KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

ಸ್ವಾತಂತ್ರ್ಯದ ಅಮೃತ ಮಹೋತ್ಸವ

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'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/JS/MGJ(Gen)/2023-24/59 Date: 04/09/2023

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2023–24ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಪದವಿಗಳಿಗೆ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 104 ಯುಎನ್ಇ 2023, ದಿ: 20.07.2023.
2. ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 2 ರಿಂದ 7, ದಿ: 31.08.2023.
3. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 04/09/2023

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2023–24ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music) /BVA / BTTM / BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS) / BBA & BA ILRD ಸ್ನಾತಕ ಪದವಿಗಳ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020ರ ಮುಂದುವರೆದ ಭಾಗವಾಗಿ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಕೋರ್ಸಿನ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಭಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

04/9/23
ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂರ್ತಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERSITY, DHARWAD

B.Sc.in Mathematics

SYLLABUS

With Effect from2023-24

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM V & VI

and

SKILL ENHANCEMENT COURSE(SEC) FOR SEMV SEM

AS PER NE P-2020

Karnatak University, Dharwad

B.Sc.in **-Mathematics**

Effective from2023-24

Sem.	Type of Course	Theory/Practical	Course Code	CourseTitle	Instruction hour/ week	Total hours /sem	Duration ofExam	Marks			Credits
								Formative	Summative	Total	
V	DSCC-9	Theory	035 MAT 011	Real Analysis-II and Complex Analysis	04hrs	56	02hrs	40	60	100	04
	DSCC-10	Practical	035 MAT 012	Practicals on Real Analysis-II and Complex Analysis	04hrs	56	03hrs	25	25	50	02
	DSCC-11	Theory	035 MAT 013	Vector Calculus and Analytical Geometry	04hrs	56	02hrs	40	60	100	04
	DSCC-12	Practical	035 MAT 014	Practicalson Vector Calculus and Analytical Geometry	04hrs	56	03hrs	25	25	50	02
	Other subject										04
	Other subject										04
	Other subject										04
	SEC-3	Practical	035MAT061	Programming with Python	04hrs	56	03hrs	25	25	50	02
	Total										**26**
VI	DSCC-13	Theory	036 MAT 011	Algebra-III and Special Functions	04hrs	56	02hrs	40	60	100	04
	DSCC-14	Practical	036 MAT 012	Practicals on Algebra-III and Special Functions and Special Functions	04hrs	56	03hrs	25	25	50	02
	DSCC-15	Theory	036 MAT 013	Numerical Analysis	04hrs	56	02hrs	40	60	100	04
	DSCC-16	Practical	036 MAT 014	Practicals on Numerical Analysis	04hrs	56	03hrs	25	25	50	02
	Other subject										4
	Other subject										4
	Other subject										4
	Internship-1		036 MAT 091	Internship				50	0	50	02
	Total										**26**

B.Sc. Semester–V

Discipline Specific Course(DSC)-9

Course Title: Real Analysis-II and Complex Analysis

Course Code:035 MAT 011

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No.of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-9	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):At the end of the course students will be able to:

CO1: Carry out certain computations such as computing upper and lower Riemann sums aswellintegrals

CO2:Describevariouscriteriaforthe Integrabilityoffunctions.

CO3: Exhibit certain properties of mathematical objects such as integrable functions, analyticfunctions,harmonic functions andsoon.

CO4: ProvesomestatementsrelatedtoRiemannintegrationaswellasinthe complexanalysis

CO5: Carry out the existing algorithms to construct mathematical structures such as analyticfunctions

CO 6: Appliesthegainedknowledgetosolvevariousotherproblems.

Unit	Title:Real Analysis-II and Complex Analysis	56.hrs/sem
UnitI	**RiemannIntegration-I**: Definition&examplesforpartitionofaninterval,refinementofapartitionandcommonrefinement.RiemannDarbouxSums-Upperandlower(Darboux)sums–definition,properties&problems. RiemannIntegral–UpperandLowerintegrals(definition&problems),Darboux'stheoremand Criterion for Integrability, Integrability of sum,difference, product,quotient and modulusofintegrablefunctions.Integralasalimitofsum(Riemannsum)–Problems.Someintegrable functions – Integrability of continuous functions,monotonicfunctions,boundedfunctionswithfinitenumberofdiscontinuity.	14 hrs
UnitII	**Riemann-StieltjesIntegralandImproperIntegral:** Fundamental theorem of Calculus–related problems, change of variables, integration by parts, firstandsecondmeanvaluetheoremsofintegralcalculus.Riemann-StieltjesIntegral–Definition&examples.RiemannIntegralasaspecialcase.ImproperIntegral-Improperintegrals of the first,second and third kind with examples. Improper integral has thelimitofthe proper integral. Comparison test, Abel's test and Dirichlet's test for the convergence of theintegralofaproductoftwofunctions.	14 hrs
UnitIII	**Complexnumbersandfunctionsofcomplexvariables:**Recaptulations(Complex numbers-Cartesianandpolarform - geometricalrepresentation - complex - Plane - Euler's formula - $e^{iz}=\cos z + i\sin z$.) Functionsofa complexvariable - limit, continuity anddifferentiabilityofacomplexfunction.Analyticfunction,Cauchy-RiemannequationsinCartesianandPolarforms – Sufficient conditionsforanalyticity (Cartesianformonly)-Harmonicfunction - standardpropertiesofanalyticfunctions -	14 hrs

