B.A. in Applied Statistics
Effective from2023-24

Sem.	Type ofCourse	Theory/Practical	Course Code	CourseTitle	Instruction hour/ week	Totalhours /sem	Duration ofExam	Marks			Credits
								Formative	Summative	Total	
V	DSCC-9	Theory	**015AST011**	Distributions and Survival Analysis	04hrs	56	02hrs	40	60	100	04
	DSCC-10	Theory	**015AST012**	Industrial Statistics	04hrs	56	02hrs	40	60	100	04
	DSCC-11	Theory	**015AST013**	Population Studies	04hrs	56	02hrs	40	60	100	04
	Other subject										04
	Other subject										04
	Other subject										04
	SEC-3	Theory	**015AST061**	Basics of Computer Fundamentals	02hrs	28	01hr	20	30	50	02
	Total										**26**
VI	DSCC-12	Theory	**016AST011**	Non-Parametric Inference	04hrs	56	02hrs	40	60	100	04
	DSCC-1**3**	Theory	**016AST012**	Operations Research	04hrs	56	02hrs	40	60	100	04
	DSCC-14	Theory	**016AST013**	Statistics for National Development	04hrs	56	02hrs	40	60	100	04
	Other subject										04
	Other subject										04
	Other subject										04
	Internship/ SEC-4	Theory	016AST061	Quantitative Aptitude for Competitive Examinations/ Project	02hrs	28	01hr	20	30	50	02
	Total										**26**

B.A. Semester–V

DisciplineSpecificCourse(DSC)-9

Course Title: Distributions and Survival Analysis

Course Code:015AST011

Type ofCourse	Theory /Practical	Credits	Instructionhour perweek	TotalNo.ofLectures/Hours /Semester	Durationof Exam	FormativeAssessmentMarks	Summative assessment Marks	TotalMarks
DSCC-9	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1:Solve problems of various analytical environments using different distributions and their properties.

CO2: Practical knowledge of carrying out numerical analysis

CO3: Explain Life Tables, types of life tables, its functions, construction.

CO4: Know survival models, concepts of survival analysis, notion of ageing.

Unit	**Title:**	**56.hrs/sem**
UnitI	Discrete distributions: Rectangular, Geometric, Negative Binomial, Hypergeometric, Multinomial- definition through probability mass function, mean, variance, moments, p.g.f., m.g.f., other properties and applications.	14Hrs
UnitII	Continuous distributions: Uniform, Exponential, lognormal, Pareto, Gamma and Weibull– definition through probability density function, mean, variance, moments, m.g.f., other properties and applications. Bivariate normal distribution- definition through probability density function, marginal and conditional distribution.	14Hrs
UnitIII	Survival Concepts: Life distributions, survival functions, failure rate, Integrated hazard function, residual life time, mean residual life time. Notion of aging:IFR, IFRA, DMRL, NBU, NBUE classes of life distributions and their dual classes. Common Life Distributions: binomial, Poisson, exponential, Weibull, gamma, Pareto and log-normal distributions.	14Hrs
UnitIV	Censoring Schemes: Type I, Type II and progressive or random censoring with biological examples. Estimation of mean survival time and variance of the estimator for Type I and Type II censored data with numerical examples. Non-parametric methods: Actuarial and Kaplan-Meier methods for estimating survival function and variance of the Estimator.	14Hrs

References:

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. Jay Kerns, G. (2010). Introduction to Probability and Statistics using R. 1st Edition, Springer.
5. Ross, S. M. (2014). Introduction to Probability Models. 11th Edition, Elsevier science.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.A. Semester–V

DisciplineSpecificCourse(DSC)-10

Course Title: Industrial Statistics

Course Code:015AST012

Type ofCourse	Theory /Practical	Credits	Instructionhour perweek	TotalNo.ofLectures/Hours /Semester	Durationof Exam	FormativeAssessmentMarks	Summative assessment Marks	TotalMarks
DSCC-10	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1 : Learn about process control and product control, different limits and causes of variation.

CO2 : Understand control chart for variables and process capability.

CO3 : Understand lot acceptance sampling and sampling plans.

