COURSES OF STUDIES

FOR

THREE YEAR DEGREE COURSE

IN

SCIENCE HONOURS

MATHEMATICS

STUDENT COPY

Choice Based Credit System(CBCS)

First & Second Semester Examination – 2018-19

Third & Fourth Semester Examination – 2019-20

Fifth & Sixth Semester Examination – 2020-21

GOVERNMENT AUTONOMOUS COLLEGE,
PHULBANI, KANDHAMAL

SYLLABI FOR CBCS COURSE

Sem	CORE COURSE (14)	Ability Enhancement Compulsory Course (AECC) (2)	Skill based Enhancement Compulsory Course (SECC) (2)	Elective: Discipline Specific DSE (4)	Elective: Generic (GE) (4)
I	CORE-I	AECC-1			GE-1 (Minor-1)
	CORE-II				
II	CORE-III	AECC-2			GE-1 (Minor-2)
	CORE -IV				
III	CORE-V		SECC-2		GE-2 (Minor-1)
	CORE-VI				
	CORE-VII				
IV	CORE-VIII		SECC-1		GE-2 (Minor-2)
	CORE-IX				
	CORE-X				
V	CORE-XI			DSE-1	
	CORE-XII			DSE-2	
VI	CORE-XIII			DSE-3	
	CORE-XIV			DSE-4 (Project)	

SECC-1 : To be offered by English Department.
SECC-2 : To be offered by Mathematics Department.
GE : Minor-1 and Minor-2 is to be decided by the college Based on Subject.

QUESTION PATTERN FOR MID SEM

Mid Semester Examination	Full Marks	No. of Short Answer type Questions (2 marks each) (Compulsory)	No. of Long Answer type Questions (8 marks each)	No. of Long Answer type Questions (12 marks each)
Practical Subject	20	6	1	*
Non-Practical Subject	20	4	*	1

QUESTION PATTERN FOR END SEM

End Semester Examination	Full Marks	GROUP – A					GROUP - B									
		No. of Short Answer type Questions (2 marks each) (Compulsory)					No. of Long Answer type Questions (8 marks each)					No. of Long Answer type Questions (12 marks each)				
Units -->		I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
Non-Practical Subject	80	10					*	*	*	*	*	1	1	1	1	1
Practical Subject	50	5					1	1	1	1	1	*	*	*	*	*

- There is no alternative questions (choice) in Group-A questions (Short Answer type questions). All questions are compulsory.
- There is internal alternative questions (choice) in each number in Group-B questions (Long Answer type questions). Examinee has to answer one questions out of two alternative questions from each number.
- There is little deviation in question pattern of AECC (Eng Communication) & SECC-I & II. Details regarding question pattern of concerned subject is given at appropriate place.)
- The duration of Mid Sem exam of each paper is 1 hour irrespective of Full marks.
- The duration of End Sem exam of each paper is 3 hours for 80 marks/50 marks.

YEAR & SEMESTER-WISE PAPERS & CREDITS AT A GLANCE

Three-Year (6-Semester) CBCS Programme (B.Sc. Hons.) (Mathematics Hons.)				
Yr.	Sl.No.	Course Structure	Code	Credit Points
FIRST YEAR		**SEMESTER-I**		
	1	Calculus-I (with Practical)	C-1.1	4+2
	2	Algebra-I	C-1.2	6
	3	Physics (Mechanics)	GE-1.3	4+2
	4	MIL Communication – Odia / English Communication	AECC-1.4	6
			TOTAL -	**24**
		SEMESTER-II		
	5	Real Analysis-I	C-2.1	6
	6	Differential Equation (with Practical)	C-2.2	4+2
	7	Chemistry (Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons)	GE-2.3	4+2
	8	Environmental Studies	AECC-2.4	6
			TOTAL -	**24**
SECOND YEAR		**SEMESTER-III**		
	9	Real Analysis-II	C-3.1	6
	10	Group theory (Algebra –II)	C-3.2	6
	11	Partial Differential equation and systems of ordinary differential equation (with Practical)	C-3.3	4+2
	12	Physics (Electricity, Magnetism and EMT)	GE-3.4	4+2
	13	Quantitative and Logical Thinking	SECC-3.5	6
			TOTAL -	**30**
		SEMESTER-IV		
	14	Numerical methods (with Practical)	C-4.1	4+2
	15	Riemann integration and series of functions (Analysis –III)	C-4.2	6
	16	Ring theory and linear algebra-I (Algebra-III)	C-4.3	6
	17	Chemistry (Chemical Energetics, Equilibria & Functional Organic Chemistry-I)	GE-4.4	4+2
	18	Communicative English	SECC-4.5	6
			TOTAL -	**30**
FINAL YEAR		**SEMESTER-V**		
	19	Multivariate Calculus (Calculus-II)	C-5.1	6
	20	Probability and statistics	C-5.2	6
	21	C^{++}	DSE-5.3	6
	22	Discrete Mathematics	DSE-5.4	6
			TOTAL -	**24**
		SEMESTER-VI		
	23	Metric Spaces and Complex Analysis	C-6.1	6
	24	Linear Programming	C-6.2	6
	25	Differential Geometry	DSE-6.3	6
	26	Project Work	DSE-6.4	6
			TOTAL -	**24**
			GRAND TOTAL -	**156**

Notes:

- C- Core Course
- GE- Generic Elective Course
- DSE- Discipline Specific Elective Course
- AECC- Ability Enhancement Compulsory Course
- SECC- Skill based Enhancement Compulsory Course
- For a 6 credit course, the total teaching hours are: Minimum- 50 Hours, Maximum-65 Hours

SEMESTER-I

C-1.1: CALCULUS-I

Full Marks – 100 (70+30)
Mid Sem – 20/1 hr
End Sem Theory – 50/3 hrs

UNIT-1

Hyperbolic function, higher order derivative, Leibnitz rule and its applications to problems, Homogeneous functions, Euler's theorem for two variables, concavity and point of inflection, special types of function (gamma and betta function with relation). L-H-Rule

UNIT-II

Asymptotes, curvature and curve tracing

UNIT-III

Reduction formula for the integral $\int \sin^n x\,dx$, $\int \cos^n x\,dx$, $\int \tan^n x\,dx$, $\int \sec^n x\,dx$, $\int \operatorname{cosec}^n x\,dx$, $\int (\log x)^n\,dx$, area, length, volume and area of surface of revolution.

UNIT-IV

Sphere, cone, cylinder and central conicoids

UNIT-V

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

PRACTICAL

End Sem Practical – 30/3 hrs

List of practical's (Using any software)
Practical /Lab work to be performed on a computer.
Record=7, Attendance=3, vive-voce=5, Experiment=15.

1. Plotting the graph of the functions $\log(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, e^{ax+b}, $|ax+b|$.
2. Plotting the graphs of the polynomials of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
3. Sketching parametric curves (Eg. Trochoid cycloid, epicycloids, hypocycloid)
4. Obtaining surface of revolution of curves.
5. Tracing of conics in Cartesian co-ordinates/polar co-ordinates.
6. Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, paraboloid, hyperbolic paraboloid using Cartesian co-ordinates.
7. Matrix operations (addition, multiplication, inverse and transpose)

Books Recommended :

1. Topics in calculus by R.K.PANDA AND P.K. SAPATHY, S.G. Publication.
2. Analytical Geometry of Quadratic surfaces, B.P. Acharya and D.C. Sahu, Kalyani Publishers, New Delhi, Ludhiana
3. Elements of vector calculus-N-Soren and R-Prasad.
4. Text book of Calculus, part-II Shanti Narayan and P.K. Mittal, S.Chand and Co.
5. Text book of Calculus, part-III Shanti Narayan and P.k.Mittal, S.Chand and Co.
6. M.J.Strauss,G.I.Bradly and K.J. Smith, 3rd Ed. Dorling Kindersly (India) P. Ltd .(Pearson Education),New Delhi -2007, chapter 4(4.3,4.4,4.5,&4.7),999.4),10(10.1-10.4)
7. H.Anton, I.Bivens and S. Davies, Calculus, 7th Ed. John Wiley and Sons (Asia)P. Ltd, Singapore, 2002: chapter: 6(6.2-6.5), 7(7.8), 8(8.2-8.3), pages 532-538, 11(11.1), 13(13.5).
8. Analytical Solid Geometry by Shanti Narayan and P.k. Mittal, S. Chand and Co.
9. G.B.Thomes and R.L. Finney, Calculus, 9th Ed. Pearson Education, Delhi, 2005.
10. R. Courant and F. john, Introduction to Calculus and analysis (volume I and II)