	constructionofanalyticfunctionwhenthe realorimaginarypartisgiven - MilneThomsonmethod.	
UnitIV	**TransformationsandComplexintegration**: Transformations:Definition - Jacobianofatransformation - Identitytransformation –Reflection – Translation – Rotation – Stretching – Inversion - Linear transformation – Definitions - Bilineartransformations –Cross-ratiooffourpoints –Cross-ratiopreservingproperty - Preservationofthe family ofstraightlines and circles - Conformalmappings – Discussionofthe transformations $w=z^2$,$w=\sin z$,$w=e^z$,$w=\frac{1}{2}\left(z+\frac{1}{z}\right)$.Complexintegration – definition,Lineintegral,propertiesandproblems. Cauchy'sIntegraltheorem - proofusingGreen'stheorem - directconsequences. Cauchy'sIntegralformulawithproof - Cauchy'sgeneralizedformulaforthederivativeswithproofandapplicationsforevaluationofs implelineintegrals.	14 hrs

References:

1. S.CMalik,*RealAnalysis*,NewAgeInternational(India)Pvt.Ltd.
2. S.C.MalikandSavitaArora,*MathematicalAnalysis*,2nded.NewDelhi,India:NewAgeinternational(P)Ltd.
3. RichardRGoldberg,*MethodsofRealAnalysis*,OxfordandIBHPublishing
4. AjitKumrandS.Kumaresan-*A BasicCourseinRealAnalysis*,TaylorandFrancisGroup.
5. L.V.Ahlfors,*ComplexAnalysis*,3rdEdition,McGrawHillEducation
6. BruceP.Palka,*IntroductiontotheTheoryofFunctionofaComplexVariable*,Springer
7. SergeLang,*ComplexAnalysis*,Springer
8. Shanthinarayan,*TheoryofFunctionsofaComplexVariable*,S.ChandPublishers.
9. S.Ponnuswamy,*FoundationsofComplexAnalysis*,2ndEdition,AlphaScienceInternationalLimited.
10. R.V.Churchil&J.W.Brown,*ComplexVariablesandApplications*,5thed,McGrawHillCompanies

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester–V

Discipline Specific Course(DSC)-10

Course Title:Practicals on Real Analysis-II and Complex Analysis

Course Code:035 MAT 012

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No.of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-10	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs):At the end of the course, students will be able to:

CO1: Learn *Free and Open Source Software (FOSS)* tools for computer programming.

CO2: Solve problems on Real Analysis and Complex Analysis studied in **035MAT011**by using FOSS softwares

CO3: Acquire knowledge of applications of Real Analysis and Complex Analysis through FOSS

Expt. No,	Title:Practicals on Real Analysis-II and Complex Analysis	56.hrs/ sem
1	Programtocheckwhetheragivensetofrealnumbersattainssupremumor infimum.	
2	Program to find upper and lower Riemann sums with respect to a givenpartition	
3	ProgramtotestRiemannIntegrability.	
4	ProgramtoevaluateRiemannintegralasalimitofsum.	
5	Programonverification ofCauchy –Riemannequations(Cartesian form)or testforanalyticity.	
6	ProgramonverificationofCauchy–Riemannequations(Polarform)ortestforanalyticity.	
7	Programtocheckwhetherafunctionisharmonicornot.	
8	Programtoconstructanalyticfunctions(throughMilne–Thompsonmethod)	
9	ProgramtofindCross-ratioofpointsandrelatedaspects.	
10	Programtofindfixedpointsofbilineartransformations.	
11	ProgramtoverifyDeMoivre’stheorem.	

