Government General Degree College, Kalna-I

Department of Mathematics

Department wise Course Structure under

CCFUP (NEP 2020)

(Major: Mathematics)

Semester-I

Course Type	Title of the Course	Credit	Full Marks	Lecture Hour
Major Course **MATH1011**	**Calculus, Geometry &Vector Calculus**	**4** (Theory-04)	**75** (Theory-60, Internal Assessment–15)	**60** (Lecture -45, Tutorial – 15)
Minor Course **PHYS1021**	**Mathematical Physics-I**	**4** (Theory-03, Practical - 01)	**75** (Theory-40, Practical-20, Internal Assessment–15)	**75** (Theory-45, Practical-30)
Multi/ Interdisciplinary **ENGL1031**	**Communication Skills**	**3** (Theory-03)	**50** (Theory-40, Internal Assessment–10)	**40** (Lecture -30, Tutorial – 10)
AEC (L1-1 MIL) **BENG1041**	**Sahityer Bodh O Bichar**	**2** (Theory-02)	**50** (Theory-40, Internal Assessment–10)	**30**
SEC **MATH1051**	**Graph Theory**	**3** (Theory-03)	**50** (Theory-40, Internal Assessment–10)	**45**
Common Value-Added Course	**Environmental Science / Education**	**4** (Theory-04)	**100**	**60**
		Total Credit = 20	**Total Marks = 400**	

MAJOR COURSE

Course Code: MATH1011
Course Name: Calculus, Geometry & Vector Calculus (Credit: 4, Marks: 75)
Total Hours: Lecture -45, Tutorial – 15

Objectives

To study calculus, geometry and vector calculus

Learning outcomes

On completion of the course, the student should have the following learning outcomes defined in terms of knowledge, skills and general competence:

Knowledge: The students would gain knowledge about

I. Higher order derivatives and its applications, concavity of curves,asymptotes and curvetracing techniques.

II. Reduction formula for integration of functions like $\sin nx$, $\sin^m x \sin^n x$ etc., area of surfaceof revolution, parametric curves etc.

III. Classification of conics and conicoids, polar equation of conics.

IV. Vector valued functions and vector calculus.

Skills: The students would be able to

I. Parametrize curves, sketch functions and plot them.

II. Visualize standard quadratic surfaces like cone, ellipsoid etc.

III. Apply calculus on vector valued functions.

IV. Find gradient of scalar functions, divergence and curl of vector valued functions.

General competence: The students would gain

I. A general idea of advance calculus and its applications.

II. The idea of solving complex problems using vector calculus and geometry.

III. Analytical and reasoning skills, which improve their thinking power and enhance their problem solving ability.

Contents:

Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications toproblems of type $e^{ax+b} \sin x$, $e^{ax+b} \cos x$, $(ax+b)^n \sin x$, $(ax+b)^n \cos x$, indeterminate forms, L'Hospital's rule, concavity of curves, points of inflection, envelopes, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinatesof standard curves. **[L-12H& T-4H]**

Reduction formulae, derivations and illustrations of reduction formulae for the integration of $\sin nx$, $\cos nx$, $\tan nx$, $\sec nx$, $(\log x)^n$, $\sin^n x \sin^m x$, parametric equations, parametrizing a curve, arc length, arc length of parametric curves, area of surface of revolution. **[L-10H& T-3H]**

Reflection properties of conics, translation and rotation of axes, general equation of second-degree, classification of conics, polar equations of conics, spheres, cylindrical surfaces. central conicoid, paraboloids, plane sections of conicoid, generating lines, classification of quadrics. **[L-11H & T-4H]**

Triple product of vectors, introduction to vector functions, algebraic operationson vector-valued functions, limits and continuity of vector functions, differentiation and partial differentiation of vector functions, gradient of a scalar function, divergence and curl of vector functions. [L-**12H & T-4H]**

Reading References

Text Books:

[1] Calculus - G.B. Thomas and R.L. Finney, 9th Ed., (Pearson Education, Delhi,2005).

[2] Calculus - M.J. Strauss, G.L. Bradley and K. J. Smith, 3rd Ed., (Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007).

[3] Integral Calculus - K. C. Maity and R. K. Ghosh.,(New Central Book Agency (P) Limited, 1999).

[4] An Elementary Treatise on Coordinate Geometry of three- Dimensions–R.J.T. Bell,(MacMillan & Co.).

[5] The Elements of Coordinate Geometry- S.L. Loney, (MacMillan & Co.).

[6] Vector Analysis- K. C. Maity and R. K. Ghosh, (New Central Book Agency (P) Ltd. Kolkata, 1999).

Reference Books:

[1] Calculus- T. M. Apostol, (Volumes I and II. Vol-I, 1966, Vol-II, 1968).

[2] Calculus- H. Anton, I. Bivens and S. Davis, 7th Ed., (John Wiley and Sons (Asia) P. Ltd., Singapore, 2002).

[3] Introduction to Calculus and Analysis - R. Courant and F. John, (Volumes I & II), (Springer- Verlag, New York, Inc., 1989).

[4] Analytical Geometry of two and three-dimensions- N. Dutta and R. N. Jana, (Shredhar Prakashani).

[5] Calculus and Mathematical Analysis- S. Goldberg, 1989.

[6] Vector Calculus- J. Marsden, and Tromba, (McGraw Hill, 1987).

[7] Schaum's outline of Vector Analysis- M.R. Spiegel, (McGraw Hill, 1980).

[8] Vector Analysis with Applications - A. A. Shaikh and S. K. Jana, (Alpha Science International Ltd., 2009).

Course Code: PHYS1021
Course Name: Mathematical Physics-I (Credits: Theory-03, Practicals-01)
F.M. =75 (Theory-40, Practical–20, Internal Assessment–15)

COURSE OBJECTIVE: The aim of this course is to equip students with mathematical methods that are important prerequisites for physics courses.

Calculus:

Recapitulation: Limits, continuity, average and instantaneous quantities, differentiation. Plotting functions. Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves. Approximation: Taylor and binomial series (statements only).

First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence and Uniqueness Theorem for Initial Value Problems. Particular Integral.

Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor,with simple illustration. Constrained Maximization using Lagrange Multipliers.

Vector Calculus:

Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields.

Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector identities.

Vector Integration: Ordinary Integrals of Vectors. Multiple integrals. Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs).

Orthogonal Curvilinear Coordinates:

Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.

Reference Books:

[1] Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.

[2] An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning

[3] Vector Analysis, M R Spiegel, Schaums Outline Series.

[4] Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.

[5] Higher Engineering Mathematics, B S Grewal, Khanna Publisher.

[6] Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning

[7] Mathematical Physics, H K Dass and R Verma, S. Chand & Company Pvt. Ltd.

[8] Engineering Mathematics, S.Pal and S.C. Bhunia, 2015, Oxford University Press

[9] Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.

[10] Essential Mathematical Methods, K.F.Riley&M.P.Hobson, 2011, Cambridge Univ. Press

Course Code: PHYS1021
Course Name: Mathematical Physics-I
Practical

COURSE OBJECTIVE: The aim of this course is to learn computer programming and numerical analysis and to emphasize its role in solving problems in Physics.

