SHIVAJI UNIVERSITY, KOLHAPUR.

Accredited By NAAC with 'A' Grade

Revised Syllabus For

Bachelor of Science

Part-II

STATISTICS

CBCS PATTERN

Syllabus to be implemented from

June, 2019 onwards.

SHIVAJI UNIVERSITY, KOLHAPUR
CBCS SYLLABUS WITH EFFECT FROM JUNE 2019
B. Sc. Part-II Semester III
SUBJECT – STATISTICS - V
DSC-7C: Probability Distributions–I
Theory : 36 hrs. Marks-50 (Credit 02)

OBJECTIVES:

The main objective of this course is to acquaintstudents with the basic concepts of discrete distributions definedoncountablyinfinitesamplespace,continuous univariate and bivariate distributions, transformationofunivariatecontinuousrandom variable.By the end of course students are expected tobe able to:

a) understand concept of discrete and continuous distributions with real life situations.
b) distinguish between discrete and continuous distributions.
c)findvarious measures of r.v. and probabilities using it's probability distribution.
d) know the relations among the different distributions.
e) understandthe concept of transformationofunivariate and bivariate continuousrandom variable.

CONTENTS:

Unit-1: (18 hrs.)

1.1DiscreteDistributions:Poisson,GeometricandNegativeBinomialDistribution:
Definitionofrandomvariable(definedoncountablyinfinitesamplespace). PoissonDistribution:DefinitionofPoissonwithparameterλ. mean,variance,probability generating function(p.g.f.).Recurrencerelationforsuccessiveprobabilities,Additive propertyofPoissondistribution.Poissondistributionasalimitingcaseof Binomial distribution,examples. GeometricDistribution:DefinitionofGeometricwithparameterp, mean,variance, distributionfunction,p.g.f.,Lackofmemoryproperty,examples. NegativeBinomialDistribution:DefinitionofNegativeBinomialwithparameters(k,p), Geometricdistributionisaparticularcase of NegativeBinomialdistribution,mean,variance, p.g.f.,Recurrencerelationforsuccessiveprobabilities,examples.

1.2ContinuousUnivariateDistribution: Definitionof thecontinuoussamplespacewithillustrations,Definitionofcontinuousrandom variable(r.v.),probability densityfunction(p.d.f.),cumulativedistributionfunction(c.d.f.) anditsproperties. Expectationof r.v.,expectationof functionof r.v.,mean,median,mode,quartiles, variance, harmonicmean,rawandcentralmoments,skewnessandkurtosis, examples. Momentgeneratingfunction(m.g.f.):definitionandproperties(i) Standardization property $M_X(0)=1$,(ii)Effectofchangeoforiginandscale,(iii)Uniquenesspropertyofm.g.f.,if exists,(statementonly).Generationofrawandcentralmoments. Cumulantgeneratingfunction(c.g.f.):definition,relationsbetweencumulantsandcentral moments(uptoorderfour).Examples.

Unit-2: **(18 hrs.)**

2.1 ContinuousBivariateDistribution: Definitionof bivariatecontinuousr. v.(X,Y), Jointp.d.f.,c.d.f.withproperties, marginalandconditionaldistribution,independenceof r.vs.,evaluationof probabilitiesofvariousregionsboundedbystraightlines. Expectation of function of r.v., means, variances, covariance, correlation coefficient, conditionalexpectation,regressionasconditionalexpectationifitislinearfunctionofother variable,conditionalvariance,proofofi)$E(X\pm Y)=E(X)\pm E(Y)$,ii)$E[E(X/Y)]=E(X)$. IfXandYareindependentr. vs.then(i)$E(XY)=E(X)E(Y)$,(ii)$M_{x+y}(t)=M_x(t)\times M_y(t)$.Examples.

2.2Transformationsofcontinuousrandom variable: Transformationofunivariatecontinuousr. v.:DistributionofY=g(X),wheregis monotonicor non-monotonicfunctions using(i)Jacobianoftransformation,(ii)Distributionfunctionand (iii)M.g.f.methods. Transformationofcontinuousbivariater. vs.:Distributionofbivariater. vs.usingJacobian oftransformation. Examplesandproblems.

