TUMKUR UNIVERSITY, TUMKUR

DEPARTMENT OF MATHEMATICS

PROPOSED SYLLABUS IN

(Approved in the BOS meeting)

MATHEMATICS FOR SIX SEMESTERS

B. Sc., DEGREE COURSE TO BE EFFECTIVE

FROM 2016-2017 ONWARDS

Choice Based Credit System (CBCS)

(Semester Scheme)

2016-2017

Tumkur University

B. Sc., MATHEMATICS SYLLABUS (CBCS)

The Tumkur University proposed to introduce credit based B. Sc. Programme from the academic year 2016-17. The enclosed syllabus has been prepared based on the guidelines provided by task force committee. Board of Studies was formed to accomplish this task. The members of the BoS (UG) played a pivotal role in preparing the syllabi. The final draft syllabus was circulated among the members for approval. The approved syllabus is enclosed herewith. The Chairman records his thanks to the members involved in the preparation of this syllabus.

B.Sc.Mathematics Programme: Course Matrix for semester I-IV

Sem	Course Number* in Semester I/II/III/IV	Subject, Paper No and Title in a Semester I/II/III/IV	Type of instruction & hours per week/course	Credits	Hours of Exam(SEE) per course/sem	Max. Marks for I.A/ Course/Sem	Max. Marks for SEE per course/ Semester	Max. Marks per course/ semester
I	1.1	Algebra and Calculus-1	T 4	4	3	10	90	100
		Practicals –I	P 4	2	3	_	50	50
II	2.2	Differential Equations	T 4	4	3	10	90	100
		Practicals -II	P 4	2	3	_	50	50
III	3.1	Real Analysis	T 4	4	3	10	90	100
		Practicals -III	P 4	2	3	_	50	50
IV	4.1	Algebra and Calculus-2	T 4	4	3	10	90	100
		Practicals -IV	P 4	2	3	_	50	50
Open Elective								
9	4.9	Elements of Basic Mathematics	T-2/P-4	2	3	_	50	50

B.Sc- Mathematics Programme: Course Matrix for semester V /VI

Sem	Course Number in Semester V/VI	Subject, Paper No, Title in a Semester V/VI	Type of instruction & hours per week & Type	Credit	Exam hours per course/ per sem	Maximum Marks for I.A/Per Course/Per Semester	Maximum Marks for SEEper course/ Per Semester	Maximum Marks per course/per semester
V	5.1	Advanced Algebra and Numerical Methods	T 3	3	3	10	90	100
	5.2(choose any one)	a) Analysis and Integral Transforms b) Probability and Statistics	T 3	3	3	10	90	100
		Practical –V (based on paper 5.1 & 5.2)	P 6 (3+3)	3	3	-	100 (50+50)	100
VI	6.1	Complex Analysis and Numerical Methods	T 3	3	3	10	90	100
	6.2(choose any one)	a) Number Theory b) Linear Programming	T 3	3	3	10	90	100
		Practicals-VI (based on paper 6.1 & 6.2)	P 6 (3+3)	3	3	-	100 (50+50)	100

NOTE : Separate examinations should be conducted for 5th and 6thsemesters for practical examinations on two separate days.

MISSION AND VISION OF THE NEW SYLLABUS IN MATHEMATICS MISSION

- Improve retention of mathematical concepts in the student.
- To develop a spirit of inquiry and scientific temper in the student.
- To improve the perspective of students on mathematics as per modern requirement.
- To initiate students to enjoy mathematics, pose and solve meaningful problems, to use abstraction to perceive relationships and structure and to understand the basic structure of mathematics.
- To enable the teacher to demonstrate, explain and reinforce abstract mathematical ideas by using concrete objects, models, charts, graphs, pictures, posters with the help of FOSS tools on a computer.
- To make the learning process student-friendly by having a shift in focus in mathematical teaching, especially in the mathematical learning environment.
- Exploit techno-savvy nature in the student to overcome math-phobia.
- Propagate FOSS (Free and open source software) tools amongst students and teachers as per vision document of National Mission for Education.
- To set up a mathematics laboratory in every college in order to help students in the exploration of mathematical concepts through activities and experimentation.
- To orient students towards relating Mathematics to applications.

VISION

- To remedy Math phobia through authentic learning based on hands-on experience with computers.
- To foster experimental, problem-oriented and discovery learning of mathematics.
- To show that ICT can be a panacea for quality and efficient education when properly integrated and accepted.
- To prove that the activity-centred mathematics laboratory places the student in a problem solving situation and then through self- exploration and discovery habituates the student into providing a solution to the problem based on his or her experience, needs, and interests.
- To provide greater scope for individual participation in the process of learning and becoming autonomous learners.
- To provide scope for greater involvement of both the mind and the hand this facilitates cognition.
- To ultimately see that the learning of mathematics becomes more alive, vibrant, relevant and meaningful; a program that paves the way to seek and understand the world around them. A possible by-product of such an exercise is that math-phobia can be gradually reduced amongst students.
- To help the student build interest and confidence in learning the subject.

Support system for Students and Teachers in understanding and learning FOSS TOOLS:

- As a national level initiative towards learning FOSS tools, IIT Bombay for MHRD, Government
- of India is giving free training to teachers interested in learning open source softwares likescilab, maxima, octave, geogebraand others.
  (website: http://spoken-tutorial.org ; email: contact@spoken-tutorial.org ; info@spokentutorial.org)

1.1: Algebra and Calculus-1

Unit-1 **15 hrs**

Recapitulation of Limit and Continuity, Differentiability of functions

Successive differentiation: Leibnitz Theorem(with proof)-Problems, increasing and decreasing functions, Concavity, convexity of functions, points of inflexion.