Topics	Description with Applications
Introduction and Overview	Computer architecture and organization, memory and Input/output devices
Basics of scientific computing	Binary and decimal arithmetic, Floating point number algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow &overflow phasize the importance of making equations in term of dimensionless variables, Iterative methods
Errors and error Analysis	Truncation and round off errors, Absolute and relative errors, Floating point computations.
Review of C&C++Programming fundamentals	Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements) (If statement. If else Statement. Nested if Structure. Else if Statement. Ternary Operator. Goto Statement. Switch Statement. Unconditional and Conditional Looping. While Loop. Do-While Loop. For Loop. Break and Continue Statements. Nested Loops), Arrays (1D & 2D) and strings, user defined functions, Structures and Unions, Idea of classes and objects

Programs:

1. Write and execute a program in C/C++ to sort elements of an array of Seven elements in ascending order.
2. Write and execute a program in C/C++ to find the area and volume of a Sphere by varying the radius.
3. Write and execute a program in C/C++ to find the value of Sine function using power series (The argument will be given during execution)
4. Write and execute a program in C/C++ to find the value of ex (x will be given during execution of the program).
5. Write and execute a program in C/C++ to compute the factorial of a positive integer including Zero.
6. Write and execute a program in C/C++ to calculate sum of squares of n natural numbers.
7. Write and execute a program in C/C++ to separate odd and even integers in arrays.
8. Write and execute a program in C/C++ to find the value of Cosine function using power series (The argument will be given during execution).
9. Write and execute a program in C/C++ to sort elements of an array of Six elements in descendingorder.
10. Write and execute a program in C/C++ to calculate value of π.
11. Write and execute a program in C/C++ to find the largest and smallest in a given set of numbers.

COURSE OUTCOME: On completion of this course, the student must be able to perform different mathematical operations like calculus and vector operations which are extremely essential to study theoretical and experimental physics.

Reference Books

[1] Introduction to Numerical Analysis, S.S.Sastry, 5th Edn., 2012, PHILearning Pvt. Ltd.
[2] Schaum's Outline of Programming with C++. J. Hubbard, 2000, McGraw-HillPub.
[3] Numerical Recipes in C: The Art of Scientific Computing, W.H. Pressetal, 3rd Edn., 2007, Cambridge University Press.
[4] A first course in Numerical Methods, U.M. Ascher & C.Greif,2012, PHI Learning.
[5] Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn., 2007, Wiley India Edition.
[6] An Introduction to computational Physics, T.Pang, 2nd Edn., 2006,Cambridge Univ. Press
[7] Computational Physics, Darren Walker, 1st Edn., 2015, Scientific International Pvt. Ltd.
[8] Programming in ANSI C, E Balagurusamy, McGraw Hill Education.
[9] Object Oriented Programming with C++, E Balagurusamy, McGraw Hill Education.
[10] Let Us C, Y Kanetkar, BPB Publications.

INTERDISCIPLINARY COURSE 1

Communication Skills

Introduction to Communication Skills

Listening:

listening to casual conversations; listening to lectures; listening to instructions; listening to theatrical or movie dialogues; listening to news bulletins

Speaking:

speaking during casual conversations; speaking to a gathering; delivering a formal speech; offering instructions / advice; speaking as a presenter on television and radio; speaking during group discussions; speaking while facing an interview board

Reading:

Reading for pleasure; reading for examinations; reading for research; reading in a group; reading newspapers

Writing:

Writing formal letters; writing emails; writing messages on social media; writing for popular magazines; report writing for newspapers; feature writing for newspapers; writing a resume, writing applications for jobs, writing memos

4. AEC (L1-1 MIL) সাহিত্যের বোধ ও বিচার BENG1041

Course Title: সাহিত্যের বোধ ও বিচার

Course Code: 4

Course Credit: 2

Course Lecture Hour: 30

Objective of the Course: এই কোর্সের উদ্দেশ্য ভাষা এবং সাহিত্য বোধ ও সাহিত্য বিচারের প্রাথমিক ধারণা দেওয়া। কোনো সাহিত্যিক নিদর্শনকে শিক্ষার্থী তার বোধ ও বিচারশক্তি দিয়ে কীভাবে আয়ত্ত করতে পারে, সেটাই এই কোর্সে তাকে শেখানো হবে।

একক ১: ভাষা অংশ (Lecture Hour: 10)

ক. বোধপরীক্ষা: (নিম্নলিখিত পাঁচটি প্রবন্ধ পাঠ্য)

১. স্বদেশী সমাজ – রবীন্দ্রনাথ ঠাকুর

২. বাঙ্গালা ভাষা – স্বামী বিবেকানন্দ

৩. বই পড়া – প্রমথ চৌধুরী

৪. স্ত্রী জাতির অবনতি – বেগম রোকেয়া

৫. অপবিজ্ঞান – রাজশেখর বসু

একক ২: সাহিত্য অংশ (Lecture Hour: 20)

ক. কবিতার ভাবসৌন্দর্য বিশ্লেষণ

রবীন্দ্রনাথ ঠাকুরের নৈবেদ্য গ্রন্থের চারটি কবিতা পাঠ্য - (বৈরাগ্যসাধনে মুক্তি সে আমার নয়, শতাব্দীর সূর্য আজি, চিত্ত যেথা ভয়শূন্য, শক্তি দম্ভ স্বার্থ লোভ)

খ. ছোটোগল্পের শিল্পসার্থকতা বিচার

রবীন্দ্রনাথ ঠাকুরের গল্পগুচ্ছ থেকে তিনটি গল্প পাঠ্য – ছুটি, বলাই, মণিহারা

Outcome of the Course: এই কোর্স পড়ার পর শিক্ষার্থী সাহিত্যের বিষয় অনুধাবনের পাশাপাশি তার শিল্পসার্থকতা ও ভাবসৌন্দর্য বিশ্লেষণ করতে শিখল।

SKILL ENHANCEMENT COURSE

Course Code: MATH1051
Course Name: Graph Theory (Credits: 03)
F.M. = 50 (Theory-40, Internal Assessment–10)

Objectives: To study the basics of Graph theory and its applications.

Learning outcomes: On completion of the course, the student should have the following learning outcomes defined in terms of knowledge, skills and general competence: Knowledge: The studentswould gain knowledge about

i. Undirected and directed graphs.
ii. Isomorphism of graphs.
iii. Eulerian graphs, Hamiltonian graphs.
iv. Various characterizations of trees with applications.
v. Bipartite graph and its characterization.
vi. Planar and non-planar graphs.
vii. Colouring of a graph.
viii. Matrix representation of graphs.

Skills: The students would be able to

i. Assimilate various graph theoretic concepts and familiarize with their applications.
ii. Efficiency in handling with discrete structures.
iii. Efficiency in notions of matrix representation of graph, planarity.
iv. Efficiency in solving concrete graph colouring problems.
v. Solve real world problems that can be modeled by graphs.

General competence: The students would gain

i. General idea of graph theory and its real-life applications.
ii. Understanding about graphic sequence.
iii. Experience to apply Euler's formula.
iv. Ability to use graphs for various map colouring problems.
v. Idea about the application of graphs in computer science.

Contents: Definition, examples and basic properties of graphs, complete graphs, Havel-Hakimi theorem (Statement and its application), bi- partite graphs, isomorphism of graphs.[L-8H & T-3H]Königsberg bridge problem, Eulerian graph, Hamiltonian graph, Representation of a graph by a matrix, the adjacency matrix, incidence matrix, weighted graph.[L-9H & T-3H] Travelling salesman's problem, shortest path, Tree and their properties, spanning tree, Dijkstra's algorithm, Warshall algorithm. [L-9H & T-3H] Planar and non-planar graphs, Euler's formula, colouring of graphs, four colour problem, five colour theorem. [L-4H & T-1H].