References and Recommended Readings

1.ParimalMukhopadhyaya: AnIntroductiontotheTheoryofProbability.WorldScientificPublishing.

2.HoggR.V.andCriagA.T.:Introduction toMathematical Statistics(Third edition), MacmillanPublishing, NewYork.

3.GuptaS.C.&KapoorV.K.:FundamentalsofMathematicalStatistics.SultanChand&sons,NewDelhi.

4. Goon, A.M., GuptaM.K. andDasguptaB: Fundamentals of Statistics Vol. Iand Vol. II WorldPress, Calcutta.

5. MoodA.M.,GraybillF.A.:Introduction totheoryofStatistics.(ChapterII,IV,V,VII)andBoesD.C.Tata, McGrawHill,NewDelhi.(ThirdEdition)

6.WalpoleR.E.&MayerR.H.:Probability&Statistics.(Chapter4,5,6,8,10)MacMillanPublishingCo.Inc, NewYork.

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SHIVAJI UNIVERSITY, KOLHAPUR
CBCS SYLLABUS WITH EFFECT FROM JUNE 2019
B. Sc. Part-IISemester III
SUBJECT – STATISTICS - VI
DSC-8C: StatisticalMethods-I
Theory : 36 hrs. Marks-50 (Credit 02)

OBJECTIVES:

The main objective of this course is to acquaint students with the basic concepts of Multiple Linear Regression, Multiple and Partial Correlation, Sampling Theory and Demography.

By the end of the course students are expected to be able to:

a) understand the concept of Multiple Linear Regression.
b) understand the concept of Multiple Correlation and Partial Correlation.
c) know the concept of sampling theory.
d) understand the need of vital statistics and concept of mortality and fertility.

CONTENTS:

Unit 1:(18 hrs.)

1.1 Multiple Linear Regression (for trivariate data only): Concept of multiple linear regression, plane of regression, Yule's notation, correlation matrix, fitting of regression plane by method of least squares, definition of partial regression coefficient and their interpretation. Residual: definition, order, properties, derivation of mean and variance, covariance between residuals.

1.2 Multiple and Partial Correlation (for trivariate data only): Concept of multiple correlation. Definition of multiple correlation coefficient $R_{i.jk}$, derivation of formula for multiple correlation coefficient$R_{i.jk}$. Properties of multiple correlation coefficient; i) $0 \leq R_{i.jk} \leq 1$, (ii) $R_{i.jk} > |r_{ij}|$, (iii) $R_{i.jk} > |r_{ik}|$ i = j =k = 1, 2, 3. i≠ j, i≠ k. Interpretation of $R_{i.jk}$ =1, $R_{i.jk}$ = 0, coefficient of multiple determination $R^2_{1.23}$. Concept of partial correlation. Definition of partial correlation coefficient $r_{ij.k}$, derivation of formula for$r_{ij.k..}$Properties of partial correlation coefficient; (i) $-1 \leq r_{ij.k} \leq 1$, (ii) $b_{ij.k} \times b_{ji.k} = r^2_{ij.k}$. Examples and problems.

Unit-2: (18 hrs.)

2.1 Sampling Theory: Concept of distinguishable elementary units, sampling units, sampling frame, random sampling and non-random sampling. Advantages of sampling method over census method, Objectives of a sample survey, Designing a questionnaire, Characteristics of a good questionnaire, Concept of sampling and non-sampling errors, Handling of non-response cases. Simple random sampling - Simple random sampling from finite population of size N withreplacement (SRSWR) and without replacement (SRSWOR): Definitions, population mean and population total as parameters. Following Results with proof:

i. In SRSWOR, the probability of a specified unit being selected in sample at any given draw is equal to 1/N.
ii. In SRSWOR, the probability of a specific unit included in the sample is n/N.
iii. In SRSWOR, the probability of drawing a sample of size 'n' from a population of size N units is $\frac{1}{\binom{N}{n}}$.
iv. In SRSWR, the probability of a specific unit included in the sample is $1 - \left(1 - \frac{1}{N}\right)^n$.
v. In SRSWR, the probability of drawing a sample of size n from a population of size N units is $\frac{1}{N^n}$.

