



Corrigendum

(Both by post and by e- mail)

No. 499 / Acd.-I

Dated: 18-01-17

To

The Principals,

(All the Affiliated Colleges under Sambalpur University having
Three Year Degree Courses excluding Autonomous Colleges.)

Sub: Syllabus & Implementation of CBCS pattern Arts/Science/Commerce (Pass and
Hons.) from the Academic Session 2016-17.

Ref :- This office letter No 8423/ Acd.-I (BOS) dated 04.11.16 .

Sir,

In inviting a reference to the letter cited above, I am directed to say that the said letter have some inadvertent typographical errors.

First line of the para No-1 be read as "In continuation to the letters and the subject cited above, I am directed to intimate you that the Vice- Chancellor has been pleased to approve the syllabus / papers related to **Mathematics** for CBCS + 3 degree courses in **B.A. and B.Sc.. (Hons.)** examinations under 6 (15) of O.U. Act -1989 giving it effect from the Academic Session, 2016-17." *instead of* "In continuation to the letters and the subject cited above, I am directed to intimate you that the Vice- Chancellor has been pleased to approve the syllabus / papers related to **Mathematics** for CBCS + 3 courses degree **B.Sc.. (Both Pass & Hons.)** examinations under 6 (15) of O.U. Act -1989 giving it effect from the Academic Session, 2016-17."

It may be noted that, the aforesaid syllabus is for both B.A. and B.Sc. (Both Pass & Hons.) courses under CBCS .

This is for your kind information and necessary action.

Yours faithfully,

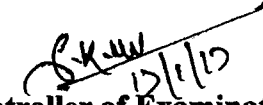
A handwritten signature in black ink, appearing to be 'B.K. W.', is written over the printed name and date. Below the signature is the date '12/1/17' and the printed name 'Controller of Examinations'. There is also a small handwritten mark resembling a stylized 'S' or 'Z' to the left of the signature.

P.T.O.

Memo No. 500 /Acad.-I(BOS), dtd. 18-01-12

Copy forwarded with enclosure for information and necessary action to:

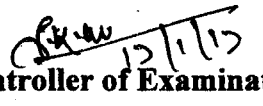
1. The Chairman, Post Graduate Council, Sambalpur University.
2. The Director, College Development Council, Sambalpur University.
3. The Director, Directorate of Distance and Continuing Education, Sambalpur University.
4. The Co-ordinator, Private Examination Cell, Sambalpur University.
5. Asst. Registrar (Examination), Sambalpur University.
6. Programmer, University Computer Unit, Sambalpur University.
7. Asst. Controller of Examinations, Sambalpur University.
8. Section Officer / Assistant –in- Charge, **e – Governance Cell**, Sambalpur University with request to make necessary corrections in the materials in the official web- site accordingly. (in + 3 cbcs-syllabus – **Mathematics –Final**)
9. Section Officers, Computer Unit, E.G.-I , EG-II , E.C.- I , EC-II,EC- IV Sections.
10. Five spare Copies for Academic-I Sections with enclosure.


Controller of Examinations

Memo No. 501 /Acad.-I(BOS), dtd. 18-01-12

Copy forwarded without enclosure for information and necessary action to:

1. **The Dy. Director, e – Governance Cell**, Sambalpur University with request for needful to provide all the materials in the official web- site accordingly.
2. P.A. to the Vice- Chancellor, Sambalpur University.
3. P.A. to the Registrar, Sambalpur University.
4. P.A. to the Controller of Examinations, Sambalpur University.


Controller of Examinations

Controller of Examinations
SAMBALPUR UNIVERSITY
JYOTI VIHAR, BURLA
Sambalpur (Odisha), PIN- 768 019



PHONE and Fax: 0663-2430806
e-mail: coesuniv@gmail.com

Urgent

(Both by post and by e- mail)

No. 8423 / Acd.-I

Dated: 04-11-16

To

The Principals,

(All the Affiliated Colleges under Sambalpur University having
Three Year Degree Courses excluding Autonomous Colleges.)

Sub: Syllabus & Implementation of CBCS pattern Arts/Science/Commerce (Pass and
Hons.) from the Academic Session 2016-17.

Ref :- This office letter No 5314/ Acd.-I dated 21.7.16 and letter No. 5970/Acd.-I
dated 8.8.16.

Sir,

In continuation to the letters and the subject cited above, I am directed to intimate you that the Vice- Chancellor has been pleased to approve the syllabus for Courses / papers related to **Mathematics** for CBCS + 3 courses degree B.Sc. (Both Pass & Hons.) examinations under 6 (15) of O.U. Act -1989 giving it effect from the Academic Session, 2016-17. The detail Courses of Studies is enclosed herewith for your reference and necessary action.

This may kindly be noted that it is the final syllabus for *Mathematics* subject/ papers under CBCS pattern. It may be made available to teachers and students concerned. Further you are requested to ensure teaching of the courses in your colleges accordingly.

Any error and omission etc. may kindly be intimated to this office.

. Any queries on the matter may be made through e-mail: coesuniv@gmail.com.

Thanking you,

Yours faithfully,

Encl: *As above*

B.K.N.
03
Controller of Examinations
Black

P.T.O.

Memo No. 8424 /Acad.-I(BOS),

dtd. 04-11-16

Copy forwarded with enclosure for information and necessary action to:

1. The Chairman, Post Graduate Council, Sambalpur University.
2. The H.O.D., P.G. Department of *Mathematics*, Sambalpur University.
3. The Director, College Development Council, Sambalpur University.
4. The Director, Directorate of Distance and Continuing Education, Sambalpur University.
5. The Co-ordinator, Private Examination Cell, Sambalpur University.
6. Asst. Registrar (Examination), Sambalpur University.
7. Programmer, University Computer Unit, Sambalpur University.
8. Asst. Controller of Examinations, Sambalpur University.
9. Section Officer / Assistant –in- Charge, *e – Governance Cell*, Sambalpur University with request to provide all the materials in the official web- site accordingly. (as + 3 cbcs-syllabus – *Mathematics –Final*)
10. Section Officers, Computer Unit, E.G.-I, EG-II, E.C-I, EC-II, EC-VI Sections.
11. Five spare Copies for Academic-I Sections with enclosure.

