

	S.R.R. & C.V.R. GOVT. DEGREE COLLEGE (A) VIJAYAWADA, N.T.R. DIST. (NAAC Accredited with 'A' Grade) AFFILIATED TO KRISHNA UNIVERSITY, MACHILIPATNAM Department of PHYSICS & ELECTRONICS ACADEMIC YEAR 2024-25
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Composition of the Board of Studies (BoS) of PHYSICS as Per UGC Guidelines

Members of Board of studies

Members of the Board of Studies of Department of Physics met on 30 -04-2024 at 3.00 PMin the Department of Physics & Electronics staff room.

S.No	Name of the faculty	Designation
1	Smt.P.Sailaja,Assoc.Prof.of Electronics SRR & CVR GDC (A),Vijayawada	Board of studies chairperson
2	Prof. M.Rami Reddy, Registrar, Krishna University, Machilipatnam	University Nominee
3	K.Ajay Kumar,Asst.Prof.of Physics GDC, Eluru, Eluru Dt. Mob:9493474612	Subject Expert
4	Dr.P.Gopi Krishna,Asst. Professor, Dept of ECM K.L.Education Foundation,Vaddeswaram, Guntur.	Subject Expert
5	N. Vara Prasad, CEO, ARETE IT Services Pvt. Ltd Mob:8885591199	Industrialist
6	T. Poojitha, M.Sc – Physics Alumni member, Mob: 7799467493	Alumni
7.	1. Dr. B. Nagamani,Asst.Prof.of Physics 2. Smt. T.V.Vakula Priya, Ast.Prof.of Physics 3. Dr.J.Nageswara Rao ,Asst.Prof.of Physics 4. Dr.T.Devender Reddy, Asst.Prof.of Physics 5. Dr. Asirvadam, Asst.Prof.of Physics 6. Sri G.V.Gangadhara Rao, Asst.Prof.of Physics	Members of the Department
8.	1. P. Durga Dinesh 2. Geetha Kumari	Students



S.R.R. & C.V.R. GOVT. DEGREE COLLEGE (A)

VIJAYAWADA, N.T.R. DT.

(NAAC Accredited with 'A' Grade)

AFFILIATED TO KRISHNA UNIVERSITY, MACHILIPATNAM

Department of PHYSICS & ELECTRONICS

ACADEMIC YEAR 2024-25

Members of the Board of Studies of Department of Physics met on 30 -04-2024 at 3.00 PM in the Department of Physics & Electronics staff room Under chairmanship of Smt. P. Sailaja, In charge of the Department, with the following agenda.

AGENDA:

1. Review of minutes of BOS.
2. To apprise and approve Departmental Vision and mission.
3. To discuss and approve curriculum structure suggested by APSCHE and from feedback of students and different stakeholders with modifications not exceeding 20% on demand of local needs and to be implemented from the year 2021-22.
4. To approve blue print and Model Question paper for theory and practical examinations.
5. Review of evaluation of Internal and External Examinations.
6. To Suggest Methodologies and innovative teaching practices.
7. To discuss and approve panel of Examiners.
8. To suggest and approve student study projects, Extension activities curricular, co-curricular activities and to discuss about certificate course - Hardware and Networking.
9. Any other with the permission of the chairman.

Programme: B.Sc. Honours in Physics (Major)

w.e.f.AY2024-25

COURSESTRUCTURE

Year	Semester	Course	Title of the Course	No. of Hours/Week	No. of Credits
II	III	5	Optics	3	3
			Optics Practical Course	2	1
		6	Heat and Thermodynamics	3	3
			Heat and Thermodynamics Practical Course	2	1
		7	Electronic Devices and Circuits	3	3
			Electronic Devices and Circuits Practical Course	2	1
		8	Analog and Digital Electronics	3	3
			Analog and Digital Electronics Practical course	2	1
	IV	9	Electricity and Magnetism	3	3
			Electricity and Magnetism Practical Course	2	1
		10	Modern Physics	3	3
			Modern Physics Practical Course	2	1
		11	Introduction to Nuclear and Particle Course	3	3
			Introduction to Nuclear and Particle	2	1
			Physics Practical Course		
	IV	Multi-Disciplinary Course	Introduction to Nano technology	2	2

SEMESTER-III COURSE 5: OPTICS

Theory

Credits: 3

3 hrs/week

COURSE OBJECTIVE:

1. The course on Optics is to provide students with a fundamental understanding of the behavior and properties of light
2. The course on Optics is to provide students understanding of interaction of light with matter.