C-1.2: ALGEBRA-I

Full Marks – 100
Mid Sem – 20/1 hr
End Sem – 80/3 hrs

UNIT-I

Polar representation of complex number, n-th roots of unity, De-Movire's theorem and its applications

UNIT-II

Equivalence relations, functions, composite functions, invertible functions, one-to-one corresponds and cardinality of a set, division algorithm, divisibility and Euclidean algorithm, Congruence relation between integers, principal of method of induction, statement of Fundamental Theorem of Arithmetic

UNIT-III

Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation Ax=b, solution sets of linear systems (Gauss elimination, gauss Jordan method), application of linear systems

UNIT-IV

Vector space, linear independence, span of a vector, subspace, rank of a matrix

UNIT-V

Introduction to linear transformation, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices, Eigen values, Eigen vectors and characteristic equation of a matrix

Books Recommended :

1. Complex Analysis, S. Armugan, A. Thangapandi Issac, Somasundaram, SCITECH Publication (India) Pvt. Ltd, Chennai.
2. Discrete Mathematics by K.H. Rosen.
3. An Introduction to linear algebra by V. Krishna Murty, V.P. Mainra, J.L Arora, Affiliated –east-west press Pvt Ltd.
4. L.V. Ahlfors, complex Analysis, McGraw-Hill (International Students Ed.)
5. Titu Andreescu and Dorin Andrica, Complex Numbers from A to Z, Birkhauser, 2006, chapter-2 .
6. Edgr G. Goodaire and Michael M. Parmenter, Discrete Mathematics with graph theory, 3rd Ed. Pearson Education (Singapore) P. Ltd, Indian Reprint, 2005, chapter: 292.4), 3, 4(4.1-4.1.6, 4.2-4.2.11, 4.4(4.1-4.4.80, 4.3-4.3.9, 5(5.1-5.1.4).
7. Dvid C. Lay, Linear Algebra and its Application .3rd Ed. Pearson Education, Asia, Indian Reprint -2007: chapter :1(1.1-1.9), 2(2.1-2.3, 2.8, 2.9), 5(5.1-5.2)

GE-1.3 : MECHANICS

Full Marks - 100
Mid Sem – 20/1 hr
End Sem Theory – 50/3 hrs

UNIT-I

Vectors: **2 Lectures**

Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter.

Ordinary Differential Equations: **2 Lectures**

1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients.

UNIT-II

Laws of Motion: **4 Lectures**

Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass.

Momentum and Energy: **2 Lectures**

Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets.

Rotational Motion: **3 Lectures**

Angular velocity and angular momentum. Torque. Conservation of angular momentum.

UNIT-III **7 Lectures**

Gravitation:

Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Basic idea of global positioning system (GPS). Weightlessness. Physiological effects on astronauts

Oscillations: **6 Lectures**

Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations.

UNIT-IV

Elasticity: **8 Lectures**

Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work

done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion - Torsional pendulum-Determination of Rigidity modulus and moment of inertia - q, η and σ by Searles method.

UNIT-V

Special Theory of Relativity: **6 Lectures**

Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities.

Note: *Students are not familiar with vector calculus. Hence all examples involve differentiation either in one dimension or with respect to the radial coordinate.*

Reference Books:

- University Physics. F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986. Addison-Wesley
- Mechanics Berkeley Physics, Vol..1: Charles Kittel, et. al. 2007, Tata McGraw-Hill.
- Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- Properties of Matter - D.S. Mathur (S. Chand publication) 2013
- Mechanics- D.C. Tayal (Himalaya Publication) 2013
- Classical Dynamics of Particles and Systems –S. T. Thornton (Cengage Learning) 2012
- Analytical Mechanics-Fowles (Cengage Learnings) 2014
- Classical Mechanics-M. Das,P.K. Jena, M. Bhuyan and R.N. Mishra (Srikrishna Publication)

PRACTICAL

End Sem Practical – 30/3 hrs

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Elastic Constants of a Wire by Searle's method.
7. To determine g by Bar Pendulum.
8. To determine g by Kater's Pendulum.
9. To study the Motion of a Spring and calculate (a) Spring Constant, (b) g.

Reference Books:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

AECC-1.4 : ଯୋଗାଯୋଗମୂଳକ ମାତୃଭାଷା- ଓଡ଼ିଆ (କଳା ଓ ବିଜ୍ଞାନ ବିଭାଗ ପାଇଁ)

Full Marks - 100
Mid Sem – 20/1 hr
End Sem – 80/3hrs

ୟୁନିଟ୍-୧ : ବିଜ୍ଞାପନ କଳା ଓ ସାହିତ୍ୟ / ବିଜ୍ଞାପନର ଆବଶ୍ୟକତା ଓ ଉପକାରିତା

ୟୁନିଟ୍-୨ : ଗଳ୍ପ- କୃଷ୍ଣଚୂଡ଼ା- ସୁରେନ୍ଦ୍ର ମହାନ୍ତି

ପାଟଦେଇ- ବୀଣାପାଣି ମହାନ୍ତି

ବୁଢ଼ାଶଙ୍ଖାରୀ- ଲକ୍ଷ୍ମୀକାନ୍ତ ମହାପାତ୍ର

ୟୁନିଟ୍-୩ : କବିତା- ଶ୍ରୀରାଧା- ରମାକାନ୍ତ ରଥ

ପ୍ରତିମା ନାୟକ- ସଚ୍ଚି ରାଉତରାୟ

ଦୁର୍ଯ୍ୟୋଧନ- ସୀତାକାନ୍ତ ମହାପାତ୍ର

ୟୁନିଟ୍-୪ : ପ୍ରବନ୍ଧ- ଗାଡ଼ି ଛାଡ଼ିଦେଲା – ଚନ୍ଦ୍ରଶେଖର ରଥ

ଆମେରିକାରେ ଲୋକଚରିତ୍ର – ଗୋଲୋକ ବିହାରୀ ଧଳ

ସ୍ୱାଧୀନ ଚିନ୍ତା – ବିଶ୍ୱନାଥ କର

ୟୁନିଟ୍-୫ : କାରକ ଓ ବିଭକ୍ତି

ପୁସ୍ତକ :

୧. ଯୋଗାଯୋଗର ଭାଷା, ଫ୍ରେଣ୍ଡସ୍ ପ୍ରକାଶନ, କଟକ

୨. ଗଳ୍ପ, କବିତା ଓ ପ୍ରବନ୍ଧ - ସଂକଳିତ ପୁସ୍ତକ, କଲେଜ ଛକ, ଫୁଲବାଣୀ

AECC-1.4 : ENGLISH COMMUNICATION

Full Marks - 100
Mid Sem – 20/1 hr
End Sem – 80/3hrs

UNIT-I : Introduction

1. What is communication?
2. Types of communication
   - Horizontal
   - Vertical
   - Interpersonal
   - Grapevine

UNIT-II : Language of Communication

1. Verbal : spoken and written
2. Non-verbal
   - Proxemics
   - Kinesics
   - Haptics
   - Chronemics
   - Paralinguistics
3. Barriers to communication
4. Communicative English

UNIT-III : Reading Comprehension (Prose & Poetry)

- Locate and remember the most important points in the reading
- Interpret and evaluate events, ideas and information
- Read "between the lines" to understand underlying meanings
- Connect information to what they already know

UNIT-IV : Writing

- Expanding an Idea
- Note Making
- Information Transfer
- Writing a Memo
- Writing Formal Email
- Writing a Business Letter
- Letters to the Editor
- CV & Resume Writing
- Covering Letter
- Report Writing
- News Story
- Interviewing for newspaper

(The above mentioned writing activities are covered in the prescribed text book Vistas and Visions)

UNIT-V : Language functions in listening and conversation

1. Discussion on a given topic in pairs
2. Speaking on a given topic individually
3. Group Discussion
4. Interview
5. Dialogue

