TURA GOVERNMENT COLLEGE:: TURA

COURSE OUTCOME (CO)

DEPARTMENT OF ENGLISH

English honours is broadly divided into Poetry, Fiction, Drama, Criticism, Language and History of English Literature.

POETRY

- Poetry papers are intended to provide a comprehensive guide to English poetry, its development, its forms, and movements, throughout the ages. The paper is also designed to help the students understand the common techniques and the basic terminology and practical elements of poetry.

FICTION

- This course is designed to familiarise students with the emergence of the Novel as an art form in the eighteenth century and its successive development throughout the eighteenth and nineteenth centuries. It includes five representative texts related to the age in which they appear.

DRAMA

- This course traces the development of drama from the Elizabethan age to the post-war era of the twentieth century. It introduces drama as a literary as well as dramatic genre with due emphasis on dramatic elements, like plot, structure, etc. The course also aims to give students an understanding of the major dramatic works with a sense of their historical and cultural context and the techniques that inform them.

CRITICISM

- Literary Criticism Paper is to orient students with the study of significant texts on Criticism. This will provide them with the necessary grounding in the subject.

LANGUAGE AND HISTORY OF ENGLISH LITERATURE:

- This course introduces the students to the Literary History of English Literature. The language component sensitises the students to the formal aspects of the English Language which also includes phonetics.

DEPARTMENT OF EDUCATION

CO1	EDUCATIONAL PSYCHOLOGY	To enable students to understand the nature of Educational Psychology, Intelligence and creativity, different aspects of personality and its development, to develop an understanding of the process of learning and to enable them to understand the nature, scope and importance of Guidance and counselling.
CO2	FOUNDATIONS OF EDUCATION	To develop an understanding of the meaning, aims and objectives of Education, the role of Philosophy and Sociology in Education and understanding of the major philosophies of Education. To enable the students to understand the cultural heritage of India, to develop knowledge of the structure and functions of the society and the process of social interactions for a change towards better human relationships.,
CO3	EDUCATIONAL SYSTEM OF EDUCATION	To make the students have a clear concept and understanding of the evolution of the educational

		system of India. To develop familiarity with the legal and constitutional provisions in education. To create an awareness of the main challenges and problem faced by the system.
CO4	**EDUCATIONAL THOUGHTS AND PRACTICES**	**To familiarize the students with educational thought of ancient thinkers, the practices of contemporary Indian Thinkers and Western Thinkers. To acquaint the students with the innovative practices in education.**
CO5	**EDUCATIONAL EVALUATION AND STATISTICS**	**To enable the students to understand the concept of measurement and evaluation, to familiarize the students about the various types of educational and psychological test and to enable them to develop the competency in solving various statistical problems.**
C06	**CONTEMPORARY INDIAN EDUCATION**	**To familiarize the students with some interventions in elementary education and quality issues in higher education. To acquaint the students with the efforts made regarding secondary education and to enable the students to understand some recent issues and trends in education.**
C07	**EDUCATIONAL TECHNOLOGY**	**To help students to understand the nature and scope of educational technology, to acquaint the students about various innovations in educational technology, to enable the students to understand the functions, principles and operations of teaching and to help them familiarize with various skills of teaching.**
CO8	**SCHOOL MANAGEMENT**	**To develop knowledge and understanding of the concept and process of school management. To develop familiarity with the concept, need and scope of educational planning. To enable the students to understand the concept, determinants and principles of curriculum constructions.**

DEPARTMENT OF ECONOMICS

Part I: Introductory Economics

This course helps the students to use microeconomic tools and concepts to address public policy and aims to help and understand recent development in macroeconomics.

Part II: Development and Environmental Economics.

Students will be able to discuss the micro principles of environmental economics and resources management, illustrate through the subjects of environmental resources, population and fertility and poverty and development.

Part III: Indian Economy

Understand the role of the Indian Economy in the global content and how different factors have affected these processes.

Part IV: Mathematic of Economists

This paper provides a good grounding and an on depth understanding of the theory and application of differential calculus and other techniques widely used in economics and Finance.

Paper V: Advance Economic Theory

This paper helps the students an understanding of microeconomics theory beyond principles of microeconomics and to further develop analytical technique and research skills from advance economic analysis.

Paper VI: International Economics.

This paper provides a good conceptual understanding of the key concepts and practical applications of both international trade and international finance.

Paper VII: Statistics

Facilitates an understanding of the main branches of basic statistical inference and developed the ability to use statistical technique to analyses data and assess the accuracy of the resulting estimate and conclusion.

Paper VIII: Public Economics

The students will be able to recognize and apply advance tools and models used in the field of Public Economics. Formulate the perspective on how public policies are formulated and how they differ from the prescribed standard of normative Public Economics.

DEPARTMENT OF HISTORY

HIS-UG-101: Ancient India

The course aims to familiarise and acquaint the students with the socio-economic developments in India from the ancient times till the 13th century.

HIS-UG-202: Medieval India

The course intends to generate an understanding the main economic and political scenario during the medieval period.

HIS-UG-303: History of Modern India

The course is designed to educate students with the main trends and developments from 18th to the 20th century.

HIS-UG- 404: Historiography

To introduce the students to the basic concepts, value and scope of history.

HIS-UG-505: Modern World (Mid 15thcentury to II World War)

To familiarise students with certain major development in the modern world and the impact on international politics with its resultant effects on world economy.

HIS-UG-506: Contemporary World (1945-1991)

To establish an understanding of contemporary world history relating to political, economic, scientific developments and social issues with reference to human rights and gender issues.

HIS-UG-507(1): China and Japan (1924-1949)

The course aims to accustom students with the beginning and the growth of modernisation in China and Japan.

HIS-UG-508 (2) North East India (1924-1972)

The course focuses on the history of North East India and hopes to introduce students to the political, social and economic effects on the history of the region.

DEPARTMENT OF PHILOSOPHY

PHIL:UG-11: Epistemology and Metaphysics

To introduce the students to the domain of philosophy with the basic concepts of the theories of knowledge, reality and truth.

PHIL:UG-21 LOGIC

Introducing the students to the basic concepts of logic e.g , sentences, proposition, argument, truth and validity. Helping them in acquiring knowledge about the traditional and modern interpretation of logical terms and to introduce them to the domain of symbolic logic.

PHIL:UG-31: Social and Political Philosophy

To acquaint the students with the relation of Philosophy to politics and other social issues.

PHIL:UG-41 INDIAN PHILOSOPHY

To offer the students a close acquaintance with the key issues and important concepts of Indian Philosophy and acquaint them with the thinkers of Indian Philosophy.

PHIL:UG-51: Western philosophy

To introduce the students to the major Philosophical thinkers of the west, e.g.,Descartes, Spinoza, Leibnitz, Locke, Berkeley, Hume, Kant, Hegel etc and to their theories.

PHIL:UG-52: Philosophy of Religion

To acquaint the students with the concepts of God, Belief, Faith, Reason, Revelation, Mysticism, Religious tolerance, Secularism, Hinduism, Buddhism, Christianity, Jainism etc.

PHIL:UG-61 ETHICS

The course is designed to educate the students with the moral principles that govern human behaviour and help them to develop capacity in assessing moral problems in life situations.

PHIL:UG-623 PHILOSOPHY OF MIND

This course acquaints the students with the nature of mind, consciousness, mental events, mental functions, mental properties, the ontology of mind and the relationship of the Mind to the Body.

DEPARTMENT OF POLITICAL SCIENCE

SEMESTER I

(Psc.01: POLITICAL THEROY)

1. This paper being the first paper offered by the department of Political science, seeks to make the fresh students of Political Science get a grasp on the ideas, concept, and theories in Political Theory.
2. Secondly, the students gain a good insight of some very significant topics relevance like for eg: why is political Theory studied? What is state and what are its function? Concepts like Right, Liberty, Equality, Law, Justice, Political obligation and lastly to have in-depth knowledge on the idea of democracy and its present significant.
3. Thus, this first paper tries to enlightened the students of Political Science to the basic concept on which the foundation of the subject entirely rests!

SEMESTER II

(Psc.02: MAJOR POLITICAL SYSTEMS

1. This paper offers for understanding for different countries with its most unique Constitutional features in stark comparison to our Indian Constitution. Since this entire paper asks to critically examine the working of those four Constitution by comparing it to India, the students tend to gain a better understanding of the different Constitution existing in the world.
2. Secondly, the students become quite knowledgeable to again understand on which Constitution setup is better for which Country.
3. Finally, by gaining this offered knowledge, in the long run, the students can be suited to go for further studies in the similar field and also, they can apply for jobs related to it, for which actually the students of Political Science can be set to be better equips than a layman or others who do not have Political Science as one of the optional papers

SEMESTER III

(Psc.03: INDIAN POLITICAL SYSTEM)

1. Students will gain a wide spectrum of ideas on the political system and political processes practice in our country India. They not only gain a better inside of the Indian political system, but it goes a long way for the students to apply for jobs related with it. Hopefully, these students will go on to become better citizen after having gain the actual knowledge

SEMESTER IV

(Psc.04: INTERNATIONAL POLITICS)

1. The scope of international politics is really wide in terms of study and also in terms job seeking.
2. The students, therefore, stand a firm ground when it comes to do with policy making and a major player in the international Arena.