Instruction to the Examiner:

1. In case the University question papers are not available the external examiner shall prepare question papers for all the experiments, in consultation with the internal examiner.
2. No students shall be allowed for the examination without their Journal / Practical records, certified by the Staff in charge and Head / Principal. If the Journal/ Practical record is not presented by the student, the Head/Principal shall issue a certificate stating that he/she has attended the regular practicals and his/her attendance is satisfactory (not less than 75% including 10% of extracurricular activities if applicable) and the candidate shall then be allowed to appear for examination. In such cases, the marks reserved, for the journal shall be deducted.
3. Candidates having an attendance record of less than 75 % (including 10% of extracurricular activities, if applicable) in that practical paper shall not be allowed to take the practical examination.
4. The Principal shall permit the students to take the examination as out of turn in any other batches only on technical reasons like overlapping of the timings with other subjects but not for any other personal reasons of the candidate including medical grounds.
5. No practical examination shall be conducted in the absence of an external examiner. Absence of external examiner if any is to be brought to the notice of the principal by the internal examiner to enable alternative arrangements to be made. The Principal shall appoint external examiners as per the instruction already given. If the internal examiner remains absent, the principal shall appoint another internal/external examiner. Under any circumstances, there shall not be two internal examiners for a given batch but two external examiners shall be allowed.

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Practicals Semester-end Examination	
Assessment	**Distribution of Marks**
Program Writing and Problem Solving	10
Program Execution	10
Viva	03
Journal	02
Total	**25Marks**

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

B.Sc. Semester–V

Discipline Specific Course(DSC)-11

Course Title:Vector Calculus and Analytical Geometry

Course Code:035 MAT 013

Type of Course	Theory /Practical	Credits	Instruction hourperweek	Total No.of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSCC-11	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):At the end of the course, students will be able to:

CO1: Getintroducedtothefundamentalsofvectordifferentialandintegralcalculus.

CO2: Getfamiliarwiththevariousdifferentialoperatorsandtheirproperties.

CO3: Getacquaintedwiththevarioustechniquesofvectorintegration.

CO4: Learntheapplicationsofvectorcalculus.

CO5: RecollectthefundamentalsofAnalyticalGeometryin3D.

CO 6: Interpretthegeometricalaspectsofplanesandlinesin3D.

Unit	Title:Vector Calculus and Analytical Geometry	56.hrs/ sem
UnitI	**VectorAlgebra**–Recapitulation (Scalarand Vector tripleproducts,geometricalinterpretation).Vectorfunctionofascalarvariable– interpretation as a space curve, derivative, tangent, normal and binormal vectors to a spacecurve; Curvature and Torsion of a space curve- definitions, derivation and problems, Serret-Frenetformulae. **Scalar field** - Gradient of a scalar field, geometrical meaning, directional derivative, unitnormal using surfaces- tangentplane and normalto the surface; Vectorfield – divergenceandcurlofavectorfield,geometricalmeaning,solenoidalandirrotationalfields;L aplacianofascalarfield;VectoridentitRecapitulationies.	14 hrs
UnitII	**Vector Integration** – Definition and basic properties, vector line integral, surface integraland volume integral; Green's theorem in the plane– Proof and related problems, Directconsequences of the theorem; Gauss' Divergence theorem– Proof and related problems,Direct consequences of the theorem; Stokes' theorem– Proofandrelatedproblems,Directconsequencesofthetheorem.	14 hrs
UnitIII	**Planes, Straight Lines and Spheres Planes:**Distance of a pointfromaplane,Anglebetweentwoplanes and pairofplanes. Bisectorsofanglesbetweentwoplanes;Straight lines: Equations of straight lines, Distance of a point from a straight line, Distancebetween two straight lines, Distance between a straight line and a plane; Spheres: Differentforms, Intersection of two spheres, Orthogonal intersection, Tangents and normal, Radicalplane,Radicalline,Coaxialsystemofspheres,Pole,Polar andConjugacy.	14 hrs
UnitIV	Locus, Surfaces, Curves and Conicoids Space curves, Algebraic curves, Ruledsurfaces,Somestandardsurfaces,Classificationofquadricsurfaces,Cone,Cylinder,C entralconicoids,Tangentplane,Normal,Polarplanes,andPolarlines.	14 hrs

References:

1. RobertJ.T.Bell(1994).AnElementaryTreatiseonCoordinateGeometryofThreeDimensions.Macmillan IndiaLtd.
2. D.Chatterjee(2009).AnalyticalGeometry:TwoandThreeDimensions.NarosaPublishingHouse.
3. ShanthiNarayanandP.K.Mittal,*AnalyticalSolidGeometry*,S.ChandPublications.
4. A.N.Das,*AnalyticalGeometryofTwoandThreeDimensions*,NewCentralBookAgencyPvt.Ltd.
5. M.D.Raisinghania,*VectorCalculus*,SChandCo.Pvt.Ltd.,2013.
6. M.Spiegel,*VectorAnalysis*,2nd Edition,Schaum'sOutlineSeries,Mc-GrawHill,Education,2017.
7. C.E.Weatherburn,*ElementaryVectorAnalysis*,Alphaedition,2019.
8. P.N. Wartikar and J. N. Wartikar,*A Textbook of Applied Mathematics*, Vol.II,PuneVidyarthiGrihaPrakashan,Pune, 2009.
9. C.E.Weatherburn,*DifferentialGeometryof ThreeDimension*,KhoslaPublishingHouse,2020.
10. B.S.Grewal,*HigherEngineeringMathematics*,KhannaPublishers.
11. G.B.ThomasandR.L.Finney,*IntroductiontoCalculusandAnalyticalGeometry*,NarosaPublishing House,2010.