Polar Coordinates- angle between the radius vector and the tangent, polar sub tangent and polar sub normal, perpendicular from pole on the tangent, pedal equations.

Unit-2 **15 hrs**

Derivative of an arc in Cartesian, polar and parametric forms.Formula for radius of curvature in Cartesian, polar, parametric and in pedal forms, centre of Curvature, evolutes, asymptotes and envelopes.

Reduction formulae for Sin^nx, Cos^nx, Tan^nx, Sec^nx, Cot^nx, $Cosec^nx$, Sin^mxCos^nx.Differentiation under the integral sign.

Unit-3 **15 hrs**

Functions of two or more variables – Explicit and implicit functions, Partial derivatives ––Homogeneous functions – Euler's theorem, total derivatives,Differentiation of implicit functions and composite functions, Jacobians – Some illustrative examples.
Taylor's and maclaurin's series for functions of two variables, maxima-minima of function of two variables.

Unit-4 **15 hrs**

Elementary row and column operations, equivalent matrices, invariance of rank under elementary operations, determination of rank of a matrix by reducing it to the echelon form.
Homogeneous and non-Homogeneous systems of 'm' linear equations in 'n' unknowns, criterion for uniqueness of solutions.

Eigen values and Eigen vectors of a square matrix, standard properties, reduction of matrix to diagonal form, Cayley-Hamilton theorem (with proof), and applications.

Books Recommended

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
3.Serge Lang – First Course in Calculus
4. LipmanBers – Calculus, Volumes 1 and 2
5. N. Piskunov – Differential and Integral Calculus
6. A. R Vasista, Differential Calculus, Krishna Series, 2003
7.B. S. Vatssa, Theory of Matrices, 2nd ed., New Delhi: New Age International Publishers., 2007.
8. S. Narayan and P.K. Mittal, Text book of Matrices, 10th ed. New Delhi: S Chand and Co. Ltd, 2004.
9. A R Vashista, Matrices, Krishna PrakashanaMandir, 2003

SUGESTED WEB LINKS.

1. www.scilab.org.
2. wxmaxima.sourceforge.net
3. www.geogebra.org
4. http://www.cs.columbia.edu/~zeph/3203s04/lectures.html
5. http://home.scarlet.be/math/matr.htm
6. http://www.themathpage.com/
7. http://www.abstractmath.org/
8. http://ocw.mit.edu/courses/mathematics/
9. http://planetmath.org/encyclopedia/TopicsOnCalculus.html
10. http://ocw.mit.edu/OcwWeb/Mathematics/18-01Fall-2005/CourseHome/index.htm
11. http://mathworld.wolfram.com/Calculus.html
12. http://ocw.mit.edu/courses/mathematics/
13. http://www.univie.ac.at/future.media/moe/galerie.ht

PRACTICALS – 1.1

Mathematics practical
Using Free and open Source Software (FOSS) tools for computer programs

(4 hours/ week per batch of not more than 25 students)
(for 25 students batch 2-Teachers & for 15 students batch single Teacher)

LIST OF PROBLEMS

1. Introduction to Scilab and commands related to the topics
2. Introduction to Maxima and commands related to the topics
3. Verification of Euler's theorem, its extension
4. nth derivative with &without Leibnitz rule.
5. Scilab and Maxima commands for plotting functions.
6. Plotting of standard Cartesian curves using Scilab/Maxima.
7. Plotting of standard parametric and Polar curves using Scilab/Maxima.
8. Computations with matrices.
9. Row reduced echelon form.
10. Establishing consistency or otherwise and solving system of linear equations.
11. Cayley-Hamilton theorem
12. Maxima commands for reduction formula with or without limits.

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics).

2.1: Differential Equations

Unit-1 **15 hrs**

Recapitulation of differential equations-Linear Equations and equations reducible to linear equation.

Exact differential equations and equations reducible to exact form with standard integrating factors. Equations of First order and higher degree- equations solvable for p, x and y. Clairaut's equations, singular solutions- geometrical meaning. Orthogonal trajectories (Cartesian and Polar).

Unit-2 **15 hrs**

Basic theory of linear differential equations(second and Higher order) , Wronskian and its properties.

Second and higher order linear differential equations with constant coefficients, complementary functions, particular integrals (standard types)

Unit-3 **15 hrs**

Cauchy-Euler differential equations. Solutions of second order ordinary differential equations with variable coefficients by the following methods:

(1) When a part of complementary function is given

(2) Variation of parameters

(3) Change of independent variables

Total differential equations – Necessary and sufficient condition for the equation Pdx + Qdy + Rdz = 0 to be exact (proof only for the necessary part) – Simultaneous equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$.

Unit-4 **15 hrs**

Formation of partial differential equations, equations of first order, Lagrange's linear equations Pp+Qq=R, Standard types of first order non-linear PDEs and Equations reducible to standard form, Charpit's method.

Solution of second order linear partial differential equations in two variables with constant coefficients by finding complimentary function and particular integral, Equations reducible to homogeneous form.