(Practice to be given using the set pieces from the prescribed textbook)

Grammar and Usage :

1. Phrasal verbs
2. Collocation
3. Using Modals
4. Use of Prepositions
5. Common Errors in English Usage

(The above mentioned grammar items are covered in the prescribed text book Vistas and Visions)

Book Prescribed :

1. *Vistas and Visions: An Anthology of Prose and Poetry.* (Ed.) Kalyani Samantray, Himansu S. Mohapatra, Jatindra K. Nayak, Gopa Ranjan Mishra, Arun Kumar Mohanty. OBS

Texts to be studied

Prose

1. Pleasures of Ignorance
2. Life style English
3. Playing the English Gentleman
4. Ecology and Community
5. My Lost Dollar

Poetry

1. Last Sonnet
2. The Darkling Thrush
3. The Felling of Banyan Tree
4. Meting Poets

All grammar and writing activities in the textbook *Vistas and Visions*

Pattern of Examination :

Mid-Semester Examination :

Using texts (500-600 words), students will be tested for

- Vocabulary : synonyms, antonyms, words used as different parts of speech = 10 marks
- Word order ; subject-predicate; subject-verb agreement = 10 marks

End-Semester Examination :

Using texts (600-700 words), students will be tested for

- Use of vocabulary in context 2 marks X 5 bits = 10 marks
- Use of grammar in context 2 marks X 5 bits= 10 marks
- Use of cohesive and transitional devices in one paragraph 2 marks X 10 bits = 20 marks
- Writing two paragraphs (expository/descriptive/narrative/ Argumentative) using topic sentences 10 marks X 2 qns = 20 marks
- Correcting in-text citation from given input 2 marks X 5 bits = 10 marks
- Preparing a correct version of Works Cited page from given input 2 marks X 5 bits = 10 marks

Suggested Readings:

1. *Fluency in English – Part II,* OUP, 2006
2. *Business English,* Pearson, 2008
3. *Communicative English* -E. Suresh Kumar and P. Sreehari
4. *Break Free : Unlock the Powerful Communicator in You*. Rajesh, V. Rupa, 2015
5. *Soft Skills* Shalini Verma, 2009
6. *Language, Literature and Creativity, Orient BlackSwan, 2013*
7. *Language through Literature.* (forthcoming) ed. Gauri Mishra, Dr. Ranajan Kaul, Dr. Brati Biswas

SEMESTER-II

C-2.1: REAL ANALYSIS-I

Full Marks – 100
Mid Sem – 20/1 hr
End Sem – 80/3 hrs

UNIT-I

Review of Algebraic and Order properties of R : Neighbourhood 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

UNIT-II

The completeness property of R : The A Archimedean property, Density of rational and irrational numbers in R, Intervals, Limit points of asset, isolated points, Illustrations of Boolean–Weierstrass theorem for sets

UNIT-III

Sequences, Bounded sequence, Convergent sequence, limit of a sequence, limit theorems, monotonic sequence, monotone convergence theorem, Subsequence, divergence criteria, monotone subsequence theorem (statement only), Bolzano-Weierstrass theorem for sequence, Cauchy sequence, Cauchy's convergence criterion

UNIT-IV

Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence, comparisons test, Ratio test, Cauchy's root test, Raabe's Test

UNIT-V

Logarithimic test, integral test, Gauss test, alternating series, Leibniz test, absolute and conditional convergence

Books Recommended :

1. G.Das and S .Pattnayak , Fundamental of Mathematics Analysis, TMH Publishing Co.,chapter; 2(2.1-to2.4,2.5 to 2.7 0,3(3.1-3.5), 4(4.1-4.7,4.10,4.11,4.12,4.13).
2. S.C. Malik and S.C. Arora- Mathematical Analysis, New Age International publications.
3. R.G. Bartle and D.R. Sheraporbert, Introduction to Real Analysis, 3rd Ed. John Wiley and Sons (Asia) Pvt. Ltd, Singapore, 2002.
4. Gerald G. Bilodeau, Paul R.Thie, G.E. Keough, An Introduction to Analysis, 2nd Ed. Johns & Bartlett 2010.
5. Brain S. Thomson, Andrew M. Bruckner and Judith B. Bruckner, Elementary Real Analysis, Prentice Hall,2001.
6. S.K. Berberian, A First Course in real analysis, Springer Verlag, New York, 1994.
7. D. Smasundaram and B. Choudhury –A First Course in Mathematical Analysis, Narosa Publication House.
8. S.L. Gupta and Nisha Rani –Real Analysis, Vikas Publishing House Pvt. Ltd, New Delhi.

C-2.2: DIFFERENTIAL EQUATION

Full Marks – 100 (70+30)
Mid Sem – 20/1 hr
End Sem Theory – 50/3 hrs

UNIT-I

Differential equation and mathematical models, orders and degree of the differential equation, formation of differential equation, Ist order and Ist degree ODE (variable separable, homogeneous exact, linear), Equation of Ist order but not Ist degree

UNIT-II

Application of Ist order differential equation (growth, Decay and chemical reactions, heat flow and oxygen debt, economics), Second order linear equations (homogeneous and non-homogeneous) with constant coefficients

UNIT-III

Second order equations with variable coefficients, variation of parameters, method of undetermined coefficients, equations reducible to linear equations with constant coefficients, Euler's equation, application of second order differential equations

UNIT-IV

Power series solutions of second order differential equations

UNIT-V

Laplace transform and its applications to solution of differential equation

PRACTICAL

End Sem Practical – 30/3 hrs

List of practical's(Using any software)
Practical /Lab work to be performed on a computer.
Record=7, attendance=3, vive-voce=5, Experiment=15

1. Plotting of second order solution of family of differential equations.
2. Plotting of third order solution of family of differential equations.
3. Growth model (exponential case only)
4. Decay model (exponential case only)
5. Oxygen debt model
6. Economic model
7. Vibration problem

Books Recommended :

1. Acourse of ordinary and partial differential equations by J. Sinha and S. Padhy, Kalyani Publication, New Delhi Chapter:1, 2(2.1-2.7), 3 4(4.1-4.7), 5, 7(7.1-7.4), 9(9.1-9.5, 9.10, 9.11, 9.13).
2. Differential Equations and their Applications, Martin Baraun, Springer International.
3. Advanced Differential Equations by M.D. Raisinghania, S. Chand & Company Ltd. New Delhi.
4. S.L. Ross, Differential Equations, John Wiley & Sons, India, 2004.
5. G. Dennis Zill, A First Course in differential equations with Modelling applications, Cengage Learning India Pvt. Ltd.

GE- 2.3 : ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS

Full Marks – 100
Mid Sem – 20/1 hr
End Sem Theory – 50/3 hrs

SECTION A: INORGANIC CHEMISTRY-1

UNIT-I : Atomic Structure (14 Periods)

Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de-Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure.

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ 2 , Schrödinger equation for hydrogen atom. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers ml and ms. Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (ms).

Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

UNIT-II : Chemical Bonding and Molecular Structure-I (16 Lectures)

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character

UNIT-III: **Chemical Bonding and Molecular Structure-II** Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements

Concept of resonance and resonating structures in various inorganic and organic compounds

MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO+ , Comparison of VB and MO approaches

SECTION B : ORGANIC CHEMISTRY-I

UNIT- IV : Fundamentals of Organic Chemistry (8 Lectures)

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis.

Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals.

Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.

Stereochemistry (10 Lectures)

Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

UNIT- V : Aliphatic Hydrocarbons (12 Lectures)

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.

Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. $KMnO_4$) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.

Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, Ozonolysis and oxidation with hot alk. $KMnO_4$.