SEMESTER V

(Psc.05: WEASTERN POLITICAL THOUGHT)

1. This paper enriches the students on the classical traditional Political Theory right from thinkers or philosophers like Plato to Marx.
2. Another benefit gain from studying this paper is on understanding the problems and solutions offered by these great thinkers. One advantage which can be accrued is that the students also can endeavour to find solutions to the problems faced by this great Thinkers.

SEMESTER V

(Psc.O.06.1: MODERN INDIAN POLITICAL IDEAS)

1. This invaluable paper helps the students know about our country's freedom fighters. It helps in knowing the contribution made by this freedom fighters. In a way their contributions will not diminish but intact, their thus gained knowledge will remain for prosperity.

SEMESTER V1

(Psc.07: GOVERNMENT AND POLITICS IN NORTHEAST INDIA)

1. This paper offers the students to know about their own region, in terms of political growth and development.
2. Its knowledge helps the students to better equips themselves, so that when they apply for jobs related to it, they stands a better change

SEMESTER V1

(Psc.O.08.3: INTERNATIONAL ORGANISATION)

1. It helps in understanding the world organization in a better way on how and way its role becomes increasingly important in the present times when the world is undergoing drastically.
2. By already knowing some of its achievements, failure, success and weaknesses, this paper helps in exploring and understanding where and how to make the world a more cordial and peaceful place to stay.

DEPARTMENT OF BENGALI

1. The course helps the students to become a responsible citizen inculcating profound moral values.
2. The students become able enough to pursue higher studies.

The students can go for any profession according to their own eligibility.

DEPARTMENT OF ASSAMESE

Teaching – Course Outcome (C O) for Assamese

. The course facilitates the students to go for higher studies in Assamese Language and Literature.

. The course opens the opportunity to have independent livelihood such as a proof reader, editor or translator

. The course helps the students to go for further studies in different discipline like journalism, teaching or writer .

. To develop the ability to use the Assamese Language effectively.

. To identify various types of oral poetry in general and more pertinently in Assamese Literature.
. To provide the students with the knowledge on traditional Assamese spoken words.

DEPARTMENT OF GARO

1) **SEMESTER- I**

PART-I (GARELH-101) PROSE, TRADITIONAL AND MODERN POETRY, RHETORIC AND PROSODY.
This paper gives an introduction to -

- Identify various types of orally transmitted Garo poetry, prose and their characteristics.
- Themes and styles of modern Garo poets.
- The devices of rhetoric and prosody used in poetry.

2) **SEMESTER- II**

PAPER-II (GARELH-201) TRADITIONAL AND MODERN DRAMA.

The objective of this paper is to introduce students to traditional drama. It helps the students to learn and understand the socio-cultural relevance of the texts and to trace the rich and varied dramatic traditions.

3) **SEMESTER- III**

PAPER-III (GARELH-301) HISTORY OF GARO LITERATURE, PROVERBS, PHRASES AND ESSAY.

- This paper enable the students to understand the history of Garo Literature from traditional oral literature and the beginning and the growth of written literature up to the 3rd quarter of the 20th Century and its changes at different periods of time.
- Proverbs and phrases are studied as important components of Garo language and literature.

4) **SEMESTER- IV**

(GAR MIL-401) GARO MODERN INDIAN LANGUAGE

This paper is designed to familiarize students with the basic concepts of traditional and modern Garo poetry, fiction etc. The course further intends to introduce to the students the elements of oral dramatic tradition of the Garos through the study of specific texts for their dramatic concerns,techniques and structural innovations.

The Course develops critical understanding and knowledge of poetry, drama and fictions on Garo Literature.

5) **SEMESTER - IV** (GARO ELECTIVE HONOURS)

PAPER-IV (GARH-401)

PROSE AND FICTION

Serves as an introduction to Prose and Fiction in Garo language. The Course attempts to offer the students the scope of viewing these texts against the background of social and historical factors.

6) **SEMESTER - V** (GARO ELECTIVE HONOURS)

PAPER-V (GARH-501) ORAL NARRATIVES

Students are introduced to the characteristic features of oral narratives , folklore and its components, mainly folktales and myths. The Course attempts to provide theoretical based to the students for the study of Folklore as a discipline. The students are expected to get a thorough idea of the origin of folklore and its growth as a separate discipline, providing enormous possibility for studying its scope , genres and its connection with the spatio-temporal dimensions of culture. The Course will train the students in field research through field works and the art of report writing.

7) **SEMESTER - V** (GARO ELECTIVE HONOURS)

PAPER-VI (GARH-502)

POETRY

This paper helps to widen the students' knowledge of poetry through Tagore's Gintanjali and Garo poetry of 20th and 21st Century. It enable the students to study the principles, types, strategies and problems of literary translation of Indian literature translated into Garo. The Course also attempts to provide an insight into their social and poetic philosophy (The nature of art, artist and imagination)

8) **SEMESTER - VI** (GARO ELECTIVE HONOURS)

PAPER-VII (GARH-601)

HISTORY OF GARO LANGUAGE AND GRAMMAR

This paper provides the origin and history of Garo language. Students are expected to acquire indepth knowledge of Garo Grammar. The paper deals with the origin of the Garo language and its changes at different periods of time.

9) **SEMESTER - VI (**GARO ELECTIVE HONOURS)

PAPER-VII (GARH-602)

LITERARY CRITICISM AND COMPOSITION

This paper serves as an introduction to-

(a) Important features of literary criticism.

(b) Traditional Garo Sayings and word-pairs.

(c) Students are expected to attempt an essay on unseen topics.

The paper instills in the students a critical awareness of Western and Garo Literary Theory: Its development and traditions.

*All text books are for detailed study.

DEPARTMENT OF GEOGRAPHY

COURSE OUTCOME:

Physical Geography

1: Learn the nature and scope of physical geography, concepts of geomorphology; continental drift; sea floor spreading and plate tectonics; exogenetic processes.

2: Understand the importance of atmosphere; heat budget and heat balance; airmass, types of fronts and cyclones; classification of world climate and global warming.

3: Understand about the science of oceanography, its features and the movement and circulation of ocean currents; classification of coral reefs and the theories relating to their formation.

4: To have an understanding about biogeography; global distribution of plants and animals; world bioms and types; concepts of biodiversity and its depletion.

5: Learn the concepts of soil and water as a resource; zonal classifications of soil and know about the hydrological cycle

6: Ability to interpret the landforms and its profiles; slope analysis; morphometric analysis of drainage basins; representation of rainfall and temperature data.

Human geography:

1: Understand the interrelationship between man and its environment; development of geographical thoughts.

2: Studies of races and racial distribution; language and its distribution; social elements and structure.

3: Study the population composition of the world; distribution; density and growth; concepts of population.

4: Know about the evolution of human settlements and determinants; types and pattern of rural settlements; urbanization and urban functions.

5: Understand the concept of political geography; geopolitics; problems of uneven politics of global development

6: Ability to prepare scale of maps; population distribution maps; age-sex pyramids; representation of socio-economic data using various methods.

Geography of India

1: Acquire knowledge in the contents of Physiography, climate, soil and vegetation of India and North East India.

2: Understand about the population composition; factors influencing the population distribution, density and its growth in India.

3: Know the salient features, problems and prospects of Agriculture, Industries; modes of transport and its distribution.

4: Acquire the knowledge about the human dimensions, society and development of North East India.

Regional Geography of South East Asia and China

1: Learn about the physical environment of South East Asia and China.

2: Understand the peopling of South East Asia and China.

3: Develop familiarity with the economic life of South East Asia and China in terms of their various activities such as agriculture and manufacturing industries; Special Economic Zones.

4: Know the External trade of South East Asia and China; ASEAN.

Map Reading, RS, GIS and Surveying

1: acquire knowledge about the History, significance, types and functions of Map reading; concepts of point, line and area; Map projections.

2: Learn principles, definition and characteristics of RS and GIS.

3: Develop skills in surveying techniques; understand the various socio-economic condition of the village.

4: Ability to prepare mapping using aerial photo and satellite imagery

5: Make use of GIS software.

Geography of Resources

1: Learn the basic concepts of resources

2: Understand the biotic resources in relation to Global distribution, global biodiversity, hot-spots and conservation; concepts of human resource and human development index.

3: Learn a variety of Abiotic resources.

4: Be able to use resource conservation in efficiency in uses, recycling, substitutions, and conservation areas.

Biogeography

1: Understand the concepts of biogeography; basic ecological concepts and principles.

2: Learn the global distribution of plants and animals; factors influencing their distributions

3: Know the concept and types of ecosystems.

4: Acquire knowledge about the concept of biodiversity; hot spots of the world and status of biodiversity in North East India.

5: Learn the ecological regions of India in relation to plant and animal diversity, interrelations, problems, conservation, and management.

Agricultural Geography

1: To help the student understand about the scope and importance of agriculture.

2: To provide them the knowledge about how agriculture originate where man himself started have a settled life.

3: To enable them to understand the different factors which affect agriculture.

4: To make them familiar about the different agricultural systems of the world.

5: To make them understand about Indian agriculture – its distribution, pattern, characteristics and associated problems.