Book for Study/References

1. M D Raisinghania, Ordinary Differential Equations (S. Chand, Delhi)
2. F Ayres: Differential Equations (Schaum Series)
3. Daniel Murray: Introductory Course in Differential Equations(Orient Longman)
4. William E Boyce and Richard C Diprima: Elementary Differential equations and BVP (John Willy and Sons)
5. B S Grewal: Engineering Mathematics
6. M D Raisinghania, Advanced Differential Equations, S Chand and Co. Pvt. Ltd., 2013
7. G F Simmons, Differential equation with Applications and historical notes, 2nd ed.: McGraw-Hill Publishing Company, Oct 1991.

SUGESTED WEB LINKS

1. http://tutorial.math.lamar.edu/classes/de/de.aspx
2. http://www.sosmath.com/diffeq/diffeq.html
3. http://www.analyzemath.com/calculus/Differential_Equations/applications.

PRACTICALS – 2.1

Mathematics practical
Using Free and open Source Software (FOSS) tools for computer programs

(4 hours/ week per batch of not more than 25 students)
(for 25 students batch 2-Teachers & for 15 students batch single Teacher)

LIST OF PROBLEMS

1. Solution of Differential equation using Scilab/Maxima and plotting the solution-I.
2. Solution of Differential equation using Scilab/Maxima and plotting the solution-II.
3. Solution of Differential equation using Scilab/Maxima and plotting the solution-III.
4. Solution of Differential equations using Scilab/Maxima and plotting the solution-IV.
5. Finding complementary function of constant coefficient second and higher order ordinary differential equations.-1
6. Finding complementary function of constant coefficient second and higher order ordinary differential equations.-2
7. Finding particular integral of constant coefficient second and higher order ordinary differential equations.
8. Verification of Cauchy-Euler differential equations.
9. Verification of Lagrange's linear equations
10. Solving second order linear partial differential equations in two variables with constant coefficient.
11. Solutions to the problems on total and simultaneous differential equations.
12. Solutions to the problems on different types of Partial differential equations.

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in place of scilab/maxima.

3.1: Real Analysis

Unit-1 **15 hrs.**

Recapitulation of Sets, relations, functions and number system

Similarity of sets, Countable and uncountable sets- standard theorems. Real line, bounded sets, suprema and infima of a set, completeness property of R, Archimedean property of R, Rational density theorem (with proof). Intervals, Neighbourhood of a point, open sets, closed sets, Concept of limit points and Bolzano-Weierstrass theorem (without proof).

Unit-2 **15 hrs.**

Definition of a sequence, bounded sequences, limit of a sequence, limit points of a sequence, sub sequences, convergent, divergent and oscillatory sequences, monotonic sequences and their properties, Cauchy sequence, Cauchy's general principle of convergence. Cauchy theorems on limits(without proof)- problems.

Unit-3 **15 hrs.**

Definition of convergence, divergence and oscillation of series, properties of convergent series, properties of series of positive terms, Geometric series, Cauchy's criterion. Tests for convergence of series-p-series (with proof), comparison tests, Cauchy's root test(with proof), D'Alembert's test(with proof), Rabee's test (with proof), Cauchy's Integral Test (without proof), absolute and conditional convergence, D'Alembert's test for absolute convergence, alternating series, Leibnitz test(without proof).

Unit-4 **15 hrs**

Recapitulation of Limits, continuity and differentiability.

Infimum and supremum of a function, theorems on continuity-(boundedness, attainment of bounds), Intermediate value property, fixed point property. Differentiability- Darboux Property, Rolle's theorem, Mean Value theorems, Taylor's theorem, Taylor's series, Maclaurin's series of sin x, cos x, e^x, log(l+x), $(l+x)^m$, Indeterminate forms.

Books for Study/References:

1. Walter Rudin: Principals of Mathematical Analysis
2. Somasundaram and B Choudhury: Mathematical Analysis
3. S C Malik and SavitaArora:Mathematical Analysis
4. N P Bali:Real Analysis
5. Robert Bertle and Donald Sherbert: Introduction to Real Analysis(John Wiley)
6. K K Azad and KavitaSrivastav: Sequence and Series
7. S Narayana and M.D. Raisinghania, Elements of Real Analysis, Revised ed., S. Chand & Company Ltd, 2011.

SUGESTED WEB LINKS:

1. http://www.themathpage.com/
2. http://www.abstractmath.org/
3. http://ocw.mit.edu/courses/mathematics/
4. http://www.math.unl.edu/~webnotes/contents/chapters.htm
5. http://www-groups.mcs.st-andrews.ac.uk/~john/analysis/index.html
6. http://web01.shu.edu/projects/reals/index.html
7. http://www.mathcs.org/analysis/reals/index.html
8. http://planetmath.org/encyclopedia/TopicsOnCalculus.html
9. http://ocw.mit.edu/OcwWeb/Mathematics/18-01Fall-2005/CourseHome/index.htm
10. http://mathworld.wolfram.com/Calculus.html
11. http://ocw.mit.edu/courses/mathematics/

PRACTICALS – 3.1

Mathematics practical

Using Free and open Source Software (FOSS) tools for computer programs

(4 hours/ week per batch of not more than 25 students)

(for 25 students batch 2-Teachers & for 15 students batch single Teacher)