LEARNING OUTCOMES:

On successful completion of this course, the student will be able to:

Explain about the different aberrations in lenses and discuss the methods of minimizing them

Understand the phenomenon of interference of light and its formation in

- (i) Thin films, Newton's rings and Michelson interferometer due to division of amplitude.
- (ii) Distinguish between Fresnel's diffraction and Fraunhofer diffraction and observe the diffraction patterns in the case of single slit and the diffraction grating and to describe the construction and working of zone plate and make the comparison of zone plate with convex lens
- (iii) Explain the various methods of production of plane, circularly and polarized light and their detection and the concept of optical activity.
- (iv) Comprehend the basic principle of laser, the working of He-Ne laser and Ruby lasers and their applications in different fields. To understand the basic principles of fiber optic communication and explore the field of Holography and Nonlinear optics and their applications.

UNIT-I ABERRATIONS

Introduction – monochromatic aberrations, spherical aberration, methods of minimizing spherical aberration, coma, astigmatism and curvature of field, distortion. Chromatic aberration-the achromatic doublet. Achromatism for two lenses (i) in contact and (ii) separated by a distance.

UNIT-II INTERFERENCE

Principle of superposition – coherence Conditions for interference of light. Fresnel's biprism determination of wavelength of light –change of phase on reflection-colors of thin films- - Determination of wavelength of monochromatic light using Newton's rings - Michelson Interferometer.

UNIT-III DIFFRACTION

Introduction, distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction – Fraunhofer diffraction pattern with N slits (diffraction grating). Resolving power of grating, Determination of wavelength of light in normal incidence using diffraction grating. Fresnel's half period zones -zone plate-comparison of zone plate with convex lens-difference between interference and diffraction.

UNIT-IV POLARISATION

Polarized light: methods of polarization by reflection, refraction, double refraction, Brewster's law-Mauls law-Nicol prism polarizer and analyzer, Quarter wave plate, Half wave plate- Idea of elliptical and circular polarization

UNIT-V LASERS AND HOLOGRAPHY

Lasers: introduction, spontaneous emission, stimulated emission. Population Inversion, Laser principle- Einstein Coefficients-Types of lasers-He-Ne laser, Ruby laser- Applications of lasers. Holography: Basic principle of holography-Gabor hologram and its limitations, Applications of holography.

REFERENCE BOOKS:

- BSc Physics, Vol .2, Telugu Academy, Hyderabad
- A Text Book of Optics-N Subramanyam, L Brijlal, S. Chand & Co.
- Unified Physics Vol. II Optics & Thermodynamics – Jai Prakash Nath & Co. Ltd., Meerut
- Optics, F.A. Jenkins and H.G. White, Mc Graw-Hill
- Optics, Ajay Ghatak, Tata Mc Graw-Hill.
- Introduction of Lasers – Avadhanulu, S. Chand & Co.
- Principles of Optics- BK Mathur, Gopala Printing Press, 1995

SEMESTER-III COURSE 5: OPTICS

Practical

Credits: 1

2hrs/week

COURSE OBJECTIVE:

1. To develop practical skills in the use of laboratory equipment and experimental techniques for studying light and its interactions with matter.

LEARNING OUTCOMES:

1. Mastery of experimental techniques: Students should become proficient in using laboratory equipment and experimental techniques for studying light and its interactions with matter.
2. Application of theory to practice: Students should be able to apply theoretical concepts learned in lectures to real-world situations, and understand the limitations of theoretical models.
3. Accurate recording and analysis of data: Students should be able to accurately record and analyze experimental data, including understanding the significance of error analysis and statistical methods.
4. Critical thinking and problem solving: Students should be able to identify sources of error, troubleshoot experimental problems, and develop critical thinking skills in experimental design and analysis.
5. Understanding of physical principles: Students should develop an understanding of the physical principles governing optics, including reflection, refraction, diffraction, interference, and polarization.