6: To stress on the recent development of Indian agriculture and the role of Green revolution in the overall development of Agriculture.

DEPARTMENT OF COMMERCE

I SEMESTER

BC-101: BUSINESS ENVIRONMENT:

- The Subject aims to provide general exposure to the students of the various components of business environment in Indian context.
- **BC-102: PRINCIPLES AND PRACTICE OF MANAGEMENT:**
- To familiarise the students with the basic process and principles of management and to make them aware of the important.
- **BC-103: FINANCIAL ACCOUNTING:**
- The subject aims to impart basic accounting knowledge as applicable to business

II SEMESTER

- **BC-201: BUSINESS ECONOMICS:**

  The subject aims to impart basic knowledge of Economic concepts relevant to business.

- **BC-202: FUNDAMENTAL MATHEMATICS:**

  The objective of the course is to familiarize the students with the knowledge of essential mathematics which are applicable in business

OR

- **BC-203: INFORMATION TECHNOLOGY IN BUSINESS:**

  To provide basic computer skills and knowledge to enhance the understanding of usefulness of Information Technology tools for business operations.

- **BC-204: INDIAN FINANCIAL SYSTEM:**

  This subject is to acquaint students with the constituents of Indian Financial System and its general operations

III SEMESTER

- **BC-301: BUSINESS STATISTICS:**

  To enable the students to gain understanding of statistical and mathematical techniques useful in business operations.

- **BC-302: BUSINESS LAWS:**

  The objective of this course is to provide a brief idea about framework of Indian Business Laws.

- **BC-303: CORPORATE ACCOUNTING:**

  To help students acquiring the conceptual knowledge of fundamentals of corporate accounting and to learn the techniques of preparing financial statements.

IV SEMESTER

- **BC-402: FINANCIAL MANAGEMENT:**

  To develop an understanding of various finance function and common techniques of financial management.

- **BC-403: AUDITING:**

  This course aims at imparting knowledge about the principles and methods of auditing and their applications in different organisations

V SEMESTER

- **BC-502: COST ACCOUNTING:**

  This course exposes the students to the basic concepts and the tools used in cost accounting.

BC-503: FINANCIAL SERVICES:

To acquaint students with various fund based and fee based financial services and to understand their role in the overall financial system.

VI SEMESTER

BC-602: ENTREPRENEURSHIP DEVELOPMENT:

To provide exposure to the students to the concept and process of entrepreneurship, and industrial growth so as to prepare them to set-up their own small enterprises.

- **BC-603: DIRECT TAX LAWS AND PRACTICE:**

  The objective of the course is to enable the students to compute direct taxes as per the Income Tax Act and to understand its implications on individuals and business firms.

DEPARTMENT OF BOTANY

COs	Students after completion of the BSc Botany Honours shall be able to:
CO 1	Classify and identify the major groups of Plants within a Phylogenetic framework.
CO 2	Know the distinguishing features of various groups of plants like algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.
CO 3	Dissect and identify the various anatomical and morphological features of a plant.
CO 4	know some of the economical, ethnobotanical and phytogeographical importance of plants.
CO 5	Identify various plant diseases and their causal organisms.
CO 6	Know the basis of physiology and biochemistry that are important for the development, reproduction and survival of the plants.

CO 7	**Understand the basics of ecosystems and it's function and structure and the importance of conservation biology.**
CO 8	**Understand the concepts of genetics, the principles of plant breeding, Genetic engineering and plant biotechnology in the improvement of plant.**
CO 9	**Perform experiments on biochemistry, physiology, ecology, plant anatomy, morphology etc.**

DEPARTMENT OF CHEMISTRY

Course Outcomes

1. Courses are Inorganic, Organic and Physical Chemistry.

2. Courses are relevant as students can further study in broad areas of chemistry like Pharmaceutical Chemistry, Food Chemistry and Industrial Chemistry etc.

3. Syllabus: The Syllabus is well updated and is frame by N.E.H.U

Inorganic Chemistry

Course Code: (Chem EH 101, Chem EH 201, Chem EH 301,Chem 302 Chem EH 401, Chem EH 402, Chem H 501, Chem 601,Chem H 604)

Aim in:

1. Developing the ability to apply the knowledge on contents of principles of Inorganic Chemistry
2. Establishing an appreciation for the role of Inorganic Chemistry in the Chemical Sciences
3. Developing expertise relevant to the professional practice of Inorganic Chemistry
4. Developing an understanding of the role of the students in measurement and problem solving involving Inorganic Chemical systems
5. Exposure to different processors used in Industries and their applications
6. Developing an understanding of the safety responsibilities involved with Inorganic Chemistry

Organic Chemistry

Course Code: (Chem EH 101,Chem E 102, Chem H 103, Chem EH 201, Chem EH 301, Chem EH 401, Chem H 502, Chem H 504,Chem 602,)

Aim in:

1. Developing spectral knowledge
2. Developing proper aptitude towards the subject
3. Creating scientific approach towards various chemical reactions
4. Developing sustainable and green approach to chemical synthesis
5. Developing better and cheaper medicines

Physical chemistry

Course Code: (Chem EH 101, Chem EH 201, Chem 202, Chem EH 301, Chem EH 401, Chem H 503, Chem H 505, Chem 603)

Aim in:

1. Developing problem solving skills
2. Developing scientific knowledge
3. Developing working knowledge of instrument
4. Developing a working formula and theory

DEPARTMENT OF MATHEMATICS

Course Outcomes

Course	Outcomes
Classical Algebra	To inculcate knowledge on selected aspects of classical algebraic structures. With a focus on area like numerical solution of equations and the systematic study of equation
Calculus	To inculcate knowledge on the ability to find the effects of changing conditions on a system. Whereby both the branches viz Differential and Integral calculus are studied.
Analytical Geometry	To inculcate knowledge on solve problems in analytic geometry and able to find appropriate solutions for given problems and knowledge of coordinates and space.
Programming in C /Fortran 77	On successful completion of this subject the students have the programming ability in C /Fortran 77 Language and use to compute different problems.
Vector calculus	To inculcate knowledge on differentiation and integration of vector fields and the knowlwdge of 3 dimensional space.
Statics	To inculcate knowledge on fixed particle properties and proofs.
Operations Research	To inculcate knowledge on maximize the profit and minimize the cost in every place.
Differential Equation	To inculcate knowledge on solving of first and second order differential equations that can be applied to other branches of mathematics.
Dynamics	To inculcate knowledge on moving particle, properties and proofs.
Real Analysis	To inculcate knowledge on real numbers and their properties & proofs.
Modern Algebra	To inculcate knowledge on algebraic equations and their relations with properties.
Computer oriented Numerical Methods	To inculcate knowledge on algebraic equations solved by Numerical Methods with the help of computer programming.
Number Theory	Define and interpret the concepts of divisibility, congruence, greatest common divisor, prime, and prime-factorization,also to formulate and prove conjectures about numeric patterns
GHS 11 : **Algebra-I, & Calculus – I**	**Algebra-I** **Students will have** • Brief review of basics in set theory ; relations ; Functions and graphs. • Studies of different mappings,properties of m x n matrix • array of numbers (motivation through systems of linear equations) **Calculus – I** • Study the properties and examples of continuous functions defined on closed and bounded intervals intermediate value theorem, uniform continuity . • In dept studies of Properties, Problems, solution and applications Derivatives . Anti-derivative (Integration)

	• Study the properties and examples of continuous functions defined on closed and bounded intervals intermediate value theorem, uniform continuity . • In dept studies of Properties, Problems, solution and applications Derivatives . Anti-derivative (Integration) • Use of ε - δ definition to find the limits and continuity of functions. • Study relationship between continuation and differentiation. • • Able to understand the idea of limits of functions by L- hospitals rule and solve the indeterminate form of limits. • Understands basic definitions and terminology associated with ordinary differential equations. • Learn rules to find integrating factors. • Finding of solutions of linear differential equations.
GHS 21 : **Geometry & Vector Calculus**	**Geometry** **Students will learn about Properties of** • Change of axes – invariants; pairs of straight lines; general equation of second degree; • General conics : equations of tangents, normals, pairs of tangents, chord of contact, chords, asymptotes. • About Polar equation, equation of a conic, • Separately study Parabola, ellipse, hyperbola; perpendicular distances • Extension of knowledge to 3 Dimensional Geometry. Learning of Equations of straight lines; • Sphere – plane section and its equation; Equation of a cone ; equation of a cylinder and right circular cylinder. **Vector Calculus** • Study differentiation & partial differentiation of a vector sum. • Learn the concept of the dot product. • To study to find gradient, divergence and curl of
GHS 31: **Algebra II, & Calculus – II**	**Algebra II** Students Learn about • Binary operations as maps; groups: • nth roots of unity etc; laws of indices in both additive and multiplicative notation; right and left cancellation laws; p; abelian group; subgroups of cyclic groups Determination of all subgroups of Z; • Order of an element; ; cosets ; Lagrange's theorem and its • Applications and problems Fermat's (little) theorem; Euler's generalizations; • Polynomials over Z / Q / R / C ; • application of Eisenstein's theorem; unique factorisation theorem; • roots of a polynomial; factor theorem; fundamental theorem of algebra (statement only); its failure; • the fundamental theorem of algebra; multiple roots, common roots, complex roots, surd roots; • Relation between roots and coefficients of a polynomial; • cubic and biquadratic equations; Descartes' rule of signs; Rolle's theorem; Cardan's method; De Moivre's theorem