Reference Books :

1. J. D. Lee: A new Concise Inorganic Chemistry, E L. B. S.
2. F. A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley.
3. Douglas, McDaniel and Alexader: Concepts and Models in Inorganic Chemistry, John Wiley.
4. James E. Huheey, Ellen Keiter and Richard Keiter: Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Publication.
5. T. W. Graham Solomon: Organic Chemistry, John Wiley and Sons.
6. Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
7. E. L. Eliel: Stereochemistry of Carbon Compounds, Tata McGraw Hill.• I. L. Finar: Organic Chemistry (Vol. I & II), E. L. B. S.
8. R. T. Morrison & R. N. Boyd: Organic Chemistry, Prentice Hall.
9. Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand

PRACTICAL

End Sem Practical – 30/3 hrs

Expt. -15, Viva- 5 & Lab. Record- 10

Section A: Inorganic Chemistry - Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydroxide present in a mixture.
2. Estimation of oxalic acid by titrating it with $KMnO_4$.
3. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$.
4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$.
6. Estimation of Na_2CO_3 & $NaHCO_3$ present in a mixture.

Section B: Organic Chemistry

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)
2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)
   (a) Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography
   (b) Identify and separate the sugars present in the given mixture by paper chromatography.

Reference Books :

1. Vogel's Qualitative Inorganic Analysis, A.I. Vogel, Prentice Hall, 7th Edition.
2. Vogel's Quantitative Chemical Analysis, A.I. Vogel, Prentice Hall, 6th Edition.
3. Textbook of Practical Organic Chemistry, A.I. Vogel , Prentice Hall, 5th edition.
4. Practical Organic Chemistry, F. G. Mann. & B. C. Saunders, Orient Longman, 1960.

AECC-2.4 : ENVIRONMENTAL STUDIES

Full Marks –100
Mid Sem – 20/1 hr
End Sem– 80/3hrs

UNIT-I :

Concept of environment : Ecology; Ecosystem; types and components of the ecosystem. Ecological adaptations of plants and animals

UNIT-II :

Functional aspects of ecosystem : Trophic level, food chain, food web, energy flow in the ecosystem, ecological pyramids, Biogeochemical cycles: Water cycle and Nitrogen cycle

UNIT-III :

Environmental Pollution : Source, causes and concept of air, water, noise, soil, pollution, Sewage & Sewage treatment, green house effect, Acid rain, Ozone layer depletion

UNIT-IV :

Conservation of Natural Resources : Resources, renewable & non renewable resources; soil, soil erosion and its conservation; Forest, deforestation; afforestation, conservation of Forest

UNIT-V :

Biodiversity and its Conservation : Introduction, Definition : genetic species and ecosystem diversity, value of biodiversity; consumptive use, productive use, social, ethical and aesthetic values, Biodiversity at global, national and local level, conservation of Biodiversity:- In situ and Ex-situ conservation, Bio-Geographic classification of India

Suggested Readings :

1. Shukla, R.S and Chandel, P.S : Plant Ecology and soil science, S. Chand & Company Ltd, New Delhi
2. Sharma, P.D. : Ecology and Environment, Rastogi Publication, Meerut.
3. Singh, J.S. Singh, S.P and Gupta, R.S (2006). Environmental Science, Kalyani Publishers, New Delhi

SEMESTER-III

C-3.1: THEORY OF REAL ANALYSIS (ANALYSIS-II)

Full Marks – 100
Mid Sem – 20/1 hr
End Sem – 80/3 hrs

UNIT-I

Limits of functions $(\in -\delta)$ approach, sequential criterion for limits, divergence criteria, limit theorem, one sided limits, Infinite limits and limits at infinity, continuous functions, sequential criterions for continuity and discontinuity.

UNIT-II

Algebra of continuous function, continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem, uniform continuity, non-uniform continuity criteria, uniform continuity theorem

UNIT-III

Differentiability of a function at a point and in an interval, algebra of differentiable functions, Increasing and decreasing function, Darboux's theorem, Rolle's theorem

UNIT-IV

Relative extreme, interior extremum theorem, mean value theorem, intermediate value property of derivatives, Applications of mean value theorem to inequalities and approximation of polynomials, Taylors theorem to inequalities.

UNIT-V

Cauchy's mean value theorem, Taylors theorem with Lagranges from of remainder, Taylors theorem with Cauchy's from of remainder, application of Taylors theorem to convex functions, relative extrema, Taylors series and Maclaurins series expansions and trigonometric functions $\log(1+x), \frac{1}{ax+b}, (1+x)^n$

Books Recommended:

1. G. Das and S. Pattanayak, Fundamental of Mathematics Analysis, TMH Publishing Co., chapter; 6(6.1-to 6.8), 7(7.1-7.7)
2. S.C. Malik and S. Aroro-Mathematical Analysis, New Age International publications.
3. R.G. Bartle and D.R. Sheraporbert, Introduction to Real Analysis, 3rd Ed. John Wiley and Sons (Asia) Pvt. Ltd, Singapore, 2002.
4. K.A. Ross, Elementary Analysis, The theory of calculus, Springer, 2004
5. A. Mattuck, Introduction to analysis, Prentice Hall, 1999
6. S.R. Ghorpada and B.V. Limaye, A Course in calculus and real analysis, Springer, 2006

C-3.2: GROUP THEORY (ALGEBRA-II)

Full Marks – 100
Mid Sem – 20/1 hr
End Sem – 80/3 hrs

UNIT-I

Group, semi group, and examples of group, elementary properties of groups, subgroups and examples of subgroups

UNIT-II

Normaliser, Normal subgroup, centre of group, centralizer, product of two subgroups, Properties of cyclic groups, classification of subgroups of cyclic groups

UNIT-III

Cycle notation for permutations, permutation groups, properties of permutations, even and odd permutations, alternating groups, properties of cosets, Lagranges theorem and consequences, Fermat's Little theorem

UNIT-IV

External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abellian groups

UNIT-V

Group homomorphisms, properties of homomorphisms, Cayle' theorem, properties of isomorphisms, First, second and third isomorphism theorem

Books Recommended :

1. Joseph A. Gallian, Contemporary Abstract Algebra (4th Edn.), Narosa publishing House, New Delhi.
2. A course in abstract algebra by V.K. KHANA and S.K. Bhamri, Vikash pub. house New Delhi
3. A Ist course in Abstract Algebra, by John B. Fraleigh, 7th Ed. Person, 2002.
4. Abstract Algebra, M. Artin, 2nd Ed. Pearson, 2011.
5. An introduction to the theory of groups, Joseph J Rotman, 4th. Ed. Springer Verlag, 1995.
6. Topics in Algebra, I.N. Herstain, Wiley Easten Limited, India, 1975.

C-3.3: PARTIAL DIFFERENTIAL EQUATIONS AND ORDINARY DIFFERENTIAL EQUATIONS

Full Marks – 100 (70+30)
Mid Sem – 20/1 hr
End Sem Theory – 50/3 hrs

UNIT-I

Systems of linear differential equations, types of linear systems, differential operators, an operator, method for linear system with constant coefficients, basic theory of linear systems in normal form, homogeneous linear systems with constant coefficient (two equation in two unknown functions)

UNIT-II

Simultaneous linear first order equations in three variables, methods of solution, pfaffian differential equations, methods of solutions of pfaffian differential equations in three variables

UNIT-III

Formation of Ist order partial differential equations, linear and non-linear partial differential equations of Ist order, special types of Ist order equations, solution of partial differential equations of first order satisfying given conditions

UNIT-IV

Linear partial differential equations with constant coefficients, Equations reducible to linear partial differential equations with constant coefficients, partial differential equations with variable coefficients, separation of variables, non-linear equation of the second order (Monge's method)

UNIT-V

Canomical form (Normal form) of second order linear differential equation, Laplace equations, Solution of the Laplace equation by separation of variables, one dimensional wave equation, solution of the wave equation (method of separation of variables). Diffusion equation, solution of one-dimensional diffusion equation, method of separation of variables

PRACTICAL

End Sem Practical – 30/3 hrs

List of practical's(Using any software)
Practical /Lab work to be performed on a computer.
Record=7, attendance=3, vive-voce=5, Experiment=15.

