St Aloysius College (Autonomous)

Mangaluru

Re-accredited by NAAC "A" Grade

Course structure and syllabus of

B.Sc.

PHYSICS

CHOICE BASED CREDIT SYSTEM

(2019 – 20 ONWARDS)

ಸಂತ ಅಲೋಶಿಯಸ್ ಕಾಲೇಜು

(ಸ್ವಾಯತ್ತ)

ಮಂಗಳೂರು– ೫೭೫ ೦೦೩

ST ALOYSIUS COLLEGE
(Autonomous)
P.B.No.720
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Re-accredited by NAAC with 'A' Grade - CGPA 3.62
Recognised by UGC as "College with Potential for Excellence"
College with 'STAR STATUS' conferred by DBT, Government of India
3rd Rank in "Swacch Campus" Scheme, by MHRD, Govt of India

No: SAC 40/Syllabus 2019-20 Date: 18-07-2019

NOTIFICATION

Sub: Syllabus of **B.Sc. Physics** under Choice Based Credit System.

Ref: 1. Decision of the Academic Council meeting held on 02-05-2019 vide Agenda No: 23(2019-20)
2. Office Notification dated 18-07-2019

Pursuant to the above, the Syllabus of **B.Sc. Physics** under Choice Based Credit System which was approved by the Academic Council at its meeting held on 02-05-2019 is hereby notified for implementation with effect from the academic year **2019-20**.

PRINCIPAL **REGISTRAR**

To:

1. The Chairman/Dean/HOD.
2. The Registrar Office
3. Library

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(ಸ್ವಾಯತ್ತ)

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Date: 25-06-2020

NOTIFICATION

Sub: Syllabus of **B.Sc. Physics** under Choice Based Credit System.

Ref: 1. Decision of the Academic Council meeting held on 09-06-2020 vide Agenda No: 15(2020-21)
2. Office Notification dated 25-06-2020

Pursuant to the above, the replacement of CBCS IV Semester to Syllabus of **B.Sc. Physics** under Choice Based Credit System which was approved by the Academic Council at its meeting held on 09-06-2020 is hereby notified for implementation with effect from the academic year **2020-21**.

PRINCIPAL **REGISTRAR**

To:

1. The Chairman/Dean/HOD.
2. The Registrar Office
3. Library

Objectives:

The goal of this course in physics is to provide the student with a flavor of the physical principles of this science, to empower them to think critically and to provide insights to students in the physical sciences inorder to enhance their career opportunities.

Programme Outcomes	
PO-1.	Develop and demonstrate an ability to understand major concepts in various disciplines of Physics.
PO-2.	Solve analytical problems, think methodically, independently to draw logical conclusions.
PO-3.	Exercise critical thinking and the scientific knowledge to design, carryout, record, analyze and co-relate the results of Physics practical.
PO-4.	Have the capability to solve problems by using research based knowledge and research methods
PO-5.	Inculcate scientific temper in fellow students and also among the larger scientific community and society in general.
PO-6.	Use modern techniques and recent methods to imbibe and propagate the concepts of Physics.
PO-7.	Think, acquire knowledge and skills through logical reasoning and inculcate the culture of self-learning.
PO-8.	Create an awareness of the impact of Physics on the society, and development outside the scientific community.
Programme Specific Outcomes	
PSO 1:	Understand and apply the principles of Properties of matter, Thermal Physics, Basic Electricity, Mechanics, Relativity and Photonics.
PSO 2:	Understand and apply the principles of Acoustics, Optics, Networks Electromagnetism and Advanced Electricity.
PSO 3:	Understand the principles of Atomic Physics, Solid State Physics, Nuclear Physics and Analogue Electronics, Communication and Digital Electronics and Special properties of materials.
PSO 4:	Understand the principles of Electrical circuits and network skills, Physics workshop skills, Basic instrumentation skills, Renewable energy and energy harvesting under Choice Based Credit System (CBCS) requirements.

COURSE STRUCTURE

Semester & Course Code	Lecture/ Practical per week (Hr)	Duration of Exam (Hr)	Max. Marks			Credits
			Internal assessment	End Semester Exam	Total	
I Sem G501.1 (Theory)	4	3	20	80	100	2
G501.1P (Practical)	3	3	10	40	50	1
G501.1E (Open Elective)	2	2	10	40	50	1
II Sem G501.2 (Theory)	4	3	20	80	100	2
G501.2P (Practical)	3	3	10	40	50	1
G501.2E (Open Elective)	2	2	10	40	50	1
III Sem G501.3 (Theory)	4	3	20	80	100	2
G501.3P (Practical)	3	3	10	40	50	1
G501.3E (Open Elective)	2	2	10	40	50	1
IV Sem G501.4 (Theory)	4	3	20	80	100	2
G501.4P (Practical)	3	3	10	40	50	1
G501.4E (Open Elective)	2	2	10	40	50	1
V Sem G501.5a (Theory)	3	3	20	80	100	2
G501.5b (Theory)	3	3	20	80	100	2
G501.5P (Practical)	4	3	20	80	100	2
VI Sem G501.6a (Theory)	3	3	20	80	100	2
G501.6b (Theory)	3	3	20	80	100	2
G501.6P (Practical)	4	3	20	80	100	2

Title of the papers with Code:

Semesters	Code	Paper Title
I	G501.1	Properties of matter, Thermal Physics and Electricity I
	G501.1P	Practical I
	G501.1E	ELECTRICAL CIRCUITS AND NETWORK SKILLS
II	G501.2	Mechanics, Relativity and Photonics
	G501.2P	Practical II
	G501.2E	PHYSICS WORKSHOP SKILLS
III	G501.3	Acoustics, Optics and Networks
	G501.3P	Practical III
	G501.3E	BASIC INSTRUMENTATION SKILLS
IV	G501.4	Electromagnetism, Electricity II and Electronics I
	G501.4P	Practical IV
	G501.4E	RENEWABLE ENERGY AND ENERGY HARVESTING
V	G501.5a	Atomic Physics
	G501.5b	Solid State Physics
	G501.5P	Practical V
VI	G501.6a	Nuclear Physics and Analog Electronics
	G501.6b	Communication and Digital Electronics, Special properties of materials
	G501.6P	Practical VI

I SEMESTER

G 501.1: PROPERTIES OF MATTER, THERMAL PHYSICS AND ELECTRICITY- I

Course Outcomes	
CO-1.	Have the required basic knowledge when the student opt for higher studies in Physics.
CO-2.	Understand the basic concepts of Elasticity
CO-3.	Gain the knowledge about the properties of materials
CO-4.	Study the motion of viscous fluid
CO-5.	Explain the basic thermodynamic properties and derive and discuss the laws of thermodynamics.
CO-6.	Enrich the knowledge of thermo electricity
CO-7.	Effectively use measuring instruments