	Calculus – II Learn the proofs of general theorem and their geometrical consequences. • Learns the notation of concavity convexity asymptotes. • Are able to trace the curves in polar and rectangular coordinates. • Understands the concepts of limit and continuity of functions of several variables. • Are able to convert Cartesian to polar coordinates and vice versa. • Learn the proof and applications of Euler's theorem on homogeneous functions
GHS 41: **Statics & Dynamics**	Static Students will attain knowledge of theory, problems and application • Composition and resolution of forces; parallelogram of forces, • Coplanar forces: Triangle of forces, Lami's Theorem and its converse. • Parallel forces. Varignon's Theorem. Couples ; • Resultant of a couple and a force. • Reduction of coplanar forces, • Learn about Friction: • Centre of gravity: **Mechanics** **Application of** • Rectilinear motion with variable Laws of forces; Motion under inverse square Law, velocity and acceleration , Amplitude, Time-period. • Collision of elastic bodies; • Projectiles; • Rectilinear motion • Tangential and normal acceleration on smooth curves, radial & transversal acceleration, motion • on a smooth plane curve such as vertical circles and cycloids. • Impulse and Impulsive force, conservation of linear momemtum. Study about • Work done by a force; work energy equation; potential function; conservative forces.
H 51: **Elementary Number Theory & Advanced Algebra**	**Elementary Number Theory** **Students Learn the theory and problems relating to** • Divisibility in the set of integers; basic properties; the division algorithm; gcd; elementary • properties; the Euclidean algorithm; lcm; primes (in the set of natural numbers); They will study fundamental theorem • of arithmetic and its applications; Learning the vast knowledge about • the property of primes; Congruences in the set of integers modulo a positive integer and basic properties; complete residue system and reduced residue system; Introducing and solving problems on • Euler's φ - function; Fermat's theorem; Euler's generalization of Fermat's theorem; applications, Wilson's theorem. They will study and learn about

	• Solution of congruences; Chinese remainder theorem, Greatest integer function; Arithmetic • functions; multiplicative functions; functions such as φ(n), μ(n), t(n), s(n), sk(n); **Advanced Algebra** Study the definition of groups rings and fields. • Are able to understand concept if subgroups, normal subgroups and quotient groups. • Use concepts of homomorphism isomorphism and endomorphism for group sand rings. • Use canonical types of groups like cyclic groups ,permutation groups and rings such as polynomial rings and quotient rings • Are able to find cossets and related theorem. • Produce groups of theorem on algebra. • Analysis vectors in Rn algebraically • Learn the concepts of linear independence and dependence, linear span basis and dimensions. • Study vector spaces and subspaces. • Use matrix algebra and relate matrices to linear transformations. • Study inner product spaces and Cauchy Schwarz's in equality.
H 52: **Differential Equations & Advanced Dynamics**	**Differential Equations** • Understands basic definitions and terminology associated with ordinary differential equations. • Learn rules to find integrating factors. • Distinguish between linear and non linear, ordinary and partial differential equations. • Recognize and solve homogeneous and non homogeneous equations by different methods • Students are able to apply the methods of variation of parameters and reduction of order. • Use working to determine linear dependence and linear independent of functions. • Learns to solve Cauchy Euler's equations. • Learn the concepts of total differential equations. • Can form partial differential equations of first order and use Langrange's methods to solve partial differential equations. • Are able to find solutions of partial differential equations by Charpit's method. • Learn to classify second order partial differential equation through lustration only. **Advanced Dynamics** Students Learn about • Motion on a rough curve; the cycloid and its dynamical properties: with resistance; Can also solve Problems on • Central forces, Central orbit; Centre of force; motion of a particle under a central force; Study the description of a • central conic under a central force; the use of reciprocal polar coordinates; stability of a nearly circular orbit.

	• Study the Use of pedal coordinates and pedal equations; apse; apsidal distance; apsidal angle; perihelion and aphelion; Understanding and Can Solve problems of • Kepler's laws of planetary motionand its deductions; a more accurate form of the third law. The Students will have knowledge and solve problems relating to • Moments and products of inertia, vector angular velocity of a rigid body; vector angular momentum of a rigid body about a fixed point, principal axes; kinetic energy of a rigid body rotating about a fixed point; momental ellipsoid; equimomental systems; coplanar distributions; general motion of a rigid body. • Motion of a rigid body in two-dimensions; Problems illustrating the laws of motion • laws of conservation of angular momentum; problems illustrating the laws of conservation of angular momentum. • The law of conservation of energy; problems illustrating the law of conservation of energy; • Impulse of a force and problems illustrating impulsive.
H 61 : **Advanced Calculus**	Students learn about • Riemann integral, Darboux's theorem Learn the Conditions, • properties of integrable their continuity and differentiability; Understanding the • Mean value theorems for integrals. • Improper integrals; test for convergence when the integrand is non-negative; absolute convergence; tests • for absolute and conditional convergence, beta and gamma functions; Abel's theorem, Dirichlet's theorem; • Frullani's integral. • Have indept knowledge about • Integrals as functions of parameters; continuity, differentiability and integrability function; learn the applications to evaluation of integrals, Improper integrals ,continuity, differentiability and integrability of uniformly convergent improper integrals of continuous • Line integral in R2, Green's theorem in R2, Surface Integral and Stokes Theorem, • Volume integral and Gauss's divergence theorem • Basic properties of Euclidean distance function in Rn, Bolzano-Weierstrass theorem; Cantor intersection theorem, Lindelof covering theorem. • Compact sets; Heine-Borel theorem; Interrmediate value theorem; uniform continuity; discontinuities of real valued functions; • Jacobian; change in the order of partial derivatives, statements of Young's Theorem, • Schwarz's Theorem and their applications, differentiation of composite functions; chain rule.
HOPT62:	Students learnt • about C fundamentals: The C character set, identifiers and keywords, Data types, constants, variables.

OP 1 : Computer programming in C & Computer Oriented Numerical Analysis **OP 2 : Operations Research** **OP 3 Hydro Mechanics** **OP4 : Financial Mathematics** **OP5 : Discrete Mathematics** **OP6 : Mathematical Modeling**	• assignment, expressions, statements, C program structure, Need of header files. • Functions: • Storage classes, String functions • Memory allocation functions • Study about Arrays and Pointers and their properties, Data files and • sorting of records Learning about Floating point representation of numbers, • Binary representation of numbers; • Interpolations • Differentiation and integration • simpson's 1/3rd rule, trapezoidal rule. • Study to find the approximate rules of non linear equation s by using different methods such as bisection, secant and Newton Raphson method. • How to find missing numbers from the available data and the estimate value of known quantity between the two known quantities. • To find the value of definite integral from set of tabulated values of the integrand by using trapezoidal and Simpsons rule.

DEPARTMENT OF PHYSICS

FIRST SEMESTER: PAPER CODE -PHY 01(T)

(Mechanics, Optics and Acoustics)

UNIT I

Students should have

CO1: Understood the concepts of inertial and non-inertial frames: components of velocity and acceleration in different coordinate systems; uniformly rotating frame, centripetal force and coriolis force.

CO2: Understood conservative nature of central forces, gravitational potential and deductions of fields due to thin spherical shell and solid sphere.

CO3: Be able to describe motion of centre of mass, linear momentum and angular momentum of system of particles; elastic and inelastic collisions, calculation of loss of kinetic energy due to direct impact in inelastic collision of two particles

CO4: Have clear concept of Galilean relativity, its failure, Galilean transformations. Describe and explain Michelson Morley Experiment.

CO5: Understand Lorentz transformation-length contraction, simultaneity and time dilation. Einstein's velocity addition rule, variation of mass with velocity, mass- energy equivalence.

UNIT II

Students should have

CO1: Be able to have clear understanding about degrees of freedom; moment of inertia, theorems on moment of inertia and its application. They should have a clear concept on Hooke's law, elastic constants and their inter relationship. They should have a concept of basics of bending of bars, cantilevers and the application to day-to-day life.

CO2: A clear concept about Bernoulli's theorem and its application.

CO3: Learnt the concept of surface tension, capillary, formation of droplets, pressure on the curved surface of a liquid and excess pressure on air bubbles.

UNIT-III

Students should

CO1: Understand the basic principles in physical optics such as Fermat's principle, cardinal points, ideas of matrix optics, lens formula by matrix method.

CO2: Understand the general theory of image formation: Cardinal points of an optical system, refraction through a thick lens, combination of thin lenses; Ramsden and Huygens eyepieces and their relative merits and demerits.

CO3: Understand different aberrations in images such as chromatic aberration and achromatic combination of lenses in contact and separated by a distance.

CO4: Have learnt Monochromatic aberrations and their reductions, aplanatic points of a sphere with proof, oil immersion objects.