Reading references

Text Books:

[1] Graph Theory-N. S. Deo, (Prentice-Hall, 1974).
[2] Introduction to Graph Theory - D. S. Malik, M. K. Sen & S. Ghosh, (Cengage Learning Asia, 2014).

Reference Books:

[1] A First Look at Graph Theory - J. Clark & D. A. Holton, (Allied Publishers Ltd., 1995).
[2] Introduction to Graph Theory- Douglas Brent West, (Prentice Hall, 2001).
[3] Graph Theory- Frank Harary, (Addison-Wesley, 1971).
[4] Graph Theory with Applications- J. A. Bondy & U.S.R. Murty, (Macmillan, 1976).

Value Added Course (VAC)

Course Code: CVA1061,
Course Title: Environmental Science / Education
FM: 100

Learning objectives

- To create awareness and understanding of the environment and its different components.
- To get knowledge on different current environmental problems and issues in national and international levels.
- To impart knowledge about the management practices of different environmental problems.
- To get real life experiences of different environmental resources, ecosystems and environmental degradation.

Unit 1: Basics of Environmental Studies: (05)

Definition, Nature, Scope and Importance; Components of environment: Environmental education

Unit 2: Natural Resources: Renewable and Nonrenewable Resources (10)

Nature and natural resources their conservation and associated problems:

- Forest resources: Uses, types and importance, Joint Forest Management & symbiotic relationship between tribal population and forests, Deforestation and its effects.
- Water resources: Distribution of water on Earth; Use, over exploitation of surface and ground water; Dams: Benefits and problems; Flood and Drought.
- Mineral resources: Mineral resources in India; Use and exploitation, Social impacts of mining.
- Food resources: World food problems and food insecurities.
- Energy resources: Renewable and Nonrenewable energy sources; Use of alternate energy sources - Case studies
- Land resources: Land as a resource; Land degradation, landslides, soil erosion, desertification.
- Use of resources for sustainable development (Concepts & Goals).

Unit 3: Ecology and Ecosystems (08)

- Concept of ecology, Population ecology, Community ecology.
- Concept of an ecosystem, different types of ecosystem.
- Food chains, food webs and ecological succession.
- Energy flow in the ecosystem and energy flow models.

Unit 4: Biodiversity and its conservation (08)

Biodiversity: Levels of biological diversity

- Values of biodiversity
- Hot-Spots of biodiversity, IUCN Red Data Book, Mega-biodiversity countries
- Threat to biodiversity
- Threatened and endemic species of India
- Conservation of biodiversity (In- situ and Ex-situ)
- Ecosystem services: Ecological, Economic, Social, Ethical, Aesthetical and Informational values

Unit 5: Environmental Pollution and Management (08)

- Nature, Causes, Effects and Control measures of – Air pollution, Water pollution, Soil pollution, Noise pollution.
- Solid waste management: Causes, effects and disposal methods; Management of biomedical and municipal solid

wastes.

- Disaster management: Floods, Earthquake, Droughts, Cyclone and Landslides.

Unit 6: Environmental Policies and Practices (10)

Constitutional Provisions for protecting environment- Article 48(A), 51A(g)

- Environmental Laws: The Environment (Protection) Act, 1986; The Air (Prevention and Control of Pollution)Act, 1981; The Water (Prevention and Control of Pollution) Act 1974; Forest (Conservation) Act, 1980.
- The wildlife Protection Act, 1972.
- Climate change, Global warming, ENSO, Acid rain, Ozone layer depletion; Montreal and Kyoto Protocols.

Unit 7: Human Communities and Environment (06)

- Human population growth; Impacts on environment.
- Environment and human health: Concept of health and disease; Common communicable and Non-communicable diseases; Health awareness programmes in India.
- Environment movements in India: Chipko Movements, Silent Valley Movement, Narmada Banchao Aandolan.

Unit 8: Field Work Report/Project Report/Term paper Marks: 20

[Based on any one of the following topics and to be evaluated by internal teachers only]

- Environmental assets - River/Forest/Grassland/Hill/Mountain etc.
- Environmental pollution - Urban/Rural/Industrial/Agricultural.
- Study of common Plants/Insect /Birds/Wild life etc.
- Study of simple ecosystems: Pond/River/Hill slope etc.

Learning outcomes

- Understanding on environment and its importance.
- Knowledge on different natural resources, causes of depletion and its sustainable uses.
- Understanding the significance of biodiversity and its conservation.
- Ideas on provisions of Indian Constitution for environmental protection.
- Understanding the interrelationship among human population growth, environment and human health.
- Knowledge of on-field experience on environmental issues through project work.

LESSON PLAN
Subject: Mathematics Major
Course Code: MATH1011
Course Name: Calculus, Geometry & Vector Calculus (Credit: 4, Marks: 75)
Total Hours: Lecture -45, Tutorial – 15

Unit- 1	**Total Lecture Hours =16 (Lecture 12 + Tutorial 04)**
CONTENTS **Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of 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, envelopes, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences.**	
Lecture Serial	**Topics of Discussion**
Lecture 1	Brief discussion on continuity, differentiability: Definition, examples and some results.
Lecture 2	Hyperbolic functions, higher order derivatives.
Lecture 3	Statement and proof of Leibnitz rule, examples.
Lecture 4	Applications of Leibnitz rule to problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n\sin x$, $(ax+b)^n\cos x$.
Lecture 5	Concavity and inflection points. Examples.
Lecture 6	Envelopes.
Lecture 7	Asymptotes.
Lecture 8	Curve tracing in Cartesian coordinates of standard curves.
Lecture 9	Curve tracing in polar coordinates of standard curves.
Lecture 10	L'Hospital's rule discussion.
Lecture 11	Applications of derivatives in real world problems
Lecture 12	Discussion of more problems.
Lecture 13	Tutorial
Lecture 14	Tutorial
Lecture 15	Tutorial
Lecture 16	Tutorial
Unit- 2	**Total Lecture Hours =13 (Lecture 10 + Tutorial 03)**
CONTENTS **Reduction formulae, derivations and illustrations of reduction formulae for the integration of $\sin nx$, $\cos nx$, $\tan nx$, $\sec nx$, $(\log x)^n$, $\sin^n x \sin^m x$, parametric equations, parametrizing a curve, arc length, arc length of parametric curves, area of surface of revolution .Techniques of sketching conics.**	
Lecture 17	General discussion on indefinite and definite integration and simple problems.
Lecture 18	Simple concept on reduction formula. Simple problems.
Lecture 19	Derivation and illustrations of reduction formulae for $\sin nx$, $\cos nx$, and applications.
Lecture 20	Derivation and illustrations of reduction formulae for $\tan nx$, $\sec nx$ and applications.
Lecture 21	Derivation and illustrations of reduction formulae $(\log x)^n$, $\sin^n x \sin^m x$ and applications.
Lecture 22	Parametric equations, parametrizing a curve. Examples
Lecture 23	Arc length, arc length of parametric curves and examples.
Lecture 24	Area of surface of revolution.
Lecture 25	More problems on area of surface of revolution.
Lecture 26	Techniques of sketching conics
Lecture 27	Tutorial
Lecture 28	Tutorial
Lecture 29	Tutorial