2.2Demography: Introductionandneedofvitalstatistics.MortalityRates:Crudedeathrate(CDR),SpecificDeathRate(SDR),StandardizedDeathRate (STDR).FertilityRates:CrudeBirthRate(CBR),AgeSpecificFertilityRate(ASFR),GeneralFertility Rate(GFR),TotalFertilityRate(TFR). ReproductionRate:GrossReproductionrate(GRR),NetReproductionRate(NRR).

References and Recommended Readings

1. Cochran,W.G:SamplingTechniques,WileyEasternLtd.,NewDelhi.
2. DesRaj:SamplingTheory.
3.Gupta S.C. and Kapoor V. K., "Fundamentals of Applied Statistics", Sultan and Chand, (2010).
4.Mukhopadhay,Parimal:TheoryandMethodsofSurveySampling,PrenticeHall.
5. SrivastavD.S:ATextbookofDemography.
6. Sukhatme,P.V.andSukhatme,B.V.:SamplingTheoryofSurveyswithApplications, IndianSocietyofAgriculturalStatistics,NewDelhi.

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SHIVAJI UNIVERSITY, KOLHAPUR
CBCS SYLLABUS WITH EFFECT FROM JUNE 2019
B. Sc. Part-IISemester IV
SUBJECT – STATISTICS - VII
DSC-7D: ProbabilityDistributions-II
Theory : 36 hrs. Marks-50 (Credit 02)

OBJECTIVES:

The main objective of this course is to acquaint students with the Uniform, Exponential, Gamma and Beta, Normal distributions and Exact Sampling distributions.

By the end of the course students are expected to be able to:

a) know some standard continuous probability distributions with real life situations.
b) distinguish between various continuous distributions.
c) find the various measures of continuous random variable and probabilities using its probability distribution.
d) understand the relations among the different distributions.
e) understand the Chi-Square, t and F distributions with their applications and inter relations.

CONTENTS:

Unit-1: (18 hrs.)

1.1UniformandExponentialDistribution: Uniformdistribution:DefinitionofUniformdistribution over(a,b), c.d.f.,m.g.f.,mean,variance,moments.Distributionof(i)(X-a)/(b-a), ii)(b-X)/(b-a), (iii)Y=F(x)whereF(x)isc.d.f.ofanycontinuousr.v.

Exponentialdistribution: p.d.f.(oneparameter),

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

c.d.f., m.g.f., c.g.f., mean, variance, C.V., moments, cumulants, median, quartiles, lack ofmemoryproperty,distributionof $-(1/\theta)\log X$ where $X\sim U(0,1)$.

1.2 GammaandBetaDistributions:

Gammadistribution:Gammadistributionwithscaleparameterθandshapeparametern, specialcase$\theta=1$,$n=1$,m.g.f.,c.g.f.,mean,mode,variance,moments,cumulants,$\beta_1,\beta_2,\gamma_1$and$\gamma_2$coefficients,additiveproperty:distributionofsumofi.i.d.exponentialvariates.

Betadistributionoffirstkind:Betadistributionoffirstkindwithparametersm&n. mean,mode,variance,symmetricwhenm=n,uniformdistributionasaparticularcase whenm=n=1,distributionof(1-X).

Betadistributionofsecondkind:Betadistributionofsecondkindwithparametersm&n. mean, mode, variance, relation between beta distributionof first kind and second kind, distributionofX+Y,X/YandX/(X+Y)whereXandYareindependentgammavariate.

Unit-2: (18 hrs.)

2.1 Normaldistribution: 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,meandeviation, moments,cumulants,measuresof skewness& kurtosis,distributionof linearcombinationof variates.DistributionofX^2if$X\sim N(0,1)$.

