLABUS
Of
Statistics

IV Semester

BACHELOR OF SCIENCE (Statistics)

As Per NEP – 2020 and Adapted from
RCU Belagavi Applicable from the
Academic Year 2024-25

Concept Note, Abbreviation Explanation and Coding:

1. **CBCS** is a mode of learning in higher education which facilitates a student to have some freedom in selecting his/her own choices, across various disciplines for completing a UG/PG program.
2. A credit is a unit of study of a fixed duration. For the purpose of computation of workload as per UGC norms the following is mechanism be adopted in the University:
   One credit (01) = One Theory Lecture (L) period of one (1) hour. One credit (01) = One Tutorial (T) period of one (1) hour.

   One credit (01) = One practical (P) period of two (2) hours.
3. Course: paper/subject associated with AECC, DSC, DSEC, SEC, VBC, OEC, VC, IC and MIL
4. In case of B.Sc. Once a candidate chose two courses/subjects of a particular two department in the beginning, he/she shall continue the same till the end of the degree, then there is no provision to change the course(s) and Department(s).
5. A candidate shall choose one of the Department's courses as major and other Department course as minor in fifth and sixth semester and major course will get continued in higher semester.
6. Wherever there is a practical there will be no tutorial and vice-versa
7. A major subject is the subject that's the main focus of Core degree/concerned.
8. A minor is a secondary choice of subject that complements core major/ concerned.
9. Vocational course is a course that enables individual to acquire skills set that are required for a particular job.
10. Internship is a designated activity that carries some credits involving more than 25 days of working in an organization (either in same organization or outside) under the guidance of an identified mentor. Internship shall be an integral part of the curriculum.
11. OEC: Students should opt OEC from departments other than major and minor disciplines

Abbreviation Explanations:

1. AECC: Ability Enhancement Compulsory Course.
2. DSC: Discipline Specific Core Course.
3. DSEC: Discipline Specific Elective Course.
4. SEC: Skill Enhancement Course.
5. VBC: Value Based Course.
6. OEC: Open/Generic Elective Course
7. VC: Vocational Course.
8. IC: Internship Course
9. L1: Language One
10. L2: MIL
11. L= Lecture; T= Tutorial; P=Practical.
12. MIL= Modern Indian Language; English or Hindi or Telugu or Sanskrit or Urdu

Program Coding:

1. Code 21: Year of Implementation
2. Code BSC: BSC Program under the faculty of Applied Science of the University
3. Code 1: First Semester of the Program, (2 to 6 represent higher semesters)
4. Code AE: AECC, (C for DSC, S for SEC, V for VBC and O for OEC)
5. Code 1: First "AECC" Course in semester, similarly in remaining semester for such other courses
6. Code LK: Language Kannada, similarly Language English, Language Hindi, Language Telugu, Language Sanskrit,&Language Urdu
7. Code 1: Course in that semester.
8. STS: Statistics

SEMESTER-IV										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L7		Kannada	40	60	100	4	-	-	3	2
		Functional Kannada								
L8		English	40	60	100	4	-	-	3	2
		Hindi								
		Sanskrit								
		Arabic								
		Urdu								
DSC7	126BSC04STADSC07T	Statistical Inference-I	40	60	100	4	-	-	4	2
DSC8	126BSC04STADSC08L	Practical	25	25	50	-	-	4	2	3
DSC		Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	3
SEC	126COM03XXXSEC03T	Artificial Intelligence	25	25	50		1	-	2	2
VBC7	126COM04XXXVBC08B	Physical Education-Sports	25		25	-	-	2	1	-
VBC8	126COM03XXXVBC09B	NCC/NSS/R&R(S&G) / Cultural	25		25	-	-	2	1	-
Total Marks					**600**	**Semester Credits**			**22**	

B.Sc. Semester – IV

Subject: STATISTICS
Discipline Specific Course (DSC)

The course STATISTICS in IV semester has two papers (Theory Paper –I for 04 credits & Practical paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Year	II	**Course Code:** 126BSC04MATDSC07T	**Credits**	04
Sem.	IV	**Course Title: STATISTICAL INFERENCE-I**	**Hours**	56
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.	

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO 1 Carryout statistical analysis by identifying families of distributions and the use of order statistics.

CO 2 To find estimators using different methods of estimation and compare estimators.

CO 3 To carryout statistical inference using different tests of hypotheses under different scenarios.

Syllabus- Course 4 (Theory): 21BSC4C2STS2L : Title- STATISTICAL INFERENCE-I	**Total Hrs: 56**
Unit-I Point Estimation-I	**16 hrs**
Families of distributions- location and scale families. Single parameter exponential family. Concept of order statistics, Distribution of maximum and minimum order statistics (with proof) and rth order statistic (without proof). Concepts of estimator and estimate. Criteria for estimators: Unbiasedness, Consistency. Invariance property of consistent estimators. Efficiency and relative efficiency. Mean squared error as a criterion for comparing estimators. Sufficient statistics. Statement of Neyman-Factorization theorem.	
Unit-II : Point Estimation-II	**12 hrs**
Fisher information function. Statement of Cramer–Rao inequality and its applications. Minimum Variance Unbiased Estimator and Minimum Variance Bound Estimator. Maximum likelihood and method of moment estimation; Properties of MLE and moment estimators and examples. Method of Scoring, Rao-Blackwell theorem and examples.	