UNIT IV

Students should

CO1: Understand the basic knowledge of interference. They can learn about different instruments such as Newton's ring apparatus, Fabry-Perot interferometer etc., which is based on the interference known as interferometer. Students will have the concept of applications of interferometer to find the wavelength of the light used, difference in wavelength between neighbouring spectrums etc.

CO2: Learnt the basics of diffraction, its dissimilarity from interference and the different types of diffraction, Fresnel's diffraction and Fraunhoffer diffraction. They will have the concept of instruments such as zone plate etc which is based on the diffraction.

CO3: Understood the Resolution of images and resolving power of various optical instruments.

CO4: Learnt the concept of physics behind the phenomena of polarisation and its various Properties/characteristics and its applications.

CO5: Learnt Dispersion and Scattering: To understand the physics behind the phenomena of Dispersion and scattering. Especially understand the various types of dispersion phenomenon with special emphasis on Rayliegh Scattering.

UNIT V

Students should

CO1: Have a concept on velocity of sound in solid and fluid. They should learn about detection and applications of ultrasonic waves, principle of ultrasonography.

CO2: Learn about intensity of sound, bel and decibel, limit of human audibility,noise and noise reduction.

CO3: Have a concept on Acoustics of buildings, they can learn about reverberation and optimum reverberation, Sabrine's formula for reverberation time, live and dead room.

SECOND SEMESTER: : PAPER CODE -PHY 02(T) : : MARKS 60

(Electromagnetism, Electronics – I)

UNIT I

Students should have

CO1: A clear idea about electric field due to a continuous charge distribution, Gauss' law in electrostatics and its application, work done in electrostatic field, conservative nature of electrostatic field. They will have a clear concept on electrostatic potential and potential energy due to charge distribution and its application to a dipole, charged disc etc.

CO2: A clear concept on electrical images and its application.

CO3: A clear concept of vector form of Biot-Savarat law, calculation of magnetic field due to straight conductor carrying current, circular coil carrying current and solenoid.

CO4: Knowledge of Gauss' law in a dielectric medium, displacement Vector. They can learn about the magnetic dipole moment and its relation to angular Momentum, gyromagnetic ratio, magnetization vector, magnetic susceptibility and permeability, hysteresis, B-H Curve.

UNIT II

Students should

CO1: Understand the related topics on current such as Non-steady current, continuity equation, rise and decay of current in LR and CR Circuits, decay constants etc.

CO2: Have studied and understood Alternating current, Complex impedance, impedance of LCR series and parallel circuits, resonance, Q-factor, power dissipation, power factor.

CO3: Understand the theory behind Generators and the three phase electrical power supply, delta and star connections, voltage regulation, current regulation.

CO4: Have studied the electromagnetic theories such as Faraday's Law, Mutual and self inductance, and understand its applications in transformer, energy in a static magnetic field, the Maxwell's displacement current, Maxwell's equations in free space and in a medium.

UNIT III

Students will have

CO1: The concept of basic circuit analysis, different laws and theorems such as Kirchoff's laws, Thevenin's theorem and Norton's theorem, two port analysis and hybrid parameters.

CO2: Understanding of the different functions of BJT and its applications. Analysis load line, Q-Point, etc.

CO3: Understanding of the different combination of BJT such as CB and CE Configuration and its h-parameters

UNIT IV

Students should have

CO1: Understood the working and function of important electronic components i.e., transistors and diodes which form the most important parts of the semi-conductor electronics and is the backbone of ICT.

CO2: Studied the different types of transistors, its functions and feedback which has a very important role in its functioning.

CO3: Understood the function and the working of diodes and the logic gates which are the fundamental process required for functioning of computers and ICT devices.

SEMESTER III PAPER CODE -PHY 03(T) MARKS 60

(Thermal Physics, Waves)

UNIT I

Students will have

CO1: The concept of kinetic theory of gases. They will learn the limitations of perfect gas equation (PV=RT) which is based on kinetic theory of gases and and Vander Waal's correction to perfect gas equation for real gas. Students will also have the concept of law of equi-partition of energy and its application.

CO2: Studied about the transport phenomena of energy, momentum and masses of gases. They Should have understood the concept of molecular diameter and its estimation.

CO3: Understood the three Laws of thermodynamics and their relation to processes like Work done in a system, Internal energy, Carnot cycle and Carnot's theorem which has a very important role in the functioning of various engines. They should have understood the concepts of entropy which plays a vital role in Thermodynamics. One can also understand the concepts of heat and temperature from the study of laws of thermodynamics.

UNIT-II

Students should have

CO1: Understood the liquefaction of gases and related terms like Boyle temperature, Inversion temperature and Regenerative cooling and Cascade cooling.

CO2: Learnt and understood the Black Body radiation and its related topics such as Planck's Quantum postulate, Planck's Law, Stefan-Boltzmann Law, Wein displacement Law, Rayleigh-Jeans Law.

CO3: Studied Phase space, Gibb's space and understand different ensemble such as microcanonical, canonical and grand canonical ensembles.

UNIT III

Students should have

CO1: Clear knowledge about simple harmonic motion, superposition of two simple harmonic motion right angles to each other and formation of Lissajous's figure, Oscillation of two masses

connected by a spring, damped SHM, Q-energy and its value. They should learn about forced vibration, its power, quality factor and sharpness of resonance.

CO2: Studied and understood the Waves and Oscillations: Linear equation of plane progressive wave and its general solution, Plane and spherical waves, Energy and Energy density of plane progressive waves.

CO3: Understood the waves in continuous media, speed of transverse waves in a uniform string, speed of longitudinal waves in a fluid, interference of sound waves, Group velocity and phase velocity, the application in plucked string and struck string and energy of vibrating strings.

CO4: Studied The Fourier series and Fourier coefficients and its application in solving various equations.

UNIT-IV

Students should have

CO1: Studied the different topics in Quantum Mechanics and understand its applications such as Heisenberg uncertainty principle and its application improving non-existence of electron in the nucleus.

CO2: Understood the concept of wave function and physical interpretation of the wave function, Normalisation of a wave function. Understood the one-dimensional time- dependent and time-independent Schrodinger equations.

SEMESTER IV PAPER CODE -PHY 04(T) MARKS 60

Atomic, Nuclear and Solid State Physics

UNIT I

Students should have

CO1: Understood the atomic structure- ionisation, excitation, mobility of ions etc. Learnt the determination of e/m by Thomson's method, measurement of electronic charge by Millikan's oil-drop method and Measurement of mass of the electron, etc.

CO2: Studied Positive ray analysis and mass-spectrographs and understand its application by learning different types of experiments- Thomson mass spectrograph, Brainbridge mass spectrograph and Aston mass spectrograph.

CO3: Learnt Bohr's theory of Hydrogen Atom, the concept of structure of atoms from which they can learn about different spectral series, quantum numbers and their significance.

CO4: Learnt the basic concept of Pauli's exclusion principle and its uses. Learnt about X-rays, its production, characteristics spectrum, continuous spectrum etc. Studied the concept of scattering , Compton scattering and wavelength change due to scattering.

CO5: Understood the basic concept of lasers, the condition for laser action and the concept of meta stable state and population inversion; HE-Ne Laser.

UNIT II

Students should have

CO1: Studied the phenomenon of natural and artificial radioactivity which is behind/ underlying the weak interaction – one of the four basic forces in nature. Learnt various phenomena like photoelectric effect, Compton scattering, pair production can be besides getting the basic ideas of decay process. Learnt about its important applications in modern science e.g., radiography, radioactive tracing and also carbon dating techniques.

CO2: Studied Particle accelerators and detectors help us to understand the basic building blocks of matter that we find in the universe. Learnt about linear accelerators, cyclotron, betatron, synchrotron, ionization chamber, GM counter, scintillation counter etc.

CO3: Understood that artificial transmutation has a very important role in the production of nuclear energy. Learnt about artificial transmutation and the scheme of nuclear reactions with special emphasis on the discovery and property of the neutron, one of the basic building blocks of matter.

CO4: learnt about Nuclear fission, energy released in fission, secondary neutrons and their importance, multiplication factor, cahin reaction, concept of critical size, nuclear reactor, types of reactors.

CO5: Learnt about nuclear fusion, origin of stellar energy, calculation of fusion energy. They also need to learn about nuclear models and binding energy.

CO6: Concept of cosmic rays and elementary particles, latitude effect, east-west effect, altitude effect, origin of cosmic rays and classification of elementary of particles.

UNIT III

Students should have

CO1: A clear knowledge on the different types of solids, cohesive energy of solids, crystal structure, translational vectors, Bravais lattice, primitive cell, unit cell, types of different6 types of crystals in 2 and 3 dimensions.

CO2: Concept on SC, BCC, FCC crystals, closed packed crystals, packing fraction, Miller indices and inter planner distances.

CO3: Knowledge of diffraction by crystals, Bragg's law, Laue's treatment of diffraction and Laue's equation, Reciprocal lattice and Weigner-Seitz cell.

CO4: A clear concept on Fermi level, energy band and band gape.

CO5: Knowledge of magnetic induction, magnetization and magnetic susceptibility, diamagnetism, para magnetism and ferromagnetism.

CO6: Clear concept of Super conductivity, persistent current, behavior of super conductivity in a magnetic field, Meissner effect, destruction of super conductivity by a magnetic field and critical fields leading to the distinction between Type-I and Type-II Superconductors.