Minimum of 6 experiments to be done and recorded

1. Determination of radius of curvature of a given convex lens-Newton's rings.
2. Resolving power of grating.
3. Dispersive power of a prism.
4. Determination of wavelength of light using diffraction grating-minimum deviation method.
5. Determination of wavelength of light using diffraction grating-normal incidence method.
6. Determination of wavelength of laser light using diffraction grating.
7. Resolving power of a telescope.
8. Refractive index of a liquid-hallow prism
9. Determination of thickness of a thin wire by wedge method
10. Determination of refractive index of liquid-Boy's method.

STUDENT ACTIVITIES

Suggested student activities

UNIT-I Aberrations:

Ask students to observe and sketch the different images produced by the lens at different distances. Build a simple optical system with two lenses in contact and ask students to calculate the focal length and magnification of the system. Then, introduce a thin glass plate between the lenses to simulate the effects of chromatic aberration and ask students to observe and discuss the changes in the image produced.

UNIT-II Interference:

Ask students to measure the diameter of the central bright spot and the diameter of the n th ring for different values of n , and then calculate the wavelength of light.

UNIT-III Diffraction:

Build a simple diffraction grating using a piece of cardboard and some sewing needles. Ask students to measure the distance between the needles, count the number of lines per unit length, and then calculate the grating spacing and the wavelength of light.

UNIT-IV Polarization:

Ask students to measure the angle of rotation of the polarized light before and after passing through the sample, and then calculate the specific rotation of the sample.

UNIT-V Lasers and Holography:

Demonstrate the principle of holography using a laser beam, a beam splitter, and a photographic plate. Ask students to record a hologram of a simple object and then reconstruct the image using a laser beam.

SEMESTER-III
COURSE 5: OPTICS

Theory

Credits: 3

3 hours/week

COURSE1:BLUEPRINT

Unit	Essayanswerquestions	Short answerqu estions	Numericalp roblem
Unit I	2(with internal choice)	2	0
Unit II	2(with internalchoice)	1	1
Unit III	2(with internal choice)	2	0
Unit IV	2(with internalchoice)	1	1
Unit V	2(with internalchoice)	2	0

SRR & CVR GOVT DEGREE COLLEGE (A), VIJAYAWADA
SEMESTER-III COURSE 5: OPTICS(2024-25)
QUESTION BANK

Theory

Credits: 3

3hrs/week

UNIT-I ABERRATIONS

Long Answer Questions:

1. What is spherical aberration? Explain methods to minimize spherical aberration?
2. Explain chromatic aberration? Derive conditions for achromatism (minimization of chromatic aberration).

Short answer Questions

1. What are aberrations? How they are formed?
2. Write a short note on Distortion.
3. Briefly explain about curvature of field.
4. Write short note on Coma.
5. Explain briefly about astigmatism.

UNIT-II INTERFERENCE

Long Answer Questions:

1. Determine wavelength of light using Fresnel's biprism
2. Describe Newton's rings method for measuring the wavelength of monochromatic light. Give necessary theory.
3. Describe the construction and working of Michelson's interferometer.

Short Answer Questions

1. Discuss coherence conditions for interference of light.
2. What is meant by phase change on reflection?
3. Explain colors of thin films.
4. Distinguish between two types of interference and give examples of each.
5. How do you determine the diameter of thin wire by the wedge-shaped air film?

UNIT-III DIFFRACTION

Long Answer Questions:

1. Explain Fraunhofer diffraction pattern with N slits or plane diffraction grating.
2. Explain Fresnel's half period zones with neat diagram?
3. Explain the construction and working of Zone Plate?

Short Answer Questions

1. Determine the wavelength of light in normal incidence method using diffraction grating.
2. Distinguish between Fresnel and Fraunhofer diffractions
3. Obtain the formula of resolving power of a grating?
4. Compare zone plate with convex lens.

UNIT-IV POLARISATION

Long Answer Questions:

1. Explain various methods for the production of polarized light?
2. Explain the construction and working of Nicol's Prism. How Nicol prism works as a polarizer and an analyzer?
3. Explain the production and detection of circularly and elliptically polarized light?

Short Answer Questions

1. Explain the concept of double refraction?
2. Explain Malus law and Brewster's law?
3. Explain the construction and working of Quarter wave plate?

4. Explain the construction and working of half wave plate?

UNIT-V LASERS AND HOLOGRAPHY

Long Answer Questions:

1. Explain construction and working of Ruby laser with diagram.
2. Explain construction and working of He-Ne laser with diagram.
3. Write various applications of lasers.
4. Write Basic principle of holography. What is Gabor hologram? Write its limitations.