LIST OF PROBLEMS

1. Illustration of convergent, divergent and oscillatory sequences using Scilab/Maxima.
2. Using Cauchy's criterion to determine convergence of a sequence (simple examples).
3. Illustration of convergent, divergent and oscillatory series using Scilab/Maxima.
4. Scilab/Maxima programs to find the sum of the series and its radius of convergence.
5. Using Cauchy's criterion on the sequence of partial sums of the series to determine convergence of series.
6. Scilab/Maxima programs to illustrate left hand limit and right hand limit of a discontinuous function.
7. Scilab/Maxima programs to illustrate continuity of a function
8. Scilab/Maxima programs to illustrate differentiability of afunction
9. Scilab/Maxima programs to verify Rolle's Theorem and Lagrange's theorem.
10. Scilab/Maxima programs to verify Cauchy's mean value theorem and finding Taylor's theorem for a given function.
11. Evaluation of limits of 0/0 form by L'Hospital's rule using Scilab/Maxima.
12. Evaluation of limits of ∞/∞ form by L'Hospital's rule using Scilab/Maxima

Note: The above list may be changed annually with the approval of the BOS in UG Mathematics). Geogebra/Octave may also be used in place of scilab/maxima.

4.1: Algebraand Calculus-2

Unit-1 **15hrs**

Definition of line integral and basic properties, examples on evaluation of line integrals.

Definition of double integrals-its conversion to iterated integrals, evaluation of double integrals by change of order of integration and by change of variables(polar). Computation of plane surface area, volume underneath a surface and volume of surface revolution by using double integrals.
Definition of triple integrals and evaluation, change of variables (spherical and cylindrical), volume as triple integral.

Unit-2 **15 hrs**

Scalar field, Gradient of a scalar field, directional derivatives, surfaces-tangent plane and normal to the surface, Vector field, divergence and curl of a vector field, geometrical meaning, solenoidal and irrotational fields, vector identities.

Vector Integration- Green's theorem in the plane (with proof),Direct consequences of the theorem, The Divergence theorem (without proof), Direct consequences of the theorem, The Stokes theorem (without proof), Direct consequences of the theorem.

Unit-3 **15 hrs**

Definition of a Group – examples: group $Z_n$of integers modulo n, group U(n) of units multiplication modulo n and some general properties, order of an element-definition & properties, Sub groups, group of permutations- cyclic permutations- even and odd permutations, order of a permutation, Dihedral groups, Klein's 4 group,Quaternion group, GL(n,R) and SL(n, R).
Cyclic groups-definition & properties, centre of a group, cosets-definition & properties, Lagrange's theorem- consequences.

Unit-4 **15 hrs**

Normal subgroups- definition, examples, and characterizations, Quotient groups-examples and theorems, Homomorphism, kernel of homomorphism, Isomorphism, Fundamental Theorem of Homomorphism, Isomorphism Theorems, Automorphisms, Cayley's theorem on permutation groups.

Books Recommended

1. Herstein I N, Topics in Algebra, 4th ed. New Delhi, India: Vikas Publishing House Pvt. Ltd, 1991.
2. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
3. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
4. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.
5. S.C.Malik and SavitaArora, Mathematical Analysis, 2nd ed. New Delhi, India: New Age international (P) Ltd., 1992
6. M D Raisinghania, Vector calculus,S Chand Co. Pvt. Ltd., 2013.
7. F B Hildebrand, Methods in Applied Mathematics.
8. B Spain,Vector Analysis , ELBS, 1994.
9. D E Bournesand, P C Kendall, Vector Analysis, ELBS, 1996.

SUGESTED WEB LINKS:

1. http://ocw.mit.edu/courses/mathematics/
2. http://planetmath.org/encyclopedia/TopicsOnCalculus.html
3. http://mathworld.wolfram.com/Calculus.html
4. http://www.univie.ac.at/future.media/moe/galerie.html
5. http://www.math.gatech.edu/~harrell/calc/
6. http://www.themathpage.com/
7. http://www.abstractmath.org/

PRACTICALS – 4.1

Mathematics practical
Using Free and open Source Software (FOSS) tools for computer programs
(4 hours/ week per batch of not more than 25 students)
(for 25 students batch 2-Teachers & for 15 students batch single Teacher)

LIST OF PROBLEMS

1. To demonstrate the physical interpretation of gradient, divergence and curl.
2. Writing gradient, divergence, curl and Laplacian in spherical coordinates.
3. Verifying whether given operator is binary or not.
4. To find identity element and inverse element of a group.
5. Finding all possible subgroups of a finite group.
6. Examples to verify Lagrange's theorem.
7. Illustrating homomorphism and isomorphism of groups.
8. Verification of Normality of a given subgroup.
9. Evaluation of the line integral with constant and variable limits.
10. Evaluation of the double integral with constant and variable limits.
11. Evaluation of the triple integral with constant and variable limits.
12. Scilab/Maxima programs for area and volume.

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in place of Scilab/maxima.

4.9: Open Elective

Elements of Basic Mathematics

Unit-1: **15 hrs.**

Brief History of Mathematics.

Number Theory:Natural numbers, integers,Real numbers, GCD, LCM, Primenumbers. Surds, Indices, Logarithms, Progressions, Arithmetic Progression, Geometric Progression, Harmonic Progression,Approximation Wrong Number, Decimal fractions, Square root and cube root, Simplifications: Partnerships, Percentage, Average, Ratio and proportions, Average & Ages Ratio & Proportion, Profit and loss, Simple interest and compound interest

Unit-2: **15 hrs.**

Set Theory: Operations of Union, Intersection, Complementation.Inclusion- exclusion principle.