SEMESTER V PAPER CODE -PHY-05(T) MARKS 70

UNIT I

Students should have

CO1: Studied about the Vector analysis such as Gradient of a scalar, divergence and curl of a vector field. Line, surface and volume integration, flux of a vector field, Gauss' divergence theorem, Green's theorem, Stokes' theorem.

CO2: Understood the Curvilinear co-ordinates, orthogonal curvilinear co-ordinates, Conditions for Orthogonality and their applications.

CO3: Learnt the concept of matrices, its different types, properties, characteristics equation, eigen values, eigen vectors, diagonalisation of matrices.

CO4: Learnt the basic concept of complex variables, Functions of complex and analytic functions, Cauchy Reiman's conditions, Cauchy's theorem, Cauchy's integral formula of simply connected and multiply connected regions,Taylor's series and Laurent series, poles and residue theorem.

UNIT II

Students should have

CO1: A concept of differential equations and general method to solve them, the meaning of ordinary point, singular point and regular singular point. They should know to solve using Frobenius method.

CO2: Knowledge of convergent solution of Legendre differential equation, its transformation to polynomial solution Pn(x). They should learn the generating function of Pn(x), recurrence relation for Pn(x), calculation of potential and intensity at a point for an electric dipole with the help of Pn(x).

CO3: A concept on convergent solution of Hermite differential equations, its transformation to polynomial solution Hn(x). They should learn the generating function,recurrence realtions, Rodrigue's formula, Orthogonality of Hn(x).

CO4: Learnt the partial differential equations, its solution by method of separation of variables and its application.

UNIT III

Students should have

CO1: Basic concept of Beta and Gamma functions and its application. They should know the evaluation of $\Gamma(1/2)$, relation between gamma and beta functions, Legendre duplication formula and evaluation definite integrals.

CO2: understood the concepts of tensor analysis and the various types and properties of tensors, Learnt to write down equations which are invariant under coordinate transformations and are most suitable for use in relativistic mechanics.

UNIT-IV

Students should have

CO1: Studied and understood the topics such as Particle as a wave packet, Gaussian wave packet, phase velocity, group velocity, probability density, probability current density.

CO2: Understood the different topics in Quantum Mechanics such as quantum mechanical operators, eigenvalues and eigen vectors of an operators, Schrodinger equation as an operators equation, Hamiltonian operator, Hermitian operator, etc.

CO3: Understood the expectation values of an operator with examples, Ehrenfest theorem. And derive Heisenberg's uncertainty relation.

UNIT-V

Students should have

CO1: Understood one-dimensional applications of time independent Schrodinger equations: particle in an infinitely-deep potential well, quantum tunnelling through a potential barrier,step potential-reflection and transmission coefficients, particle in a shallow well and linear harmonic oscillator.

CO2: Understood the topics such as Orbital angular momentum operators in Cartesian and spherical polar coordinates and their commutation relations, Spin operators and their eigen values and eigen vectors, Pauli's spin operators and their properties, Schrodinger's equation for Hydrogen atom in spherical polar coordinates, etc.

FIFTH SEMESTER PAPER CODE - (PHY-06) MARKS 70

UNIT-I

Students should have

CO1: Knowledge of differential form of Gauss' Law, Poisson and Laplace's equations, Uniqueness theorem, Maxwell's equation for time dependent electromagnetic field in vacuum and in material media, boundary conditions.

CO2: Studied concept of Polarization and Polarization vector, Potential and field due to polarized matter. Learnt about Gauss' Law in dielectric, electric susceptibility and dielectric constant, boundary conditions satisfy by E and D athe the interface between two homogeneous dielectrics and Clausius- Mossoti's relation.

UNIT II

Students should have

CO1: Learnt the concept of electromagnetic potentials, magnetic potentials and magnetic vector Potentials, Gauge transformation and Laurent gauge and Coulomb gauge.

CO2: Understood the concept of electromagnetic waves, wave equation, plane wave solution for Maxwell's equation, orthogonality of E and B and propagation vector, poynting vector and its physical significance, momentum and energy, the reflection and transmission at dielectric boundaries.

UNIT III

Students should have

CO1: Understood the concept of FET (Field effect transistor). They should have knowledge of similarities between BJT, FET and JFET, static and transfer characteristics of JFET, pinch off voltage and should have an idea of MOSFET (Metal Oxide semiconductor field effect transistor).

CO2: A clear concept of ideal OP AMP (operational amplifier), differential Amplifier, offset parameters, differential gain, CMRR.

CO3: Knowledge of multistage amplifiers, analysis of RC coupled CE amplifier, feedback amplifiers, analysis of Colpitt's and Hartley's oscillator and elements of communication system.

UNIT-IV

Students should have

CO1: Studied digital signal and understand the difference between analog and digital signals and their uses. Learnt the binary system and their conversion to decimal, binary arithmetic such as addition, subtraction, two's compliment scheme, etc.

CO2: Understood the Boolean algebra, de' Morgan's theorems, TTL Logic families, multiplexer, demultiplexer, digital comparator.

UNIT-V

Students should have

CO1: Studied the classification of computers: analog and digital. Learn the flowchart and algorithm, determination of the root of a quadratic equation, summation of arithmetic series.

CO2: Studied the Fortran and its characters such as integer constant, real constant, complex constant, logical constant and variables like real variables, integer variables, logical variables, subscripted variables and library functions.

CO3: Understand the executable statements such as GO TO Statement, IF, IF THEN, ELSE, END IF, DO Statement, etc and Non-executable statements such as DIMENSION, IMPLICIT, EXPLICIT, FORMAT, COMMON, EQUIVALENCE Statements.

SIXTH SEMESTER PAPER CODE - (PHY-07) MARKS 70

(Condensed Matter Physics)

UNIT I

Students should have

CO1: A concept of Thermodynamic relations, thermodynamic variables, extensive and intensive Variables, Maxwell's relation and its application, Tds equation, heat capacity equations, internal energy equation, Joule Thompson cooling, thermodynamic potentials, Clausius Claypeyron's equation on how the temperature remain constant when change of state takes place as long as the changes takes place and equilibrium of thermodynamic variables.

CO2: Learnt that Statistics and Probability is a part of mathematics which help us to understand and study The various phenomena in condensed matter physics and quantum mechanics. Learnt

the different statistical laws, binomial distribution, calculation of mean; Stirling's approximation; Gaussian distribution, Poisson's distribution.

CO3: Studied part of classical mechanics; Generalised coordinate and momenta, constraints, Lagrangian and Hamiltonian; the density distribution in phase space and understand the application to one-dimensional harmonic oscillator and free particles.

CO4: Studied the Principle of equal a priori probability, ergodic hypothesis, Liouville theorem, statistical equilibrium and understand its application in probability calculations, behaviour of the density of states, sharpness of the probability distribution, probability distribution in microcanonical, canonical and grand-canonical ensembles.

UNIT II

Students should have

CO1: Studied concepts of thermal equilibrium in a thermodynamic system, β-parameter, probability entropy, partition function, free energy, specific heat, laws of equipartition of energy, Maxwell-Boltzman function and its application to perfect gas and derivation of Maxwell-Boltzmann distribution function aswell as derivation of Maxwell- Boltzmann distribution of molecular speeds, mean velocity, rms velocity, most probable velocity and mean free path.

CO2: Understood the concept of quantum Statistics, Bose Einstein (BE) and Fermi Dirac (FD) distributions, Application of BE and FD to free electron in metals and calculation Fermi energy.

UNIT III

Students should have

CO1: Understood different Crystal Structures in terms of Symmetry in crystals and symmetry elements, point and Space Groups.;structures of NaCl, CsCl,diamond, ZnS with diagrams

CO2: Understood Brillouin zones, form factor, atomic form factor, Fourier analysis of basis, structure of factor of bcc and fcc. Explain Reciprocal Lattice and its importance. Describe RL of bcc and fcc, with deductions of structure factors, atomic form factor.
Explain with diagram experimental techniques.

CO3: Learnt about bonding in solids, Madelung energy and Madelung constant in ionic crystals, London-London interaction and cohesive energy.

CO4: Learnt lattice vibrations in monoatomic and diatomic chain of atoms, lattice heat capacity, phonon density of states

CO5: Learnt Einstein and Debye's theories of heat capacity with mathematical deductions.

UNIT IV

Students should have

CO1: Learnt quantum mechanical treatment of free electrons in metals, concept of Fermi level, density of states, heat capacity of the electron gas, experimental heat capacity of metals, electrical conductivity, experimental resistivity of metals. Matthiesen's Rule, plasma frequency, Hall Effect, thermal conductivity of metals, Wiedemann Franz Law.

CO2: A clear concept of nearly free electron theory model, origin of the energy gap and its magnitude, bands and band gap; equations of motion, effective mass in semiconductors, Si and Ge; intrinsic carrier concentration and mobility; impurity conductivity

CO3: Understood different theories of magnetism: Langevin's theory of diamagnetism and

paramagnetism; Weiss's theory of ferromagnetism; anti-ferro-magnetism and ferrimagnetism.