Short Answer Questions:

1. What is LASER? Give its significance.
2. What is concept of population inversion?
3. Write brief note on Einstein Coefficients.
4. Distinguish between spontaneous emission and stimulated emission.
5. Write any four Applications of holography.
6. Write the principle of laser.

SECTION-A

Answer any Five of the following Questions

5X4=20 Marks

1. Write short note on Coma.
2. Explain briefly about astigmatism.
3. In a Newton Ring experiment, the diameter of the 5th ring was 0.3 cm and the diameter of 25th ring was 0.8 cm. If the radius of curvature of the plano convex lens is 100 cm find the wavelength is used.
4. What is meant by phase change on reflection?
5. Distinguish between Fresnel and Fraunhofer diffractions
6. Obtain the formula of resolving power of a grating?
7. Calculate the thickness of a quarter-wave plate made of quartz to be used with sodium light $\lambda = 6000 \text{ \AA}$, $\mu_o = 1.544$ and $\mu_e = 1.553$
8. Explain the construction and working of Quarter wave plate?
9. Distinguish between spontaneous emission and stimulated emission.
10. Write any four Applications of holography.

SECTION-B

Answer all questions

5X8=40 Marks

11. What is spherical aberration? Explain methods to minimize spherical aberration? (or)

Explain chromatic aberration? Derive conditions for achromatism (minimization of chromatic aberration).

12. Describe Newton's rings method for measuring the wavelength of monochromatic light. Give necessary theory. (or)

Describe the construction and working of Michelson's interferometer.

13. Explain Fraunhofer diffraction pattern with N slits or plane diffraction grating. (or)

Explain Fresnel's half period zones with neat diagram?

14. Explain various methods for the production of polarized light? (or)

Explain the construction and working of Nicol's Prism. How Nicol prism works as a polarizer and an analyzer?

15. Explain construction and working of He-Ne laser with diagram. (or)

Write Basic principle of holography. What is Gabor hologram? Write its limitations.

SEMESTER-III
COURSE 6: HEAT AND THERMODYNAMICS

Theory

Credits: 3

3 hours/week

COURSE OBJECTIVE:

The course on Heat and Thermodynamics aims to provide students with a fundamental understanding of the principles of heat and energy transfer and their applications in various fields

LEARNING OUTCOMES:

On successful completion of this course, the student will be able to:

1. Understand the basic aspects of kinetic theory of gases, Maxwell-Boltzmann distribution law, equipartition of energies, mean free path of molecular collisions and the transport phenomenon in ideal gases, estimation of size of the molecule
2. Gain knowledge on the basic concepts of thermodynamics, the first and the second law of thermodynamics, the basic principles of refrigeration, the concept of entropy, the thermodynamic potentials and their physical interpretations. Understand the working of Carnot's ideal heat engine, Carnot cycle and its efficiency
3. Develop critical understanding of concept of Thermodynamic potentials, the formulation of Maxwell's equations and its applications.
4. Differentiate between principles and methods to produce low temperature understand the practical applications of substances at low temperatures and their properties.
5. Examine the nature of black body radiations and the basic theories, Measurement of surface temperature of sun.

UNIT-I: KINETIC THEORY OF GASES:

Kinetic Theory of gases- Introduction, Maxwell's law of distribution of molecular velocities, Mean free path, Principle of equipartition of energy, Transport phenomenon in ideal gases: viscosity and Thermal conductivity. Estimation of the size of molecule.

UNIT-II: THERMODYNAMICS:

Introduction- Reversible and irreversible processes, Carnot's engine and its efficiency, Carnot's theorem, Second law of thermodynamics, Entropy: Physical significance, Change in entropy in reversible and irreversible processes; Temperature Entropy (T-S) diagram and its uses; change of entropy when ice changes into steam.

UNIT-III: THERMODYNAMIC POTENTIALS AND MAXWELL'S EQUATIONS:

Thermodynamic Potentials-Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy and their significance, Derivation of Maxwell's thermodynamic relations from thermodynamic potentials, Clausius - Clapeyron's equation and applications, Expression Joule-Kelvin coefficient for ideal and Van der Waals' gases.