Time and work, Time and distance, Mensuration, Permutations and combinations, Data tables, Probability, Pie charts, Bar graphs, Line graphs, Mixed graphs, Case study,Volume surface and area, Stocks and Shares, Bankers Discount, Basic differentiation and Integration

Recommended Books:

1) R. S Agarwal, Quantitative aptitude for Competitive examinations, S. Chand Company, New Delhi
2) Dinesh Khattar, The Pearson guide to Quantitative aptitude for Competitive examinations, The Pearson Pvt. Ltd.
3) Kolman and Busby: Discrete Mathematics , PHI

5.1:Advanced Algebra and Numerical Methods

Unit-1: **15 hrs.**

Rings – Examples, Integral Domain, Division rings, Rings of matrices, Fields, Polynomial rings, Subrings, Subfields. Characteristic of a ring, special elements of a ring, Ideals – Algebra of Ideals, Principal ideal ring, Divisibility in an integral domain – Units and Associates, irreducible and prime elements. Quotient ring homomorphism of rings – Kernel of a ring homomorphism – Fundamental theorem of homomorphism.

Unit-2 **15 hrs.**

Vector spaces, subspaces, direct sums, quotient spaces, linear combination of vectors,linear span, linear independence and dependence, basis and dimension-examples and theorems,dimension of subspaces.
Linear transformations, null space, range, rank and nullity of a linear transformation.

Unit-3 **15 hrs.**

Numerical solutions of Algebraic and transcendental equations– Bisection method –
The method of false position – Newton – Raphsonmethod .Numerical solutions of non-homogeneous system of linear algebraic equations by Gauss elimination, Gauss-Siedal and Jacobi's methods.

Numerical solutions of first order linear differential equations– Picard's method,
Euler – Cauchymethod – Euler's modified method – Runge-Kutta fourth order method –

Books Recommended

1. Herstein I N, Topics in Algebra, 4th ed. New Delhi, India: Vikas Publishing House Pvt. Ltd, 1991.
2. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
3. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
4. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.
5. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
6. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, IndianReprint, 2007.
7. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
8. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.
9. M K Jain, S R K Iyengar, and R K Jain, Numerical Methods for Scientific and Engineering Computation, 4th ed. New Delhi, India: New Age International, 2012.

SUGESTED WEB LINKS:

1. http://www.themathpage.com/
2. http://www.abstractmath.org/
3. http://ocw.mit.edu/courses/mathematics/
4. http://planetmath.org/encyclopedia/TopicsOnCalculus.html
5. http://ocw.mit.edu/OcwWeb/Mathematics/18-01Fall-2005/CourseHome/index.htm
6. http://mathworld.wolfram.com/Calculus.html
7. http://www.univie.ac.at/future.media/moe/galerie.html
8. http://www.math.gatech.edu/~harrell/calc/
9. http://www.amtp.cam.ac.uk/lab/people/sd/lectures/nummeth98/index.htm
10. http://math.fullerton.edu/mathews/numerical.html
11. http://www.onesmartclick.com/engineering/numerical-methods.html

PRACTICALS – 5.1

Mathematics practical

Using Free and open Source Software (FOSS) tools for computer programs

(3 hours/ week per batch of not more than 25 students)

(for 25 students batch 2-Teachers & for 15 students batch single Teacher)

LIST OF PROBLEMS

1. Examples on different types of rings.
2. Examples on integral domains and fields.
3. Examples on subrings, ideals and subrings which are not ideals.
4. (i) Vector space, subspace – illustrative examples.
   (ii)Expressing a vector as a linear combination of given set of vectors.
   (iii)Examples on linear dependence and independence of vectors.
5. Basis and Dimension – illustrative examples.
6. (i)Verifying whether a given transformation is linear.
   (ii)Problems on rank and nullity
7. Solving algebraic equation (Bisection method).
8. Solving algebraic equation - Newton-Raphson methods.
9. Solving ordinary differential equation by modified Euler's method.
10. Solving ordinary differential equation by Runge-Kutta method of 4^{th} order
11. Solving algebraic equation (Regula-Falsiand Newton-Raphson methods).
12. .Solving system of equations (Jacobi and Gauss-Seidel methods).

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in place of scilab/maxima.

5.2a: Analysis and Integral Transforms

Unit-1: **15 hrs.**

Improper Integrals: Gamma and Beta functions and results following thedefinition, Connection between Beta and gamma functions – applications of evaluation of integrals.

Fourier Series: Introduction, periodic functions, Trigonometric Fourier series of functions with period 2π and period 2L, Fourier series of even and odd functions, Half range cosine and sine series.

Unit-2: **15 hrs.**

Laplace Transforms and Inverse Laplace Transforms. Laplace transforms of derivatives and integrals. Shifting theorems.Convolution theorem (without proof).Applications of Laplace Transform to the solution of differential equations.

Unit-3: **15 hrs.**

The Fourier integral, complex Fourier transform, inverse transforms, basic properties, finite Fourier transforms, transforms of the derivatives and the derivatives of the transforms, problems there on. Application of Fourier transforms to ODEs and PDEs.