UNIT I (17 Hrs.) Properties of matter :

Elasticity: Introduction. Elastic constants and Poisson's ratio. Elastic after effect and elastic fatigue. Relation between shear and longitudinal strains. Relation between elastic constants. Uniform and non-uniform bending. Bending moment. Cantilever – theory. Torsion – Expression for couple per unit twist. Torsion pendulum – theory, advantages. Searle's double bar – theory, advantages.(Problems) 10 Hrs

Surface tension : Introduction. Molecular theory of surface tension. Surface energy. Excess pressure inside a spherical bubble – different cases. Capillarity – theory of measurement of surface tension using capillary rise. Theory of drop weight method of measuring surface tension. Interfacial tension – theory and measurement using drop weight method. (Problems) 4Hrs

Viscosity : Introduction. Coefficient of viscosity. Derivation of Poiseuille's formula. Terminal velocity. Stokes law – expression for the terminal velocity and coefficient of viscosity. (Problems) 3Hrs

UNIT II (17 Hrs.) Thermal Physics :

Radiation : Black body radiation. Stefan's law. Distribution of energy in the black body spectrum. Statements of Wein's law, Wein's displacement law, Rayleigh – Jean's law. Derivation of Planck's law using Einstein's A and B coefficients. (Problems) 4 Hrs

Liquefaction of gases : Work done during isothermal and adiabatic changes. Porous plug experiment. Joule – Kelvin effect. Expression for temperature of inversion. Principle of regenerative cooling. Cooling by adiabatic demagnetization. (Problems) 4 Hrs

Thermodynamics : Carnot's engine & Carnot's cycle – expression for efficiency. Second law of thermodynamics. Derivation of Clausius – Clepeyron latent heat equation and applications.(Problems) 4 Hrs

Thermo-emf : Seebeck effect, neutral temperature. Thermoelectric power. Thermo-couple – measurement of temperature. 2 Hrs

Thermal conductivity : Introduction. Coefficient of thermal conductivity. Heat flow through a bar. Forbe's method to find K. Heat flow through compound wall. (Problems) 3 Hrs

UNIT III (17 Hrs.) Electricity I

Circuit laws : Passive and active elements. Resistance and conductance. Ideal and practical voltage sources and current sources. Kirchhoff's current and voltage laws. Voltage division and current division laws.(Problems) 3 Hrs

Transients : Growth and decay of current in a LR circuit - time constant. Charging and discharging in a CR circuit - time constant. Oscillatory discharge of a LCR circuit - condition for under damped, critically damped and over damped oscillations. (Problems) 6 Hrs

Electrical Measurements : Introduction. Measurement of inductance by Maxwell's bridge and Anderson's method - theory. Measurement of capacitances by de-Sauty method, Wein's bridge and Schering bridge - theory. Measurement of high resistance by substitution method and by leakage. (Problems) 7 Hrs

Text Books:

1. B.V.Narayana Rao: First year B.Sc Physics, Wiley Eastern Limited
2. D.S.Mathur : Heat and Thermodynamics, S.Chand& Co
3. *R Murugeshan : Electricity and Magnetism , S Chand & Co., New Delhi*

REFERENCE BOOKS :

i. *D S Mathur :Properties of matter , S Chand & Co.*
ii. *J C Upadhyaya :Properties of matter , Ramprasad & Sons Agra.*
iii. *Brijlal & Subramanyam : Heat and thermodynamics , S.Chand & Co*
iv. *M W Zemansky, Sears & Dittman :Heat & thermodynamics , 6th Ed. McGraw Hill.*
v. *C Kittel & Kroemer :Thermal Physics; 2nd Edn ; CBS Publishers, New Delhi.*
vi. *Halliday, Resnick, Krane :Physics 5th Edn. ; John Willey (Asia)*
vii. *E M Purcell : Electricity & Magnetism - 2nd Ed., Mc Graw Hill*
viii. *D. N. Vasudeva : Fundamentals of Electricity and Magnetism ,S Chand & Co*

Semester-I G501.1P: Practical-I	
Course Outcomes	
CO-1.	Successfully handle and complete practical problems connected with the experiments related to properties of matter.

1. q - by stretching & verification of Hooke's law (Graphical method)
2. q - by cantilever bending
3. Torsion pendulum - rigidity modulus.
4. Searle's double bar - determination of q, n and σ
5. n - by static torsion.
6. Surface tension and interfacial tension - drop weight method.
7. Coefficient of viscosity by Stokes method
8. Thermal conductivity by Forbe's method.
9. High resistance by leakage
10. CR – charging and discharging.

OPEN ELECTIVE

Semester-I G501.1E (Open Elective): Electrical Circuits and Network Skills	
Course Outcomes	
CO-1.	Acquire necessary skills/hands on experience/working knowledge of multimeters, ammeters, voltmeters and electrical components.
CO-2.	Be proficient in electrical wiring.

Theory: 30 Lectures Credit : 01

The aim of this course is to enable the students to design and trouble shoot the electrical circuits, networks and appliances through hands-on mode

Unit 1: Basic Electricity Principles

Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter. (3 Lectures)

Understanding Electrical Circuits

Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources and the difference between the two. Advantages of three phase over single phase. (Qualitatative). Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money. (4 Lectures)

Electrical Drawing and Symbols

Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop. (4 Lectures)

UNIT II Generators and Transformers

DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers. (3 Lectures) Electric Motors: Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor. (4 Lectures)

Solid-State Devices

Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources (qualitative)(3 Lectures)

Electrical Protection

Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection, lightning conductors. Interfacing DC or AC sources to control elements (relay protection device) (4 Lectures)

Electrical Wiring

Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board. (5 Lectures)

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand & Co.
2. A text book of Electrical Technology - A K Theraja
3. Performance and design of AC machines - M G Say ELBS Edn.

Pattern of Question paper

Part A: Six short answer type questions out of which five are to be answered. Each questions carries two marks 5 x 2 =10 marks

Part B: Three questions of out of five each carrying 10 marks

3 x 10 = 30 marks

Part C: Two numerical problems to be answered out of Four each problem carrying Five marks

2 x 5 = 10 marks

Total 50 marks

In part B each main question must have two sub divisions (a) and (b) for 6 marks and 4 marks respectively.