2.2ExactSamplingDistributions: Chi-Squaredistribution:Definitionofchi-square,derivationofp.d.f.ofchisquaredistribution withndegreesoffreedomusingm.g.f.,mean,variance, mode,moments, c.g.f.,cumulants,skewnessandkurtosis,additiveproperty.

Student'st-distribution:Definitionofstudent'st

variate.Derivationofp.d.f.,mean,mode,variance,moments,β_1,β_2,$\gamma_1$and$\gamma_2$coefficients.
Snedecor's Fdistribution: Definition ofFvariate, derivation ofp.d.f., mean, variance and mode.Distributionof1/F.Interrelationbetweent,Fandχ^2(WithoutProof).

References and Recommended Readings

1. Trivedi R. S.: Probability and Statistics with Reliabilityand Computer ScienceApplication, Prentice – HallofIndiaPvt.Ltd.,NewDelhi.
2.ParimalMukhopadhyaya: AnIntroductiontotheTheoryofProbability.WorldScientificPublishing.
3.HoggR.V.andCriagA.T.:Introduction toMathematical Statistics(Third edition), MacmillanPublishing, NewYork.
4. Goon, A.M., GuptaM.K. andDasguptaB: Fundamentals of Statistics Vol. Iand Vol. II WorldPress, Calcutta.
5.GuptaS.C.&KapoorV.K.:FundamentalsofMathematicalStatistics.SultanChand&sons,NewDelhi.
6.GuptaS.C.&KapoorV.K.:AppliedStatistics.SultanChand&sons,NewDelhi.
7. MoodA.M.,GraybillF.A.:Introduction totheoryofStatistics.(ChapterII,IV,V,VII)andBoesD.C.Tata, McGrawHill,NewDelhi.(ThirdEdition)
8.WalpoleR.E.&MayerR.H.:Probability&Statistics.(Chapter4,5,6,8,10)MacMillanPublishing Co.Inc, NewYork

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SHIVAJI UNIVERSITY, KOLHAPUR
CBCS SYLLABUS WITH EFFECT FROM JUNE 2019
B. Sc. Part-IISemester IV
SUBJECT – STATISTICS -VIII
DSC-8D: StatisticalMethods-II
Theory : 36 hrs. Marks-50 (Credit 02)

OBJECTIVES:

The main objective of this course is to acquaint students with the concepts of Time Series, Reliability Theory, Statistical Quality Control, Testing of Hypothesis.

By the end of the course students are expected to be able to:

a) know the concept and use of time series.
b) understand the meaning, purpose and use of Statistical Quality Control, construction and working of control charts for variables and attributes
c) apply the small sample tests and large sample tests in various situations.

CONTENTS:

Unit-1:(18 hrs.)

1.1TimeSeries: Meaningandneedoftimeseriesanalysis,componentsof time series; (i) Secular trend(ii)Seasonal variation(iii) Cyclicalvariation(iv) Irregularvariation,AdditiveandMultiplicativemodel, utilityoftimeseries. Measurementoftrend:(i)Movingaveragesmethod(ii)Progressiveaveragemethod(iii)Least squaremethod.(iv)Measurementofseasonalindicesbysimpleaveragemethod.

1.2StatisticalQualityControl: Meaningandpurposeof S.Q.C.,Processcontrol,Productcontrol,chancecauses,assignable causes,Shewhart'scontrolchart-construction&working,lackofcontrolsituation.Controlchartsforvariables-controlchartformean,controlchartforrange,constructionand workingofmean&rangechartsforunknownstandards,revisedcontrollimits.Controlcharts forAttributes– Defects,defectives,fractiondefective,controlchartforfraction defective(p-chart)for fixedsamplesizeandunknownstandards,constructionandworkingof chart.Controlchartsfor numberofdefects(C-chart)for unknownstandards,constructionand workingofC-chart.

Unit2:(18 hrs.)