CO4: Learnt superconductivity, classification into Type I and II, heat capacity, energy gap, isotope effect, and thermodynamics of superconducting transition; basic ideas of BCS Theory and high temperature superconductors

SIXTH SEMESTER PAPER CODE - (PHY-08) MARKS 70

Atomic and Molecular Spectroscopy, Nuclear Physics

UNIT I

Students should have

CO1: Learnt space quantization and spinning electron, Stern Gerlach experiment, quantum numbers- vector atom model and their physical significance; spin orbit interaction- explanation of fine structure.

CO2: Learnt Spectral terms- s,p,d,f, magnetic moment due to orbital and spin motion, Bohr magneton, Lande g-factor, Larmor's Theorem, gyromagnetic ratio; Zeeman effect- classical and quantum theory, anomalous Zeeman effect for one electron system; alkali spectrum, effect of screening and screening constant

CO3: A clear concept of Two electron system: L-S coupling, j-j coupling, Pauli's exclusion principle, spectra of helium and alkaline earth atoms; singlet and triplet fine structure and selection rules.

UNIT II

Students should have

CO1: Learnt types of molecular spectra- rotational, vibrational and electronic spectra; pure rotational spectra of diatomic rigid body rotator- quantum mechanical derivation of energy levels, frequency of spectral lines, selection rule.

CO2: A clear concept of vibrating diatomic molecule as harmonic oscillator- frequency, energy levels, selection rules, spectrum, vibrational- rotational spectra, selection rules.

CO3: Understood electronic spectra, electronic bands, sequence and progression, Frank Condon principle.

CO4: Learnt Raman effect- quantummechanical explanation, Raman shifts,Stoke's and anti-Stoke's lines, selection rules,comparison of Raman and IR Spectra.

CO5: Understood concept of UV and IR spectroscopy, Atomic Emission Spectroscopy (AES), Atomic Absorption spectroscopy (AAS) and ideas of X-ray Fluorescence (XRF) and applications.

UNIT III

Students should have

CO1: Studied the structure and composition of the nucleus and understand the basic properties such as charge, mass, size, spin, magnetic moment, electric quadruple moment, binding energy, binding energy per nucleon and its variation with mass number of the nucleus.

CO2: Studied Coulomb energy, volume energy, surface energy and other correction, explanation of B-E Curve, liquid drop model, shell model, Schmidt lines.

CO3: Understood the properties of nuclear forces, two nucleon system, square well solution of the deuteron problem.

CO4: Studied various theories related to Radioactivity such as Geiger-Nuttal law, Gamov's theory of α- decay, Fermi theory of β-decay and understand the related topics like neutrinos and anti-neutrinos, nuclear radiation, energy levels, biological effects of nuclear and electromagnetic radiations and precautionary measures against radiation hazards.

CO5: Studied the various topics related to nuclear reactions such as Rutherford's experiment on artificial transmutation, conservation theorems, Q-value, threshold energy and cross section of nuclear reactions.

CO6: Clear Understanding of artificial radioactivity-nuclear fission by studying theories like Bohr Wheeler theory of nuclear fission, condition of spontaneous fission, four factor formula for a nuclear multiplication factor, chain reaction, criticality, moderators, types of reactors-power, breeder reactor.

CO7: Studied nuclear fusion reaction in the plasma, condition for maintaining fusion reaction, Tokamak experiment in fusion systems

UNIT IV

Students should have

CO1: Studied the Cosmic rays and understand the effect on it such as the effect of earth's magnetic field on the cosmic ray trajectories, Discovery of muon, pion, heavy mesons, and hyperons in cosmic rays.

CO2: Study the Elementary particles and understand the concept of antiparticles, fundamental interactions, forces and fields.

CO3: Study and understand the resonant particles and discovery and important properties, strangeness, conservation and violation of strangeness in the particle interactions, isospin, hypercharge.

CO4: Understood the Symmetries and Conservation laws, Baryon and Lepton conservation and basic idea of quarks and quark model

SEMESTER III PAPER CODE -PHY 03(P) MARKS 40

Students should be able to

CO1: Determine the value of coefficient of linear expansion by using Pullinger's apparatus and optical lever

CO2: Determine the value of specific heat of a given liquid my using the method of cooling

CO3: Determine the co-efficient of thermal conductivity of a given good conductor by using Searle's method

CO4: Determine the refractive index of the material of a given prism by using a spectrometer and monochromatic light.

CO5: Determine the magnifying power of a telescope by angular method

CO6: Determine the radius of curvature of a lens by using Newton's Ring Method

CO7: Determine the grating constant by using spectrometer

CO8: Determine the power of combination of two thin convex lenses in contact by

isplacement method

CO9: Determine the speed of waves on stretched strings

CO10: Determine the frequency of a tuning fork by Melde's Method

SEMESTER V PAPER CODE -PHY 05(P) MARKS 30

Students should be able to

CO1: Determine the value of co-efficient of thermal conductivity of a given bad conductor by using Lee's method

CO2: Determine the velocity of ultrasonic waves in a liquid

CO3: Measure the width of a single slit from the study of its Fraunhoffer diffraction

CO4: Determine the wavelength of sodium light using biprism.

CO5: Determine the specific rotation of a given solution using polarimeter

SEMESTER V PAPER CODE -PHY 06(P) MARKS 30

Students should be able to

CO1: Determine Young's Modulus (Y) of glass using Cornu's method

CO2: Determine Planck's constant by photocell

CO3: Determine the specific charge (e/m) of an electron by Thomson's method

CO4: Determine the forward and reverse bias characteristics of Zener diode and hence determine the value of breakdown voltage

CO5: Determine the reduction factor of a tangent galvanometer and the value of horizontal component of earth's magnetic field by electrolysis method

CO6: Determine the monochromatic wavelength by using Michelson's interferometer

DEPARTMENT OF ZOOLOGY

SEMESTER	COURSE CODE	COURSE OUTCOME
I	ZOO IA	**CO 1.** Introduction of Systematics to Impart Knowledge on Taxonomic Hierarchy, Binomial Nomenclature, Classification from Bacteria to Chromista, Salient Characteristics from Non-Chordates to Chordates. **CO 2.** Study of Morphology, life-cycle, pathogenecity and prevention of protozoan parasites and helminthes. Morphology and physiology of Sycon, Obelia colony, Leech, Cockroach, Pila and Asterias. **CO 4.** Salient features of Balanoglossus and Amphioxus. Morphology and physiology of Petromyzon, Labeo and Rabbit. CO 5. Origin of Life, Theories and evidences of evolution.
	ZOO IB	**CO1.** To dissect the nervous system and reproductive system of Cockroach. **CO2.** To dissect the digestive system and afferent branchial system of Channa sp. **CO3.** Demonstration of dissections of Arterial, digestive and Urinogenital systems of Albino rats/ chicken. **CO4.** General protocol for preparation of permanent slides. CO5. Permanent slide preparations of Paramecium/ Euglena, Obelia, parapodia of Nereis, Gemmules of Sponge and blood film. **CO6.** Osteology of Mammalia

		CO7. Study of Prepared slides of earthworm, Ascaries, Amphioxus and frog/toad. **CO8.** Study of Museum specimens from non-chordates and chordates. **CO9** Study of Fossils **CO10.** Evidences of evolution through charts and models.
II	ZOO 2 A	**CO1.** Study on structure of Prokaryotic and Eukaryotic Cells, Cell organelles and their functions. **CO 2.** Study on the chemical composition and organization of Euchromatin and heterochromation, Morphology and classification of chromosomes, Study of polytene and lampbrush chromosomes. **CO 3.** Study of Cell cycle, Cancer cells, types of cancer and carcinogens; Immunity, types of immunity and organs of Immune System. **CO 4.** Basic concepts of Genetics, Gene Interactions, lethal genes and Chromosomal theory of Inheritance. **CO 5.** Sex Determination, Linkage, crossing over and chromosomal aberrations.
	ZOO 2 B	CO1. Study of cell organelles from slides/charts. CO2. Preparation of permanent slides and study of different stages of mitosis in onion root tip. CO3. Preparation and study of different stages of meiosis from Grasshopper testis. CO4. Study of Chromosome types from slides. CO5. Preparation and study of Polytene Chromosomes from Chironomous larva. CO6. Study of Phenotypic variations in a natural population (three characters). CO7. Determination and study of multiple alleles (ABo blood groups) and Rh factor.
III	ZOO 3 A	CO1. Physiology of digestion and absorption of carbohydrates, proteins, lipids and vitamins; respiration in vertebrate lungs, composition of blood and types of hearts in vertebrates. CO2. Structure of mammalian kidney and its functions; Ultra structure of skeletal muscles and neurons in relations to their mechanism of functions. CO3. Structure and functions of major endocrine glands and Neuro-endocrine system in insects. CO4. Study of Classifications and significance of carbohydrates, proteins and lipids. Essential and Non-essential Amino-acids, Glycolysis, TCA cycle and B-Oxidation of fatty acids. CO5. Properties, classification and nomenclature of Enzymes and Nucleic acids.
	ZOO 3 B	CO1. Preparation of haemin crystals from human blood. **CO2**. Determination of blood clotting time of human blood. **CO 3.** Oxygen consumption in fish with reference to body weight. **CO 4.** Histology of endocrine glands from permanent slides. **CO 5.** Detection of carbohydrates, proteins and lipids. **CO 6**. Estimation of Ascorbic acid by titration method.
IV	ZOO 4 A	**CO 1.** Study of Developmental biology - Gametogenesis to formation of three germinal layers. Metamorphosis in insects and amphibians. **CO 2.** Study of ecology- concepts, sub-divisions, scope and importance. **CO3.** To study natural resources and their management; Environmental pollution and their effects. **CO4**. To study Pisciculture and Sericulture, method of culture, management and its economic importance. **CO 5.** To study Apiculture, Life history, social organisation, methods of bee-keeping and economic importance. Integrated Pest management.
	ZOO 4 B	**CO1.** To study types of vertebrate eggs. **CO 2**. To study larval forms of crustacean, Molluscan and echinoderm from permanent slides. **CO3.** To study permanent slides on the stages of development of frog. **CO 4**. Preparation of permanent slides of larval forms of non-chordates. **CO 5**. Study of metamorphosis in Amphibia by models/charts. **CO 6**. Estimation of dissolved oxygen in water samples.