Memo No. 8425 /Acad.-I(BOS),

Ex-III
02/11/16
Controller of Examinations
Blair

dtd. 04-11-16

Copy forwarded without enclosure for information and necessary action to:

1. *The Dy. Director, e – Governance Cell*, Sambalpur University with request for needful to provide all the materials in the official web- site accordingly .
2. P.A. to the Vice- Chancellor, Sambalpur University.
3. P.A. to the Registrar, Sambalpur University.
4. P.A. to the Controller of Examinations, Sambalpur University.

Sn//-

Ex-III
02/11/16
Controller of Examinations
Blair

SAMBALPUR UNIVERSITY

STRUCTURE OF THE BA/BSC MATHEMATICS HONOURS SYLLABUS BASED ON
CHOICE BASED CREDIT SYSTEM

EFFECTIVE FROM 2016-17

Semester	Course Number	Title of the Course	Number of credits assigned to the course		
			Theory	Practical (P)/ Tutorial (T)	Total Credits
DISCIPLINE SPECIFIC CORE COURSES(14 PAPERS)(DSC)					
1st	DSC- MATH-H -1	Calculus(P)	4	2	6
	DSC—MATH-H -2	Algebra	5	1	6
2nd	DSC- MATH-H -3	Real Analysis	5	1	6
	DSC- MATH-H -4	Differential equations(P)	4	2	6
3rd	DSC- MATH-H -5	Theory of Real functions	5	1	6
	DSC- MATH-H -6	Group Theory-I	5	1	6
	DSC- MATH-H -7	Multivariable calculus	5	1	6
4th	DSC- MATH-H -8	Numerical Methods(P)	4	2	6
	DSC- MATH-H -9	Riemann integration and series of functions	5	1	6
	DSC- MATH-H -10	Ring Theory and Linear Algebra-I	5	1	6
5th	DSC- MATH-H -11	Partial differential equations and system of ODEs (P)	4	2	6
	DSC- MATH-H -12	Group Theory-II	5	1	6
6th	DSC- MATH-H -13	Metric Space and Complex analysis	5	1	6
	DSC- MATH-H -14	Ring Theory and Linear Algebra-II	5	1	6
DISCIPLINE SPECIFIC ELECTIVE COURSES(4 PAPERS)(DSE)					
5Th	DSE- MATH-H-1	Discrete Mathematics	5	1	6
		Or Number Theory	5	1	6

		Or Object oriented programming in C++	5	1	6
5th	DSE- MATH-H-2	Probability and Statistics	5	1	6
		Or Industrial Mathematics	5	1	6
		Or Theory of Equations	5	1	6
6th	DSE- MATH-H-3	Mathematical Methods	5	1	6
		Or Bio Mathematics	5	1	6
		or Linear Programming	5	1	6
6th	DSE- MATH-H-4	Mathematical Modelling	5	1	6
		Or Mechanics	5	1	6
		Or Differential Geometry	5	1	6
		Or Project	6	1	6
GENERIC ELECTIVES(GE) 4 PAPERS					
1st	GE-MATH-H-1A	Calculus	5	1	6
	GE-MATH-H-1B	Or Matrix Theory	5	1	6
2nd	GE-MATH-H-2A	Differential equations	5	1	6
	GE-MATH-H-2B	Or Numerical methods	5	1	6
3rd	GE-MATH-H-3A	Linear Programming	5	1	6
	GE-MATH-H-3B	Or Discrete Mathematics	5	1	6
4th	GE-MATH-H-4A	Algebra	5	1	6
	GE-MATH-H-4B	Or Mathematical methods	5	1	6

ABILITY ENHANCEMENT COURSES(AEC)TWO TYPES(AECC+SEC)					
ABILITY ENHANCEMENT COMPULSORY COURSES(AECC)					
1st	AECC-MATH-1	Environmental science	2		
2nd	AECC-MATH-2	English/MIL/Hindi communication	2		
SKILL ENHANCEMENT COURSES(SEC) 2 credits					
3rd	SEC- MATH-H-1A	Programming in C	2		2
	SEC- MATH-H-1B	or Logic and Set theory	2		2
4th	SEC-MATH-H-2A	Graph theory	2		2
	OR SEC- MATH-H-2B	or Operating System (LINUX)	2		2
		Total credits for honours Mathematics(DSC+DSE+GE +SEC)	140 credits		

SCHEME OF EXAMINATION FOR UNDERGRADUATE HONOURS MATHEMATICS COURSES

1. The duration of Each theory examination will be of 2 hours carrying 50 marks. The grade point conversion, CGPA calculation and percentage conversion will be done as per Sambalpur University guidelines.

2. Each paper has three units. Question of each paper will have two groups namely Group A and group B.

3. Group A will have one question having 9 short answer type questions of 2 marks each choosing three short questions from each unit. The students will have to answer seven out of that having $7 \times 2 = 14$ marks in total.

4. Group B will have three long answer type questions choosing one from each of the three units($12 \times 3 = 36$ marks) with alternatives. Each question may have two parts namely (a) and (b) distributing 12 marks as per the weightage of the questions.

5. The questions should be such that it would take maximum 25 minutes to answer one full long question of 12 marks and 5 minutes to answer one short question of 2 marks.

6. The valuation of the tutorial is through two periodical tests from first unit and second unit of the course respectively of 25 marks each conducted by the tutor in the class. Each test should be of one hour duration. The tutor may conduct one extra periodical from the third unit for the defaulters who could not appear the exam due to medical reasons/demise of family members/accidents/activities permitted by the college. The answer scripts of the periodicals should be preserved for technical reasons as per rule.