UNIT-IV: LOW TEMPERATURE PHYSICS:

Various methods for producing very low temperatures (Joule expansion, Joule Kelvin effect and Adiabatic expansion), Porous plug experiment, Distinction between adiabatic and Joule Thomson expansion, Expression for Joule Thomson cooling, Production of low temperatures by adiabatic demagnetization (qualitative). Properties of substances at low temperatures.

UNIT-V: QUANTUM THEORY OF RADIATION:

Black body, Spectral energy distribution of black body radiation, Wein's displacement law and Rayleigh Jean's law (No derivations), Planck's law of black body radiation-Derivation, Deduction of Wein's law and Rayleigh- Jean's law from Planck's law, Solar constant and its determination using Angstrom pyro heliometer, Estimation of surface temperature of Sun.

REFERENCE BOOKS

1. BSc Physics, Vol.2, Telugu Akademy, Hyderabad
2. Thermodynamics, R.C. Srivastava, S.K. Saha & Abhay K. Jain, Eastern Economy Edition.
3. Heat and Thermodynamics -N Brij Lal, P Subrahmanyam, S.Chand & Co.,2012
4. Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd, 2000
5. University Physics, HD Young, MW Zemansky, FW Sears, Narosa Publishers, New Delhi

SEMESTER-III

COURSE 6: HEAT AND THERMODYNAMICS

Practical

Credits: 1

2 hours/week

COURSE OBJECTIVE:

The objectives for practical in Heat and Thermodynamics can vary depending on the specific course or program, but here are some general objectives that may apply, to develop practical skills in the use of laboratory equipment and experimental techniques for studying heat and thermodynamics.

LEARNING OUTCOMES:

1. Mastery of experimental techniques: Students should become proficient in using laboratory equipment and experimental techniques for studying heat and thermodynamics.
2. Application of theory to practice: Students should be able to apply theoretical concepts learned in lectures to real-world situations, and understand the limitations of theoretical models.
3. Accurate recording and analysis of data: Students should be able to accurately record and analyze experimental data, including understanding the significance of error analysis and statistical methods.
4. Critical thinking and problem solving: Students should be able to identify sources of error, troubleshoot experimental problems, and develop critical thinking skills in experimental design and analysis.
5. Understanding of physical principles: Students should develop an understanding of the physical principles governing heat and thermodynamics, including the laws of thermodynamics, heat transfer, and thermodynamic cycles.

Minimum of 6 experiments to be done and recorded

1. Specific heat of a liquid –Joule’s calorimeter –Barton’s radiation correction
2. Thermal conductivity of bad conductor-Lee’s method
3. Thermal conductivity of rubber.
4. Measurement of Stefan’s constant.
5. Specific heat of a liquid by applying Newton’s law of cooling correction.
6. Heating efficiency of electrical kettle with varying voltages.
7. Thermo emf- thermo couple - Potentiometer
8. Thermal behaviour of an electric bulb (filament/torch light bulb)
9. Measurement of Stefan’s constant- emissive method
10. Study of variation of resistance with temperature - Thermistor.

STUDENT ACTIVITIES

Unit I: Kinetic Theory of Gases

Activity: Speed Distribution Analysis

Students can conduct a simple experiment using gas molecules (e.g., small balls) in a container. They can measure the speeds of the molecules using a motion sensor or stopwatch and analyze the distribution of molecular velocities. They can compare the observed distribution with the expected Maxwell's law of distribution.

Unit II: Thermodynamics

Activity: Heat Engine Efficiency Calculation

Students can work in groups to design a simple heat engine (e.g., using a syringe and a small turbine). They can measure the temperature changes and calculate the efficiency of their engine. They can compare their calculated efficiency with the theoretical Carnot efficiency to understand the limitations of real heat engines.

Unit III: Thermodynamic Potentials and Maxwell's Equations

Activity: Thermodynamic Relations Verification

Students can solve numerical problems involving different thermodynamic potentials (internal energy, enthalpy, Helmholtz free energy, and Gibbs free energy) and verify the Maxwell's thermodynamic relations. They can compare the calculated values using different relations to ensure consistency.

Unit IV: Low Temperature Physics

Activity: Adiabatic Demagnetization Experiment

They can discuss the distinction between adiabatic and Joule-Thomson expansions.

Unit V: Quantum Theory of Radiation

Activity: Black Body Radiation Spectrum Analysis

They can estimate the surface temperature of the Sun using the solar constant and Angstrom pyro heliometer data.