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Quiz/Assignment/SmallProject	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester–V

DisciplineSpecificCourse(DSC)-12

Course Title:Practicals on Vector Calculus and Analytical Geometry

Course Code:035 MAT 014

Type ofCourse	Theory /Practical	Credits	Instructionhour perweek	TotalNo.ofLectures/Hours /Semester	Durationof Exam	FormativeAssessmentMarks	Summative assessment Marks	TotalMarks
DSCC-12	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs):Attheend ofthecourse,studentswillbeableto:

CO1: Learn*FreeandOpenSourceSoftware(FOSS)*toolsforcomputerprogramming

CO2: SolveproblemsrelatedtoAnalyticalGeometryusingFOSSsoftware.

CO 3: SolveproblemsrelatedtoVectorCalculususingFOSSsoftware.

CO 4: Aquire the knowledge of applications of AnalyticalGeometry and Vector Calculus.

Expt. No,	Title:Practicals on Vector Calculus and Analytical Geometry	56.hrs/ sem
1	Programonmultipleproductofvectors–ScalarandCrossproduct.	
2	Programonvectordifferentiationandfindingunittangent.	
3	Programtofindcurvatureandtorsionofaspacecurve.	
4	ProgramtofindthegradientandLaplacianofascalarfunction,divergenceandcurlofavectorfunction.	
5	Programtodemonstratethephysicalinterpretationofgradient,divergenceandcurl.	
6	Programtoevaluateavectorlineintegral.	
7	Programtoevaluateasurfaceintegral.	
8	Programtoevaluateavolumeintegral.	
9	ProgramtoverifyGreen'stheorem.	
10	Programtofindequationandplotsphere,coneandcylinder	
11	Programtofinddistancebetweenastraightlineandaplane.	
12	Programtoconstructandplotsomestandardsurfaces.	

Instruction to the Examiner:

1. In case the University question papers are not available the external examiner shall prepare question papers for all the experiments, in consultation with the internal examiner.
2. No students shall be allowed for the examination without their Journal / Practical records, certified by the Staff in charge and Head / Principal. If the Journal/ Practical record is not presented by the student, the Head/Principal shall issue a certificate stating that he/she has attended the regular practicals and his/her attendance is satisfactory (not less than 75% including 10% of extracurricular activities if applicable) and the candidate shall then be allowed to appear for examination. In such cases, the marks reserved, for the journal shall be deducted.
3. Candidates having an attendance record of less than 75 % (including 10% of extracurricular activities, if applicable) in that practical paper shall not be allowed to take the practical examination.
4. The Principal shall permit the students to take the examination as out of turn in any other batches only on technical reasons like overlapping of the timings with other subjects but not for any other personal reasons of the candidate including medical grounds.
5. No practical examination shall be conducted in the absence of an external examiner. Absence of external examiner if any is to be brought to the notice of the principal by the internal examiner to enable alternative arrangements to be made. The Principal shall appoint external examiners as per the instruction already given. If the internal examiner remains absent, the principal shall appoint another internal/external examiner. Under any circumstances, there shall not be two internal examiners for a given batch but two external examiners shall be allowed.

Practicals Semester-end Examination	
Assessment	**Distribution of Marks**
Program Writing and Problem Solving	10
Program Execution	10
Viva	03
Journal	02
Total	**25Marks**

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

B.Sc. Semester–V

Skill Enhancement Course: SEC-3

Course Title:Programming with Python

Course Code:035 MAT 061

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
SEC-3	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs):Attheend ofthecourse,studentswillbeableto:

CO1: LearnthesyntaxandsemanticsofPythonprogramminglanguage.

CO2: WritePythonfunctionstofacilitatecodereuseandmanipulatestrings.

CO3: Understandtheuseofbuilt-infunctionstonavigatethefilesystem

CO4: Applytheconceptsoffilehandling.

Unit	Title:Programming with Python	56 hrs/ sem
UnitI	**Introduction,BasicsandProgramflow:** Python character set, Tokens, Variables and assignments, print statement, comments, Pythondata structure and data types, string operation in Python, Simple input and output includingsimpleoutput-formatting,operatorsinPython,expressions,standardlibrarymodules,Debugging,indentation,Flowofcontrol(if,if-else,if-elif,nestedif),rangefunction,iteration/loopingstatements,Stringandlistmanipulation,Tuples,dictionaries,sorting techniques.	
UnitII	**Functions,librariesandFilehandling:** Understanding and creating your own functions, Function parameters, Flow of execution in afunctioncall,passingparameters,Returningvaluesfromfunctions,Scopeofafunction,Importing modules in a Python using standard library functions and Modules, Creating aPython library, Data files, Operating and closing files, workingwithtextfiles,Standard input,outputand errorstreams,Working with binary andCSVfiles.	
Expt. No	**Title of the Experiment**	
1	Programs to demonstrate the usage of operators and Input / Output statements	
2	Programs to demonstrate the usage of conditional statements	
3	Programs to demonstrate usage of control structures	
4	Programs to demonstrate the usage of Functions	
5	Programs to demonstrate the usage of recursion functions	
6	Programs to demonstrate the usage of String functions	
7	Programs to demonstrate the usage of lists.	