Semester-II G501.2: Mechanics, Relativity and Photonics	
Course Outcomes	
CO-1.	Understand the principles and methods used in analyzing motion of Particle, Verify Conservation laws and gain knowledge about the Rigid body mechanics.
CO-2.	Grasp the ideas of Classical theory of relativity, Special theory of relativity.
CO-3.	Understand Laser fundamentals, Types of LASER, Optical fibers and Photonic Crystals and its application.

UNIT I (17 Hrs.) Mechanics:

Motion of a particle : Inertial and non-inertial frames of reference. Motion of a particle in an accelerated frame of reference. Pseudo force with examples. Coriolis force with examples. (Problems) 3 Hrs

Conservation Laws :

i. **Conservation of Linear momentum :** Statement. Motion of a rocket, expression for final velocity - multistage rockets and their advantages. (Problems)
ii. **Conservation of angular momentum:** Statement, Examples. Conservation of angular momentum under a central force. (Problems)
iii. **Conservation of Energy :** Principle of conservation of energy. Applications : Vertical oscillations of the light loaded spring. (Problems) 7 Hrs

Rigid Body mechanics: Moment of inertia and radius of gyration. Theorems of Moments of inertia - Statements and proof. Expressions for the M.I. of a disc and rectangular lamina. Flywheel – theory. Theory of the compound pendulum, Interchangeability of center of suspension and center of oscillation.(Problems) 7 Hrs

UNIT II (17 Hrs.) Relativity:

Classical theory of relativity : Galilean transformation equations. Galilean principle of relativity. Galilean invariance of space and time. Classical velocity addition theorem. 4 Hrs

Special theory of relativity : Introduction. Michelson – Morley experiment (Qualitative). Postulates of special theory of relativity. Lorentz transformation equations. Galilean transformation equations from Lorentz transformation equations. Length contraction, time dilation, simultaneity, relativistic velocity addition theorem. Variation of mass with velocity – qualitative. Einstein's mass energy equivalence - derivation. Relativistic expression for kinetic energy. Relation between energy and momentum.(Problems) 13 Hrs

UNIT III (17 Hrs.) Photonics :

Laser fundamentals : Introduction – Physical principles, induced absorption, spontaneous and stimulated emission. Population inversion. Laser action. Coefficient of gain. Optimum level of output power. Pumping and pumping schemes. Properties of laser- coherence, intensity, directionality, mono-chromaticity and focusability. (Problems) 7 Hrs

Laser types : Solid state laser – Nd – YaG laser. Gas laser: He – Ne laser, Semiconductor laser – diode lasers. Metal vapour laser. Mention of applications of lasers. 5 Hrs

Optical fiber : Structure of optical fibres, types- single mode and double mode, step index, graded index fibres, attenuation in fibres – various kinds of losses, Optical fibre communication and its advantages.(Problems) 3Hrs

hotonic crystals : One dimensional, two dimensional and three dimensional photonic crystals and their applications. 2 Hrs

TEXT BOOKS :

1. *R Shankaranarayana : Mechanics Sultan Chand & Co*
2. *A P French :Special theory of relativity, Arnold Heinemann, India*
3. *R Murugeshan :Modern Physics , S Chand and Co., New Delhi*
4. *C.L.Arora : Text Book of Optics, S.Chand & Co*

REFERENCE BOOKS :

1. *J C Upadhyaya: Mechanics; Ramprasad & Sons Agra*
2. *A P French :Newtonian Mechanics ; Thomas Nelson & Sons*
3. *K N Srinivasa Rao :Classical Mechanics ; Universities Press, India*
4. *Rana & Joag :Classical Mechanics ; Tata Mc Graw Hill*
5. *A N Matveev :Mechanics and Theory of Relativity -; MIR Publishers, Moscow*
6. *Resnick :Special theory of relativity; John Wiley (Asia)*
7. *E Hecht: Optics ,4th Edn ; Pearson Education Asia.*
8. *Silfvast W T: Laser Fundamentals , Cambridge University Press (India).*
9. *Halliday, Resnick and Krane :Physics. , 5th Ed., John Wiley (Asia)*
10. *Anuradha De: Optical fibre and laser, New AgePublications*

Semester-II G501.2P: Practical-II	
Course Outcomes	
CO-1.	Have the ability to plan a scientific experiment based on compound pendulum like systems, energy storage systems using flywheels.
CO-2.	Have the ability to carry out a scientific experiment to estimate the stability of the material under stress and strain.

1. Bar pendulum - h - T graph
2. Spiral spring – rigidity modulus
3. Fly wheel - MI and mass of the wheel.
4. Theorems of MI
5. MI of Irregular body.
6. Conservation of energy and momentum
7. q by cantilever oscillations
8. Bifilar suspension
9. q by uniform bending
10. Laser divergence

Semester-II G501.2E (Open Elective): Physics Workshop Skills	
Course Outcomes	
CO-1.	Acquire skills/ hands-on experience/working knowledge on various machine tools like lathes, shapers, drilling machines, cutting tools, welding sets and also different gear systems.
CO-2.	Acquire skills in usage of multimeters, soldering iron, oscilloscopes, power supplies and relays.

Theory: 30 Lectures Credit : 01

The aim of this course is to enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode

UNIT 1:Introduction:

Measuring units. conversion to SI and CGS. Familiarization with meter scale, Verniercalliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc. Importance of caliberation. (4 Lectures)

Mechanical Skills:

Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding. Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools, lubricating oils. Cutting of a metal sheet using blade. Smoothening of cutting edge of sheet using file. Drilling of holes of different diameter in metal sheet and wooden block. Use of bench vice and tools for fitting. Make funnel using metal sheet. (10 Lectures)

UNIT II:Electrical and Electronic Skill:

Use of Multimeter. Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB. Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay, safety aspects (10 Lectures)

Introduction to prime movers:

Mechanism, gear system, wheel, Fixing of gears with motor axle. Lever mechanism, Lifting of heavy weight using lever. braking systems, pulleys, working principle of power generation systems. (6 Lectures)

Demonstration practicals (to be designed by the students).