CO4 : Construct control charts

CO5 : Know acceptance sampling plans

Unit	Title:	56.hrs/ sem
UnitI	**Statistical Quality Control:** Concept of quality and its management - quality planning, quality control and quality improvement, quality pioneers, quality costs. Meaning, aims and objectives of statistical quality control. Concept of variations and its impact, chance & assignable causes of variation. Relevance of exploratory data analysis, run plot, lag plot, frequency distribution and other QC tools. Statistical quality control, Process control, Product control, Importance & uses of statistical quality control in industry. Introduction to control charts.	14 Hrs
UnitII	**Control charts for variables:** Theoretical basis and practical background of control charts for variables. 3σ - Limits, Warning limits and Probability limits. Derivation of control limits and construction of $\overline{X}$ & R charts and $\overline{X}$ & S charts. Interpretation Criteria for detecting lack of control. Rational subgroups, Natural tolerance limits and specification limits, Process capability studies.	14 Hrs
UnitIII	**Control charts for attributes:** Theoretical basis and practical background of control charts for attributes. Fraction defective p-chart, number of defectives np-chart, number of defects per unit C – chart, and U – chart, derivation of control limits and interpretations.	14 Hrs
UnitIV	**Acceptance Sampling (Product Control) :** Lot Acceptance Sampling – Sampling Inspection,100 % inspection and rectifying	14 Hrs

	inspection AQL, LTPD, Producer's Risk and Consumer's Risk. Acceptance sampling plans – single and double sampling plans by attributes.	

References:

1. Montgomery D.C. (1996) Introduction to Statistical Quality Control, Wiley, New York.
2. Grant E.L. (1980) Statistical Quality Control McGraw Hill, New York.
3. Weetherhill G.B. and Brow D.W. (1991) Statistical Process Control. Chapman and Hall, London.
4. Gupta S C and Kapoor V K. Fundamentals of Applied Statistics. S Chand & Sons.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.A. Semester–V

DisciplineSpecificCourse(DSC)-11

Course Title: Population Studies

Course Code:015AST013

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-14	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):Attheend ofthecourse,studentswillbeableto:

CO1 : Acquire knowledge about the size, composition, organization and distribution of the population.

CO2 : Perform basic demographic analysis using various techniques.

CO3 : Study the trend of population growth which describes the past evolution, present distribution and future changes in the population of an area.

CO4 : Acquire knowledge about the construction of life table and its applications in demographic analysis.

Unit	Title:	42.hrs/ sem
UnitI	**Introduction and Sources of Demographic Data :** Demography**:** Its definition, nature, and scope. Sources of demographic data – salient features of Census, Civil Registration System, Demographic Surveys, their limitations and uses. Coverage and content errors. Vital Statistics: Introduction, definition, and uses of Vital statistics. Sources of data on Vital statistics. Measurement of population, rates, and ratios of vital events.	14 hrs
UnitII	**Measures of Fertility :** Basic concepts and terms used in the study of fertility. Measures of fertility- Crude Birth Rate (CBR), General fertility rate (GFR), Age-Specific Fertility Rate (ASFR), Total Fertility Rate (TFR), use of Birth order statistics, Child Women ratio.	14 hrs
UnitIII	**Measures of Mortality** Basic concepts and definitions of mortality. Measures of mortality- Crude Death Rate (CDR), Age Specific Death Rate(ASDR), Standardized death rates, Neonatal, Perinatal and Postnatal mortality rates, Maternal and Infant mortality rates. Cause Specific Death Rate.	14 hrs

Unit IV	**Measures of reproduction and Life Tables :** Measures of reproduction- Gross Reproduction rate and Net Reproduction rate. Measurement of population growth rate- simple growth rate and compound growth rate. Pearl's Vital Index. Population Estimation, Life tables : Components of a life table, force of mortality and expectation of life table, types of life tables. Construction of life tables using Reed-Merrell's method , Greville's method. Uses of life tables.	14 hrs