Unit- 3	**Total Lecture Hours =15 (Lecture 11 + Tutorial 04)**
CONTENTS **Reflection properties of conics, translation and rotation of axes and second degree equations, classification of conics using the discriminant, polar equations of conics. Spheres.Cylindrical surfaces. Central conicoids, paraboloids, plane sections of conicoids, Generating lines, classification of quadrics,** **Illustrations of graphing standard quadric surfaces like cone, ellipsoid.**	
Lecture 30	Reflexion properties of conics, translation and rotation of axes with examples
Lecture 31	Invariants and some problems
Lecture 32	General equation of 2nd degree: Classification and canonical forms of conics
Lecture 33	Polar equation of conics : Equations of straight line, circle, conic
Lecture 34	Polar equation of conics : Some problems
Lecture 35	Spheres: Some basic properties and problems
Lecture 36	Some more problems on sphere
Lecture 37	Cylindrical surface and central conicoids, ellipsoid, hyperboloid and paraboloid
Lecture 38	Generating lines: Properties and problems
Lecture 39	General equation of 2nd degree in three variables
Lecture 40	Some more problems determining nature and canonical forms of conics in 3D
Lecture 41	Tutorial
Lecture 42	Tutorial
Lecture 43	Tutorial
Lecture 44	Tutorial
Unit- 4	**Total Lecture Hours =16 (Lecture 12 + Tutorial 04)**
CONTENTS **Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions**	
Lecture 45	Preliminary idea about product of vectors, product of three and four vectors, geometrical interpretation of scalar and vector triple product.
Lecture 46	Discussion of some elementary geometrical problem by application of vector method, coplanarity of three vectors etc.
Lecture 47	Discussion of problems on triple product, application of vectors in mechanics.
Lecture 48	Introduction to vector functions, definition of vector function and example of different kinds of vector valued functions.
Lecture 49	Algebra of vector-valued functions, examples.
Lecture 50	Definition of limit for a vector valued function, algebra of limits and examples.
Lecture 51	Definition of continuity for a vector valued function, algebra of continuous vector functions and examples.
Lecture 52	Definition of differentiability for a vector valued function, algebra of differentiable vector functions and examples.
Lecture 53	Integration of vector functions: Definition, discussion of some properties and evaluation of integration of vector valued function.
Lecture 54	Gradient of Scalar functions with examples, Directional Derivatives
Lecture 55	Divergence of vector functions and solenoidal vectors
Lecture 56	Curl of vector functions and irrotational vectors
Lecture 57	Tutorial
Lecture 58	Tutorial
Lecture 59	Tutorial
Lecture 60	Tutorial

Departmental Continuous Internal Evaluation (CIE) Structure

Type of Evaluation	Assignment	Project	MCQ	Viva Voce
Marks Allotted	10	10	10	10

LESSON PLAN
Subject: Physics Minor
Paper Code: PHYS1021
Paper Name: Mathematical Physics-I (Credits: Theory-03, Practicals-01)
F.M. =75 (Theory-40, Practical–20, Internal Assessment–15)

COURSE OBJECTIVE: The aim of this course is to equip students with mathematical methods that are important prerequisites for physics courses.

Module-ICalculus
Contents Recapitulation: Limits, continuity, average and instantaneous quantities, differentiation. Plotting functions. Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves. Approximation:Taylor and binomial series (statements only). First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence and Uniqueness Theorem forInitial Value Problems. Particular Integral. Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration.Constrained Maximization using Lagrange Multipliers.
Module Objectives: 1. Recapitulation of function, limit and continuity 2. To know the methods of solving the first order and second order differential equation. 3. To know the methods of solving the partial differential equation.

Lecture Serial	Topics of Discussion
Lecture-1	**Function:** Limits, continuity, average and instantaneous quantities,differentiation.
Lecture-2	**Function Plot:** Plotting functions. Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves.
Lecture-3	**Approximation Method:** Taylor and binomial series
Lecture-4	**Nature of Differential Equations:** Definition of differential equation. Representation of differential equation. Ordinary differential equation, Degree of a differential equation, Partial differential equation.
Lecture-5	**First Order Differential Equation:** Definition, Linear Equations, Bernoulli Equations, Homogeneous Equation, Some examples on 1st or-der homogeneous equation.
Lecture-6	**Exact Differential Equation:** Condition for exact differential equa- tion, Some examples regarding exact differential equation.
Lecture-7	**Inexact Differential Equation:** Integrating factor, Some examples re- lated to inexact differential equation.
Lecture-8	**Second Order Differential Equations:** Homogeneous equation and non-homogeneous equation. Definition of Wronskian, Some problems regarding Wronskian.
Lecture-9	**Second Order Differential Equations:** The use of a known solution to find a another solution. Homogeneous equation with constant coefficients.
Lecture-10	**Second Order Differential Equations:** Nonhomogeneous second orderdifferential equation, The method of undetermined coefficients.
Lecture-11	**Second Order Differential Equations:** Vibration in mechanical system.
Lecture-12	**Operator Method:** Particular solution of first and second order linerequations.

Lecture-13	**Particular Integrals:** Properties of particular integrals. Some examplesregarding the particular integrals.
Lecture-14	**Existence and Uniqueness Theorems:** Statements and some examples ofinitial value problem.
Lecture-15	**Partial derivatives:** Exact and inexact differentials.
Lecture-16	**Partial derivatives: I**ntegrating factor, with simple illustration.
Lecture-17	**Lagrange Multipliers:** Constrained Maximization using LagrangeMultipliers.
Lecture-18	**Lagrange Multipliers:** Some examples regarding lagrange multipliers.

Tutorial Assignment—I

Module-II Vector Calculus

Contents

Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields.

Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector identities.

Vector Integration: Ordinary Integrals of Vectors. Multiple integrals. Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs)

Module Objectives:

1. This module delivers idea about dot and cross products of vectors and their significance And one can understand the laws of vector algebra to solve various problems associated with Vectorcalculus.
2. This unit gives the students idea about vector differentiation
3. One can get knowledge about Gradient of scalar field, Divergence and curl of a vector field and their significance.
4. This unit enables the student to solve various problems associated with vector differentiation
5. This unit delivers idea about vector integration, both ordinary and multiple integration.
6. This unit enables the student to solve various problems associated with vector line, surfaceand volume integration.
7. One can also get knowledge about Vector Theorems and can apply them to solve variousproblems on vector integration.

Lecture Serial	Topics of Discussion
Lecture-19	**Introduction to Vector:** Vector definition, unit vector, polar and axial vector, Properties of vectors under rotations.
Lecture-20	**Product of Vectors:** Product of two vectors, Scalar product and its invarianceunder rotations. Vector product, Significance of dot and cross product.
Lecture-21	**Vector Product:** Scalar triple product and their interpretation in terms of areaand volume respectively. Vector triple product.
Lecture-22	**Laws of vector algebra:** Properties of dot and cross product.
Lecture-23	**Scalar and Vector fields and Vector Derivatives:** Defination, Directional derivatives and normal derivative, Gradient of a scalar field and its geometrical interpretation.
Lecture-24	**Divergence of a vector field:** Defination, Some example regarding divergence, Physical significance of divergence of a vector field.
Lecture-25	**Curl of a vector field:** Defination, Some example regarding curl, Physical significance of curl of a vector field.
Lecture-26	**Vector Operator:** Del and Laplacian operators. Vector identities.
Lecture-27	**Vector Operator:** Some examples regarding vector operator
Lecture-28	**Vector Integrals:** Ordinary Integrals of Vectors. Multiple integrals,Jacobian and its apllications.
Lecture-29	**Line Integrals:** Conservative vector field and scaler potential
Lecture-30	**Line Integrals:** Few instances regarding line integrals.