Reference Books:

1. A text book in Electrical Technology - B L Theraja – S. Chand and Company.
2. Performance and design of AC machines – M.G. Say, ELBS Edn.
3. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
4. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn.,Editor Newnes [ISBN: 0750660732]
5. New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

Pattern of Question paper

Part A

Six short answer type questions out of which five are to be answered. Each questions carries two marks

5 x 2 =10 marks

Part B

Three questions of out of five each carrying 10 marks

3 x 10 = 30 marks

Part C

Two numerical problems to be answered out of Four each problem carrying Five marks

2 x 5 = 10 marks

Total 50 marks

In part B each main question must have two sub divisions (a) and (b) for 6 marks and 4 marks respectively

Semester-III G501.3: Acoustics, Optics and Networks	
Course Outcomes	
CO-1.	Interpret Free and forced oscillations, analyze the propagation of progressive waves.
CO-2.	Acquire the knowledge about properties of sound.
CO-3.	Identify Interference, Diffraction and Polarization of light in day-to-day life.
CO-4.	Understand Network Theorems and apply them to solve complex circuits.

UNIT I (17 Hrs.) Acoustics:

Free and Forced Oscillations : Equation for a harmonic oscillator. Work done by a harmonic force. Free undamped vibrations. Effect of damping - equation for forced oscillations and its solution - condition for resonance and illustration for phenomenon of resonance. (Problems) 7 Hrs

Progressive Wave : Equation for a progressive wave in one dimension. Differential equation of wave motion. Expression for velocity of longitudinal waves in a fluid. Newton's formula for velocity of sound in air – Laplace's correction. Longitudinal vibrations in a rod. Velocity of longitudinal waves in a rod. Velocity of transverse vibrations in a string. Expression for frequency of fundamental and overtones. (Problems) 10 Hrs

UNIT II (17 Hrs.) Optics:

Interference of Light : Introduction. Division of wavefront. Fresnel's biprism – qualitative. Division of amplitude. Theory of interference at a thin transparent film by reflected light. Colour of thin films. Interference at an air wedge. Fringes of equal thickness, expression for fringe width. Theory of Newton's rings with reflected light. (Problems). 6 Hrs

Diffraction of Light : Introduction. Fresnel and Fraunhofer diffraction. Concept of Fresnel's theory of half period zones - rectilinear propagation of light. Zone plate- construction and theory. Comparison between zone plate and convex lens. Fraunhofer diffraction at a single slit . Theory of plane diffraction grating - normal incidence and oblique incidence. Resolving power and dispersive power of a grating - qualitative. Diffraction haloes (Problems) 6Hrs

Polarization : Introduction. Plane of vibration and plane of polarization. Double refraction, optic axis, principal section of doubly refracting crystals, principal refractive indices. Theory of retarding plates - half wave plate and quarter wave plate. Circularly and elliptically polarized light – analytical treatment. Fresnel's theory of optical activity. (Problems) 5 Hrs

Unit III (17 Hrs.) Networks:

Network analysis : Path, node, loop and mesh in an electrical network. Mesh analysis using Cramer's rule. Conversion from star to delta connection and vice versa. (problems) 6 Hrs

Network theorems : Superposition, Thevenin, Norton and maximum power transfer theorems. Millman theorem.Two-port networks – h parameters (Problems) 11 Hrs

TEXT BOOKS:

1. *Brijlal & Subramanyam: Waves & Oscillations , S Chand & Co*
2. *Hayt, Kemmerly & Durbin : Engineering Circuit Analysis, 6th Edn , Tata McGraw Hill.*
3. *Brijlal & Subramanyan :Optics , S Chand & Co*

REFERENCE BOOKS :

1. *A.P. French :Waves and Oscillations , Arnold Heinman India.*
2. *Berkeley Physics Course Vol. III - Waves - Crawford; Mc Graw Hill*
3. *Kinsler & Fray :Fundamentals of Acoustics; 4th Ed. John Wiley, Asia*
4. *Halliday, Resnick & Krane :Physics , 5th Ed. John Wiley (Asia)*
5. *B. K. Mathur : A Text Book of Optics , Gopal Printing press, Kanpur*
6. *E. Hecht: Optics,. 4th Ed., Person Education Asia*
7. *Jenkins & White :Fundamentals of Optics - 4th Ed, Mc Graw Hill.*
8. *Hayt, Kemmerly & Durbin : Engineering circuit analysis, 6th Ed., Tata Mc Graw Hill*
9. *Robert Boylestad : Introductory Circuit Analysis , 8th Edn ; Prentice Hall*
10. *Khanna & Gulati : Fundamentals of Optics (1994) , S Chand &Co*
11. *Anuradha De: Optical fibre and laser, New AgePublications*
12. *C L Arora: Optics, S Chand & Co*

Semester-III G501.3P: Practical-III	
Course Outcomes	
CO-1.	Analyze the devices based on interference and diffraction phenomena used in telecommunication and in optical fiber communication systems.
CO-2.	Interpret and determine the refractive index of various materials used in measuring instruments.

1. Damped oscillations of a simple pendulum
2. Helmholtz resonator
3. Diffraction grating - minimum deviation.
4. Diffraction at a straight wire.
5. Dispersive power of a grating
6. Resolving power of a grating
7. Newton's rings
8. Frequency of ac using sonometer
9. Network theorems
10. Air wedg

Semester-III G 501.3E (Open Elective): Basic Instrumentation Skills	
Course Outcomes	
CO-1.	Gain the necessary knowledge on accuracy, precision, resolution, range and errors in measurements.
CO-2.	Acquire hands-on skills in usage of oscilloscopes, multimeters, rectifiers, amplifiers, oscillators, LCR meters and high voltage probes.

Theory: 30 Lectures Credit : 01

Objectives:

This course is to get exposure with various aspects of instruments and their usage through hands-on mode. Experiments listed below are to be done in continuation of the topics.

Unit 1: Basics of Measurement

Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. (4 Lectures)

Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter, specifications and their significance. (4 Lectures)

Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance. Qualitative treatment. (6 Lectures)

Use of CRO for the measurement of voltage dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working. (3 Lectures)

Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function

generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis. (4 Lectures)

Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges. (3 Lectures)

Digital Instruments: Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter. (3 Lectures)

Demonstration experiments and hands on experience

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co
2. Performance and design of AC machines - M G Say ELBS Edn.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Logic circuit design, Shimon P. Vingron, 2012, Springer.
5. Digital Electronics, SubrataGhoshal, 2012, Cengage Learning.
6. Electronic Devices and circuits, S. Salivahanan& N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
7. Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk 2008, Springer
8. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

Pattern of Question paper

Part A

Six short answer type questions out of which five are to be answered. Each questions carries two marks

5 x 2 =10 marks

Part B

Three questions of out of five each carrying 10 marks

3 x 10 = 30 marks

Part C

Two numerical problems to be answered out of Four each problem carrying Five marks

2 x 5 = 10 marks

Total 50 marks

In part B each main question must have two sub divisions (a) and (b) for 6 marks and 4 marks respectively

Semester-IV G501.4: Electromagnetism, Electricity-II and Electronics-I	
Course Outcomes	
CO-1.	Gain knowledge about Scalar and Vector fields
CO-2.	Set up the Maxwells wave equation in free space and material media.
CO-3.	Understand representation of Alternating Currents through phasors, Frequency response of Electrical filters, Modes of Power Transmission and applications of p-n diode.
CO-4.	Understand working principle of Transistors and design of Transistor Biasing Circuits.