Book for Study/References

1. M G Smith: Laplace Transforms(van-Nostrad)
2. I N Sneddon: Fourier Transforms(McGraw Hill)
3. Churchil R. V and Brown J W: Fourier Series and Boundary Value Problems
4. E Kreyszig,Advanced Engineering Mathematics, Eighth Edition New Delhi, India: Wiley IndiaPvt. Ltd., 2010.
5. Dr. B. S. Grewal, Higher Engineering Mathematics, Thirty ninth Edition, Khanna Publishers, July2005.
6. K SankaraRao, Introduction to Partial Differential Equations, PHI Learning Pvt. Ltd., NewDelhi: 2012.
7. N H Shah, Ordinary and Partial Differential Equations Theory and Applications, PHI LearningPvt. Ltd., New Delhi: 2010.
8. M. D. Raisinghania, Ordinary and Partial Differential Equation, Chand (S.) &Co.Ltd., India:March 17, 2005..

SUGGESTED WEB LINKS:

1. http://ocw.mit.edu/courses/mathematics/
2. http://math.fullerton.edu/mathews/c2003/ComplexUndergradMod.html
3. http://www.fourier-series.com/
4. http://mathworld.wolfram.com/
5. http://www.princeton.edu/~rvdb
6. http://www.zweigmedia.com/RealWorld/Summary4.html
7. http://people.brunel.ac.uk/~mastjjb/jeb/or/contents.html
8. http://people.brunel.ac.uk/~mastjjb/jeb/or/lpmore.html

PRACTICALS – 5.2a

Mathematics practical

Using Free and open Source Software (FOSS) tools for computer programs

(3 hours/ week per batch of not more than 25 students)

(for 25 students batch 2-Teachers & for 15 students batch single Teacher)

LIST OF PROBLEMS

1. To plot periodic functions with period 2π and 2L.
2. To find full range trigonometric Fourier series of some simple functions with period 2π.
3. To find full range trigonometric Fourier series of some simple functions with period 2L.
4. Plotting of functions in half-range and including their even extensions.
5. Plotting of functions in half-range and including their odd extensions.
6. To find the half-range sine series of simple functions.
7. To find the half-range cosine series of simple functions.
8. Fourier transforms to ODEs.
9. Fourier transforms to PDEs
10. Finding the Laplace transforms of some standard functions.
11. Verification of Convolution theorem.
12. Laplace Transform to the solution of differential equations.

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in place of Scilab/maxima.

5.2b: Probability and Statistics

Recapitulation of measures of central tendency, measures of dispersion, definition of probability, conditional probability, Baye's theorem, random variables, binomial distribution.

Unit-1 **15hrs**

Curve fitting (least square method)- fitting straight line $y=ax+b$, parabola $y= ax2+bx+c$ and other curves of the form $y= ab^x$, $y= ae^{bx}$, $y= a^xb$. Correlation and Regression- Correlation coefficient, regression lines and regression coefficient.

Unit-2 **15hrs**

Random Variables: Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, probability and moment generating function.

Unit-3 **15hrs**

Special Distributions: Poisson distribution, Exponential and Normal distribution- standard normal distribution and normal probability curve.

Book for Study/References:

1. S C Gupta and V K Kapoor: Fundamentals of Mathematical Statistics (S Chand and Co)
2. G.Shankar Rao: Probability and statistics for science and Engineering(Universities Press(India) Private Ltd.)-2011
3. Kapur, J. N and H. C. Saxena: Mathematical Statistics, India: S. Chand and Company-2006.
4. Kandaswamy, P., K. Thilagavathi and K. Gunavathi: Probability and statistics and Qeuing Theory, New Delhi; S. Chand-2007
5. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
6. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
7. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

SUGGESTED WEBLINKS

1) http://stattrek.com/
2) https://www.khanacademy.org/math/probability
3) https://www.udacity.com/course/intro-to-statistics--st101
4) http://oli.cmu.edu/courses/free-open/statistics-course-details/

PRACTICALS – 5.2b

Mathematics practical
Using Free and open Source Software (FOSS) tools for computer programs

(3 hours/ week per batch of not more than 25 students)
(for 25 students batch 2-Teachers & for 15 students batch single Teacher)

LIST OF PROBLEMS

1) Sample space and events
2) Finite probability spaces
3) Addition principle
4) Conditional probability
5) Multiplication theorem for Conditional probability
6) Independent events-1
7) Independent repeated trials
8) Random variables
9) Probability distribution of random variables
10) Expectation of a random variable
11) Variance and standard deviation of random variable
12) Binomial Distribution

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in Place of scilab/maxima.

6.1: Complex Analysis and Numerical Methods

Unit-1: **15 hrs**

Functions of a complex variable, limits, theorems on limits, continuous functions, differentiability, analytic functions, Cauchy- Reimann equations (Cartesian and polar form), harmonic functions, harmonic conjugate, Construction of analytic functions-Milne Thomson method, singularities.

Power Series: Absolute convergence of power series, circle and radius of convergence of power series, sum function of a power series.

Unit-2: **15 hrs**

Complex Integration: Introduction, complex line integral- examples and properties, Cauchy's integral theorem, Winding number, Cauchy's integral formula-higher derivatives, Morera's theorem, Cauchy inequality, Liouville's theorem and its applications, Fundamental theorem of algebra.

Unit-3: **15 hrs.**

Finite differences– Forward and backward differences – shift operator –Interpolation – Newton – Gregory forward and backward interpolation formulae – Lagrange's interpolation formula Divided differences, Numerical Differentiation.