SEMESTER-III
COURSE 6: HEAT & THERMODYNAMICS

Theory

Credits: 3

3 hours/week

COURSE 6: BLUEPRINT

Unit	Essayanswerquestions	Short answerqu estions	Numericalp roblem
Unit I	2(with internal choice)	2	0
Unit II	2(with internalchoice)	1	1
Unit III	2(with internal choice)	2	0
Unit IV	2(with internalchoice)	1	1
Unit V	2(with internalchoice)	1	1

SRR & CVR GOVT DEGREE COLLEGE (A), VIJAYAWADA
SEMESTER-III COURSE 6: HEAT & THERMODYNAMICS(2024-25)
QUESTION BANK

Theory

Credits: 3

3hrs/week

UNIT-I KINETIC THEORY OF GASES

Long Answer Questions:

1. Derive the coefficient of thermal conductivity of a gas on the basis of kinetic theory of gases.
2. Derive the coefficient of viscosity of a gas on the basis of kinetic theory of gases.
3. Derive an expression for the Maxwell's Law of distribution of molecular speeds in a gas.

Short answer Questions

4. Write a short note on mean free path.
5. Write a short note on the principle of equipartition of energy.
6. Write a short note on transport phenomenon in ideal gases.
7. Write a short note on the estimation of size of the molecules.

UNIT-II THERMODYNAMICS

Long Answer Questions:

8. Explain the working of Carnot's engine and derive an expression for its efficiency.
9. What is Temperature-Entropy (T-S) diagram. Obtain the relation for the efficiency of a Carnot Cycle. Write its uses.
10. Write a note on change in entropy in reversible and irreversible processes.

Short Answer Questions

11. Write a short note on reversible and irreversible processes.
12. Write a short note on second law of thermodynamics.
13. State and Prove Carnot's theorem.
14. What is entropy and give its physical significance.
15. Derive an expression for change of entropy when ice changes into steam.

UNIT-III THERMODYNAMIC POTENTIALS AND MAXWELL'S EQUATIONS

Long Answer Questions:

16. Derive Maxwell's thermodynamic equations using thermodynamic potentials.
17. Derive Clausius- Clapeyron's equation and write its applications.
18. Derive an expression for Joule-Kelvin coefficient for ideal and Vander Waal's gases.

Short Answer Questions

19. What are thermodynamic potentials and write their significance.
20. Derive Clausius-Clapeyron's equation.

UNIT-IV LOW TEMPERATURE PHYSICS

Long Answer Questions:

21. Explain in detail the Porous plug experiment.
22. Derive an expression for Joule Thomson Cooling.
23. Explain the production of low temperatures by adiabatic demagnetization.

Short Answer Questions

24. Write the differences between adiabatic and Joule Thomson expansion.
25. Write the properties of substances at low temperatures.
26. Write a short note on various methods of producing very low temperatures.

UNIT-V QUANTUM THEORY OF RADIATION

Long Answer Questions:

27. Deduce Planck's Law of black body radiation.
28. Show that Wien's displacement law is a special case of Planck's Radiation law.
29. Show that Raleigh-Jeans Law is special case of Planck's Radiation Law.
30. What is solar constant and how to determine Solar constant using Angstrom Pyrheliometer?

Short Answer Questions:

31. Estimate the surface temperature of the sun.
32. Write a short note on spectral energy distribution of black body radiation.
33. State and explain Wein's displacement Law.
34. State and explain Rayleigh-Jean's Law.

SECTION-A

Answer any Five of the following Questions

5X4=20 Marks

1. Write a short note on mean free path.
2. Write a short note on transport phenomenon in ideal gases.
3. Write a short note on reversible and irreversible processes.
4. Calculate the efficiency of a reversible engine that operates between 327°C and 127°C
5. What are thermodynamic potentials and write their significance.
6. Derive Clausius-Clapeyron's equation.
7. Write the differences between adiabatic and Joule Thomson expansion.
8. The Vanderwaal's constant a and b for one mole of a gas are $0.245 \text{ atm-liter}^2/\text{mole}^2$ and $2.67 \times 10^{-2} \text{ liter/mole}$ respectively. Calculate the temperature of inversion.
9. Estimate the surface temperature of the Sun.
10. Find the wavelength at which maximum energy radiated by a black body at a temperature 327°C . Wein's constant $3 \times 10^{-3} \text{ m-K}$

SECTION-B

Answer all questions

5X8=40 Marks

11. Derive the coefficient of thermal conductivity of a gas on the basis of kinetic theory of gases.
(or)

Derive the coefficient of viscosity of a gas on the basis of kinetic theory of gases.