1. To find the general solution of the non-homogeneous system of the form $\frac{dx}{dt} = ax + by + f(t)$, $\frac{dy}{dt} = cx + dy + g(t)$ with given conditions.
2. Plotting the integral surfaces of a given first order PDE with initial data.
3. Solution of wave equation $\frac{\partial^2 u}{\partial t^2} - c^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associated conditions
   (i) $u(x,0) = \phi(x)$, $u_t(x,0) = \psi(x)$ $x \in R$, $t > 0$.
   (ii) $u(x,0) = \phi(x)$, $u_t(x,0) = \psi(x)$, , $u_x(0,t) = 0$ $x \in R^+$, $t > 0$
   (iii) $u(x,0) = \phi(x)$, $u_t(x,0) = \psi(x)$, , $u\ (0,t) = 0$ $x \in R^+$, $t > 0$
   (iv) $u(x,0) = \phi(x)$, $u_t(x,0) = \psi(x)$, , $u\ (0,t) = 0$ $u\ (l,t) = 0$ $0 < x < l, t > 0$
4. Solution of wave equation $\frac{\partial^2 u}{\partial t^2} - c^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associated conditions
   (i) $u(x,0) = \phi(x)$, $u\ (0,t) = a$ $u\ (l,t) = b$ $0 < x < l, t > 0$
   (ii) $u(x,0) = \phi(x)$, $x \in R$ $0 < t < T$,
   (iii) $u(x,0) = \phi(x)$, $u\ (0,t) = a$, $x \in R^+$, $t \geq 0$

Books Recommended :

1. A course of ordinary and partial differential equations by J. Sinha and S. Padhy, Kalyani Publication, New Delhi Chapter: 11, 12, (13.1-13.5), 15(15.1, 15.5), 16(16.1, 16.1.1), 17(17.1, 17.2, 17.3)
2. Tyn Myint- and Lokenath Debnath, Linear partial Differential equations for scientist and Engineers, 4th edition, Springer, Indian reprint, 2006.
3. S.L Ross, Differential equations, 3rd Ed. John Wiley and sons, India, 2004.

GE-3.4 : ELECTRICITY, MAGNETISM AND EMT

Full Marks - 100
Mid Sem – 20/1 hr
End Sem Theory – 50/3 hrs

UNIT-I

Vector Analysis: **8 Lectures**

Scalar and Vector product, gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).

UNIT-II

Electrostatics: **12 Lectures**

Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere.

Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

UNIT-III

Magnetism: 6 Lectures

Magnetostatics: Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.

UNIT-IV

Electromagnetic Induction: 4 Lectures

Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.

UNIT-V

Maxwell's equations and Electromagnetic wave propagation: 10 Lectures

Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.

Reference Books:

- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education
- Electricity & Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press
- Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.
- Electricity and Magnetism- K.K. Tewari (S. Chand Higher Academics)2013

PRACTICAL

End Sem Practical – 30/3 hrs

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. Ballistic Galvanometer:
   (i) Measurement of charge and current sensitivity
   (ii) Measurement of CDR
   (iii) Determine a high resistance by Leakage Method
   (iv) To determine Self Inductance of a Coil by Rayleigh's Method.
3. To compare capacitances using De'Sauty's bridge.
4. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx)
5. To study the Characteristics of a Series RC Circuit.
6. To study a series LCR circuit LCR circuit and determine its (a) Resonant frequency, (b) Quality factor
7. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To verify the Thevenin and Norton theorems
10. To verify the Superposition, and Maximum Power Transfer Theorems

Reference Books

- Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed. 2011, Kitab Mahal

GE-3.5: QUANTITATIVE AND LOGICAL THINKING

Full Marks – 100
Mid Sem – 20/1 hr
End Sem – 80/3 hrs

I. QUANTITATIVE APTITUDE & DATA INTERPRETATION

UNIT – I :

Whole numbers, Integers, Rational and irrational numbers, Fractions, Square roots and Cube roots, Surds and Indices, Problems on Numbers, Divisibility

Steps of Long Division Method for Finding Square Roots:

UNIT – II :

Basic concepts, Different formulae of Percentage, Profit and Loss, Discount, Simple interest, Ratio and Proportion, Mixture

UNIT – III :

Time and Work, Pipes and Cisterns, Basic concepts of Time, Distance and Speed; relationship among them

UNIT – IV :

Concept of Angles, Different Polygons like triangles, rectangle, square, right angled triangle, Pythagorean Theorem, Perimeter and Area of Triangles, Rectangles, Circles

UNIT – V :

Raw and Grouped Data, Bar Graphs, Pie charts, Mean, Median and Mode, Events and Sample Space, Probability

II. LOGICAL REASONING

UNIT – I :

Analogy basing on kinds of relationships, Simple Analogy; Pattern and Series of Numbers, Letters, Figures. Coding-Decoding of Numbers, Letters, Symbols (Figures), Blood relations

UNIT – II :

Logical Statements– Two premise argument, More than two premise argument using connectives

UNIT – III :

Venn Diagrams, Mirror Images, Problems on Cubes and Dices

SEMESTER-IV

C-4.1: NUMERICAL METHODS

Full Marks – 100 (70+30)
Mid Sem – 20/1 hr
End Sem Theory – 50/3 hrs

UNIT-I

Algorithms, convergence, errors, relative, absolute, round off, truncation, transcendental and polynomial equations, bisections method, Newton's method, Secant method, rate of convergence of these methods

UNIT-II

Systems of linear algebraic equations, Gaussian Elimination and Gauss Jordan methods, gauss Jacobi method, Gauss Seidel method and their convergence analysis

UNIT-III

Interpolation, Lagrange and Newton's method, error bounds, finite difference operator, Gregory forward and back ward difference interpolation

UNIT-IV

Numerical Integration, Trapezoidal rule, Simpsons rule, Simpsons 3/8 rule mid point rule, composite trapezoidal rule, composite Simpsons rule,

UNIT-IV

Ordinary differential equations, Euler's method, Runga kutta methods of order two and four.

PRACTICAL

End Sem Practical – 30/3 hrs

List of practical's (Using any software)
Practical/Lab work to be performed on a computer.
Record=7, attendance=3,vive-voce=5,Experiment=15.

1. Calculate the sum $1+\frac{1}{2}+\frac{1}{3}+---+\frac{1}{n}$.
2. To find the absolute value of an integer.
3. Enter 100 integers into an array and sort them in an ascending order.
4. Bisection method
5. Newton rapson method
6. Secant method

7. Regular method
8. LU decomposition method
9. Gauss Jacobi method
10. SOR Method or Gauss-Seidel method
11. Lagranges or Newton's interpolation
12. Simpsons method

Books Recommended :

1. Numerical methods for scientific and engineering computation by M.K.Jain, S.R.K.Iyengar and R.K.Jain, 6th Ed. New age International publisher, India, 2007.
2. Numerical Methods, Dutta and Jena.
3. A friendly Introduction to numerical analysis, Brain Bradie, Pearson Ed. India, 2007.
4. A course on Numerical Analysis, B.P. Acharya and R.N. Das, Kalyani Publishers.
5. Applied Numerical Analysis by C.F. Gerald and P.O. Wheatley, Pearson Ed., India, 2008.
6. A first course in Numerical Methods by Uri M. Ascher and Chen Greif, 7th Ed., PHI Learning Private Ltd., 2013.
7. Numerical methods using Matlab by John H. Mathews and Kurties D. Fink, 4th Ed. PHI Learning Private Ltd., 2012.

C-4.2: RIEMANN INTEGRATION AND SERIES OF FUNCTIONS (ANALYSIS-III)

Full Marks – 100
Mid Sem – 20/1 hr
End Sem – 80/3 hrs

UNIT-I

Riemann integration: Inequality of upper and lower sums, Riemann conditions of Integrability, Riemann sum and definition of Riemann integral through Riemann sums, equivalence of two definitions, Riemann integrability of monotone and continuous functions, properties of Riemann integral, definition and integrability of piecewise continuous and monotone functions, intermediate value theorem for integrals, Fundamental theorem of integral calculus

UNIT-II

Improper integral, convergence of Betta and Gamma function

UNIT-III

Point wise and uniform convergence of sequence of functions, theorem on continuity, derivability and integrability of the limit function of a sequence of functions, series of functions, theorems on the continuity and derivability of the sum functions of a series of functions

UNIT-IV

Cauchy criterions for uniform convergence and Weierstrass M. Test, Limit superior and limit inferior, power series, radius of convergence, Cauchy Hadamard theorem,

UNIT-V

Differentiation and integration of power series, Abels Theorem, Weierstrass Approximation theorem.