8	Programs to demonstrate the usage of dictionaries	
9	Programs to demonstrate the usage of tuples.	
10	Programs to apply the concepts of file handling and regEx using packages.	
11	Programs to search and sort the numbers	
12	Programs to demonstrate the working of scraping websites with CSV	

References:

1. AutomatetheBoringStuffwithPython-AlSweigart,WillamPollock,2015
2. PythonCookBook-DavidBeazelyandBrainK.Jones2022.
3. BasicPythonProgrammingforBeginners - VaradaRajkumar,MarapalliKrishna,JayaPrakash,BlueRose Publishers,2022.
4. Python-JohnShovicandAlanSimpson,Paperback,2020.
5. LearningPython -MarkLutz,O'ReillyMedia,Paperback,2nd edition,2020.
6. Programming andProblem SolvingThroughPython-SatishJainandShashiSingh,BPB Publications,2020

Instruction to the Examiner:

1. Students have to explain in brief of the problem and model to be used with the Python algorithm.
2. Out of the above 12Program's, students have to pick any one and answer it.
3. Executethe program and write the output.

Practicals Semester-end Examination	
Assessment	**Distribution of Marks**
Program Writing and Problem Solving	10
Program Execution	10
Viva	03
Journal	02
Total	**25Marks**

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

B.Sc. in Mathematics

VI Semester

W. e. f.: 2023-24

B.Sc. Semester–VI

DisciplineSpecificCourse(DSC)-13

Course Title:Algebra-III and Special Functions

Course Code:036 MAT 011

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-13	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1: Understand theconceptsof Rings,IntegralDomains,Fields

CO 2: Becomefamiliarwiththeconcepts Principal,PrimeandMaximalideals

CO3: LearnpropertiesofBeta-Gammafunctions

CO4: Realise the importanceofBessel'sandLegendre'sFunctions

Unit	Title:Algebra-III and Special Functions	56.hrs/ sem
UnitI	**Rings,IntegralDomains,Fields :**Rings – definition and properties of rings, Rings of integers modulo n, Subrings, Ideals - Principal,PrimeandMaximalidealsinacommutativering-examplesandstandardproperties.Fields–properties,Every field is an integral domain,Everyfiniteintegraldomainisafieldwithexamples.	14 hrs
UnitII	**Vector spaces** - Definition, examples and properties; Subspaces- Examples, criterionfor a subset to be a subspace and some properties; Linear Combination- Linear span,Linear dependenceandLinearindependence,basicpropertiesoflineardependenceandindependence, techniques of determining linear dependence and independence in variousvector spaces and related problems; Basis and dimension- Co-ordinates,ordered basis,some basic properties of basis and dimension and subspacespannedbygivensetofvectors.	14 hrs
UnitIII	**Beta-GammaFunctions:** Definitions,Propertiesandexamples,relationsbetweenbetaandgammafunctions,standard theorems, applications of evaluations of definite integrals, duplication formulaandapplications.	14 hrs
UnitIV	**Bessel'sandLegendre'sFunctions:** Solution to differential equation - Ordinary, singular andregularpointsofsecondorderlineardifferentialequation,seriessolutionwhen$x$=0isanordinarypoint,Frobeniusmethod**.** Bessel'sdifferentialequation-Definitionanddiscussionofitssolutions;Bessel'sfunction $J_n(x)$ - Definition, various recurrence relations for Bessel function (derivation),Generatingfunctionfor$J_n(x)$(derivation),valueof$J_{1/2}$andexpansionsforJ_0andJ_1andrelatedproblems. Legendre function- Discussion of solutions to Legendre's differential equation andLegendrepolynomials$P_n(x)$- Variousrecurrencerelations(derivations),Generatingfunctionfor$P_n(x)$(derivation)– OrthogonalityofLegendrePolynomials.	14 hrs

References:

1. I.N.Herstein,*TopicsinAlgebra*,2ndEdition,Wiley.

2. VijayKKhannaandSKBhambri(1998),ACourseinAbstractAlgebra,Vikas Publications.

3. MichaelArtin(2015),Algebra,2nd ed.,Pearson.

4. JosephA,Gallian(2021),ContemporaryAbstractAlgebra,10th ed.,Taylorand FrancisGroup.

5. StephenH.Friedberg,ArnoldJ.Insel&LawrenceE.Spence(2003),LinearAlgebra (4thEdition),Printice-HallofIndiaPvt.Ltd.

6. F.M.Stewart,*IntroductiontoLinearAlgebra*,DoverPublications.

7. S.Kumaresan,*LinearAlgebra*,PrenticeHallIndiaLearningPrivateLimited.

8. KennethHoffman&RayKunze(2015),LinearAlgebra,(2nd Edition),PrenticeHall India LeaningPrivate Limited.

9. G. E. Andrews, R. Askey and R. Roy, Special Functions, Cambridge University Press

10 S. Kanemitsu and H. Tsukada, Vistas of special functions, World Scientific.

11. G. B. Thomas, Thomas Calculus, 13th Edition, Pearson publication.

12.B. S. Grewal, Higher Engineering mathematics, Khanna Publications

13.K. F. Riley, M. P. Hobson and S. J. Bence, Mathematical Methods for Physics and Engineering, Third Edition, Cambridge University Press.

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

B.Sc. Semester–VI

DisciplineSpecificCourse(DSC)-14

Course Title:Practicals on Algebra-III and Special Functions

Course Code:036 MAT 012

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-14	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs):Attheend ofthecourse,studentswillbeableto:

CO1: Learn*FreeandOpenSourceSoftware(FOSS)*toolsforcomputerprogramming

CO2: SolveproblemonLinearAlgebrastudiedin**036MAT011**byusingFOSSsoftware's.

CO3: AcquireknowledgeofapplicationsofLinearAlgebrathroughFOSS.

Expt. No,	Title:Practicalson Algebra-III and Special Functions	56.hrs/ sem
1	Programon Rings of integers modulo n,	
2	PrimeandMaximalidealsinacommutativering	
3	Programm on IntegralDomain	
4	Programon linearcombinationofvectors.	
5	Programtoverifylineardependenceandindependence.	
6	Programtofindbasisanddimensionofthesubspaces.	
7	Programonsolutions of Beta-Gammafunctions	
8	Programm to solutions of definite integrals	
9	Programtofind ordinary, singular andregularpoints.	
10	Programtosolvethe Bessel'sdifferentialequation	
11	Programtoevaluate $Jn(x)$	
12	Programtosolvethe Legendre's differential equation	

Instruction to the Examiner:

1. In case the University question papers are not available the external examiner shall prepare question papers for all the experiments, in consultation with the internal examiner.
2. No students shall be allowed for the examination without their Journal / Practical records, certified by the Staff in charge and Head / Principal. If the Journal/ Practical record is not presented by the student, the Head/Principal shall issue a certificate stating that he/she has attended the regular practicals and his/her attendance is satisfactory (not less than 75% including 10% of extracurricular activities if applicable) and the candidate shall then be allowed to appear for examination. In such cases, the marks reserved, for the journal shall be deducted.
3. Candidates having an attendance record of less than 75 % (including 10% of extracurricular activities, if applicable) in that practical paper shall not be allowed to take the practical examination.
4. The Principal shall permit the students to take the examination as out of turn in any other batches only on technical reasons like overlapping of the timings with other subjects but not for any other personal reasons of the candidate including medical grounds.
5. No practical examination shall be conducted in the absence of an external examiner. Absence of external examiner if any is to be brought to the notice of the principal by the internal examiner to enable alternative arrangements to be made. The Principal shall appoint external examiners as per the instruction already given. If the internal examiner remains absent, the principal shall appoint another internal/external examiner. Under any circumstances, there shall not be two internal examiners for a given batch but two external examiners shall be allowed.

Practicals Semester-end Examination	
Assessment	**Distribution of Marks**
Program Writing and Problem Solving	10
Program Execution	10
Viva	03
Journal	02
Total	**25Marks**

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

B.Sc. Semester–VI

DisciplineSpecificCourse(DSC)-15

Course Title:Numerical Analysis

Course Code:036 MAT 013

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-15	**Theory**	**04**	**04**	**56hrs.**	**2hrs.**	**40**	**60**	**100**

Course Outcomes (COs):Attheend ofthecourse,studentswillbeableto:

CO1: Describevariousoperatorsarisinginnumericalanalysissuchasdifferenceoperators,shiftoperat orsandso on.

CO2:

Articulatetherationalebehindvarioustechniquesofnumericalanalysissuchasinfindingroots,integral sand derivatives.

CO3: Reproduce the existing algorithms for various tasks as mentioned previously innumericalanalysis.

CO4: Applytherulesofcalculusandotherareasofmathematicsinjustifyingthetechniquesofnumerical analysis.

CO5: Solveproblemsusingsuitablenumericaltechnique

CO 6:

Appreciatetheprofoundapplicabilityoftechniquesofnumericalanalysisinsolvingreallifeproblemsan dalsoappreciatethewaythetechniquesaremodifiedtoimprovetheaccuracy.