12. Explain the working of Carnot's engine and derive an expression for its efficiency. (or)

What is Temperature-Entropy (T-S) diagram. Obtain the relation for the efficiency of a Carnot Cycle.

13. Derive Maxwell's thermodynamic equations using thermodynamic potentials. (or)

Derive an expression for Joule-Kelvin coefficient for ideal and Vander Waal's gases.

14. Explain in detail the Porous plug experiment. (or)

Explain the production of low temperatures by adiabatic demagnetization.

15. Deduce Planck's Law of black body radiation. (or)

What is solar constant and how to determine Solar constant using Angstrom Pyrheliometer?

SEMESTER-III
COURSE 7: Electronic Devices and Circuits

Theory

Credits: 3

3 hrs/week

COURSE OBJECTIVE:

The course on Electronic Devices and Circuits aims to provide students with a fundamental understanding of electronic devices and their applications in various circuits.

LEARNING OUTCOMES:

1. Understand the behavior of P-N junction diodes in forward and reverse bias conditions and analyze the impact of junction capacitance on diode characteristics.
2. Analyze and compare the characteristics and operation of different BJT configurations (CB, CE, and CC) and demonstrate proficiency in biasing techniques.
3. Comprehend the operation and characteristics of FETs, including JFETs and MOSFETs, and explain the working principles and characteristics of UJT.
4. Describe the operation and applications of various photoelectric devices such as LEDs, photo diodes, phototransistors, and LDRs.
5. Understand the operation of rectifiers (half-wave, full-wave, and bridge), analyze the ripple factor and efficiency, and demonstrate knowledge of different filter types and three-terminal voltage regulators

UNIT I: PN JUNCTION DIODES

P - N junction Diode, Forward and Reverse bias Ideal Diode, Expression for reverse saturation current – Tunnel Diode - Construction, working, V-I characteristics and Applications, Zener diode – V- I characteristics, Applications.

UNIT –II: BIPOLAR JUNCTION TRANSISTOR AND ITS BIASING: (D.C)

Transistor construction, working of PNP and NPN Transistors, Active, Cutoff and Saturation conditions, Configurations of Transistor - CB, CE, and CC, Input and Output Characteristics of CB and CE configurations, Comparison of CE and CB configurations, Hybrid parameters of a Transistor and equivalent circuit, BJT Transistor Biasing – Need for stabilization, Thermal runaway, Stability factor, Biasing methods - Voltage-Divider Bias.

UNIT-III: FIELD EFFECT TRANSISTORS & POWER ELECTRONIC DEVICES

Difference between JFET and BJT, Construction and working of JFET (n – channel), Drain and Transfer Characteristics, MOSFET (n – channel) - Depletion-type, and Enhancement - Type MOSFETs. JFET Biasing: Voltage Divider Biasing. UJT - Construction, working, V-I characteristics, SCR – Construction, Working and Characteristics

UNIT IV: PHOTO ELECTRIC DEVICES:

Light-Emitting Diodes (LEDs) - Construction, working, characteristics and Applications, IR Emitters, Photo diode - Construction, working, characteristics and Applications, Phototransistors - Construction, working and characteristics, Applications, Structure and operation of LDR, Applications, Differences between photo diode and LDR.

UNIT-V: POWER SUPPLIES:

Rectifiers: Half wave, Full wave and bridge rectifiers - Efficiency (with derivations), ripple factor- Zener diode as Voltage Regulator, Filters- L-section, π -section filters.

REFERENCE BOOKS:

1. Electronic Devices and Circuit Theory --- Robert L. Boylestad & Louis Nashelsky.
2. Electronic Devices and Circuits I – T.L.Floyd- PHI Fifth Edition
3. Integrated Electronics – Millman & Halkias.
4. Electronic Devices & Circuits – Bogart.
5. Sedha R.S., A Text Book Of Applied Electronics, S.Chand & Company Ltd

SEMESTER-III
COURSE 7: Electronic Devices and Circuits

Practical

Credits: 1

2 hrs/week

OBJECTIVE:

The course objectives for a practical course in Electronic Devices and Circuits might provide hands-on experience with the fundamental principles of electronic devices and circuits.