Lecture-31	**Surface Integrals:** Basic theory on surface integrals.
Lecture-32	**Surface Integrals:** Some examples regarding vector integrals
Lecture-33	**Surface Integrals:** Few instances regarding vector integrals
Lecture-34	**Volume Integrals:** Basic theory on volume integrals. Some example onvolume integrals.
Lecture-35	**Green's Theorem:** Green's theorem in the plane. Discuss some exapmles.
Lecture-36	**Stokes' Theorem:** Statement of Stokes theorem. Application of Stokes' theorem.
Lecture-37	**Stokes' Theorem:** Verification of Stokes' theorem**.**
Lecture-38	**Gauss' divergence theorem:** Statement of Gauss' theorem and its physical significant. Application of divergence theorem.
Lecture-39	**Few more Intergral Theorem:** Application of Stokes' and Gauss' divergence theorem.
Tutorial Assignment—II	
Module-III **Orthogonal Curvilinear Coordinates**	
Contents Orthogonal Curvilinear Coordinates:Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.	
Module Objectives: 1. To understand the generalized coordinate system. 2. To learn and apply techniques of orthogonal curvilinear coordinate system in cylindrical andspherical coordinate system.	
Lecture Serial	**Topics of Discussion**
Lecture-40	**Curvilinear Coordinates:** Unit Vector in Curvilinear coordinate sys-tem, Arc length and Volume elements
Lecture-41	**Differential operators:** Gradient of a scalar in orthogonal curvilinearcoordinates.
Lecture-42	**Differential operators:** Divergence of a vector in orthogonal curvilinearcoordinates, Laplacian operator.
Lecture-43	**Differential operators:** Curl of a vector in orthogonal curvilinearcoordinates
Lecture-44	**Spherical Polar Coordinate:** Differential operators in terms of spher-ical coordinate.
Lecture-45	**Cylindrical Coordinate system:** Differential operators in terms ofcylindrical coordinate.
Tutorial Assignment—III	

COURSE OUTCOME: On completion of this course, the student must be able to perform different mathematical operations like calculus and vector operations which are extremely essentialto study theoretical and experimental physics.

Reference Books:

[1] Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
[2] An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning
[3] Vector Analysis, M R Spiegel, Schaums Outline Series.
[4] Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
[5] Higher Engineering Mathematics, B S Grewal, Khanna Publisher.
[6] Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning
[7] Mathematical Physics, H K Dass and R Verma, S. Chand & Company Pvt. Ltd.
[8] Engineering Mathematics, S.Pal and S.C. Bhunia, 2015, Oxford University Press
[9] Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
[10] Essential Mathematical Methods, K.F.Riley & M.P.Hobson, 2011, Cambridge Univ. Press

Practical

COURSE OBJECTIVE: The aim of this course is to learn computer programming and numerical analysis and to emphasize its role in solving problems in Physics.

Contents
Introduction and Overview: Computer architecture and organization, memory and Input/outputdevices. **Basics of scientific computing:** Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow&overflow emphasize the importance of making equations in terms of dimensionless variables, Iterativemethods. **Errors and error Analysis:** Truncation and round off errors, Absolute and relative errors, Floating point computations. **Review of C&C++Programming fundamentals:** Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements) (If statement. If else Statement. Nested if Structure. Else if Statement. Ternary Operator. Goto Statement. Switch Statement. Unconditional and Conditional Looping. While Loop. Do-While Loop. For Loop. Break and Continue Statements. Nested Loops), Arrays (1D & 2D) and strings, user defined functions, Structures and Unions, Idea of classes and objects.
Programs:
1. Write and execute a program in C/C++ to sort elements of an array of Seven elements inascending order.
2. Write and execute a program in C/C++ to find the area and volume of a Sphere by varying theradius.
3. Write and execute a program in C/C++ to find the value of Sine function using power series(The argument will be given during execution)
4. Write and execute a program in C/C++ to find the value of e x (x will be given during executionof the program).
5. Write and execute a program in C/C++ to compute the factorial of a positive integer includingZero.
6. Write and execute a program in C/C++ to calculate sum of squares of n natural numbers.
7. Write and execute a program in C/C++ to separate odd and even integers in arrays.
8. Write and execute a program in C/C++ to find the value of Cosine function using power series
(The argument will be given during execution)
9. Write and execute a program in C/C++ to sort elements of an array of Six elements in assendingorder.
10. Write and execute a program in C/C++ to calculate value of π.
11. Write and execute a program in C/C++ to find the largest and smallest in a given set ofnumbers.

COURSE OUTCOME: On completion of this course, the student must be able to perform different mathematical operations like calculus and vector operations which are extremely essentialto study theoretical and experimental physics.

Reference Books:

[1] Introduction to Numerical Analysis, S.S.Sastry, 5th Edn., 2012, PHILearning Pvt. Ltd.
[2] Schaum's Outline of Programming with C++., J B.Hubbard, 2000, McGraw-Hill Pub.
[3] Numerical Recipes in C: The Art of Scientific Computing, W.H. Pressetal, 3rd Edn., 2007, Cambridge University Press.
[4] A first course in Numerical Methods, U.M.Ascher&C.Greif, 2012, PHI Learning.
[5] Elementary Numerical Analysis, K.E.Atkinson, 3rd Edn., 2007,Wiley India Edition.
[6] An Introduction to computational Physics, T.Pang, 2nd Edn., 2006,CambridgeUniv. Press
[7] Computational Physics, Darren Walker, 1st Edn. 2015, Scientific International Pvt. Ltd.
[8] Programming in ANSI C, E Balagurusamy, McGraw Hill Education.
[9] Object Oriented Programming with C++, E Balagurusamy, McGraw Hill Education.
[10] Let Us C, Y Kanetkar, BPB Publications.

LESSON PLAN

Subject: Mathematics

Paper: MATH1051 (Graph Theory)

Total Lecture Hours = 40 (L-30, T-10)

Unit 1: Total Lecture Hours =11 (08 Lectures+03 Tutorials)	
Lecture Serial	**Topics of Discussion**
Lecture 1	Some basic definitions like vertex, edges etc. with examples
Lecture 2	Some basic properties related to vertices and edges of graphand their examples
Lecture 3	Concept of Pseudo graph with examples and problems
Lecture 4	The idea of complete graph and examples
Lecture 5	Some theorems, examples and problems of complete graph
Lecture 6	Connected and Bi-partite graphs: Definition and some examples and some theorems
Lecture 7	Some more theorems and problems on bi-partite graphs
Lecture 8	The concept of isomorphism between two graphs withExamples and problems
Lecture 9	Tutorial
Lecture 10	Tutorial
Lecture 11	Tutorial
Unit 2: Total Lecture Hours =12 (09 Lectures+03 Tutorials)	
Lecture Serial	**Topics of Discussion**
Lecture 12	The introduction of Konigsberg's bridge problem and theorigin of graph theory
Lecture 13	Definition of Eulerian circuits and Eulerian graphs withexamples
Lecture 14	Some theorems and problems on Eulerian graph and theconclusion of the Konigsberg's bridge problem.
Lecture 15	Definition of Hamiltonian cycles and Hamiltonian graph withexamples
Lecture 16	Some theorems and examples of Hamiltonian graph
Lecture 17	The relation and comparing between Eulerian graph andHamiltonian graph with examples
Lecture 18	The adjacence matrix with examples and some properties
Lecture 19	The incidence matrix of a graph with examples and someproperties
Lecture 20	Concept of weighted graph with some examples
Lecture 21	Tutorial
Lecture 22	Tutorial
Lecture 23	Tutorial
Unit 3: Total Lecture Hours =12 (09 Lectures+03 Tutorials)	
Lecture Serial	**Topics of Discussion**
Lecture 24	Definitions and examples of Tree
Lecture 25	Some more definitions, theorems on Tree
Lecture 26	Some more results and problems on Tree
Lecture 27	Definition of spanning tree and examples
Lecture 28	Some theorems and examples of tree and spanning tree
Lecture 29	The concept of Travelling sale's man problem of shortestpath