References

1	Bhende, Asha and Tara Kanitkar, (2004): Principles of Population Studies, 5th Ed. Himalaya Publishers, New Delhi.
2	Biswas, S. (1988): Stochastic Processes in Demography & Application, Wiley Eastern Ltd.
3	Keyfitz, N and Caswell. H (2005): Applied Mathematical Demography, Springer.
4	Mishra, B. D, (1981): An Introduction to the Study of Population, South Asian Publishers, Pvt. Ltd.
5	Ramakumar, R, (1986): Technical Demography, Wiley Eastern Ltd, New Delhi.
6	Pathak, K. B and F. Ram, (1998): Techniques of Demographic Analysis, Himalaya Publishing House, Mumbai.
7	Pressat, R, (1972): Demographic Analysis, Edward Arnold, London.
8	Shryock, H. S. et al (1979): The Methods & Materials of Demography, Condensed Edition by Stockwell, E. G, Academic Press, New York.
9	Srinivasan K. (1998): Basic Demographic Techniques & Applications, Sage Publications, New Delhi

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.A. Semester–V

Skill Enhancement Course: SEC-3

Course Title:BASICS OFCOMPUTER FUNDAMENTALS

Course Code:015AST061

Type ofCourse	Theory /Practical	Credits	Instructionhour/week	TotalNo.ofLectures/Hours /Semester	Durationof Exam	FormativeAssessmentMarks	Summative assessment Marks	TotalMarks
SEC-3	**Theory**	**02**	**02**	**30hrs.**	**1hr.**	**20**	**30**	**50**

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO 1: Acquire confidence in using computer techniques available to users;

CO 2: Understand data, information and file management;

CO 3: Create documents using Word processor, Spreadsheet& Presentation Software;

CO 4: Understand computer networks, Internet;

CO 5: Use e-Governance applications;

Unit	Title:	30 Hrs/ sem
UnitI	**Introduction:** **Word Processing:** Word Processing Basics; Opening and Closing of documents; Text creation and Manipulation; Formatting of text; Table handling; Spell check, language setting and thesaurus; Printing of word document. **Spread Sheet:** Basics of Spreadsheet; Manipulation of cells; Formulas and Functions; Editing of Spread Sheet, printing of Spread Sheet. **Introduction to Data Analysis Using Excel,Descriptive Statistics using Excel,Graphical presentation using Excel,** Construction of Frequency Tables and Cross Tables.	15 Hrs
UnitII	Use of **Analysis ToolPak for performing:** Anova, Correlation, Covariance, F-Test Two-Sample for Variances, Random Number Generation Rank and Percentile Regression Sampling, t-Test, z-Test.	15 Hrs

References:

1. V.K.Kapoor (2004), Information Technology and computer applications, Sultan Chand and sons, New Delhi.
2. Joseph Schmuller (2016),Statistical Analysis with Excel For Dummies.
3. Vikash Gupta (2001), Condex Computer course kit, Dreamtech,Publications,New Delhi.
4. Rajaaraman and Niharika (2014), Fundamentals of Computers, PHI,NewDelhi.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	5
InternalAssessmentTest2	5
Quiz/Assignment/SmallProject	5
Seminar	5
Total	**20Marks**
FormativeAssessmentasperguidelines.	

B.A. in Applied Statistics

VI Semester

W. e. f.: 2023-24

B.A. Semester–VI

DisciplineSpecificCourse(DSC)-12

Course Title: Non-parametric Inference

Course Code:016AST011

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-12	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1: Understand general concepts of non-parametric statistics

CO2: Know the importance of non-parametric tests

CO3: Perform various non-parametric tests

CO4: Know various applications of these tests

Unit	Title:	56.hrs/ sem
UnitI	Introduction to nonparametric and distribution-free tests, advantages and limitations.One sample tests: Kolmogorov-Smirnov test, sign test, Wilcoxon signed rank test. Applications of these tests.	14 Hrs
UnitII	Two sample tests: Mann-Whitney test (Wilcoxon rank sum test), Wald-Wolfowitz Run test, signed rank and Wilcoxon signed rank test. Applications of these tests.	14 Hrs
UnitIII	Two sampleand other nonparametric tests : Kolmogorov-Smirnov test, Spearman's rank, linear rank statistics, Chi-square goodness of fit and independence of attributes. Applications of these tests.	14 Hrs
UnitIV	Several samples: median test, Kruskal -Wallis test, Friedman's test.Applications of these tests.	14 Hrs

References:

1. Rohatgi V.K. (1984). An Introduction to Probability Theory and Mathematical Statistics. Wiley Eastern, New Delhi.
2. Jayant V. Deshpande, IshaDewan: Non-parametric Statistics, Theory and Methods,;
3. Jean Gibbons and Subhabrata Chakraborti: Non-Parametric Statistical Inference.CRC Press
4. V.K. Rohatgi,StatisticalInference,WILEY Series

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.A. Semester–VI

DisciplineSpecificCourse(DSC)-13

Course Title:**Operations Research**

Course Code:**016AST012**

Type ofCourse	Theory /Practical	Credits	Instructionhour perweek	TotalNo.ofLectures/Hours /Semester	Durationof Exam	FormativeAssessmentMarks	Summative assessment Marks	TotalMarks
DSCC-13	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1 : Formulate a linear programming problem and solve it for optimal solution using graphical Methods.

CO2 : Solve transportation proband give the optimal solution.

CO3 : Solve assignment problems and give the optimal solution.

CO4 : Solve game problems using different techniques.

Unit	Title:	56.hrs/ sem
UnitI	**Linear Programming Problem:** Origin, development, definition and applications of Operations research. Definition of LPP and statement of the general linear programming problem. Definition of terms- Objective function, feasible solution and Optimal solution. Mathematical formulation of linear programming problem in case of two variables with examples. Graphical method of solving LPP and merits and demerits. Simple numerical problems.	14 Hrs
UnitII	**Transportation Problem:** Introduction, definition of Transportation Problem (TP), balanced and unbalanced TP. Feasible solution, basic solution, basic feasible solution, degenerate solution, non-degenerate solution and optimal solution. Methods of finding initial basic feasible solution-North West Corner Rule, Matrix Minima method (lowest cost entry method) and Vogel's approximation method (Unit cost penalty method) and simple problems.	14 Hrs
UnitIII	**Assignment Problem:** Introduction and definition of Assignment problem, mathematical model, balanced and unbalanced assignment problem, Hungarian method of solving an AP, Distinction between Transportation Problem & Assignment Problem. Simple numerical problems on assignment	14 Hrs

UnitIV	**Game Theory:** Introduction, two person zero sum games, Pure and mixed strategies, maximin and minimax principle, games with saddle point and without saddle points, solution of 2x2 rectangular games, 2xn and mx2 graphical method of solving game problems, dominance rule. Simple numerical problems.	14 Hrs

References:

1. Kanti Swarup, Gupta, P.K. and Man Mohan: Operations Research, Sultan Chand & Sons, New Delhi.
2. Gupta, P.K. and Hira, D.S.: Operations Research, S. Chand & Company Ltd., New Delhi.
3. Gupta, R.K.: Operations Research, Krishna Prakashana Mandir, Meerut.
4. Sharma, S.D.: Operations Research, Kedarnath Ramnath & Co. Publishers, Meerut.
5. Kapoor, V.K: Operations Research, Sultan Chand & Sons, New Delhi.
6. Kapoor, V.K.: Operations Research Problems & Solutions, Sultan Chand & Sons, New Delhi.
7. Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.A. Semester–VI

DisciplineSpecificCourse(DSC)-14

Course Title: Statistics for national Development

Course Code:016AST013

Type ofCourse	Theory /Practical	Credits	Instructionhour perweek	TotalNo.ofLectures/Hours /Semester	Durationof Exam	FormativeAssessmentMarks	Summative assessment Marks	TotalMarks
DSCC-11	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1: Different methods of collection of data