Numerical integration– General quadrature formula – Trapezoidal Rule – Simpson's 1/3 rule – Simpson's 3/8 th rule, Weddle's rule.Error analysis of these methods.

Books for study/ References:

1. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed.,McGraw – Hill International Edition, 2009.
2. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts inMathematics, Springer-Verlag New York, Inc., New York, 1997.
3. Shastry S. S: Numerical analysis (PHI)
4. M K Jain, S R K Iyengar and R K Jain: Numerical Methods (New Age International)
5. Shield P: Numerical Analysis (Schaum Series)
6. Balaguruswamy E: Numerical Methods (Tata McGraw Hill)

SUGGESTED WEBLINKS:

1. http://www.mathcs.org/analysis/reals/index.html
2. http://www.amtp.cam.ac.uk/lab/people/sd/lectures/nummeth98/index.htm
3. http://math.fullerton.edu/mathews/numerical.html
4. http://www.onesmartclick.com/engineering/numerical-methods.html

PRACTICALS – 6.1

Mathematics practical
Using Free and open Source Software (FOSS) tools for computer programs

(3 hours/ week per batch of not more than 25 students)
(for 25 students batch 2-Teachers & for 15 students batch single Teacher)

LIST OF PROBLEMS

1. Some problems on Cauchy-Riemann equations (polar form).
2. Implementation of Milne-Thomson method of constructing analytic functions(simple examples).
3. Illustrating orthogonality of the surfaces obtained from the real and imaginary parts of an analytic function.
4. Verifying real and imaginary parts of an analytic function being harmonic (in polar coordinates).
5. Examples connected with Cauchy's integral theorem.
6. Complex Integration-Cauchy's integral theorem.
7. Cauchy's integral-higher derivatives, Morera's theorem- Cauchy inequality.
8. Liouville's theorem - Fundamental theorem of algebra
9. The nth differences of polynomial.
10. Newton-Gregory forwad and backward interpolation.
11. Scilab/Maxima programs to evaluate integrals using Simpson's $1/3^{rd}$ rule.
12. Scilab/Maxima programs to evaluate integrals using Simpson's $3/8^{th}$ rule.

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in Place of scilab/maxima.

6.2a: Number Theory

UNIT -1 **15 hrs**

The Division Algorithm, the Greatest Common Divisor, The Euclidean Algorithm, Prime numbers and their properties, the Linear Diophantine Equation, The Fundamental Theorem of Arithmetic (with proof).

UNIT -2 **15 hrs**

Basic Properties of Congruences and applications, Binary and Decimal Representations of Integers, Linear Congruences and their solutions, Chinese Remainder Theorem and applications, Fermat's Little Theorem and Pseudo primes, Wilson's Theorem, Fermat's numbers.

UNIT -3 **15 hrs**

Multiplicative Functions, The Sum and Number of Divisors, The Möbius Inversion Formula, The Greatest Integer Function, Euler's Phi-Function, Euler's Generalization of Fermat's Theorem, Properties of Phi-Function.

Books Recommended:

1. David M. Burton, Elementary Number Theory 6th Ed., Tata McGraw-Hill Edition, Indianreprint, 2007.
2. Richard E. Klima, Neil Sigmon, Ernest Stitzinger, Applications of Abstract Algebra with Maple, CRC Press, Boca Raton, 2000.
3. I. Niven, H.S. Zuckerman and H.L. Montgomery, An Introduction to The Theory of Numbers, Fifth Edition, New Delhi: John Wiley & Sons, Inc., 2012.
4. K. Ireland and M. Rosen, A Classical Introduction to Modern Number Theory, Second Edition, New York: Springer-Verlag, 2010.
5. G. A. Jones And J. Mary Jones, Elementary Number Theory, Springer, 1998.
6. J. H. Silverman, A Friendly Introduction To Number Theory, Pearson Prentice Hall, 2006.

SUGGESTED WEBLINKS:

1) http://www.numbertheory.org/
2) www.freebookcentre.net
3) mathworld.wolfram.com
4) https://www.math.brown.edu/NTgroup.html

PRACTICALS – 6.2a

Mathematics practical
Using Free and open Source Software (FOSS) tools for computer programs

(3 hours/ week per batch of not more than 25 students)
(for 25 students batch 2-Teachers & for 15 students batch single Teacher)

LIST OF PROBLEMS

1) Scilab/ maxima program for Division Algorithm
2) Scilab/ maxima program for Generating prime numbers
3) Scilab/ maxima program for Euclidean Algorithm
4) Scilab/ maxima program for Finding GCD of two integers
5) Scilab/ maxima program for Finding LCM of two integers
6) Scilab/ maxima program for Fundamental principle of Arithmetic
7) Scilab/ maxima program for Congruence relation.
8) Scilab/ maxima program for Linear congruence equation
9) Scilab/ maxima program for Ordered partitions
10) Scilab/ maxima program for Unordered partitions
11) Scilab/ maxima program for Inclusion- exclusion principle
12) Scilab/ maxima program for Sum rule and product rule principle

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in Place of scilab/maxima.

6.2b: Linear Programming

Unit-1: **15 hrs.**

Linear Programming Problems, Graphical Approach for Solving some Linear Programming Problems, Basic feasible solutions(B.F.S), degenerate and non-degenerate BFS, examples of basic solutions which are not feasible. Upper bound on the number of B.F.S. Upper bound on the absolute value of the basic variables. Convex Sets, Supporting and Separating Hyper planes.