7. One of the suggested pattern of a question for semester examination is given below.

(35)

SUGGESTED PATTERN OF QUESTION FOR MATHEMATICS HONOURS STUDENTS

SEM <->/<Degree>/2016-17/ MATH/SU

<Year>

<Subject>

TIME-2 HOURS

CREDIT- <->

FULL MARKS-50.

The symbols carry their usual meaning.

GROUP A

1. Answer any seven from the following.

Marks 7x2=14

(a) < short question Unit-I>

(b) < short question Unit-I>

(c) < short question Unit-I>.

(d) < short question Unit-II>.

(e) < short question Unit-II>

(f) < short question Unit-II>

(g) < short question Unit-III>

(h) < short question Unit-III>

(i) < short question Unit-III>

GROUP B

[12x3=36]

Answer one question from each unit.

UNIT-I

2.(a) < Long question Unit-I>

[marks]

Sh

(b) < Long question Unit-I>

[marks]

3.(a) < Long question Unit-I>

[marks]

(b) < Long question Unit-I>

[marks]

UNIT-II

4.(a) < Long question Unit-II>

[marks]

(b) < Long question Unit-II>

[marks]

5.(a) < Long question Unit-II >

[marks]

(b) < Long question Unit-II>

[marks]

UNIT-III

6.(a) < Long question Unit-III>

[marks]

(b) < Long question Unit-III>

[marks]

7.(a) < Long question Unit-III>

[marks]

(b) < Long question Unit-III>

[marks]



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DETAILED SYLLABUS FOR HONOURS MATHEMATICS COURSES

B.A./B.SC.(HONOURS)-MATHEMATICS

SEMESTER-I

(CORE COURSES)
DSC-MATH-H1

CALCULUS (WITH PRACTICAL) - 6 credits

Theory (Credits-4)

Unit-I

Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of the type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n \sin x$, $(ax+b)^n \cos x$, concavity and inflection points, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L-Hospitals rule,

Unit-II

Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x dx$, $\int \cos^n x dx$, $\int \tan^n x dx$, $\int \sec^n x dx$, $\int (\log x)^n dx$, $\int \sin^n x \cos^n x dx$, Volumes by slicing, disks and washers methods, volumes by cylindrical shells, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution. Techniques of sketching conics, reflection properties of conics, rotation of axes and second degree equations, classification into conics using the discriminant, polar equations of conics.

Unit-III

Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration.



Practical (Credits-2)**List of Practicals**

(Using any software/MATLAB to be performed on a Computer.)

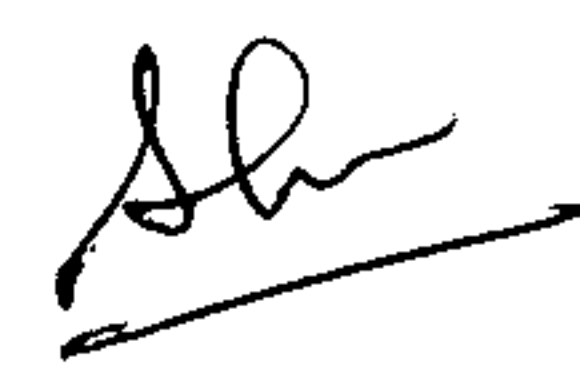
- Plotting the graphs of the functions e^{ax+b} , $\log(ax + b)$, $1/(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$, $|ax + b|$ and to illustrate the effect of a and b on the graph.
- Plotting the graphs of the polynomial of degree 4 and 5.
- Sketching parametric curves (Eg. Trochoid, cycloid, hypocycloid).
- Obtaining surface of revolution of curves.
- Tracing of conics in cartesian coordinates/polar coordinates.
- Sketching ellipsoid, hyperboloid of one and two sheets (using Cartesian coordinates)

BOOKS RECOMMENDED

1. H. Anton, I. Bivens and S. Davis, Calculus, 10th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002. Chapters: 2(2.3), 3(3.1, 3.3), 5(5.2-5.5), 6(6.5, 6.8), 10(10.1, 10.4, 10.5), 11(11.1, 11.4), 12(12.1, 12.2, 12.6).
2. Analytical Geometry of Quadratic Surfaces, B.P. Acharya and D.C. Sahu, Kalyani Publishers, New Delhi, Ludhiana. Chapters: 2, 3.
3. Text Book of Calculus, Part-II-Shanti Narayan, S. Chand & Co., Chapters: 6, 7, 10(Art. 33-36).
4. Text Book of Calculus, Part-III- Shanti Narayan, S. Chand & Co., Chapters: 1(Art. 1, 2), 3(Art. 7, 8), 6(15 restricted).

BOOKS FOR REFERENCE

1. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
2. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.
3. Shanti Narayan and P.K. Mittal-Analytical Solid Geometry, S. Chand & Company Pvt. Ltd., New Delhi.
4. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.



**DSC-MATH-H2
ALGEBRA**

Theory- 5 Credits, Tutorial-1 Credit

Unit-I

Polar representation of complex numbers, n-th roots of unity, De Moivre's theorem for rational indices and its applications.

Equivalence relations, Functions, Composition of functions, Invertible functions, One to one correspondence and cardinality of a set, Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algorithm, Congruence relation between integers, Principles of Mathematical Induction, statement of Fundamental Theorem of Arithmetic.

Unit-II

Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation $Ax = b$, solution sets of linear systems, applications of linear systems, Vector spaces and subspaces, examples, linear independence, linear dependence, basis, dimension, examples .

Unit-III

Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. Subspaces of R^n , dimension of subspaces of R^n and rank of a matrix, Eigen values, Eigen Vectors and Characteristic Equation of a matrix.