		CO 7. Estimation of dissolved carbon-dioxide in water samples. **CO 8.** Estimation of total alkalinity in water samples. **CO 9.** Qualitative study of plankton from fresh water samples. **CO 10.** To study the life cycle of silk moth. **CO 11.** Study of different castes of honey bee. **CO 12.** Identification of Indian major carps and Common exotic carps.
V	ZOO 5 A	**CO 1.** To study locomotion and nutrition of protozoa, Canal and skeletal systems in Porifera, Polymorphism in Siphonophora, Corals and coral reefs, Morphological and physiological adaptations of parasitic helminthes and Excretory system in Annelida. **CO 2.** General organisation and affinities of Onychophora, Types of mouth parts and feeding in insects, Vision in Arthropoda, Torsion and detorsion in Gastropoda, Comparative Study of water vascular system in Echinodermata. **CO 3.** Study on Affinities of Balanoglossus (Hemichordata) and Amphioxus (Protochordata), Retrogressive metamorphosis in Ascidia, Comparative study of Petromyzon and Myxine (Agnatha), Scales and fins in fishes, Accessory respiratory organs (Pisces), Migration in fishes, General characters and affinities of Dipnoi. **CO 4.** Study on Parental care of Amphibian, Poisonous and non-poisonous snakes, Poison apparatus and mechanism of biting (Reptilia), Flight adaptation and migration in birds (Aves), Affinities of Monotremata and Marsupial, Dentition in mammals, Study of comparative anatomy of kidney in vertebrates. **CO 5.** Study of concepts and Zoogeographic realms, Patterns and regulation of behaviour by genetic and hormonal, Colouration and mimicry, Adaptation of Vertebrates in Aquatic, desert, arboreal, cursorial and deep sea.
	ZOO 5 B	**CO 1.** To dissect and study the nervous system in prawn/earthworm. **CO 2.** To dissect and study the accessory respiratory organs in teleost fish. **CO 3.** To dissect and study the digestive system in Clarias. **CO 4.** To dissect and study the reproductive system in Clarias. **CO 5.** Permanent mounting of Cyclops on slides. **CO 6.** Permanent mounting of setae of earthworm on slides. **CO 7.** Permanent mounting of Spicules of Sponge on slides. **CO 8.** Permanent mounting of Cycloid, Ctenoid and placoid scales of fishes on slides. **CO 9.** Permanent mounting of filoplumes, down feathers, barbs and barbules of birds on slides. **CO 10.** Study of permanent slides of T/S of stomach, intestine, liver, kidney, spleen, gonads of Pisces/Aves/mammals. **CO 11.** Study of permanent slides (whole mount) of Representatives from Protozoa to Echinodermata. **CO 12.** Adaptive modifications of beak and feet in birds using charts and models.
VI	ZOO 6 A	**CO 1.** Genome organisation in bacteria, virus and eukaryotes; Central dogma of molecular biology; DNA replication in prokaryotes; Transcription and translation in prokaryotes; Genetic code, Regulation of Gene expression in Prokaryotes; lac operon. **CO 2.** Fine structure of gene: Cistron, recon and muton; Split genes and overlapping genes; Transposons; Gene mutation. Types and mutagenic agents; DNA damage and repair; Detection of Mutation in Drosophila (Muller's CLB method). **CO 3.** Extra-nuclear inheritance; Kappa particles in Paramecium, Sex-linked inheritance in Drosophila (eye colour) and man (Colour-blindness); Dosage compensation and Lyon's hypothesis; Non-disjunction of sex-chromosomes in Drosphila; Human karyotype; Sex determination in man; Genetic disorders in man- Down's Syndrome, Turner's Syndrome and Klinefelter's syndromes; Phenylketonurea, Hemophilia. **CO 4.** Humoral and cell mediated immunity; Characteristics and functions of antigens and antibodies; Antigen-antibody interaction; Major histo-compatibility complex; Introduction to cytokines.

		CO 5. Principals and applications of biological techniques; Light and Electron Microscopy; Centrifugation; Chromatography (Paper, gel filtration and ion-exchange).
	ZOO 6 B	**CO 1.** Seperation and identification of amino acids by paper chromatography. **CO 2.** Demonstration of antigen-antibody interaction in vitro; Single radial immune-diffusion in agarose gel. **CO 3.** Study of nucleic acids from models/charts. **CO 4.** Calorimetric estimation of DNA and RNA. **CO 5.** Preparation and identification of Meiotic stages from Grasshopper testis. **CO 6.** Karyo-typing of normal human chromosomal complement from supplied photographic plates. **CO 7.** Karyo-typing of normal human chromosomal complement of Down's, Turner's and Klinefelter's syndrome from supplied photographic plates. **CO 9.** Demonstration of electrophoretic separation of DNA/ proteins.
	ZOO 7 A	**CO 1.** Chemical foundations of physiology; concept of normal, molar and molal solutions; Acids, bases, pH and buffer; diffusion and osmotic pressure. Enzyme kinetic: Michaelis-Menten equation and its relation enzyme activity; Significance of K_m and $V_{max;}$ Enzyme inhibition (Reversible and irreversible). **CO 2.** Carbohydrates: Linear and ring forms of monosaccharides (Pentose and Hexose); Polysaccharides (Starch, glycogen and hyaluronic acid); Glycogenesis and glycogenolysis; Electron transport system and oxidative phosphorylation; Amino acids, peptides and proteins; levels of organisation, transamination, deamination and urea cycle. **CO 3.** Structure and functions of haemoglobin; Blood coagulation, Coagulation factors and mechanism; Cardiac cycle, blood pressure and its regulation, Mechanism of gaseous exchange through gills and lungs, osmoregulation in fish. **CO 4.** Neurosecretory cells; Types of neurohormones; endocrine and paracrine hormones; placental hormones; hormones of gastrointestinal tract; pheromones, Biosynthesis of thyroid hormones, mechanism of hormone action, protein/peptide and steroid hormones. **CO 5.** Reproductive cycle in mammals; Hormonal regulations of gametogenesis in humans; In vitro-fertilisation, embryo transfer technology; pregnancy hormones; contraceptive methods.
	ZOO 7 B	**CO 1.** To study WBC count in human blood. **CO 2.** To study RBC count in human blood. **CO 3.** Estimation of Glucose by calorimetric method. **CO 4.** Estimation of protein by calorimetric method. **CO 5.** Estimation of haemoglobin in human blood. **CO 6.** Study of human salivary amylase activity in relation to temperature. **CO 7.** Dissection and display of pituitary and gonads in a teleost. **CO 8.** Study of endocrine glands in albino mouse/rat from charts/models. **CO 9.** To prepare histological slides of vertebrate tissues and adrenal glands.
	ZOO 8 A	**CO 1.** Patterns of cleavage; Morphogenetic movements; embryonic induction and concept of organiser; Gastrulation in chick. **CO 2.** Foetal membranes and types of placenta in mammals; Organogenesis of vertebrate eye; Regeneration in invertebrates and vertebrates; Teratogenesis and developmental birth defects; concepts of ageing. **CO 3.** Salient features of aquatic and terrestrial ecosystems; Liebig's law of limiting factors and Shelford's law of tolerance; Bio-geographical cycles; Ecological succession, Major biomes. **CO 4.** Environmental concerns; radioactive pollution; biological indicators; Biomagnification; ozone depletion; green house effect; global warming and acid rains. Wildlife conservation in situ and ex situ. **CO 5.** Introduction to genetic engineering; introduction to host cells; particle gun; southern blotting; PCR; DNA finger printing; Genomic library and cDNA LIBRARY; application of rDNA technology ; Ethical Issues and Biosafty Regulations.
	ZOO 8B	**CO 1.** To prepare permanent slides and study the developmental stages of chick's embryo.

		CO 2. To study regeneration of hydra/planaria. **CO 3.** Study of developmental stages of chick's embryo from permanent slides. **CO 4.** Community analysis. **CO 5.** Quantitative analysis of aquatic communities from different water bodies. **CO 6.** Quantitative estimation of planktons. **CO 7.** Analysis of community similarities and species diversity indices. **CO 8.** To undertake field study and to write field report.

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