Unit	Title:Numerical Analysis	56.hrs/ sem
UnitI	**AlgebraicandTranscendentalEquations:** Errors-Significantdigits,absolute,relative,percentageerrors,roundingoffandtruncation errors (meanings and related problems), general error formula (derivation offormulaandproblemsbasedonit),errorinseriesapproximation:Taylorseriesapproximatio ns(problemsonly),Solutionstoalgebraicandtranscendentalequations-Bisection method, Regula-Falsi method, iterative method Newton-Raphson method andsecant method (Plain discussion of the rationale behind techniques and problems on theirapplications).	14 hrs
UnitII	**SystemofLinearAlgebraicEquations:** DirectMethods–Gausseliminationmethod,Gauss-JordaneliminationmethodandTringularization method; Iterative methods – Jacobi method, Gauss-Jacobi method, Gauss-Seidalmethod,Successive-OverRelaxationmethod(SOR)method.	14 hrs
UnitIII	**PolynomialInterpolations:** Finitedifferences.Forward,backwardandcentraldifferencesandshiftoperators:definitions, propertiesandproblems;Polynomialinterpolation–Newton - Gregoryforwardandbackwardinterpolationformulas,Gauss'sForwardandbackwardinterp	14 hrs

	olation formulas, Lagrange interpolation polynomial, Newton's divided differencesand Newton's general interpolation formula (Discussion on setting up the polynomials,differencesbetweenthemandproblemsontheirapplications).	
UnitIV	**NumericalDifferentiationandIntegration:** Formulaforderivatives(tillsecondorder)basedonNewton-Gregoryforwardandbackwardinterpolations(Derivationsandproblemsbasedonthem).NumericalIntegration-Generalquadratureformula,Trapezoidalrule,Simpson's1/3rule,Simpson's 3/8 rule and Weddell's rule (derivations for only general quadrature formula,trapezoidalruleandSimpson's1/3rdruleandproblemsontheapplicationsofallformulas).	14 hrs

References:

1. E.IsaacsonandH.B.Keller,*AnalysisofNumericalmethods*,DoverPublications.
2. S.S.Sastry,*IntroductorymethodsofNumericalAnalysis*,5thEdition,PHILearningPrivate Limited.
3. EKreyszig,*AdvancedEngineeringMathematics*,WileyIndiaPvt.Limited
4. B.S.Grewal,*NumericalMethodsforScientistsandEngineers*,KhannaPublishers.
5. M.K.Jain,S.R.K.IyengarandR.K.Jain,*NumericalMethodsforScientificandEngineeringcomputation*,4thEdition,New AgeInternational
6. H.C.Saxena,*FiniteDifferenceandNumericalAnalysis*,S.ChandPublishers
7. B.D.Gupta,*NumericalAnalysis*,KonarkPublishersPvt.Ltd.

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

B.Sc. Semester–VI

DisciplineSpecificCourse(DSC)-16

Course Title:Practicals on Numerical Analysis

Course Code:036 MAT 014

Type ofCourse	Theory /Practical	Credits	Instructionhou rperweek	TotalNo.ofLectu res/Hours /Semester	Durationof Exam	FormativeA ssessmentM arks	Summative assessment Marks	TotalMa rks
DSCC-16	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**25**	**25**	**50**

Course Outcomes (COs):Attheend ofthecourse,studentswillbeableto:

CO1: Learn*FreeandOpenSourceSoftware(FOSS)*toolsforcomputerprogramming

CO2: SolveproblemonNumerical Analysisstudiedin**036MAT013**byusingFOSSsoftware's.

CO3: AcquireknowledgeofapplicationsofLinearAlgebrathroughFOSS.

Expt. No,	Title:Practicals on Numerical Analysis	56.hrs/ sem
1	Programtofindthe rootofanequationusingbisectionandRegula-Falsimethods.	4
2	Programtofindthe rootofanequationusingNewton-RaphsonandSecantmethods.	4
3	Programtosolvethe systemofalgebraicequationsusingthe Gauss-eliminationmethod.	4
4	Programtosolvethe systemofalgebraicequationsusingthe Gauss-Jordanmethod.	4
5	Programtosolvethe systemofalgebraicequationsusingthe Gauss-Jacobimethod.	4
6	Programtosolvethe systemofalgebraicequationsusingthe Gauss-Seidelmethod.	6
7	Programtosolvethesystemofalgebraicequationsusingthe SORmethod	4
8	ProgramtoevaluateintegralusingSimpson's1/3and3/8rules.	6
9	ProgramtoevaluateintegralusingTrapezoidalandWeddlerules	6
10	Programtofindthesumsofpowersofsuccessivenaturalnumbersusing the Newton–Gregorytechnique.	6
11	Program to finddifferentiation at specified point usingthe Newton-Gregoryinterpolation method.	4
12	Programtofindthemissingvalueofthe tableusingthe Lagrangemethod.	4