BOOKS RECOMMENDED:

1. Andreescu and Dorin Andrica, Complex Numbers from A to Z, Birkhauser, 2006. Chapter:2
2. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005. Chapter 2 (Section 2.4), Chapter 3, Chapter 4 (Sections 4.1 up to 4.1.6, 4.2 up to 4.2.11, 4.4 (till 4.4.8), 4.3.7 to 4.3.9), Chapter 5 (5.1.1, 5.1.4).
3. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007. Chapters:1(1.1-1.9), 2(2.1-2.3; 2.8, 2.9), 5(5.1,5.2).



BOOKS FOR REFERENCE:

1. An Introduction to Linear Algebra by V Krishna Murthy, V P Mainra, J L Arora, Affiliated East-West Press Pvt. Ltd.
2. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed., McGraw Hill International Edition, 2009.

GENERIC COURSES (SEMESTER-I)

GE-MATH-H-1A

CALCULUS

Theory- 5 Credits, Tutorial-1 Credit

Unit-I

Limit and Continuity, Discontinuity, Differentiation- derivative of functions, derivatives of parametrically defined functions, derivative of implicitly defined functions, Successive differentiation- n'th derivative of rational functions, n'th derivative of power of sine and cosine function, Leibnitz's theorem, Taylors series.

Unit-II

Mean value theorems-Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Maxima and Minima- necessary and sufficient condition for extreme values, use of second order derivative, Partial differentiation- limit continuity of functions of two variables, partial derivative.

Unit-III

Definite integral- Reduction formulae, Fundamental theorem of Integral calculus, Summation of series, Area of plane regions, Rectification lengths of plane curves.

BOOKS RECOMMENDED:

1. Shanti Narayan, P.K.Mittal, Differential calculus, S.Chand & Company P(Ltd.), 2012.
2. Shanti Narayan, P.K.Mittal, Integral calculus, S.Chand & Company P(Ltd.), 2011.
3. H. Anton, I. Bivens and S. Davis, Calculus, 10th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.

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GE-MATH-H-1B**MATRIX THEORY****Theory- 5 Credits, Tutorial-1 Credit****UNIT- I**

Vector spaces, Examples, subspaces, examples. Concept of Linear dependence and Independence, Basis and dimension, examples of different bases.

Linear transformation, Representation of linear transformations by matrices, Kernel and images of a Linear transformation, Geometric ideas, Some special linear transformations and their matrices.

UNIT-II

Matrix operations, Types of matrices. Determinants, cofactors, minors, Rank of a matrix. Elementary row operations, matrix inverses, Adjoint of matrix

UNIT-III

Eigen values and Eigen vectors, Characteristic equations, Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3. , Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four.

Books Recommended

1. S Kumaresan, *Linear Algebra*, A geometric approach Prentice Hall of India Learning Pvt. Ltd., New Delhi, 2014.
2. An Introduction to Linear Algebra by V Krishna Murthy, V P Mainra, J L Arora, Affiliated East-West Press Pvt. Ltd.
3. Richard Bronson, *Theory and Problems of Matrix Operations*, Tata McGraw Hill,
4. A.I. Kostrikin, *Introduction to Algebra*, Springer Verlag, 1984.



SEMESTER-II
(CORE COURSES)

DSC-MATH-H3

REAL ANALYSIS

Theory- 5 Credits, Tutorial-1 Credit

Unit-I

Review of Algebraic and Order Properties of R , δ -neighborhood of a point in R , Idea of countable sets, uncountable sets and uncountability of R . Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Suprema and Infima, The Completeness Property of R , The Archimedean Property, Density of Rational (and Irrational) numbers in R , Intervals.

Unit-II

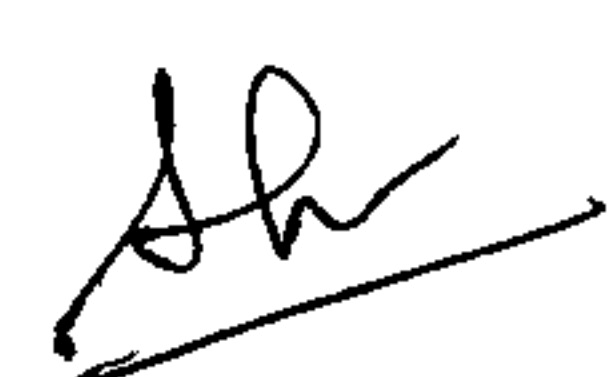
Limit points of a set, Isolated points, Illustrations of Bolzano-Weierstrass theorem for sets. Sequences, Bounded sequence, Convergent sequence, Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria, Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy's Convergence Criterion.

Unit-III

Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's n th root test, Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence.

BOOKS RECOMMENDED:

1. R.G. Bartle and D. R. Sherbert, *Introduction to Real Analysis* (3rd Edition), John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002. Chapter 1 (Section 1.3), Chapter 2 (Sections 2.1, 2.2.7, 2.2.8), Chapter 2 (Sections 2.3, 2.4, 2.5.), Chapter 3 (Section 3.1-3.5) Chapter 4 (Section 4.1), Chapter 9.
2. G. Das and S. Pattanayak, *Fundamentals of Mathematical Analysis*, TMH Publishing Co. Chapter 3.1-3.4, Chapter 4 (4.1 -4.13)
3. S.C. Mallik and S. Arora-*Mathematical Analysis*, New Age International Publications. chapters: 1, 3, 4 (1-8).



BOOKS FOR REFERENCES:

1. A.Kumar, S. Kumaresan, A basic course in Real Analysis, CRC Press, 2014.
2. Brian S. Thomson, Andrew. M. Bruckner, and Judith B. Bruckner, *Elementary Real Analysis*, Prentice Hall, 2001.
3. Gerald G. Bilodeau, Paul R. Thie, G.E. Keough, *An Introduction to Analysis*, Jones & Bartlett, Second Edition, 2010.