Lecture 30	Dijkstra's algorithm and it's application to find shortest path
Lecture 31	Some more problems of finding shortest path
Lecture 32	Warshall algorithm for finding shortest path between all the pair of vertices in a weighted graph
Lecture 33	Tutorial
Lecture 34	Tutorial
Lecture 35	Tutorial
Unit 4: Total Lecture Hours =05 (04 Lectures+01 Tutorials)	
Lecture Serial	**Topics of Discussion**
Lecture 36	Planar & Non-planar graph
Lecture 37	Euler's Formula
Lecture 38	Colouring of graphs
Lecture 39	Four Colour Theorem & Five Colour conjecture
Lecture 40	Tutorial

Departmental Continuous Internal Evaluation (CIE) Structure

Type of Evaluation	Assignment	Project	MCQ	Viva Voce
Marks Allotted	10	10	10	10

Semester-II

Course Type	Title of the Course	Credit	Full Marks	Lecture Hour
Major Course MATH2011	**Introductory Algebra & Number Theory**	**4** (Theory-04)	**75** (Theory-60, Internal Assessment–15)	**60** (Lecture -45, Tutorial – 15)
Minor Course CHEM1021	**General Chemistry-I**	**4** (Theory-03, Practical - 01)	**75** (Theory-40, Practical-20, Internal Assessment–15)	**75** (Theory-45, Practical-30)
Multi/ Interdisciplinary ENGL2031	**Technical Writing**	**3** (Theory-03)	**50** (Theory-40, Internal Assessment–10)	**40** (Lecture -30, Tutorial – 10)
Ability Enhancement Course [L2-1] ENGL2041	**Functional English**	**2** (Theory-02)	**50** (Theory-40, Internal Assessment–10)	**30**
SEC MATH2051	**Programming in C**	**3** (Theory-03)	**50** (Theory-40, Internal Assessment–10)	**45**
VAC CVA 2061	**Understanding India/Fitness & Hygiene & Yoga/Digital India**	**4** (Theory-04)	**100**	**60**
		Total Credit = 20	**Total Marks = 400**	

SEMESTER – II

MAJOR COURSES

Course Code: MATH2011
Course Name: Introductory Algebra and Number Theory (Credit: 4, Marks: 75)
Total Hours: Lecture -45, Tutorial – 15

Objectives

To present a systematic introduction to number theory and basic course on algebra.

Learning outcomes

On completion of the course, the student should have the following learning outcomes defined in terms of knowledge, skills and general competence:

Knowledge: The students would gain knowledge about

i. number theory which has wide applicability in advanced mathematics and also in various practical field, e.g., cryptography, computer science and many competitive exams.
ii. complex number and its properties which are equally indispensable tools for advanced studies and different practical field.
iii. a basic introduction to modern algebra which has wide applicability in different branch of sciences.

Skills:

The students would be able to

i. access and also generate different tricky examples and counter examples involving integers during their advanced study of ring theory and field theory.
ii. simplify a mathematical problem in different field of science using complex number.
iii. motivate themselves for future research after getting the glimpse of gateway of modern algebra from classical algebra and number theory and relate use of group, ring and field in different field of science.

General competence: The students would gain

i. descriptive idea of various properties of complex number.
ii. knowledge of richness in number theory.
iii. understanding in basic concepts of group, ring and field.
iv. expertise in solving many tricky problems in number theory, complex numbers.

Contents:

Algebra

Complex Numbers: De Moivre's theorem for rational indices and its applications.

Theory of equations: Fundamental Theorem of Algebra (Statement), Relation between roots and coefficients, Transformation of equation, Descarte's rule of signs, Cubic and biquadratic equations, Reciprocal equation, separation of the roots of equations, Strum's theorem.
Inequality: The inequality involving AM≥GM≥HM, Cauchy-Schwartz inequality. [L-**10H & T-4H]**

Partial order, total order relations, partitions of a set and its connection with equivalence relation, greatest lower bound, least upper bound, maximal, minimal elements, lattice, bounded lattice, modular lattice, distributive lattice, complemented lattice, statement of Zorn's lemma.

[L-**5H & T-2H]**

Semigroups, Monoids, Groups – examples including permutation group, Matrix groups $(M_{n\times n}(\mathbb{R}), GL_n(\mathbb{R}), SL_n(\mathbb{R}))$, Z_n, elementary properties of groups, generators and relations, order of an element of a group, Subgroups and examples of subgroups, cosets, normal subgroup, center of a group, cyclic groups, Lagrange's theorem, Rings, subrings, Ideals (left, right and two sided), integral domain, field, subfield – examples and basic properties, characteristic of a ring and field.

[L-**10H & T-4H]**

Number Theory

Well ordering principle of set of natural numbers, pigeon-hole principle, division algorithm, greatest common divisor (gcd), Euclidean algorithm, least common multiple (lcm), Linear Diophantine equation, prime numbers, relatively prime numbers and related properties including Euclid's lemma, fundamental theorem of arithmetic and its applications, perfect square and square free integers, congruences, solution of congruences, Binary and decimal representation of integer, Chinese remainder theorem and its application. Fermat's little theorem, Wilson's theorem, sum of two squares, Arithmetic function-$\phi(n), d(n), \sigma(n)$. [L-**20H & T-5H]**

Reading References:

Text books:

1. Classical Algebra- S. K. Mapa,8th Edition, (Sarat Book House).
2. Topics in Abstract Algebra – M.K. Sen, S. Ghosh, P. Mukhopadhyay, S. K. Maity, 3rd Edition (University Press).
3. Higher Algebra- S. K. Mapa,8th Edition, (Sarat Book House).
4. An introduction to Theory of Numbers- Niven, Ivan,S. Zuckerman Herbert, L. Montogomery Hugh,5th Edition, (Willey).
5. Elementary Number Theory- D. M. Burton, (Mc Graw Hill Education).

Reference Books:

1. Topics in Algebra – I. N. Herstein,2nd Edition, (Wiley).
2. Contemporary Abstract Algebra - Gallian, A. Joseph, Standard Edition, (Cengage India Private Limited).
3. Higher Algebra - S. Barnards, J. M. Child, (Arihant).
4. Algebra - M. Artin, 2nd Edition, (Pearson Education, India).
5. A first course in Abstract Algebra - J. B. Fraleigh7th Edition, (Pearson Education, India).