UNIT I (17 Hrs.) Electromagnetism:

Scalar and Vector Fields : Scalar and vector fields with examples. Gradient of a scalar function. Relation between field and potential. Divergence and curl of a vector. Gauss and Stoke's theorems. (Problems) 6 Hrs

Electromagnetic Theory : Equation of continuity - setting up of Maxwell's field equations - concept of displacement current. Field equations in a medium - wave equations for field vectors and deduction of the expression for velocity. Relation between refractive index and permittivity. Poynting's vector and its significance. Propagation of electromagnetic waves in a transparent medium. Properties of electromagnetic waves. Distinction between normal and anomalous dispersion. Mention of Cauchy's formula. (Problems).

11 Hrs

UNIT II (17 Hrs.) Electricity II:

Alternating Currents : Concept of phasor, RMS values of voltage and currents, power in AC circuits , power factor, Response of series LCR circuit to sinusoidal voltages using phasor. Graphical study –mention of expression for Q factor. Parallel LCR circuit - graphical study of frequency response - resonance - half power frequency and band width. (Problems) 6 hrs

Filters : High pass and low pass filters using CR circuits – frequency response curves, cutoff frequency. Band pass and band stop filters - qualitative. (Problems) 3 Hrs

p-n diode applications : p-n junction and its characteristics. Rectification. Half-wave, full-wave and bridge rectifiers. Expressions for efficiency, ripple factor and voltage regulation of half-wave and bridge rectifiers (derivation). Action of filters. (i) capacitor input (ii) inductor input (iii) LC filter and (vi) π-filter(qualitative) 6 Hrs

Power Transmission : Principle of three phase power generation and transmission - Its advantages. Star and delta connections. Line and phase voltage - line and phase current, relation between them. (Problems) 2 Hrs

UNIT III (17 Hrs.) Electronics I :

Transistors : Transistor - Introduction. Action of n-p-n transistor, Modes of transistor connection. CE Characteristics. Definition of α and β, relation between them, h-parameter equivalent circuit for CE configuration, Field effect transistor – construction of n-channel FET, characteristics, comparison with bipolar junction transistor. MOSFET – enhancement and depletion type- construction (qualitative) (Problems) 13 Hrs

Transistor circuits : Biasing of a transistor – fixed bias, emitter bias, collector feedback bias and voltage divider bias. DC load line. (Problems) 4 Hrs

TEXT BOOKS:

1. Brijlal & Subrahmanyam :Electricity and electronics, Ratan Prakashan Mandir
2. Boylested & Nashelsky: .Electronic Devices & Circuits, 8th Ed. Prentice Hall
3. R Murugeshan : Electricity and Magnetism , S Chand & Co., New Delhi
4. David Griffiths*: Introduction to Electrodynamics Prentice Hall of India*

REFERENCE BOOKS :

1. *Mathew N O,Sadiku :Elements of Electromagnetics 3rd Edn,Oxford University Press (India)*
2. *F T Ulaby :Fundamentals of Applied Electromagnetics Prentice Hall of India*
3. *Guru and Hiziroglu :Electromagnetic Field Theory Fundamentals , Thomson Asia Pvt Ltd*
4. *Floyd :Electronic Device, 6th Edn, Pearson Education, Asia.*
5. *C L Arora, Magnetism, Electrostatics, Electricity and Modern Physics –*
6. *Premier Publishing Company, Delhi*

Semester-IV G501.4P: Practical-IV	
Course Outcomes	
CO-1.	Understand theoretical principles behind electrical networks and grids.
CO-2.	Acquire the working knowledge of electrical devices such as ammeter voltmeter, oscillator and oscilloscopes.

1. Airey's disc and grating constant using laser
2. Diffraction at a thin wire – determination of diameter
3. de Sauty bridge – law of combination of capacitors
4. Series and parallel LCR circuit
5. Phasor diagram
6. Self inductance by Anderson's bridge
7. Low pass and high pass filters
8. Transistor characteristics (CE)
9. Bridge rectifier
10. p-n diode characteristics

Semester-IV G501.4E (Open Elective): Renewable Energy and Energy harvesting (Credits: 01) Theory: 30 Lectures	
Course Outcomes	
CO-1.	Define basic properties of renewable energy sources.
CO-2.	Decide on the viability of a given energy harvesting technology in any given environment.
CO-3.	Acquire knowledge of energy storing systems.
CO-4.	Realize the environmental impact of renewable energy harvesting technologies.

Course objectives:

1. To draw attention towards and develop an understanding about available renewable energy resources.
2. Impart basic theoretical knowledge.
3. Provide hands-on learning on renewable energy harvesting.

Course outcomes:

On successful completion of the course the student must be in a position to :

1. Define basic properties of renewable energy sources.
2. Decide on the viability of a given energy harvesting technology in any given environment.
3. Acquire knowledge of energy storing systems.
4. Realise the environmental impact of renewable energy harvesting technologies.

Fossil fuels and Alternate Sources of energy: Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity. **(3 Lectures)**

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems. **(6 Lectures)**

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. **(3 Lectures)**

Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. **(3 Lectures)**

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass. **(2 Lectures)**

Geothermal Energy: Geothermal Resources, Geothermal Technologies. **(2 Lectures)**

Hydro Energy: Hydropower technologies, environmental impact of hydro power sources. **(2 Lectures)**

Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials, modelling piezoelectric generators, piezoelectric energy harvesting applications **(4 Lectures)**

Electromagnetic Energy Harvesting: Linear generators, recent applications **(2 Lectures)**

Carbon captured technologies, cell, batteries, power consumption **(2 Lectures)**

Environmental issues and Renewable energy sources, sustainability. **(1 Lecture)**

Demonstrations and Experiments

1. Field Visit/ Industrial Visit
2. Demonstration of Training modules on Solar energy, wind energy, etc.
3. Conversion of vibration to voltage using piezoelectric materials
4. Conversion of thermal energy into voltage using thermoelectric modules.