DSC-MATH-H-4**DIFFERENTIAL EQUATIONS (With Practicals)**

Theory-⁴~~5~~ Credits, Tutorial-~~1~~ Credit Practical - 2 Credits *sh*

UNIT-I

Differential equations and mathematical models, General, Particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equations and Bernoulli's equation, special integrating factors and transformations.

Introduction to compartmental models, Exponential decay radioactivity (case study of detecting art forgeries), lake pollution model (with case study of Lake Burley Griffin), drug assimilation into the blood (case study of dull, dizzy and dead), exponential growth of population, Density dependent growth, Limited growth with harvesting.

UNIT-II

General solution of homogeneous equation of second order, principle of superposition, Wronskian, its properties and applications, method of undetermined coefficients, method of variation of parameters, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation.

UNIT-III

Equilibrium points, Interpretation of the phase plane, predatory-pray model and its analysis, epidemic model of influenza and its analysis, battle model and its analysis.

Practical / Lab work to be performed on a computer: 2 credits

Modeling of the following problems using *Matlab / Mathematica / Maple* etc.

(26)

1. Plotting of second order solution family of differential equation.
2. Plotting of third order solution family of differential equation.
3. Growth model (exponential case only).
4. Decay model (exponential case only).
5.
 - (a) Lake pollution model (with constant/seasonal flow and pollution concentration).
 - (b) Case of single cold pill and a course of cold pills.
 - (c) Limited growth of population (with and without harvesting).
6.
 - (a) Predatory-prey model (basic volterra model, with density dependence, effect of DDT, two prey one predator).
 - (b) Epidemic model of influenza (basic epidemic model, contagious for life, disease with carriers).
 - (c) Battle model (basic battle model, jungle warfare, long range weapons).
7. Plotting of recursive sequences.
8. Study the convergence of sequences through plotting.
9. Verify Bolzano Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.
10. Study the convergence/divergence of infinite series by plotting their sequences of partial sum.
11. Cauchy's root test by plotting n th roots.
12. Ratio test by plotting the ratio of n th and $n+1$ th term

BOOKS RECOMMENDED:

1. Belinda Barnes and Glenn R. Fulford, *Mathematical Modeling with Case Studies, A Differential Equation Approach using Maple and Matlab*, 2nd Ed., Taylor and Francis group, London and New York, 2009. Chapter:2(2.1-2.3, 2.5-2.8); chapter:3(3.1-3.3);chapter:5 (5.1-5.3,5.7); chapter:6 (6.1-6.4)
2. S.L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, India, 2004.Chapter:1, 2; chapter:4(4.5)
3. Martha L Abell, James P Braselton, *Differential Equations with MATHEMATICA*, 3rd Ed., Elsevier Academic Press, 2004.
4. Simmons G F *Differential equation* Tata Mc GrawHill , chapter: 3 (14-19).



BOOKS FOR REFERENCES:

1. Martin Braun, Differential Equations and their Applications, Springer International, Student Ed.
2. 2. Zafer Ahsan, Differential Equations and their Applications, PHI.

GENERIC COURSES (SECOND SEMESTER) GE-MATH-H-2A

DIFFERENTIAL EQUATIONS (6 credits) Theory- 5 Credits, Tutorial-1 Credit

UNIT-I

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for x, y, p. Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order.

UNIT-II

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

UNIT -III

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method. Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

BOOKS RECOMMENDED:

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967.
3. Simmons G F *Differential equation* Tata Mc GrawHill

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GE-MATH-H-2B**NUMERICAL METHODS (6 Credits)****Theory- 5 Credits, Tutorial-1 Credit****UNIT-I**

Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method,

Gauss Elimination and Gauss Jordan methods, LU decomposition, Gauss-Jacobi, Gauss-Siedel.

UNIT-II

Lagrange and Newton interpolation: linear and higher order, finite difference operators. Numerical differentiation: forward difference, backward difference and central Difference.

UNIT-III

Integration: trapezoidal rule, Simpson's rule, Euler's method, Runge-Kutta methods of orders two and four..

BOOKS RECOMMENDED:

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 5th Ed., New age International Publisher, India, 2007.

References:

1. S. S. Sastry, *Introductory method for Numerical Analysis*, PHI New Delhi.

2. S. D. Conte and Carl De Boor, *Elementary Numerical Analysis*, Mc Graw Hill.

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27/10/16

SAMBALPUR UNIVERSITY

STRUCTURE OF THE BA/BSC MATHEMATICS HONOURS SYLLABUS BASED ON
CHOICE BASED CREDIT SYSTEM

EFFECTIVE FROM 2016-17

Semester	Course Number	Title of the Course	Number of credits assigned to the course		Total Credits
			Theory	Practical (P)/ Tutorial(T)	
DISCIPLINE SPECIFIC CORE COURSES(14 PAPERS)(DSC)					
1st	DSC- MATH-H -1	Calculus(P)	4	2	6
	DSC—MATH-H -2	Algebra	5	1	6
2nd	DSC- MATH-H -3	Real Analysis	5	1	6
	DSC- MATH-H -4	Differential equations(P)	4	2	6
3rd	DSC- MATH-H -5	Theory of Real functions	5	1	6
	DSC- MATH-H -6	Group Theory-I	5	1	6
	DSC- MATH-H -7	Multivariable calculus	5	1	6
4th	DSC- MATH-H -8	Numerical Methods(P)	4	2	6
	DSC- MATH-H -9	Riemann integration and series of functions	5	1	6
	DSC- MATH-H -10	Ring Theory and Linear Algebra-I	5	1	6
5th	DSC- MATH-H -11	Partial differential equations and system of ODEs (P)	4	2	6
	DSC- MATH-H -12	Group Theory-II	5	1	6
6th	DSC- MATH-H -13	Metric Space and Complex analysis	5	1	6
	DSC- MATH-H -14	Ring Theory and Linear Algebra-II	5	1	6
DISCIPLINE SPECIFIC ELECTIVE COURSES(4 PAPERS)(DSE)					
5Th	DSE- MATH-H-1	Discrete Mathematics	5	1	6
		Or Number Theory	5	1	6