Books Recommended :

1. G. Das and S. Pattanayak, Fundamental of Mathematics Analysis, TMH Publishing Co., Chapter; 8,9,10
2. S.C. Malik and S. Aroro-Mathematical Analysis, New Age International Publications.
3. R.G. Bartle and D.R. Sheraporbert, Introduction to Real Analysis, 3rd Ed. John Wiley and Sons (Asia) Pvt. Ltd, Singapore, 2002.
4. K.A. Ross, Elementary Analysis, the theory of calculus, Springer, 2004
5. Charle G. Denlinger, Elements of real Analysis, Jones and Bartlett (Students Ed.), 2011
6. Shanti Narayan and M.D. Raisinghania, Elements of Real Analysis, S. Chand & Co. Pvt. Ltd.

C-4.3: RING THEORY AND LINEAR ALGEBRA (ALGEBRA-III)

Full Marks – 100
Mid Sem – 20/1 hr
End Sem – 80/3 hrs

UNIT-I

Definition and examples of rings, properties of rings, sub rings, integral domains and fields, characteristic of a ring

UNIT-II

Idel, idel generated by a subset of rings, factor rings, operation on ideals, prime and maximal idels

UNIT-III

Ring homeomorphisms, properties of ring homomorphisms, isomorphism theorem, I, II, III, field of quotients

UNIT-IV

Vector space, subspace, algebra of subspaces, quotient space, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspace

UNIT-V

Linear transformation, null space, range, rank, and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformation, isomorphisms, isomorphism theorem, invertibility, and isomorphisms, change of co-ordinate matrix

Books Recommended :

1. Joseph A. Gallian, Contemporary Abstract Algebra (4th Edn.), Narosa Publishing House, New Delhi.
2. A course in abstract algebra by V.K. Khana and S.K. Bhamri, Vikash Pub. house, New Delhi.
3. Stephen H. Friedberg Amold J. Insel, Lawrence E.S. Pence, Liner Algebra, 4th Ed. Prentice Hall of India Pvt. Ltd, New Delhi, 2004 chapter 1(1.2-1.6) 2(2.1-2.5)
4. A Ist course in Abstract Algebra, by John B. Fraleigh, 7th Ed., Person, 2002.
5. Abstract Algebra, M. Artin, 2nd Ed. Pearson, 2011.
6. Introduction to linear algebra, S. Lang, 2nd Ed. Springer, 2005
7. Topics in Algebra, I.N. Herstain, Wiley Easten Limited, India, 1975.
8. Linear algebra and its application, by Gibert Strang. Cengage Learning India Pvt. Ltd.
9. Linear algebra by S. Kumar, A Geometric Approch, Prentice Hall of India, 1999.
10. Kenneth Ho man, Ray Alden Kunze, Linear Algebra, 2nd Ed. Prentice Hall of India, 1971.

GE- 4.4 : CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL ORGANIC CHEMISTRY-I

Full Marks – 100
Mid Sem – 20/1 hr
End Sem Theory – 50/3 hrs

SECTION A: PHYSICAL CHEMISTRY-1

UNIT-I : Chemical Energetics (10 Lectures)

Review of thermodynamics and the Laws of Thermodynamics.

Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation.

Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

Chemical Equilibrium: (8 Lectures)

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG^o , Le Chatelier's principle. Relationships between Kp, Kc and Kx for reactions involving ideal gases.

UNIT- II : Ionic Equilibria: (12 Lectures)

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

SECTION B: ORGANIC CHEMISTRY-2

UNIT- III : (8 Lectures)

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Aromatic hydrocarbons

Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.

Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

Alkyl and Aryl Halides **(8 Lectures)**

Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions.

Preparation: from alkenes and alcohols.

Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

UNIT- IV : **(14 Lectures)**

Alcohols, Phenols and Ethers (Upto 5 Carbons)

Alcohols: Preparation: Preparation of 1^0 , 2^0 and 3^0 alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.

Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. $KMnO_4$, acidic dichromate, conc. HNO_3). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

Phenols: (Phenol case) Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. ReimerTiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction.

Ethers (aliphatic and aromatic): Cleavage of ethers with HI.

UNIT-V: Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions.

Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH2/NH3 (or NaNH2/NH3).

Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides

Aldehydes and ketones (aliphatic and aromatic): (Formaldehye, acetaldehyde, acetone and benzaldehyde)

Preparation: from acid chlorides and from nitriles.

Reactions – Reaction with HCN, ROH, $NaHSO_3$, NH2-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Pondorff Verley reduction.

Reference Books :

1. T. W. Graham Solomons: Organic Chemistry, John Wiley and Sons.
2. Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
3. I.L. Finar: Organic Chemistry (Vol. I & II), E. L. B. S.
4. R. T. Morrison & R. N. Boyd: Organic Chemistry, Prentice Hall.
5. Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand.
6. G. M. Barrow: Physical Chemistry Tata McGraw-Hill (2007).
7. G. W. Castellan: Physical Chemistry 4th Edn. Narosa (2004).
8. J.C. Kotz, P.M. Treichel & J.R. Townsend: General Chemistry Cengage Lening India Pvt. Ltd., New Delhi (2009).
9. B. H. Mahan: University Chemistry 3rd Ed. Narosa (1998).
10. R. H. Petrucci: General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).

PRACTICAL

End Sem Practical – 30/3 hrs

Expt. -15, Viva- 5 & Lab. Record- 10

Section A: Physical Chemistry : Thermochemistry

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO_3, NH_4Cl).
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of ΔH.

Ionic equilibria

pH measurements

a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
b) Preparation of buffer solutions:
   (i) Sodium acetate-acetic acid
   (ii) Ammonium chloride-ammonium hydroxide Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.
   (a) Bromination of Phenol/Aniline
   (b) Benzoylation of amines/phenols
   (c) Oxime and 2,4 dinitrophenylhydrazone of aldehyde/ketone
4. Identification of simple organic compounds containing C, H, O & C, H, N & their confirmation using melting & boiling point only.

Reference Books :

1. A.I. Vogel: Textbook of Practical Organic Chemistry, 5th edition, Prentice-Hall
2. F. G. Mann & B. C. Saunders, Practical Organic Chemistry, Orient Longman (1960)
3. B.D. Khosla, Senior Practical Physical Chemistry, R. Chand & Co

SECC-4.5 : COMMUNICATIVE ENGLISH

(Enriching Linguistic Knowledge & Communication Proficiency)

Full Marks - 100
Mid Sem – 20/1 hr
End Sem – 80/3hrs

UNIT-I : BUSINESS COMMUNICATION AND GRAMMAR

Why English Communication is Essential and How to Improve the Skill?

Introduction to Voice and Accent, Why do we have such different accents?, Accent Training-Consequences, Voice and accent in the Enterprise Industry, Globally Comprehensible Accent, Introduction to Phonetics, International Phonetic Alphabet

Consonant Sounds

Vowels

Diphthongs

A Few Phonic Rules

Word Stress: Syllables

Intonation : Intonation and Stress

Pacing and Chunking : Common Patterns of Pacing, Importance of Chunking

Fluency

Indianisms : Errors relating to Grammar, Vocabulary

UNIT-II : GRAMMAR

English: Spoken Versus Written Communication

Nouns : Kinds of Nouns, Activity 3: Noun Ping-pong, Nouns-Number, Noun-Gender, Countable and Uncountable Nouns

Pronouns : Reflexive Pronouns, Relative Pronouns, Demonstrative Pronouns, Interrogative Pronouns, Indefinite pronouns, Activity 4: Sentence Auction

Adjectives : Activity 5 : Picture perfect, Positioning of adjectives, Comparative Degrees of Adjectives, Order of Adjectives

Adverbs : Kinds of Adverb, Degree of Comparison, Word Order with Adverbs, Activity 6: Relay Race

Prepositions : Activity 7: Treasure Hunt, Activity 8: Route Map, Prepositions with Adjectives, Nouns and Verbs

Conjunctions : Coordinating conjunctions, Subordinating Conjunctions, Correlative Conjunctions, Connecting Adverbs, Activity 9: The Socks Story

Verbs : Verb Classification, List of irregular verbs, Activity 10: Word Search

Subject and verb agreement, Activity 11: Tossed Word Salad, Activity 12: The Sentence Pageant