Reference Books:

Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi

- Solar energy - M P Agarwal - S Chand and Co. Ltd.
- Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
- Godfrey Boyle, “Renewable Energy, Power for a sustainable future”, 2004,
- Oxford University Press, in association with The Open University. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
- J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
- http://en.wikipedia.org/wiki/Renewable_energy

Semester-V G501.5a: Atomic Physics	
Course Outcomes	
CO-1.	Understand Atoms. Various Models, and Atomic Spectra
CO-2.	Interpret the Wave properties of Particles
CO-3.	Comprehend Schrodinger equation and its applications in the case of 1-D and 3-D potential well
CO-4.	Analyze Electron spectra, Molecular Spectra, coherent and incoherent scattering.

UNIT I (12 Hrs.) Atomic spectra:

Atomic Spectra : Review of atom models, vector atom model, space quantization, quantum numbers l and m_l. Electron spin - quantum numbers s and m_s. Pauli's exclusion principle. Spectroscopic notation of energy levels of single and two electron system. L - S and j - j coupling schemes. Magnetic moment due to orbital motion. Magnetic moment due to spin. Total magnetic moment. Stern - Gerlach experiment - experimental procedure and interpretation of result. Spin-orbit coupling. Expression for the spin orbit interaction energy (qualitative). Fine structure. Separation of sodium lines. Normal Zeeman effect, expression

for Zeeman shift (on the basis of vector atom model), Anomalous Zeeman effect (qualitative). (Problems) 13 Hrs

UNIT II (17 Hrs.) Quantum mechanics

Wave properties of particles : de Broglie waves, Experimental verification by Davisson and Germer. Phase and group velocity of waves. Uncertainty principle, γ - ray microscope. Three sets of uncertainty relations. Application of uncertainty relation - estimation of width of spectral lines, impossibility of the existence of electrons inside the nucleus. (Problems) 6Hrs

Schrodinger equation : Wave function in complex form, properties of wave function. Normalization of wave functions Setting up of time dependent Schrodinger wave equation. Probability current, Expectation value. Operators for linear momentum and total energy. To arrive at the time independent (steady state) Schrodinger wave equation. Eigen values and eigen functions. Solution of Schrodinger equation for a particle in a box of infinite barrier. Graphs of ψ and $|\psi|^2$. Extension to three dimensional box. Degeneracy. Expression for energy of linear harmonic oscillator (solution to be assumed), zero point energy. (Problems) 7Hrs

UNIT III (12 Hrs) Electron, Molecular spectra and Scattering:

Electron : Determination of e/m of electron by Thomson's method, determination of charge of electron by Millikan's oil drop method. (Problems) 3 Hrs

Molecular Spectra : Different regions of molecular spectra. Theory of pure rotational Spectra of diatomic molecules. Theory of Vibration - Rotational spectra of diatomic molecules. Application of molecular spectra. (Problems) 5 hrs

Scattering: Coherent and incoherent scattering. Rayleigh scattering. Blue colour of the sky. Raman effect. Quantum theory of Raman effect, experimental arrangement, Characteristic properties of Raman lines. Intensity, depolarisation ratio of Raman lines. Applications of Raman effect. Compton effect - expression for Compton shift. (Problems) 5 Hrs

TEXT BOOKS:

1. *R.Murugeshan & Kiruthiga Shivaprasath : Modern Physics, S Chand & Co*

2. *Gupta, Kumar & Sharma: Quantum Mechanics, Jaiprakashnath & Co*
3. *Arthur Beiser : Perspectives of Modern Physics, McGraw-Hill Book Co*

REFERENCE BOOKS :

1. *Beiser : Concepts of Modern Physics , 6th Ed., Tata Mc Graw Hill*
2. *Bernstein, Fishbane and Gasirowicz :Modern Physics, Pearson Education Asia.*
3. *Semat and Albright : Introduction to atomic and nuclear physics ,5th Ed. , Chapman and Hall.*
4. *Kenneth S Krane :Modern Physics , Joh Wiley (Asia)*
5. *Banwell :Fundamentals of Molecular spectroscopy , 4th Ed., Tata Mc Graw Hill*
6. *Bransden :Physics of Atoms & Molecules, 2nd Ed. Pearson Education (Asia)*
7. *Eisberg and Resnick :Quantum Physics of atoms, molecules, solids, Nuclei and particles, 2nd Ed. John Wiley Asia*
8. *A P French :Quantum Physics , Thomas Nelson and Sons*
9. *E Wichman :Quantum Physics, Berkeley Physics Course Vol. IV ; Mc Graw Hill*
10. *Gasorovicz :Quntum Physics , John Willey Asia*
11. *Haken and Wolf :The Physics of Atoms and Quanta, 6th Ed. Springer*
12. *Singh,Bagde & singh, Quantum mechanics, S Chand and co, New Delhi.*
13. *S N Ghoshal: Atomic Physics, S Chand & Co*

Semester-V **G501.5b: Solid State Physics**	
Course Outcomes	
CO-1.	Understand the principles of Statistical Physics and apply it to understand the physical properties of bulk materials
CO-2.	Get acquainted with the Classical theory of Metals, Quantum theory of Metals and understand the origin of band theory of solids.
CO-3.	Familiarize with General properties of crystals, non crystalline solids, X-ray Crystallography
CO-4.	Explain the origin of Magnetic and Dielectric properties of various materials.

UNIT I (12 Hrs.) Thermal properties:

Statistical Physics : Statistical ideas in Physics, Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics, MB statistics as the classical limit of BE and FD statistics. Boltzmann tail. 3hrs

Specific Heat of Solids : Molar specific heat, Dulong - Petit law, its limitations, Einstein's theory of specific heat at low and high temperatures, its limitations, Debye's theory of specific heat at low and high temperatures assuming the modes of vibration in the frequency interval ν and ν + dν , its limitations, comparison of Einstein's and Debye's theories (Problems) 7 Hrs

Thermal conductivity : Introduction ,thermal conductivity of insulators. Primary scattering mechanisms- (i) phonon-phonon interactions, (ii) scattering by imperfections and boundary scattering. Lee and Charlton's method to determine K of bad conductor. 3 Hrs

Unit II (12 Hrs.) Electrical properties

Classical theory of metals : Lorentz - Drude model. Explanation of electrical resistance. Expression for electrical conductivity. Deduction of Ohm's law, limitations of classical theory. (Problems) 3Hrs

Quantum theory of metals: Fermi energy - expression for Fermi energy and average energy of electrons at absolute zero. Mention of expressions above absolute zero. Hall Effect, expression for Hall coefficient and its significance. Measurement of Hall coefficient. (Problems) 5Hrs