		Or Object oriented programming in C++	5	1	6
5th	DSE- MATH-H-2	Probability and Statistics	5	1	6
		Or Industrial Mathematics	5	1	6
		Or Theory of Equations	5	1	6
6th	DSE- MATH-H-3	Mathematical Methods	5	1	6
		Or Bio Mathematics	5	1	6
		or Linear Programming	5	1	6
6th	DSE- MATH-H-4	Mathematical Modelling	5	1	6
		Or Mechanics	5	1	6
		Or Differential Geometry	5	1	6
		Or Project	6	1	6
GENERIC ELECTIVES(GE) 4 PAPERS					
1st	GE-MATH-H-1A	Calculus	5	1	6
	GE-MATH-H-1B	Or Matrix Theory	5	1	6
2nd	GE-MATH-H-2A	Differential equations	5	1	6
	GE-MATH-H-2B	Or Numerical methods	5	1	6
3rd	GE-MATH-H-3A	Linear Programming	5	1	6
	GE-MATH-H-3B	Or Discrete Mathematics	5	1	6
4th	GE-MATH-H-4A	Algebra	5	1	6
	GE-MATH-H-4B	Or Mathematical methods	5	1	6

ABILITY ENHANCEMENT COURSES(AEC)TWO TYPES(AECC+SEC)					
ABILITY ENHANCEMENT COMPULSORY COURSES(AECC)					
1st	AECC-MATH-1	Environmental science	2		
2nd	AECC-MATH-2	English/MIL/Hindi communication	2		
SKILL ENHANCEMENT COURSES(SEC) 2 credits					
3rd	SEC- MATH-H-1A SEC- MATH-H-1B	Programming in C	2		2
		or Logic and Set theory	2		2
4th	SEC-MATH-H-2A OR SEC- MATH-H-2B	Graph theory	2		2
		or Operating System (LINUX)	2		2
		Total credits for honours Mathematics(DSC+DSE+GE +SEC)	140 credits		

SCHEME OF EXAMINATION FOR UNDERGRADUATE HONOURS MATHEMATICS COURSES

1. The duration of Each theory examination will be of 2 hours carrying 50 marks. The grade point conversion, CGPA calculation and percentage conversion will be done as per Sambalpur University guidelines.

2. Each paper has three units. Question of each paper will have two groups namely Group A and group B.

3. Group A will have one question having 9 short answer type questions of 2 marks each choosing three short questions from each unit. The students will have to answer seven out of that having $7 \times 2 = 14$ marks in total.

4. Group B will have three long answer type questions choosing one from each of the three units($12 \times 3 = 36$ marks) with alternatives. Each question may have two parts namely (a) and (b) distributing 12 marks as per the weightage of the questions.

5. The questions should be such that it would take maximum 25 minutes to answer one full long question of 12 marks and 5 minutes to answer one short question of 2 marks.

6. The valuation of the tutorial is through two periodical tests from first unit and second unit of the course respectively of 25 marks each conducted by the tutor in the class. Each test should be of one hour duration. The tutor may conduct one extra periodical from the third unit for the defaulters who could not appear the exam due to medical reasons/demise of family members/accidents/activities permitted by the college . The answer scripts of the periodicals should be preserved for technical reasons as per rule.

7. One of the suggested pattern of a question for semester examination is given below.

SUGGESTED PATTERN OF QUESTION FOR MATHEMATICS HONOURS STUDENTS

SEM <->/<Degree>/2016-17/ MATH/SU

<Year>

<Subject>

TIME-2 HOURS

CREDIT- <->

FULL MARKS-50.

The symbols carry their usual meaning.

GROUP A

1. Answer any seven from the following.

Marks 7x2=14

(a) < short question Unit-I>

(b) < short question Unit-I>

(c) < short question Unit-I>.

(d) < short question Unit-II>.

(e) < short question Unit-II>

(f) < short question Unit-II>

(g) < short question Unit-III>

(h) < short question Unit-III>

(i) < short question Unit-III>

GROUP B

[12x3=36]

Answer one question from each unit.

UNIT-I

2.(a) < Long question Unit-I>

[marks]

(b) < Long question Unit-I>

[marks]

3.(a) < Long question Unit-I>

[marks]

(b) < Long question Unit-I>

[marks]

UNIT-II

4.(a) < Long question Unit-II>

[marks]

(b) < Long question Unit-II>

[marks]

5.(a) < Long question Unit-II >

[marks]

(b) < Long question Unit-II>

[marks]

UNIT-III

6.(a) < Long question Unit-III>

[marks]

(b) < Long question Unit-III>

[marks]

7.(a) < Long question Unit-III>

[marks]

(b) < Long question Unit-III>

[marks]

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DETAILED SYLLABUS FOR HONOURS MATHEMATICS COURSES

B.A./B.SC.(HONOURS)-MATHEMATICS

SEMESTER-I

(CORE COURSES)
DSC-MATH-H1

CALCULUS (WITH PRACTICAL) - 6 credits

Theory (Credits-4)

Unit-I

Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of the type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n \sin x$, $(ax+b)^n \cos x$, concavity and inflection points, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L-Hospitals rule,

Unit-II

Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x dx$, $\int \cos^n x dx$, $\int \tan^n x dx$, $\int \sec^n x dx$, $\int (\log x)^n dx$, $\int \sin^n x \cos^n x dx$, Volumes by slicing, disks and washers methods, volumes by cylindrical shells, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution. Techniques of sketching conics, reflection properties of conics, rotation of axes and second degree equations, classification into conics using the discriminant, polar equations of conics.

Unit-III

Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration.

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Practical (Credits-2)

List of Practicals

(Using any software/MATLAB to be performed on a Computer.)