Determiners and Modifiers : Kinds of determiners, The Definite and the Indefinite Article, Definite Article: The, Activity 13: Proof Reading

Tenses : Reference Table, Present Tense, Activity 14: Instruction Manual, Activity 15: Commentary, Past Tense, Activity 16:The Chain List, Activity 17: Transcription, Future Tense, Activity 18: This Week for You, Activity 19: Verb Grand Prix

Punctuation : Forms of Punctuation

UNIT-III : READING COMPREHENSION

Reading – A 7 Step Process, Techniques to enhance students' reading skills, Types of reading skills, Skimming, Scanning, Extensive reading, Intensive reading, Three levels of Reading, Improving your reading speed, Reading Comprehension Practice Exercises

SEMESTER-V

C-5.1: MULTIVARIATE CALCULUS (CALCULUS-II)

Full Marks – 100
Mid Sem – 20/1 hr
End Sem – 80/3 hrs

UNIT-I

Functions of several variables, limit and continuity of functions of two variables, partial differentiation, total differentiability, sufficient condition for differentiability, Chain rule for one and two independent parameters,

UNIT-II

Directional derivative, the gradient, maximal and normal property of the gradient, tangent planes, angle between planes

UNIT-III

Extreme of functions of two variables, method of Lagrange multipliers, constrained optimization problems, Definition of vector field, divergence and curl.

UNIT-IV

Double integration over rectangular region, double integration over non-rectangular region, double integrals in polar co-ordinates, Triple integral, triple integral over a parallelopiped and solid regions, Volume by triple integrals, cylindrical and spherical co-ordinate, change of variables in double integrals

UNIT-V

Line integrals, Applications of line integrals, Mass and work, Fundamental theorem for line integrals, conservative vector fields, independence of path, greens theorem, surface integrals, integrals over parametrically defined surfaces, Stokes theorem, The Divergence theorem.

Books Recommended :

1. Mathematical analysis by S.C. Malik and S.C. Arora.
2. Text book of calculus by Shanti Narayan, S. Chand & Co.
3. M.J. Strauss, G.L. Bradly and J. Smith, calculus, 3rd Ed. Dorling Kindersely (India) Pvt. Ltd. (Pearson Ed.), Delhi-2007.
4. G.B. Thomas and R.L. Finney, Calculus, 9th Ed. Pearson Ed. Delhi, 2005.
5. E. Marsden, A.J. Tromba and A. Weinstain, Basic Multivariable calculus, Springle (SIE), Indian reprint.
6. Santosh K. Sengar –Advanced Calculus, Cengage Learning India Pvt. Ltd.

C-5.2: PROBABILITY AND STATISTICS

Full Marks – 100
Mid Sem – 20/1 hr
End Sem – 80/3 hrs

UNIT-I

Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions

UNIT-II

Mathematical expectation, moments, moments generating function, characteristics function, joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions

UNIT-III

Discrete distributions, uniform, binomial, Poisson, geometric, negative binomial, continuous distributions uniform, normal, exponential

UNIT-IV

Expectation of function of two random variables, conditional expectations, independent random variables, bivarite normal distribution, correlation coefficient, joint moment generating function and calculation of covariance, linear regression for two variables

UNIT-V

Chebyshev's inequality, statements and interpretation of (weak) law of large numbers and strongly law of large numbers, central limit theorem for independent and identically distributed random variables with finite variance, Markov chains, Cheapman-Kolmogorov equations, classification of states

Books Recommended :

1. Introduction to Mathematical Statistics, by Robert V. Hogg, Joseph, W. McKean and Allen T. Craig, Pearson Ed. Asia, 2007, chapter: 1(1.1, 1.3, 1.5-1.9), 2(2.1, 2.3-2.5).
2. Irwin Miller and Marylees, John E. Freund, Mathematical statistics with Applications, 7th Ed. Pearson Ed. Asia, 2006, chapter 4, 5(5.1-5.5, 5.7), 6(6.2, 6.3, 6.5-6.7), 14(14.1, 14.2).
3. Sheldon Ross, Introduction to Probability Models, 9th Ed. Academic Press, Indian Reprint, 2007, Chapter 2(2.7), 4(4.1-4.3).
4. ALEXANDER M. Mood, Fraklin A.G. Raybill and Duance C. Boes, Introduction to the theory of Statistics, 3rd Ed. Tata McGraw-Hill, Reprint-2007.
5. S.C. Gupta and V.K. Kapoor-Fundamentals of Mathematical statistics, S. Chand and Company Pvt. Ltd. New Delhi.
6. S. Ross – A First Course in probability, Pearson Ed.

DSE-5.3: C++

Full Marks – 100 (70+30)
Mid Sem – 20/1 hr
End Sem Theory – 50/3 hrs

UNIT-I

Introduction to structured programming : data types, simple data types, floating data types, character data types, string data types, arithmetic operators and Operator precedence, variables and constant, declarations, expressions, input using the extraction operator >> and cin, output using the insertion operator << and count, pre-processor directives, increments (++) and decrement ({) operations, creating C++ program, input/output

UNIT-II

Relational operators, logical operators and logical expression, if and if–else statement, switch and break statements

UNIT-III

for, while and do-while loops and continue statement, nested control statement

UNIT-IV

value returning functions, value versus reference parameters, local and global variables

UNIT-V

one dimensional array, two-dimensional array, pointer data and pointer variables

Books Recommended :

1. D.S. Malik: C++ programming Language, Ed. 2009, Course technology, Cengage Learning, India Ed. chapter 2(pages-37-95), 3(pages-96-129), 49 pages (134-178), 5(pages-181-236), 6, 7(pages-287-304), 9(pages-357-390), 14(pages-594-600)
2. E. Balaguruswami: Object oriented programming with C++, Fifth Ed. Tata McGraw Hill Ed. Pvt. Ltd.
3. R. Johnsonbaugh and M. Kalin –Application programming in ANSIC, Pearson Ed.
4. S.B. Lippman and J. Lajoic, C++Primer, 3rd. Ed, Addison Wesley, 2000.
5. Bjarne Stroustrup, The C++ programming Language, 3rd Ed., Addison Wesley.

PRACTICAL

End Sem Practical – 30/3 hrs

List of practical's(Using any software)

Practical /Lab work to be performed on a computer.

Record =3, attendance=2, vive-voce=5, Experiment=15.

1. Calculate the sum $1+\frac{1}{2}+\frac{1}{3}+---+\frac{1}{n}$

2. Write a user defined function to find the absolute value of an integer and use it to evaluate the function $\frac{(-1)^n}{n!}$ for n=-2,-1,1,2
3. Calculate the factorial of any natural number.
4. Read floating numbers and compute two averages: the average of negative numbers and the average of positive numbers.
5. Write a program that prompts the user to input a positive integer. It should then output a message indicating whether the number is a prime number.
6. Write a program that prompts the user to input the value of a, b and c involved in the equation $ax^2++bx+c=0$ and out put the type of the roots of the equation, also the program should output all the roots of the equation.
7. Write a program that generate random integer between 0 and 99, given that first two Fibonacci numbers are 0 and 1, generate all Fibonacci numbers less than or equal to generated number.
8. Write a program that does the following :
   (i) Prompts the user to input five decimal numbers
   (ii) Points the five decimal numbers.
   (iii) Converts each decimal number to the nearest integer.
   (iv) Adds these five integers
   (v) Prints the sum and average of them.
9. Write a program that uses while loops to perform the following steps
   (i) prompt the user to input two integers first Number and second number (first number should be less than the second number)
   (ii) output all odd and even numbers between first number and the second number.
   (iii) output the sum of all even numbers between first number and the second number.
   (iv) output the sum of the square of all odd numbers first number and the second number.
   (v) output all uppercase letters corresponding to the numbers between first number and the second number.
10. Write a program that prompts the user to input five decimal numbers, the program should then add the five decimal numbers, convert the sum to the nearest integer, and print the result.
11. Write a program that prompts the user to inter the length of three sides of a triangle and then output a message indicating whether the triangle is a right triangle or scalene triangle.
12. Write a value returing function smaller to determine the smallest number from a set of numbers, use this function to determine the smallest number from set of 10 numbers.
13 Write a function that takes as a parameter an integer and returns the number of odd, even and zero digits, also write a program to test your function.
14. Enter 100 integers into an array and short them in an ascending /descending order and print the largest /smallest integers.
15. Enter 10 integers in to an array and then search for a particular integer in the array.
16. Multiplication /addition of two matrices using two dimensional array.