Unit-III Testing of Hypotheses	**18 hrs**
Statistical hypotheses - null and alternative, Simple and composite hypotheses. Type-I and Type-II errors, test functions. Randomized and non-randomized tests. Size, level of significance, Power function, power of tests. Critical region, p- value and its interpretation. Most Powerful (MP) and UMP test. Statement of Neyman-Pearson Lemma and its applications. Likelihood ratio tests. Large and small samples tests of significance. Tests for single mean, equality of two means, single variance and equality of two variances for normal populations. Tests for proportions.	
Unit-IV Interval Estimation	**10 hrs**
Confidence interval, confidence coefficient, shortest confidence interval. Methods of constructing confidence intervals using pivotal quantities. Construction of confidence intervals for mean, difference of two means, variance and ratio of variances, proportions, difference of two proportions and correlation coefficient.	

Books recommended.

1. Gupta S.C. and V.K. Kapoor (2020), Fundamental of Mathematical Statistics, Sultan Chand and Co. 12th Edition.
2. Hogg, R. V. McKean J. W. and Craig, A. T. (2012), Introduction to Mathematical Statistics, Pearson 7th Edition.
3. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009), Probability and Statistical Inference, 10th Edition, Pearson Education, New Delhi.
4. Kale, B.K. (1999). A First Course on Parametric Inference, New Delhi, Narosa Publishing House.
5. Kendall, M.G., et. al., (1996).An Introduction to the Theory of Statistics, Universal Book Stall.
6. Rohatgi, V.K. and A.K. Md. Ehsanes Saleh. (2002). An Introduction to Probability Theory and Mathematical Statistics, New York, John Wiley.
7. Ross, S.M. (2014), Introduction to Probability and Statistics for Engineers and Scientists, 5th Edition, Academic Press.

B.Sc. Semester – IV

Subject: STATISTICS
Discipline Specific Course (DSC)

Course No.-4 (Practical) : 126BSC04MATDSC08L

Year	II	**Course Code: 21BSC4C2STS2P**	**Credits**	02
Sem.	IV	**Course Title: PRACTICAL**	**Hours**	52
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 25		Summative Assessment Marks: 25	Duration of ESA:.03 hrs.	

Course Outcome (CO):

After completion of course (Practical), students will be able to gain :

CO 1 Practical knowledge of computing the estimates and test statistics using R.

CO 2 Practical knowledge of carrying out statistical inference with different tests of hypotheses.

CO 3 Practical knowledge on carrying out MP and UMP tests using R.

List of the Experiments for 52 hrs / Semesters

Note: The first practical assignment is on R-programming and R packages. Practical assignments 2 to 10 have to be first solved manually (using scientific calculators) and executed using R-programming.

1. Demonstration of R-functions for estimation and testing of hypotheses.
2. Point estimation of parameters and obtaining estimate of standard errors and mean square error.
3. Computing maximum likelihood estimates.
4. Computing moment estimates.
5. Interval estimation: Construction of confidence interval (large and small samples)
6. Evaluation of Probabilities of Type – I and Type – II errors and power of tests.
7. Small sample tests: Tests for mean, equality of means under normality when variance is (i) known (ii) unknown, P-values.
8. Small sample tests: single proportion and equality of two proportions, variance and equality of two variances under normality.P-values for the above tests.
9. Large sample tests: Tests for mean, equality of means when variance is (i) known (ii) unknown, under normality, variance and equality of two variances under normality. P-values for the above tests.
10. MP and UMP tests for parameters of binomial, Poisson distributions, normal and Exponential(scale parameter only) distributions and power curve.

General instructions:

Computation of all the practicals manually and using R

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

Students have to attempt 3 practical questions out of four practical questions given, each carrying 7 marks.

1. **7 Marks**
2. **7 Marks**
3. **7 Marks**
4. **Viva 2 Marks**
5. **Journal 2 Marks**

Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

Books recommended.

1. Gupta S.C. and V.K. Kapoor (2020), Fundamental of Mathematical Statistics, Sultan Chand and Co. 12th Edition.
2. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009), Probability and Statistical Inference, 10th Edition, Pearson Education, New Delhi.
3. Ross, S.M. (2014), Introduction to Probability and Statistics for Engineers and Scientists, 5th Edition, Academic Press.
4. R for beginners by Emmanuel Paradis (freely available at **https://cran.r-project.org/doc/contrib/Paradisrdebuts_en.pdf**)