2.1Testing ofHypothesis-I: Notion of Population, Sample, Parameter,Statistic,Derivation of samplingdistribution of Statistic $\bar{X}$ and S^2 when sample is from normal distribution, hypothesis, simpleandcomposite hypothesis,nullandalternativehypothesis, typeIandtype IIerrors,criticalregion,levelofsignificance.oneandtwotailedtest,poweroftest.

LargeSampleTests:Generalprocedureoftestingofhypothesis.a)Testsformeans:i)testing ofpopulationmean;$H_0:\mu=\mu_0$, ii)testingequalityofpopulationmeans;$H_0:\mu_1=\mu_2$b)TestsforProportion:i)testingofpopulationproportion;$H_0:P=P_0$ii)testingequalityofpopulationproportion;$H_0:P_1=P_2$c)testforpopulationcorrelation:i)$H_0:\rho=\rho_0$ii)$H_0:\rho_1=\rho_2$(byZ-transformation)

2.2Testing ofHypothesis-II (Small sample Tests): DefinitionofFisher'st-variate,
t-test: a)testformeans:i)H0:$\mu=\mu_0$,ii)$H_0:\mu_1=\mu_2$,$(\sigma_1^2=\sigma_2^2)$, iii)Pairedt-test,
χ^2–test:i)testforpopulationvarianceH0:$\sigma^2=\sigma_0^2$(Mean known and unknown),
ii)testforgoodnessoffit,
iii)testforindependenceofattributes;a)mxncontingencytable,
b)2x2contingencytable-Test statistic with proof,Yate'scorrectionforcontinuity.
F–test: testforequalityoftwopopulationvariancesH0:$\sigma_1^2=\sigma_2^2$.

References and Recommended Readings

1. Barlow R. E. and ProschanFrank,"Statistical Theory of Reliability and Life Testing",Holt RinebartandWinstonInc.,NewYark.
2. Chatfield C. "The Analysis of Time Series –An Introduction", Chapman & Hall, 2004.
3.GuptaS.C.& KapoorV. K.,"Fundamentals of AppliedStatistics",SultanChand&Sons,NewDelhi.
4. Kendall M.G. "Time Series", Charles Griffin, 1978.
5. MontgomeryD.C. "IntroductiontoStatistical QualityControl", John Wiley and sons, 2009.
6.SinhaS.K., "ReliabilityandLifeTesting",SecondEdition,WileyEasternPublishers,NewDelhi.
7. SnedecorG.W.andCochoranW.G."StatisticalMethods",LowaStateUniversityPress.

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Equivalencefor Theory Papers

OldSyllabus		**Revised Syllabus**	
Semester No. Paper No.	**Title of the Paper**	**Semester No. Paper No.**	**Title of the Paper**
Semester III Paper V	ProbabilityDistributions-I	SemesterIII DSC – 7C **STATISTICS - V**	ProbabilityDistributions-I
Semester III Paper VI	StatisticalMethods-I	SemesterIII DSC – 8C **STATISTICS - VI**	StatisticalMethods-I
Semester IV Paper VII	ProbabilityDistributions-II	SemesterIV DSC – 7D **STATISTICS - VII**	ProbabilityDistributions-II
Semester IV Paper VIII	StatisticalMethods-II	SemesterIV DSC – 8D **STATISTICS - VIII**	StatisticalMethods-II

SHIVAJI UNIVERSITY, KOLHAPUR
CBCS SYLLABUS WITH EFFECT FROM JUNE 2019
B. Sc. Part-II
SUBJECT – STATISTICS -Practical
Practical: 192 hrs. Marks-100 (Credit 04)

OBJECTIVES:

By the end of the course students are expected to be able to:

a) compute probabilities of standard probability distributions.
b) compute the expected frequencies and test the goodness of fit.
c) understand how to obtain random sample from standard probability distribution and sketch of the p.m.f./p.d.f. for given parameters.
d) fit plane of multiple regression and compute multiple and partial correlation coefficients.
e) draw random samples by various sampling methods
f) construct various control charts.
g) understandthe applications of Poisson, Geometric and Negative Binomial distributions.