Band theory of solids : Band formation in solids, classification of solids - metals, insulators and semiconductors. Intrinsic semiconductors – Fermi level, expression for conductivity of intrinsic semiconductors, variation of resistance with temperature, Extrinsic semiconductors, donor and acceptor levels, variation of electrical conductivity of extrinsic semiconductors. (Problems) 5Hrs

UNIT III (13 Hrs.) General properties

Crystals : Definition of a lattice, unit cell, seven crystal systems. Miller indices. Simple cubic, bcc and fcc crystals with examples. (problems) 2Hrs

Non-crystalline solids : Introduction to glassy materials. Glass transition temperature. Types of glasses. Qualitative discussion of properties of glasses – electrical conductivity, thermal conductivity and specific heat. 2 Hrs

X-ray Crystallography : Introduction to X-rays. Continuous and characteristic X-ray spectra, Mosley's law. Mention of X-ray diffraction pattern for simple cubic, bcc and fcc crystals. Bragg's law. Bragg's spectrometer. (Problems) 3 Hrs

Magnetic materials : Elementary ideas. Origin of atomic magnetism in materials, classification – diamagnetic, paramagnetic and ferromagnetic materials. Domain theory of ferromagnetism. Ferri-magnetism. B – H Curve. Applications of magnetic materials. (Problems) 3 Hrs

Dielectrics materials : Introduction, dielectric polarization, polar and non-polar dielectrics. Electric polarization P and dielectric susceptibility χ, derivation of relation between P , χ and ε_r. (Problems). 2 Hrs

TEXT BOOKS:

1. *Ali Omer : Elementary solid Physics , Pearson Education Asia.*
2. *S. O Pillai : Solid State Physics , New Age international*
3. *Alonso Finn: University Physics, Pearson Education Ltd(England)*

REFERENCE BOOKS :

1. *C Kittel: Introduction to solid Physics, 7^{th} Edn; Joh Wiley (Asia).*
2. *Bernstein, Fishbane & Gasiorowicz :;Modern Physics , Pearson Education Asia.*
3. *H P Myers : Introductory solid state Physics , Viva books.*
4. *H C Gupta :Solid State Physics , Vikas Publishing House.*
5. *Ibac & Luth :Solid State Physics , 2^{nd} Ed. Springer international.*
6. *Bransden :Physics of Atoms and Molecules , 2^{nd} Ed. Pearson Education Asia.*
7. *W D Callister : Materials Science and Enginerring , 5^{th} Ed. John Wiley Asia.*
8. *Cullity & Stock : Elements of X-ray Diffraction , Prentice Hall.*

Semester-V G501.5P: Practical V	
Course Outcomes	
CO-1.	Confirm the theoretical observation with the experimental values.

1. Fermi energy of a metal
2. Band pass and band stop filters
3. Zener regulator
4. Dielectric constant of a solid
5. Verification of Curie – Weiss law
6. Planck's constant using LED
7. Specific charge of an electron
8. Phase shift oscillator
9. Reflection grating using laser
10. Characteristics of G M counter and mass attenuation constant

Semester-VI G501.6a: Nuclear Physics and Analog Electronics	
Course Outcomes	
CO-1.	Understand Nuclear Decay and spectra of nuclear radiation, scattering from nucleus and knowing nuclear structure
CO-2.	Familiarize Artificial Transmutation of Elements, Nuclear Fission and Fusion, Radiation Hazards.
CO-3.	understand working principle of particle accelerators and detectors and their applications.
CO-4	Design and understand the working of Transistor Amplifiers, oscillators, Operational Amplifiers and its applications.

Unit I (13 Hrs.) Radioactivity and Nuclear structure:

Nuclear Decay and spectra of nuclear radiation : Successive disintegration Radioactive equilibrium (transient and secular). Radioactive dating. Alpha decay, empirical relation between range and velocity, range and energy, Geiger - Nuttal relation. Beta ray spectra, Neutrino hypothesis, three types of beta decay. Gamma ray emission. (Problems) 5Hrs

Nuclear Structure : Distance of closest approach, Rutherford's alpha scattering formula (assuming expression for impact parameter). Dempster's mass spectrograph.
Characteristics of nuclear forces, Yukawa's theory, Liquid drop model, semi-empirical mass formula. (Problems). 4 Hrs

Cosmic rays : Primary and secondary cosmic rays – composition. Cosmic ray showers. Van Allen radiation belts. 1 Hr

Particle Physics : Particles and antiparticles. Qualitative discussion of Dirac's theory. Conservation laws. Classification of fundamental particles. Basic interactions in nature, their strengths, ranges and quanta exchanged. Quark model. 2 Hrs

UNIT II (13 Hrs.) Nuclear reactions

Artificial transmutation of elements : Q value of nuclear reaction. Threshold energy for endoergic reaction. Types of nuclear reactions. Transuranic elements. Cross section for nuclear reaction. Properties of the neutron. Detection of neutrons, Radioisotopes and applications. (Problems) 4 Hrs

Nuclear Fission and Fusion : Nuclear fission-chain reaction. Thermal reactors - Four factor formula for thermal reactors and condition for criticality. Thermo nuclear reactions. Plasma and magnetic bottle. (Problems) 3Hrs

Radiation Hazards : Radiation level. Sources of radiations . Protection and prevention techniques. 1 Hr

Particle accelerators and detectors : Linear accelerator, Cyclotron and Betatron. GM Counter, Principle of semiconductor detector.(Problems) 5 Hrs

UNIT III (13 Hrs.) Analog Electronics:

Amplifiers : Small signal CE amplifier – expression for gain, input and output resistances using small signal h – parameter model. Frequency response of CE amplifier. Qualitative discussion of CB and CC amplifiers. Comparison of the three types of amplifiers. (Problems) 5 Hrs

Operational Amplifiers : Concept of an ideal amplifier. Op-amp characteristics (IC 741), applications – inverting, non-inverting and difference amplifiers. Derivation of expression for voltage gain. Adders. Buffer amplifier. (Problems) 4 Hrs

Oscillators : Block diagram for feed back network, positive feedback. Barkhausen criterion for oscillations in electronic circuits. Classification of oscillators. RC phase shift oscillator using transistor. Wein bridge oscillator using op-amp - expression for the frequency of oscillation. (Problems) 4Hrs

TEXT BOOKS :

1. R.Murugeshan & Kiruthiga Shivaprasath : Modern Physics, S Chand & Co
2. R A Gayakwad : Opamps & Linear Integrated Circuits , 3rd Ed. Prentice Hall of India.