Instruction to the Examiner:

6. In case the University question papers are not available the external examiner shall prepare question papers for all the experiments, in consultation with the internal examiner.
7. No students shall be allowed for the examination without their Journal / Practical records, certified by the Staff in charge and Head / Principal. If the Journal/ Practical record is not presented by the student, the Head/Principal shall issue a certificate stating that he/she has attended the regular practicals and his/her attendance is satisfactory (not less than 75% including 10% of extracurricular activities if applicable) and the candidate shall then be allowed to appear for examination. In such cases, the marks reserved, for the journal shall be deducted.
8. Candidates having an attendance record of less than 75 % (including 10% of extracurricular activities, if applicable) in that practical paper shall not be allowed to take the practical examination.
9. The Principal shall permit the students to take the examination as out of turn in any other batches only on technical reasons like overlapping of the timings with other subjects but not for any other personal reasons of the candidate including medical grounds.
10. No practical examination shall be conducted in the absence of an external examiner. Absence of external examiner if any is to be brought to the notice of the principal by the internal examiner to enable alternative arrangements to be made. The Principal shall appoint external examiners as per the instruction already given. If the internal examiner remains absent, the principal shall appoint another internal/external examiner. Under any circumstances, there shall not be two internal examiners for a given batch but two external examiners shall be allowed.

Practicals Semester-end Examination	
Assessment	**Distribution of Marks**
Program Writing and Problem Solving	10
Program Execution	10
Viva	03
Journal	02
Total	**25Marks**

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

B.Sc. Semester–VI

INTERNSHIP

Course Title:INTERNSHIP

Course Code:036 MAT 091

Type ofCourse	Theory /Practical	Credits	Instructionhour/week	TotalNo.ofLectures/Hours /Semester	Durationof Exam	FormativeAssessmentMarks	Summative assessment Marks	TotalMarks
INTERNSHIP	**Practical**	**02**			**3hrs.**	**50**	**0**	**50**

Course Outcomes (COs):Attheend ofthecoursestudentswillbeableto:

CO1: Conduct the field visit based on the objectives of the internship

CO2: Participate in a professional activity and gain practical workexperience.

CO3: Learn the behavioural approach and fascinate in communication.

CO4: Interact with the different personalities of local agencies.

CO5: Prepare the report with sound techniques/ technology

Whenever an internship is not feasible, the students can choose the Project work

Project Work: Short-term work in the college/other Institutions: The project work may include in Educational Institutions /R & D organizations/review of current literature/ theoretical methods/ Mathematical applications.

Practical work may involve the execution of programs/ studies on properties/characterizations/ applications/activities for reported/unreported research or any suitable combination thereof. In the case of the students who would work outside the campus, the Supervising Staff member may visit him/her/them.

FormativeAssessmentforInternship	
Assessment	**Distribution of Marks**
InternalAssessmentTest1	10
InternalAssessmentTest2	10
Case Study/ Assignment/ Field activity/Project, etc	10
ReportPrsentation and Discussion	10
Viva-Voce	10
Total	**50Marks**
FormativeAssessmentasperguidelines.	

Internship:

A course requiring students to participate in a professional activity or work experience or cooperative education activity with an entity external to the education institution, normally under the supervision of an expert of the given external entity. A key aspect of the internship is induction into actual work situations for 2 credits. Internships involve working with local industry, local governments (such as panchayats, and municipalities)or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in on-site experiential learning.

Note;

1. 1 credit internship is equal to 30hrs on field experience.
2. Internship shall be Discipline Specific of 45-60 hours (2 credits) with a duration 1-2 weeks.
3. Internship may be full-time/part-time (full-time during the last 1-2 weeks before the closure of the semester or weekly 4hrs in the academic session for 13-14 weeks). The college shall decide the suitable method for programme-wise but not subject-wise.
4. Internship mentor/supervisor shall avail work allotment during the 6^{th} semester for a maximum of 20 hours.
5. The student should submit the final internship report (45-60 hours of Internship) to the mentor for completion of the internship.
6. Method of evaluation: Presentations/Report submission/Activity etc.

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 05 marks 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 weightage shall be given to each unit based on the number of hours Prescribed

Format for Model question paper Unit wise

Question Numbers	Number of questions to be set in Unit	Number of questions to be answered	Marks for each question	Max marks for the question
1	Unit-I ------2 Unit-II ------1 Unit-III -----1 Unit-IV ------2 Total : 6	5	2	10
2	Unit-I ------1 Unit-II ------1 Unit-III -----2 Unit-IV ------1 Total: 5	4	5	20
3	Unit-I ------1 Unit-II ------1 Unit-III------1 Unit-IV------1 Total: 4	3	10	30