DSE-5.4: DISCRETE MATHEMATICS

Full Marks – 100
Mid Sem – 20/1 hr
End Sem – 80/3 hrs

UNIT-I

Logic, proportional equivalence, predicates and quantifiers, nested quantifiers, method of proof, relations and their properties, n-ary, relations and their applications

UNIT-II

Boolean functions and their representation, the basic counting, the pigeon–hole principle, generalised Permutation and combination

UNIT-III

Recurrence relation, counting using recurrence relations, solving linear homogeneous recurrence relations with constant coefficient, generating functions, solving recurrence relations using generating functions

UNIT-IV

Partially ordered sets, Hass diagram of partially ordered sets, maps between ordered sets, duality principle, Lattices as ordered sets, Lattices as algebraic structures, sub lattices, Boolean algebra and its properties

UNIT-V

Graphs: Basic concepts and graph terminology, representing graphs and graph isomorphism, Distance in a graph, cut-vertices and cut-edges, connectivity, Euler and Hamiltonian path

Books Recommended :

1. Kenneth H. Rosen, Discrete Mathematics and Applications, Tata McGraw Hill Publications, chapter 1(1.11-1.5),4(4.1,4.2,4.5),6(6.1,6.2,6.5,6.6),7(7.1,7.2) 8,10(10.1,10.2)
2. B.A. Davey and H.A. Priestley, Introduction to Lattices and order, Cambridge University Press, Cambridge, 1990.
3. Edgar G. Goodaire and Michael M. Parmeter, Discrete Mathematics with Graph theory, 2nd Ed., Pearson Ed. (Singapore) Pvt. Ltd, Indian Reprint 2003.
4. Rudolf Lidl and G Nter Pilz, Applied Abstract Algebra, 2nd Ed., Undergraduate texts in Mathematics, Springer, Indian reprint-2004.
5. D.S. Malik- Discrete Mathematics, theory and application, Cengage Learning India Pvt. Ltd.
6. Kevin Ferland- Discrete Mathematical Structures, Cengage Learning India Pvt. Ltd.

SEMESTER-VI

C-6.1: METRIC SPACES AND COMPLEX ANALYSIS

Full Marks – 100
Mid Sem – 20/1 hr
End Sem – 80/3 hrs

UNIT-I

Metric space : definition and examples, sequences in metric spaces, Cauchy sequences, complete metric spaces, open and closed balls, neighbourhood, open sets, interior of a set, limit point of a set, closed set, diameter of a set, Cantors theorem, subspace, dense sets, separable spaces

UNIT-II

Continuous mapping, sequential criterion and other characterization of continuity, Uniform continuity, homeomorphism, contraction mapping, Banach Fixed point theorem, connectedness, connected subsets of R

UNIT-III

Properties of complex number, regions in the complex plane, functions of complex variable, mappings, derivatives, differentiation formulae, Cauchy-Riemann equations, sufficient conditions for differentiability

UNIT-IV

Analytic functions, example of analytic function, exponential functions, Logarithmic functions, trigonometric functions, derivative of function definite integrals of functions, contours, contour integrals and its examples, upper bounds for moduli of contour integral integrals, Cauchy-Goursat theorem, Cauchy integral formula

UNIT-V

Liouvile's theorem and the fundamental theorem of algebra, convergence of sequences and series, Taylor series and its example, Laurent series and its example, absolute and uniform convergence of power series

Books Recommended :

1. P.K. Jain and K. Ahmad, metric space, Narosa publishing house, New Delhi, Chapter -2(1-9), 3(1-4), 4(1-4), 6(1-2), 7(1 only).
2. James Ward Brown and Ruael V. Churchill, complex variable s and applications, 8th Ed. McGraw Hill international Ed. 2009 chapter 1(11 only), 2(12, 13), 2(15-22, 24, 25), 3(29, 30, 34), 4(37-41, 43-46, 50-53), 5(55-60, 62, 63, 66)
3. Satish Shirali and Harikishan L. Vasudevaa, Metric spaces, Springer Verlag, London -2006.
4. SS. Kumaesen topology of metric spaces, 2nd Ed., Narosa publishing House, 2011
5. S. Ponnusamy –Foundations of complex analysis, Alpha Science International Ltd. J.B. Convey – functions of complex variable, Springle.
6. N. Das–complex function theory, Allied Publishers Pvt. Ltd., Mumbai.

C-6.2: LINEAR PROGRAMMING

Full Marks – 100
Mid Sem – 20/1 hr
End Sem – 80/3 hrs

UNIT-I

Introduction to linear programming problem, theory of simplex method, optimality and unboundedness, the simplex algorithm, simplex method in tableau format

UNIT-II

Introduction to artificial variables, two phase method, big M method and their comparison, Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual

UNIT-III

Transportation problem and its mathematical formulation, north west corner method, least cost method and vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem

UNIT-IV

assignment problem and its mathematical formulation, Hungarian method for solving assignment problem

UNIT-V

Game theory, formulation of two person zero sum games, solving two person zero sum game, games with mixed strategies, graphical solution procedure, linear programming solution of games

Books Recommended :

1. Mokhtar S. Bazaara, John J. Jarvis and Hanif D. Sherali, linear programming and network flows, 2nd Ed. John Wiley and Sons, India, 2004, Chapter- 3(3.2-3.3,3.5-3.8), 4(4.1-4.4), 6(6.1-6.3)
2. F.S. Hillier and G.J. Lieberman, Introduction to operation research, 9th Ed., Tata McGraw Hill, Singapore 2009 chapter -14.
3. Hamdy A. Taha, Operation research, An Introduction, 8th Ed. Prentice Hall India, 2006, Chapter 5(5.1,5.3,5.4)
4. G. Hadley, Operation Research, Narosa publishing house, New Delhi, 2002.
5. Kanti Swarup, P.K. Gupta and Man Mohan - Operation research, S. Chand and Co. Pvt. Ltd.
6. N.V.R Naidu, G. Rajenddra and T. Krishna Rao - Operation Research, I.K. International Publishing house Pvt. Ltd, New Delhi, Bangalore.
7. P.K. Gupta and D.S. Hira - Operation research, S. Chand and Co. Pvt. Ltd.

DSE-6.3: DIFFERENTIAL GEOMETRY

Full Marks – 100
Mid Sem – 20/1 hr
End Sem – 80/3 hrs

UNIT-I

Theory of space curves, space curves, planer curves, curvature, torsion and serret-Frenet formule, osculating circles, Existence of space curves, Evolutes and involutes

UNIT-II

Osculating circle and spheres, Existence of space curves, Evolutes and involutes

UNIT-III

Developable: developable associated with space curves and curves on surfaces, minimal surfaces

UNIT-IV

Theory of Surfaces: parametric curves on surface, direction coefficient, first and second fundamental forms, principal and Gaussian curvatures,

UNIT-IV

Lines of curvature, Euler's theorem, Rodrigue's formula, conjugate and asymptotic lines

Books Recommended :

1. C.E. Weatherbun, Differential geometry of three dimension, Cambridge University Press-2003, chapter 1(1-4,7,8,10), 2(13,14,16,17), 3, 4(29-31,35,37,38)
2. A text book of vector calculus, Shanti Narayana and J.N. Kapoor
3. T.J. Willmore, An introduction to differential geometry, Dover publication.
4. S. Lang, Fundamental of differential geometry, Springer, 1999.
5. B.O'Neill Elementary differential geometry 2nd Academic Press, 2006.

6. A.N. Pressley –Elementary differential geometry, Springer.
7. B.P. Acharya and R.N. Das, fundamentals of differential geometry, Kalyani publisher, Ludhiana, New Delhi.

DSE-6.4: PROJECT WORK

Full Marks – 100
End Sem Project – 100

Project=75, Viva-Voce =25

Topics to be announced by the HOD.

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