- Plotting the graphs of the functions e^{ax+b} , $\log(ax+b)$, $1/(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $|ax+b|$ and to illustrate the effect of a and b on the graph.
- Plotting the graphs of the polynomial of degree 4 and 5.
- Sketching parametric curves (Eg. Trochoid, cycloid, hypocycloid).
- Obtaining surface of revolution of curves.
- Tracing of conics in cartesian coordinates/polar coordinates.
- Sketching ellipsoid, hyperboloid of one and two sheets (using Cartesian coordinates)

BOOKS RECOMMENDED

1. H. Anton, I. Bivens and S. Davis, Calculus, 10th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002. Chapters: 2(2.3), 3(3.1, 3.3), 5(5.2-5.5), 6(6.5, 6.8), 10(10.1, 10.4, 10.5), 11(11.1, 11.4), 12(12.1, 12.2, 12.6).
2. Analytical Geometry of Quadratic Surfaces, B.P. Acharya and D.C. Sahu, Kalyani Publishers, New Delhi, Ludhiana. Chapters: 2, 3.
3. Text Book of Calculus, Part-II-Shanti Narayan, S. Chand & Co., Chapters: 6, 7, 10(Art. 33-36).
4. Text Book of Calculus, Part-III- Shanti Narayan, S. Chand & Co., Chapters: 1(Art. 1, 2), 3(Art. 7, 8), 6(15 restricted).

BOOKS FOR REFERENCE

1. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
2. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.
3. Shanti Narayan and P.K. Mittal-Analytical Solid Geometry, S. Chand & Company Pvt. Ltd., New Delhi.
4. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.

DSC-MATH-H2 ALGEBRA

Theory- 5 Credits, Tutorial-1 Credit

Unit-I

Polar representation of complex numbers, n -th roots of unity, De Moivre's theorem for rational indices and its applications.

Equivalence relations, Functions, Composition of functions, Invertible functions, One to one correspondence and cardinality of a set, Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algorithm, Congruence relation between integers, Principles of Mathematical Induction, statement of Fundamental Theorem of Arithmetic.

Unit-II

Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation $Ax = b$, solution sets of linear systems, applications of linear systems, Vector spaces and subspaces, examples, linear independence, linear dependence, basis, dimension, examples.

Unit-III

Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. Subspaces of \mathbb{R}^n , dimension of subspaces of \mathbb{R}^n and rank of a matrix, Eigen values, Eigen Vectors and Characteristic Equation of a matrix.

BOOKS RECOMMENDED:

1. Andreescu and Dorin Andrica, Complex Numbers from A to Z, Birkhauser, 2006. Chapter:2
2. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005. Chapter 2 (Section 2.4), Chapter 3, Chapter 4 (Sections 4.1 up to 4.1.6, 4.2 up to 4.2.11, 4.4 (till 4.4.8), 4.3.7 to 4.3.9), Chapter 5 (5.1.1, 5.1.4).
3. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007. Chapters:1(1.1-1.9), 2(2.1-2.3; 2.8, 2.9), 5(5.1,5.2).



BOOKS FOR REFERENCE:

1. An Introduction to Linear Algebra by V Krishna Murthy, V P Mainra, J L Arora, Affiliated East-West Press Pvt. Ltd.
2. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed., McGraw Hill International Edition, 2009.

GENERIC COURSES (SEMESTER-I)

GE-MATH-H-1A

CALCULUS

Theory- 5 Credits, Tutorial-1 Credit

Unit-I

Limit and Continuity, Discontinuity, Differentiation- derivative of functions, derivatives of parametrically defined functions, derivative of implicitly defined functions, Successive differentiation- n'th derivative of rational functions, n'th derivative of power of sine and cosine function, Leibnitz's theorem, Taylors series.

Unit-II

Mean value theorems-Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Maxima and Minima- necessary and sufficient condition for extreme values, use of second order derivative, Partial differentiation- limit continuity of functions of two variables, partial derivative.

Unit-III

Definite integral- Reduction formulae, Fundamental theorem of Integral calculus, Summation of series, Area of plane regions, Rectification lengths of plane curves.

BOOKS RECOMMENDED:

1. Shanti Narayan, P.K.Mittal, Differential calculus, S.Chand & Company P(Ltd.), 2012.
2. Shanti Narayan, P.K.Mittal, Integral calculus, S.Chand & Company P(Ltd.), 2011.
3. H. Anton, I. Bivens and S. Davis, Calculus, 10th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.

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GE-MATH-H-1B**MATRIX THEORY****Theory- 5 Credits, Tutorial-1 Credit****UNIT- I**

Vector spaces, Examples, subspaces, examples. Concept of Linear dependence and Independence, Basis and dimension, examples of different bases. Linear transformation, Representation of linear transformations by matrices, Kernel and images of a Linear transformation, Geometric ideas, Some special linear transformations and their matrices.

UNIT-II


Matrix operations, Types of matrices. Determinants, cofactors, minors, Rank of a matrix. Elementary row operations, matrix inverses, Adjoint of matrix

UNIT-III

Eigen values and Eigen vectors, Characteristic equations, Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3. , Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four.

Books Recommended

1. S Kumaresan, *Linear Algebra*, A geometric approach Prentice Hall of India Learning Pvt. Ltd., New Delhi, 2014.
2. An Introduction to Linear Algebra by V Krishna Murthy, V P Mainra, J L Arora, Affiliated East-West Press Pvt. Ltd.
3. Richard Bronson, *Theory and Problems of Matrix Operations*, Tata McGraw Hill,
4. A.I. Kostrikin, *Introduction to Algebra*, Springer Verlag, 1984.



SEMESTER-II
(CORE COURSES)

DSC-MATH-H3

REAL ANALYSIS

Theory- 5 Credits, Tutorial-1 Credit

Unit-I

Review of Algebraic and Order Properties of R , δ -neighborhood of a point in R , Idea of countable sets, uncountable sets and uncountability of R . Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Suprema and Infima, The Completeness Property of R , The Archimedean Property, Density of Rational (and Irrational) numbers in R , Intervals.