Chemistry MINOR

Paper code: CHEM102-I

Paper title: General Chemistry-I Credits 3+1

Theory Credits 3

1. **Atomic structure**

Bohr's theory for hydrogen atom (simple mathematical treatment), atomic spectra of hydrogen and Bohr's model, Sommerfeld's model, quantum numbers and their significance, Pauli's exclusion principle, Hund's rule, electronic configuration of many-electron atoms, Aufbau principle and its limitations *6 Hours*

2. **Periodic properties**

Classification of elements on the basis of electronic configuration: general characteristics of s-, p-, d- and f-block elements, positions of hydrogen and noble gases, atomic and ionic radii, ionization potential, electron affinity and electronegativity,periodic and group-wise variation of above properties in respect of s- and p- block elements

6 Hours

3. **Acids and bases**

Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents,Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept, hard and soft acids and bases (HSAB concept), applications of HSAB process, acidity and basicity of common organic compounds *7 Hours*

4. **Aliphatic hydrocarbons**

Functional group approach for the following compounds to be studied in context of their preparations, properties, structures and reactions

Alkanes (up to 5 carbons): preparation- catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis using Grignard reagent; Reaction mechanism for free radical substitution, halogenation

Alkenes (up to 5 carbons): preparation- elimination reactions, dehydration of alcohols and dehydrohalogenation of alkyl halides, *cis* alkenes (partial catalytic hydrogenation) and trans alkenes (Birch reduction), reactions- *cis*-addition (alkaline KMnO4) and trans-addition (bromine) with mechanism, addition of HX [Markownikoff's (with mechanism) and anti-Markownikoff's addition], hydration, ozonolysis, oxymercuration-demercuration and hydroboration-oxidation reaction

Alkynes (up to 5 carbons):preparation- acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal dihalides, formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alkaline $KMnO_4$ *10 Hours*

5. Ideal and real gases

Concept of pressure and temperature, Deviation of gases from ideal behaviour, compressibility factor, Boyle temperature, Andrew's and Amagat's plots, van der Waals equation and its features, derivation and application in explaining real gas behaviour, existence of critical state, critical constants in terms of van der Waals constants, law of corresponding states

Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only) *5 Hours*

6. Thermodynamics-I

Intensive and extensive properties state and path functions, isolated, closed and open systems, zeroth law of thermodynamics,concept of heat, work, internal energy and statement of first law; enthalpy, H, relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases

Standard states, heat of reaction, enthalpy of formation of molecules and ions, enthalpy of combustion and its applications, laws of thermochemistry, bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchoff's equation and effect of pressure on enthalpy, adiabatic flame temperature, explosion temperature

7 Hours

7. Chemical Kinetics-I

Introduction of rate law, order and molecularity, extent of reaction, rate constants, rates of first-, second- and n-th order reactions and their integrated forms (with derivation), pseudo first order reactions, determination of order of a reaction- half-life and differential method, opposing reactions, consecutive reactions and parallel reactions (elementary idea)

Theories of reaction rate: Temperature dependence on reaction rate, Arrhenius equation, energy of activation *4 Hours*

Reference Books:

1. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.

2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970.

4. Atkins, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).

5. Cotton, F.A., Wilkinson, G. and Gaus, P.L., Basic Inorganic Chemistry 3rd Ed.; Wiley India.

6. Sharpe, A.G., Inorganic Chemistry, 4th Indian Reprint (Pearson Education) 2005.

7. Huheey, J. E.; Keiter, E.A. &Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson, 2006.

8. Mingos, D.M.P., Essential trends in inorganic chemistry. Oxford University Press (1998).

9. Burgess, J., Ions in solution: basic principles of chemical interactions. Ellis Horwood (1999).

10. Clayden, J., Greeves, N. & Warren, S. Organic Chemistry, Second edition, Oxford University Press, 2012.

11. Smith, J. G. Organic Chemistry, Tata McGraw-Hill Publishing Company Limited.

12. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

13. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd., (Pearson Education).

14. Morrison, R. T. Study guide to organic Chemistry, Pearson.

15. Pathak & Saha, Organic Chemistry (Volume-1), Books and Allied (P) Ltd.

16. Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, Oxford University Press.

17. Castellan, G. W., Physical Chemistry, Narosa Publishing House.

18. McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva Press.

19. Engel, T. & Reid, P. Physical Chemistry, Pearson.

20. Mortimer, R. G. Physical Chemistry, Elsevier.

21. Ball, D. W. Physical Chemistry, Thomson Press.

22. Glasstone, S. & Lewis, G.N. Elements of Physical Chemistry.

23. Rakshit, P.C., Physical Chemistry, Sarat Book House.

24. Zemansky, M. W. &Dittman, R.H. Heat and Thermodynamics, Tata-McGraw-Hill.

25. Rastogi, R. P. & Misra, R.R. An Introduction to Chemical Thermodynamics, Vikas Publishing House.

26. Clauze& Rosenberg, Chemical Thermodynamics: Basic concepts & Methods, John Wiley & Sons, 2008.

27. Sharma, K. K. & Sharma, L. K., A Textbook of Physical Chemistry, Vikas Publishing House.

28. Bajpai, D. N., Advanced Physical Chemistry, S. Chand Publication.

29. Rajaram, J. Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson.

30. Chatterjee Hrishikesh, Physical Chemistry (Volume-1), Platinum Publisher

31. Kapoor, K.L., Textbook of Physical Chemistry (Volume 1 and Volume-2), McGraw Hill Education

32. Ghoshal, A. Numerical problems & short questions on Physical Chemistry, Books and Allied (P) Ltd.

33. Maron, S. &Prutton, Principles of Physical Chemistry, Collier Macmillan Ltd.

34. Levine, I. N. Physical Chemistry, Tata McGraw-Hill.

Practical Credit 1

(i) Determination of boiling points

Boiling points of common organic liquid compounds e.g., ethanol, cyclohexane, ethyl methyl ketone, cyclohexanone, acetylacetone, anisole, crotonaldehyde, mesityl oxide,etc.

12 Hours

(ii) Identification of a pure organic compound

Solid compounds: oxalic acid, succinic acid, resorcinol, urea, glucose, benzoic acid and salicylic acid.

Liquid Compounds: acetone, aniline and nitrobenzene *18 Hours*

Reference Books:

1. Bhattacharyya, R. C, A Manual of Practical Chemistry.

2. Vogel, A. I. Elementary Practical Organic Chemistry, Part 2: Qualitative Organic Analysis, CBS Publishers and Distributors.

3. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009).

4. A.K. Manna, Practical Organic Chemistry, Books & Allied (P) Ltd.

Ghosh, Das Sharma, Majumdar, Manna, Chemistry in Laboratory, Santra Publication (P) Ltd.

INTERDISCIPLINARY COURSE

ENGL2031: Technical Writing
[3 Cr, Full Marks: 50 (Theory: 40 + IA: 10), LH: 45 hrs]

COURSE OBJECTIVE:

Technical writing is a necessary requirement in many professions, and this course is designed to make students aware ofthe various forms of such writing. The objective is to equip students to face the challenges of technical writing in professional life.

Introducing Technical Writing(LH: 15)
What is technical writing?
Difference between technical writing and other forms of writing
Roles and responsibilities of technical writers
Qualities and qualifications of technical writers

Forms and Styles of Technical Writing(LH: 30)
Styles in technical writing
Forms of discourse, audience analysis, persuasion
Grammar in technical writing, revising a written document
Clarity, precision, coherence and logic in technical writing
Collecting notes, writing summaries and drafts, writing minutes and resolutions of meeting
Designing and reviewing documents
Document formats, differences between hard and soft copy versions
Web content writing
Collaborative writing
Professional Ethics, plagiarism, and copyright

COURSE OUTCOME:

It is expected that students emerging from this course will be capable of handling the demands and challenges of technical writing in the course of their professional careers in government and private sectors as well as in transactions of business.