Practical–II(Credit 02)

1.FittingofDiscreteUniformdistribution.
2.FittingofBinomialdistribution.
3.FittingofHypergeometricdistribution.
4.FittingofPoissondistribution.
5.FittingofGeometricdistribution.
6.FittingofNegativeBinomial distribution.
7.ModelsamplingfromDiscreteUniformdistribution.
8.ModelsamplingfromBinomialdistribution.
9.ModelsamplingfromHypergeometricdistribution.
10.ModelsamplingfromPoissondistribution.
11.ModelsamplingfromGeometricdistribution.
12.ModelsamplingfromNegativeBinomialdistribution.
13.FittingofContinuousUniformdistribution.
14.FittingofExponentialdistribution.
15.FittingofNormaldistribution.
16.ModelsamplingfromContinuousUniformdistribution.
17. ModelsamplingfromExponentialdistribution.
18.ModelsamplingfromNormaldistributionusing:(i)Normaltableand (ii)Box-Mullertransformation.
19.FittingofBinomial,Poisson&NegativeBinomialdistributionusingMS-EXCEL.
20.FittingofExponential&NormaldistributionusingMS-EXCEL.

Practical–III (Credit 02)

1. ApplicationsofPoissondistribution.
2. Applicationsof Geometricand Negative Binomialdistributions.
3. ApplicationofExponential&Normaldistribution.
4. Multiple regression.
5. Multiple correlation.
6. Partial correlation.
7. Simplerandomsampling.
8. DemographyI(Mortalityrates).
9. DemographyII(FertilityandReproductionrates).
10. TimeSeries.(Trendbymovingaverage method&leastsquaremethod, Seasonal indicesby simple average method.)
11. ConstructionofR and $\overline{X}$ charts.
12. ConstructionofPandCcharts.
13. Largesampletestsformeans.
14. Largesampletestsforproportions.
15. Testsforpopulationcorrelationcoefficients.(UsingFisher'sZtransformation.)
16. TestsbasedonChi-squaredistribution. (Testforpopulationvariance,Testforgoodness offit, Testsforindependence.)
17. Testsbasedontdistribution.($\mu=\mu_0,\mu_1=\mu_2$;pairedttest)
18. TestsbasedonFdistribution.($\sigma_1=\sigma_2$)
19. Sketch of discrete distributions: Binomial, Poisson, Geometric and Negative Binomial distributionfor various parameters using MS-EXCEL.
20. Sketch of continuous distributions: Exponential, Gamma and Beta distributions for variousparameters using MS-EXCEL.

Note: 1.Forfittingofalldistributions,testofgoodnessoffitisnecessary.
2.Formodelsampling fromalldistributions, inversec.d.f.transformation methodhastobe used in Practical - II.
3.For experiment no.1 to 6 in Practical II, Probabilities has to be calculated by recurrence relation only.
4. There should be at least FOUR problems in each experiment.
5. Computer printout is to be attached to the journal for the experiment based on MS-EXCEL.
6. Observation table and/or calculations using statistical formulae should be done by MS-EXCEL and verify by using library functions for theexperiment based onMS-EXCEL.
7. Student must complete the entire practical to the satisfaction of the teacher concerned.
8. Student must produce the laboratory journal along with the completion certificate signed by Head of Department, at the time of practical examination.
9. There will be study tour or case study. Areport on the same has to besubmittedbyeverystudent alongwiththejournal.

Laboratoryrequirements:
Laboratoryshouldbewellequippedwithsufficientnumberofelectroniccalculatorsandcomputer s alongwithnecessarysoftware,printersandUPS.

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. There should be one sub-question of 10 marks based on MS-EXCEL in any one of the four questions.

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

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

d) 5 marks are reserved for journal and 5 marks are reserved for study tourreport/Casestudyinpracticalpaper- III examination.

e) Practical examination is of 4hours duration which includes oral as well asonline demonstration.

f)Thereshouldbetwosubjectexpertsatthetimeofpracticalexamination.

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