Unit-2: **15 hrs.**

Theory of simplex method, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, degeneracy, introduction to artificial variables, two-phase method, Big-M method and their comparison, revised simplex method.

Unit-3: **15 hrs.**

Duality, formulation of the dual problem, primal- dual relationships, Fundamental Theorem of Duality. Farka's theorem. Complementary Slackness theorem, economic interpretation of the dual, Dual simplex method, sensitivity analysis.

BooksRecommended

1. KantiSwarup, P.K.Gupta, and ManMohan, Operations Research, Reprint, New Delhi, India: Sultan Chand & Sons, 1994.
2. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear programming and NetworkFlows, 2nd Ed., John Wiley and Sons, India, 2004.
3. F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, 8th Ed., Tata McGrawHill, Singapore, 2004.
4. Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prentice-Hall India, 2006.
5. G Hadley, Linear Programming, Reprint, New Delhi: Narosa Publishing House, 2002

SUGGESTED WEB LINKS:

1. http://www.zweigmedia.com/RealWorld/Summary4.html
2. http://people.brunel.ac.uk/~mastjjb/jeb/or/lpmore.html
3. http://www2.isye.gatech.edu/~jswann/casestudy/assign.html
4. http://mathworld.wolfram.com/GameTheory.html

PRACTICALS – 6.2b

Mathematics practical
Using Free and open Source Software (FOSS) tools for computer programs

(3 hours/ week per batch of not more than 25 students)
(for 25 students batch 2-Teachers & for 15 students batch single Teacher)

LIST OF PROBLEMS

1) Introduction to linear programminig
2) Linear inequalities and bounds-1
3) Linear inequalities and bounds-2
4) Linear inequalities and bounds-3
5) Solution of linear system of equations-1
6) Solution of linear system of equations-2
7) Solution of linear system of equations-3
8) Finding the feasible solution of an LPP-
9) Solving LPP by graphical method-1
10) Solving LPP by graphical method-2
11) Solving LPP by graphical method-3
12) Finding optimal solution of an LPP

Note: The above list may be changed annually with the approval of the BOS in UG (Mathematics). Geogebra/Octave may also be used in Place of scilab/maxima.

Question Paper Pattern

Theory

(External Exam: 90 marks + internal assessment:10 marks = 100 Total Marks)

For I/II/III/IV Semesters

Duration: 3 hours Max. **Max. Marks: 90**

PART- A	
I. Answer any 6 questions	**6 X 2 = 12**
Question Number	**Unit Number**
1 to 2	Unit- 01
3 to 4	Unit- 02
5 to 6	Unit- 03
7 to 8	Unit- 04
PART –B	
II. Answer any 6 questions	**6 X 3 = 18**
Question Number	**Unit Number**
1 to 2	Unit- 01
3 to 4	Unit- 02
5 to 6	Unit- 03
7 to 8	Unit- 04
PART- C	
III. Answer any 3 questions	**3 X 5 = 15**
1 to 4	Unit- 01
IV. Answer any 3 questions	**3 X 5 = 15**
5 to 8	Unit- 02
V. Answer any 3 questions	**3 X 5 = 15**
9 to 12	Unit- 03
VI. Answer any 3 questions	**3 X 5 = 15**
13 to 16	Unit- 04

Practical

For I/II/III/IV Semesters

Duration: 3 hours Max. **Max. Marks: 50**

Marks Allotment	
Record	10
Program writing & problem Solving	15
Program execution	15
Viva-voce	10
Total	**50 marks**

Question Paper Pattern-Theory

For V and VI Semesters

Duration: 3 hours Max. **Max. Marks: 90**

PART-A	
I. Answer any 6 questions	**6 X 2 = 12**
Question Number	**Unit Number**
1 to 3	Unit- 01
4 to 5	Unit- 02
6 to 7	Unit- 03
PART-B	
II. Answer any 6 questions	**6 X 3 = 18**
Question Number	**Unit Number**
1 to 3	Unit- 01
4 to 5	Unit- 02
6 to 7	Unit- 03
PART-C	
III. Answer any 4 questions	**4X 5 = 20**
1 to 5	Unit- 01
IV. Answer any 4 questions	**4X 5= 20**
6 to 10	Unit- 02
V. Answer any 4 questions	**4X 5= 20**
11 to 15	Unit- 03

Practical

For V and VI Semesters

Duration: 3 hours Max. **Max. Marks: 50**

Marks Allotment	
Record	10
Program writing & problem Solving	15
Program execution	15
Viva-voce	10
Total	**50 marks**

Question Paper Pattern- 2.9 Open Elective (Theory)

Duration: 3 hours Max. **Max. Marks: 50**

PART-A	
Answer all the questions **10 X 1 = 10** **Multiple choice questions.**	
Question Number	**Unit Number**
1 to 5	Unit- 01
6 to 10	Unit- 02
PART-B	
Answer any 8 questions **8 X 2 = 16**	
1 to 5	Unit- 01
6 to 10	Unit- 02
PART-C	
Answer any 6 questions **6 X 4 = 24**	
1 to 5	Unit- 01
6to 10	Unit- 02

Note: In future this paper may set all objective type questions making students to answer by using OMR/ICT