CO2: Role of national sample survey office

CO3: Knowledge of different types of sample surveys

CO4:Know different development indices

CO5: Understand some population growth models

Unit	Title:	56.hrs/ sem
UnitI	An outline of present official statistical system in India, Role, function, and activities of Central and State Statistical organizations. Methods of collection of official statistics, their reliability and limitations. Role of Ministry of Statistics & Program Implementation (MoSPI), Central Statistical Office (CSO), National Sample Survey Office (NSSO), Registrar General Office and National Statistical Commission.	14 Hrs
UnitII	Scope and content of Population census of India. Population census methods, economic census. Methods of national income estimation, problems in the estimation of national income. System of collection of Agricultural Statistics. Crop yield, Production Statistics, Crop estimation and forecasting. Statistics related to industries, foreign trade, balance of payment, cost of living, inflation, educational and other social statistics.	14 Hrs
UnitIII	Economic development: Classical growth models of Adam Smith Malthus, Devid Richardo. Growth in per capita income and distributive justice. Indices of development, Human Development Index. Estimation of National Income: product approach, income approach and expenditure approach.	14 Hrs
UnitIV	Poverty measurement: measures of incidence and intensity, combined measures, Kakwani and Sen indices. Population growth models – exponential, logistic, Gompertz models. Population projection using Leslie matrix.	14 Hrs

References:

1. Morris H Hansen and William N Hurwitz. Sample Survey Methods and Theory, Volume 1: Methods and Applications (Wiley Classics Library).
2. Dr V K Gupta and Baidya Nath Mandal. Combinatorics in Sample Surveys VIS-A-VIS Controlled Selection.
3 Gupta, K. R. (2010). Economic Growth Models, Atlantic Publishers and Distributors, New Delhi.
4. Parimal Mukhopadhyay. Theory and Methods Of Survey Sampling
5. Ramkumar, R. (1986). Technical Demography, Wiley Eastern, New Delhi.
6. Sen, A. (1977). Poverty and Inequality, Stanford University Press, USA.
7. Bhende A and Kanitkar T. Principles of population studies, Himalaya publishing house.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40Marks**
FormativeAssessmentasperguidelines.	

B.A. Semester–VI

SEC -4

Course Title:SEC: Quantitative Aptitude for Competitive Examinations

Course Code:016AST061

Type ofCourse	Theory /Practical	Credits	Instructionhour/week	TotalNo.ofLectures/Hours /Semester	Durationof Exam	FormativeAssessmentMarks	Summative assessment Marks	TotalMarks
SEC-4	**Theory**	**02**	**02**	**30**		**20**	**30**	**50**

* in lieu of internship, 01 additional SEC/ Course based Activities may be offered

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1:Develop general skills required competitive exams

CO2: Develop general skills required to take decision logically

CO3: Solve critical problems related to classification, directions, etc.

Unit	Title: for SEC	28.hrs/ sem
UnitI	**Numerical Aptitude** Number Systems, H.C.F. and L.C.M. of Numbers, Square Roots and Cube Roots Fundamental arithmetical operations, Percentage, Profit and Loss, Ratio and Proportion, Simple Interest, Compound Interest, time and work.	14 Hrs
UnitII	**Reasoning and Mental Ability** Coding-Decoding, Symbol notations, Number Series, Analog and Classification, Blood Relations, Direction Sense. Ranking and Comparison, Input and Output, Assumptions, Conclusion and Inferences.	14 Hrs

References:

1. Aggarwal R. S., Quantitative Aptitude for Competitive Examination, S. Chand Publication.
2. Dinesh Khattar, The Pearson Guide To Quantitative Aptitude for Competitive Examination, Pearson Publication.
3. Ningappa A. H. Mental Ability, Ashok Publication.

FormativeAssessmentforTheory	
AssessmentOccasion/type	**Marks**
InternalAssessmentTest1	5
InternalAssessmentTest2	5
Quiz/Assignment/SmallProject	5
Seminar	5
Total	**20Marks**
FormativeAssessmentasperguidelines.	

UG programme: 2023-24

GENERAL PATTERN OF THEORY QUESTION COURSE FOR DSCC/ OEC

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10 marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks
(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours Prescribed

Internship for graduate Programme (As per UGC)

Course title	Internship Discipline specific
No. of contact hours	90
No. of credits	2
Method of evaluation	Presentation/Report of submission/Activity etc.,

- Internship shall be Discipline Specific of 90 hours (2 credits) with a duration 4-6 weeks.
- Internship may be full-time/part-time (full-time during semester holidays and part-time in the academic session).
- Internship mentor/supervisor shall avail work allotment during 6^{th} semester for a maximum of 20 hours.
- The student should submit the final internship report (90 hours of Internship) to the mentor for completion of the internship.
- The detailed guidelines and formats shall be formulated by the universities separately as prescribed in accordance to UGC guidelines.