Unit-II

Limit points of a set, Isolated points, Illustrations of Bolzano-Weierstrass theorem for sets. Sequences, Bounded sequence, Convergent sequence, Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria, Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy's Convergence Criterion.

Unit-III

Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's n th root test, Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence.

BOOKS RECOMMENDED:

1. R.G. Bartle and D. R. Sherbert, *Introduction to Real Analysis* (3rd Edition), John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002. Chapter 1 (Section 1.3), Chapter 2 (Sections 2.1, 2.2.7, 2.2.8), Chapter 2 (Sections 2.3, 2.4, 2.5.), Chapter 3 (Section 3.1-3.5) Chapter 4 (Section 4.1), Chapter 9.
2. G. Das and S. Pattanayak, *Fundamentals of Mathematical Analysis*, TMH Publishing Co. Chapter 3.1-3.4, Chapter 4 (4.1 -4.13)
3. S.C. Mallik and S. Arora-*Mathematical Analysis*, New Age International Publications. chapters: 1, 3, 4 (1-8).

BOOKS FOR REFERENCES:

1. A.Kumar, S. Kumaresan, A basic course in Real Analysis, CRC Press, 2014.
2. Brian S. Thomson, Andrew. M. Bruckner, and Judith B. Bruckner, *Elementary Real Analysis*, Prentice Hall, 2001.
3. Gerald G. Bilodeau, Paul R. Thie, G.E. Keough, *An Introduction to Analysis*, Jones & Bartlett, Second Edition, 2010.

DSC-MATH-H-4**DIFFERENTIAL EQUATIONS (With Practicals)**

Theory-⁴~~3~~ Credits, Tutorial-~~1~~ Credit Practical - 2 Credits ^u
 UNIT-I ^u

Differential equations and mathematical models, General, Particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equations and Bernoulli's equation, special integrating factors and transformations.

Introduction to compartmental models, Exponential decay radioactivity (case study of detecting art forgeries), lake pollution model (with case study of Lake Burley Griffin), drug assimilation into the blood (case study of dull, dizzy and dead), exponential growth of population, Density dependent growth, Limited growth with harvesting.

UNIT-II

General solution of homogeneous equation of second order, principle of superposition, Wronskian, its properties and applications, method of undetermined coefficients, method of variation of parameters, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation.

UNIT-III

Equilibrium points, Interpretation of the phase plane, predatory-pray model and its analysis, epidemic model of influenza and its analysis, battle model and its analysis.

Practical / Lab work to be performed on a computer: 2 credits

Modeling of the following problems using *Matlab / Mathematica / Maple* etc.

- (11)
1. Plotting of second order solution family of differential equation.
 2. Plotting of third order solution family of differential equation.
 3. Growth model (exponential case only).
 4. Decay model (exponential case only).
 5.
 - (a) Lake pollution model (with constant/seasonal flow and pollution concentration).
 - (b) Case of single cold pill and a course of cold pills.
 - (c) Limited growth of population (with and without harvesting).
 6.
 - (a) Predatory-prey model (basic volterra model, with density dependence, effect of DDT, two prey one predator).
 - (b) Epidemic model of influenza (basic epidemic model, contagious for life, disease with carriers).
 - (c) Battle model (basic battle model, jungle warfare, long range weapons).
 7. Plotting of recursive sequences.
 8. Study the convergence of sequences through plotting.
 9. Verify Bolzano Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.
 10. Study the convergence/divergence of infinite series by plotting their sequences of partial sum.
 11. Cauchy's root test by plotting n th roots.
 12. Ratio test by plotting the ratio of n th and $n+1$ th term

BOOKS RECOMMENDED:

1. Belinda Barnes and Glenn R. Fulford, *Mathematical Modeling with Case Studies, A Differential Equation Approach using Maple and Matlab*, 2nd Ed., Taylor and Francis group, London and New York, 2009. Chapter:2(2.1-2.3, 2.5-2.8); chapter:3(3.1-3.3);chapter:5 (5.1-5.3,5.7); chapter:6 (6.1-6.4)
2. S.L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, India, 2004.Chapter:1, 2; chapter:4(4.5)
3. Martha L Abell, James P Braselton, *Differential Equations with MATHEMATICA*, 3rd Ed., Elsevier Academic Press, 2004.
4. Simmons G F *Differential equation* Tata Mc GrawHill , chapter: 3 (14-19).

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BOOKS FOR REFERENCES:

1. Martin Braun, Differential Equations and their Applications, Springer International, Student Ed.
2. 2. Zafer Ahsan, Differential Equations and their Applications, PHI.

GENERIC COURSES (SECOND SEMESTER) GE-MATH-H-2A

DIFFERENTIAL EQUATIONS (6 credits) Theory- 5 Credits, Tutorial-1 Credit

UNIT-I

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for x, y, p. Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order.

UNIT-II

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

UNIT -III

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method. Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

BOOKS RECOMMENDED:

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967.
3. Simmons G F *Differential equation* Tata Mc GrawHill

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GE-MATH-H-2B

NUMERICAL METHODS (6 Credits)

Theory- 5 Credits, Tutorial-1 Credit

UNIT-I

Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method,

Gauss Elimination and Gauss Jordan methods, LU decomposition, Gauss-Jacobi, Gauss-Siedel.

UNIT-II

Lagrange and Newton interpolation: linear and higher order, finite difference operators. Numerical differentiation: forward difference, backward difference and central Difference.

UNIT-III

Integration: trapezoidal rule, Simpson's rule, Euler's method, Runge-Kutta methods of orders two and four..

BOOKS RECOMMENDED:

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 5th Ed., New age International Publisher, India, 2007.

References:

1.S. S. Sastry, *Introductory method for Numerical Analysis*, PHI New Delhi.

2. S. D. Conte and Carl De Boor, *Elementary Numerical Analysis*, Mc Graw Hill.

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