ABILITY ENHANCEMENT COURSE

ENGL2041: Functional English
[2 Cr, Full Marks: 50 (Theory: 40 + IA: 10), LH: 30 hrs]

COURSE OBJECTIVE:

The importance of functional English at the present moment cannot be over-emphasized. Recognizing this importance, the course seeks to acquaint students with the various uses of English in today's world, with particular focus on developing one's conversational and writing skills together with the ability to comprehend English speech and writing.

What is functional English? (LH: 1)
Aims and objectives of functional English (LH: 1)
Functional English and formal English/ literary English (LH: 1)
Types and modes of Communication (LH: 1)
Language of communication (LH: 1)
Conversational skills (LH: 1)
Verbal and Non-verbal communication(LH: 1)
Personal, social and business communication (LH: 1)
Understanding English language films, songs, documentaries, news bulletins, sports commentaries (LH: 4)
Comprehension skills (LH: 2)
Paraphrasing difficult passages (LH: 2)
Analysis and Interpretation (LH: 1)
Writing for classified advertisements (LH: 2)
Using idioms and phrases (LH: 2)
One-word substitution (LH: 1)
Figures of speech: simile, metaphor, irony, personification, hyperbole (LH: 3)
Reading online content (LH: 1)
George Bernard Shaw: "Spoken English and Broken English" (LH: 4)

COURSE OUTCOME:

Besides developing the student's ability to comprehend the English that one hears and reads, the course will also enhance the student's skills at using English in speech and in various forms of writing. Thus, the course shall fulfil to a large extent an intensely felt need in today's professional world.

SKILL ENHANCEMENT COURSES

Course Code: MATH2051
Course Name: Programming in C
(Credit: 3, Marks: 50)
Total Hours: Lecture -30, Tutorial – 15

Objectives

To learn the basics of C programming and its different features viz. branching & looping, array, user defined functions, structures and pointers

Learning outcomes

On completion of the course, the student should have the following outcomes defined in terms of knowledge, skills and general competence:

Knowledge: The students would gain knowledge about the

i. basics of C programming i.e., basic structure, keywords, identifiers, operators with operator precedence and associativity, input-output statements.
ii. concepts of branching & looping and array.
iii. user defined functions and their use.
iv. use of structures and pointers.

Skills: The students would be able to

i. learn the keywords, identifiers, different types of operators with precedence and associativity, use of formatted and non-formatted input-output statements.
ii. use branching and looping statements for decision making.
iii. learn the concepts of array, string handling arrays.
iv. use library and user-defined functions along with string handling functions.
v. write programs using structures and pointers.

General Competence: The students would gain

i. general idea about the writing of different C programs using branching & looping statements, arrays, functions, structures and pointers.
ii. program writing and reasoning skills which improve their thinking power.

Contents:

Introduction, basic structures, character set, keywords, identifiers, constants, variable-type declaration, operators: arithmetic, relational, logical, assignment, increment, decrement, conditional. [L- 3H & T- 1H]

Operator precedence and associativity, arithmetic expression, evaluation and type conversion, character reading and writing, formatted input and output statements. [L- 3H & T-1H]

Decision making (branching and looping): Simple and nested *if, if – else, switch, while, do-while, for* statements. [L- 5H & T-3H]

Concept of array variables, string handling with arrays – reading and writing, string handling functions. [L- 4H &T-2H]

User defined functions, call-by-value, call-by-reference functions and their uses, return values and their types, nesting of functions, recursion. [L- 5H & T-3H]

Structures: Declaration, initialization, nested structures, array of structures, array within structures. [L- 4H & T- 2H]

Pointers: Declaration, initialization, accessing variables through pointer, pointer arithmetic, pointers and arrays. [L- 6H & T-3H]

Reading references:

Text Books:

1. Programming in ANSI C-E. Balaguruswamy, (TMH, 2011).
2. Programming with C-B. S. Gottfried, (TMH, 2011).

Reference Books:

1. Programming with C-K. R. Venugopal and S. R. Prasad, (TMH, 1997).
2. The C Programming Language -Brian W. Kernighan and Dennis Ritchie, (Pearson Education India, 2015).
3. C Language and Numerical Methods-C. Xavier, (New Age International (P) Ltd. Pub, 2007).
4. The C Programming Language-Brian W. Kernighan / Dennis Ritchie, (Pearson Education India, 2015).

Semester-II	Course Type with Code	Name of the Course	Credit	Lect.	Tuto.	Pract./ Viva-voce	Full Marks	Distribution of Marks		
								Theory	Pract./ Viva-	Internal Assessment
	Value Added (VA) Course Code:CVA2061	Health & Wellness, Yoga Education, Sports and Fitness	4	3	0	1	100	60	20	20

Value Added (VA) Course

Course Name: Health & Wellness, Yoga Education, Sports and Fitness
Course Code: CVA2061 **Total Lecture Hours (Theory) :** 45
Credit: 4 **Total Lecture Hours (Practical):** 30

Unit- 1: Concepts of Wellness and Illness (15 Lecture Hours)

Concept of health (Modern and Ancient View); Concept of Wellness and Illness (Modern and Ancient View); Concept of Body (Pancha Kosha according to Taittiriya Upanisada); Potential causes of illness according to Yoga Vasishta- Concept of Adhi and Vyadhi and their consequences on the body

Unit- 2: Yogic Concept on Holistic Health (15 Lecture Hours)

Total Human Development through Yogic practices for Pancha Kosha (Annamaya Khosha, Pranamaya Kosha, Manomaya Kosha, Vijnanamaya Kosha and Ananda Maya Kosha) and its integration with Ashtanga Yoga of Patanjali.

Unit- 3: Yoga as Preventive Health Care (15 Lecture Hours)

Concept of stress according to modern science and yoga; Stress as the cause for illness; Role of Yoga in Stress Management: Holistic approach of catering to moderation in eating (yogic Diet), Sleeping (rhythm of the nature), Working (the sense of duty as per BG), Entertainment (moderation), Change in life style;

Unit-4 (Practical) : Asana (30 Lecture Hours)

Pranayama: Anulome-Vilome, Suryabhidana, Chancrabhedana, Ujjai, Sitali

Meditation: A-U-M Meditation, Yog Nidra

Reference Books:

1. Ajith ‘Yoga Pravesh’ Rastrotana Paruhad Bangalore.
2. Bachelor of Sports Management Syllabus (Revised) 2008.
3. B. C. Rai Health Education and Hygiene, Published by Prakashana Kendra, Lucknow.
4. B.K.S. Iyenger ‘Yoga The Path of Holistic Health’, Dorling Kindersley, Delhi 2001.
5. Dixit Suresh (2006) Swasthya Shiksha Sports Publication, Delhi.
6. Puri, K. Chandra, S.S (2005) Health and Physical Education, New Delhi, Surjeet Publication.
7. A Text Book on Physical Education & Health Education Fitness, Wellness and Nutrition, Dr. A. K. Uppal, Dr. P. P. Ranganathan.
8. Warner W. K. Oeger & Sharon A. Hoeger, Fitness & Wellness, Morton Publishing Co., 1990
9. Robert Malt. 90 day Fitness Plan, D. K. Publishing, Inc. 95, Madison Avenue, New York 2001.

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