REFERENCE BOOKS :

1. Beiser :Concepts of Modern Physics; 6th Ed. Tata Mc Graw Hill.
2. Fishbane, Gasirowicz :Modern Physics - Bernstein,; Pearson Education Asia.
3. K S Krane :Modern Physics , John Wiley Asia.
4. K S Krane: Introductory Nuclear Physics, John Wiley.
5. Semat & Albright: Introduction to atomic & nuclear Physics , 5th Ed. Chapman & Hall.
6. Eisberg & Resnick :Quantum Physics of atoms, molecules, solid, nuclei & particles , 2nd Ed. John Wiley Asia.
7. Irving Kaplan :Nuclear Physics , John Wiley.
8. Boylested & Nashelsky :Electronic Devices & Circuits , 8th Ed. Prentice Hall of India.

9. Floyd :Electronic Device , 6th Ed. Pearson Education, Asia.
10. R F Coughlin and F F Driscoll :Operational Amplifiers and Linear Integrated
11. Circuits , 6th Ed. Pearson Education Asia.
12. David A Bell: Operational Amplifiers and Linear Ics , 2nd Ed. Prentice Hall of India.

PAPER : G501.6b COMMUNICATION AND DIGITAL ELECTRONICS, SPECIAL PROPERTIES OF MATERIALS

G501.6b: Communication and Digital Electronics and, Special properties of materials	
Course Outcomes	
CO-1.	Understand the fundamental concepts of modulation and demodulation, working of transmitter and receivers, comprehend the basic concept of TV communication.
CO-2.	Understand the basics of Boolean Algebra and gainknowledge about designing of arithmetic logic and sequential circuits.
CO-3.	Design flip flops, registers and counters.
CO-4.	Comprehend the importance of superconductors, nano materials and nonlinear optical materials, understand the principles and discuss their applications

UNIT I (13 Hrs.) Communication Electronics :

Modulation : Need for modulation - amplitude modulation**,** mention of expressions for AM and power relations. SSB transmission, advantages of SSB transmission in AM. Qualitative

discussion of FM. Comparison of AM and FM systems. Pulse modulation- introduction to different types (qualitative) (Problems). 6 Hrs

Transmitters and Receivers : Block diagram of AM and FM transmitters. Receiver characteristics – sensitivity, selectivity, stability, fidelity and signal to noise ratio. Superheterodyne receiver for AM and FM (Block diagram) 5 Hrs

Television : CRT, CRO. Scanning principle – progressive and interlaced. Basics of colour mixing. 2Hrs

Unit II (13 Hrs.) Digital Electronics :

Boolean algebra : Logic gates - basic gates NOT, OR and AND using discrete components . Truth table, Boolean theorems, de-Morgan's theorem, simplification of Boolean expressions using Boolean algebra, Realization of basic gates and XOR gate using NAND & NOR gates. Half adder and Full adder circuits. (Problems) 5 Hrs

Sequential logic circuits : Introduction to flip-flops. RS, D , JK & M/S flip-flops. Serial shift register using D flip-flops. Asynchronous binary counters using JK flip-flops. Working of a decade counter. 7-segment display – common anode and common cathode. (Qualitative). 8hrs

Unit III (13 Hrs.) Special properties of materials

Superconductivity : Elementary ideas. Experimental facts - transition temperature, critical field, critical current, isotope effect and Meissner effect. Type I and type II superconductors. High temperature superconductivity. Application of superconductivity. (Problems) 5hrs

Nano-materials : Nano scale systems – zero dimensional, one dimensional and two dimensional systems, introduction to physical, chemical and biological nano scale systems, hybrid nano scale system. Nano devices – nano tubes, nano films and quantum dot. Nano composite materials 4 Hrs

Nonlinear Optics : Introduction, wave propagation in an anisotropic crystal, nonlinear polarization, second harmonic generation, phase matching, sum and difference frequency generation. 4 Hrs

TEXT BOOKS:

1. *Floyd, Digital Fundamentals, 8th Ed. Pearson Educational Asia.*

2. Kennedy and Davis: Electronic Communications, 4th Ed,. Tata MC Graw Hill.

3. B.B.Laud : Lasers and Nonlinear Optics, 2nd Ed.,Wiley Pub. New York.

REFERENCE BOOKS :

1 *Morris Mano: Digital Design,: 3rd Ed., Prentice Hall of India.*

2. R Tocci :Digital System , 8th Ed., Pearson Educational Asia.

3. Miller & Beasley :Electronic Communication , 6th Ed. ,Prentice Hall of India.

4. S P Basavaraju: Detailed text book of Engineering Physics , Subhas Stores, Books corner, Bangalore

5. Arthur Beiser :Concepts of Modern Physics, 5th Ed,. Tata Mc Graw Hill

6. Fishbane, Gasirowicz :Modern Physics - Bernstein; Pearson Education Asia.

7. K S Krane: Modern Physics , John Wiley Asia.

8. R.Murugeshan & Kiruthiga Shivaprasath : Modern Physics, S Chand & Co

9. Subramaniam,Brijlal & Avadhanulu :Optics , New edition, S Chand and Co,

10. Nanowork: C N R Rao

G501.6P: Practical VI	
Course Outcomes	
CO-1.	Understand the diode and transistor characteristics.
CO-2.	Design and construct oscillators and amplifier circuits using Op-amp.
CO-3	Determine the energy gap of thermistor and Germanium & Silicon diodes.

1. Inverting and non-inverting amplifier using op-amp
2. Wein bridge oscillator using opamp 741 IC
3. Logic gates- OR, AND, NOT , NAND & NOR gates
4. CE amplifier
5. Astable multivibrator
6. Verification of inverse square law using G M counter
7. Energy gap of a forward biased diode
8. Energy gap of an intrinsic semiconductor
9. Study of AM wave

10. Michelson interferometer

PATTERN OF QUESTION PAPER

PART – A

12 short answer type questions with 4 questions selected from each unit , out of which 10 are to be answered .Each question carries 2 marks

10 x 2 = **20 marks**

PART- B

Main questions from UNIT I	Answer 2 out of 3	**20 marks**
Main questions from UNIT II	Answer 2 out of 3	**20 marks**
Main questions from UNIT III	Answer 2 out of 3	**20 marks**

3 x 20 = **60 marks**

PART - C

6 problems with at least 1 problem from each unit, out of which 4 are to be answered

Each problem carries 5 marks.	4 x 5 =	**20 marks**
	Total:	**100 marks**

In PART – B , Each main question must have two sub divisions (a) and (b) for 6 marks and 4 marks respectively.

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