LEARNING OUTCOMES:

1. Understand the principles of electronic devices and circuits and their applications in real-world scenarios.
2. Analyze and design electronic circuits using diodes, transistors, and operational amplifiers.
3. Understand the importance of biasing and stability in electronic circuits and how to achieve them.
4. Develop the skills to design and analyze amplifier circuits and to understand the concept of feedback and its application in electronic circuits.
5. Analyze and design simple oscillators, power supplies, and filters.
6. Gain hands-on experience with electronic test equipment such as multimeters, oscilloscopes, and function generators.
7. Develop skills in circuit construction, measurement, and testing.
8. Learn how to troubleshoot and diagnose electronic circuit problems.
9. Understand the safety procedures for working with electronic circuits and equipment.

Minimum of 6 experiments to be done and recorded

1. V-I Characteristics of junction diode
2. V-I Characteristics of Zener diode
3. Transistor characteristics – CB configuration
4. Transistor characteristics – CE configuration
5. FET input and output characteristics
6. UJT characteristics
7. LDR characteristics
8. Full wave and Bridge rectifier with filters

STUDENT ACTIVITIES

Unit I: PN Junction Diodes

Activity: V-I Characteristic Analysis Students can analyze the V-I characteristics of a PN junction diode by using a simple circuit setup. They can measure the voltage across the diode for different values of forward and reverse bias currents and plot the corresponding current-voltage graph. They can discuss the behavior of the diode in different bias conditions.

Unit II: Bipolar Junction Transistor and Its Biasing

Activity: Transistor Configuration Analysis Students can analyze the characteristics of different transistor configurations (CB, CE, CC) using a transistor tester or a circuit setup. They can measure and compare the input/output characteristics, gain, and voltage levels for each configuration. They

can discuss the advantages and disadvantages of each configuration.

Unit III: Field effect transistors & Power electronic devices

Activity: FET Transfer Characteristic Analysis Students can analyze the transfer characteristics of a FET by measuring the drain current (I_D) for different gate-source voltages (V_{GS}). They can plot the transfer characteristic curve and observe the variations in I_D with V_{GS} . They can discuss the operation modes of FETs based on the transfer characteristics.

Unit IV: Photoelectric Devices

Activity: LED and Photodiode Circuit Demonstration Students can set up simple LED and photodiode circuits to demonstrate their operation. They can observe the emission of light from an LED when a suitable voltage is applied and measure the current. They can also detect light using a photodiode and measure the output current for different light intensities.

Unit V: Power Supplies

Activity: Rectifier Efficiency Calculation Students can analyze the efficiency of different rectifier circuits (half wave, full wave, and bridge rectifiers) by measuring the input and output power. They can calculate the rectifier efficiency and compare the results for different rectifier configurations. They can discuss the factors affecting efficiency and the importance of regulation

SEMESTER-III
COURSE 7: Electronic Devices and Circuits
Credits: 3

Theory

3 hrs/week

Blue Print

Unit	Essay Answer questions	Short Answer Questions	Numerical Problems
Unit I	2 (with internal choice)	1	1
Unit II	2 (with internal choice)	2	0
Unit III	2 (with internal choice)	2	0
Unit IV	2 (with internal choice)	2	0
Unit V	2 (with internal choice)	1	1

QUESTION BANK

Essay Questions

UNIT I

1. Explain the operation of a p-n junction diode in forward biased and reverse biased condition. Deduce the expression for reverse saturation current of diode.
2. With a neat diagram explain the working of a Zener junction diode in forward bias and reverse bias. Draw its I – V graph.
3. Explain the construction and working of tunnel diode. Write its applications.

UNIT II

4. Draw and explain the input and output characteristics of a transistor in CE configuration.
5. Draw and explain the input and output characteristics of a transistor in CB configuration.
6. Justify the statement “Potential divider bias is the most commonly used biasing method” for BJT circuits. Explain how bias compensation can be done in such biasing through diodes?
7. Explain the hybrid parameters of a transistor with equivalent circuit diagram.

UNIT III

8. Describe working of n-channel JFET with help of constructional diagram and draw and explain its drain and transfer characteristics.
9. With neat diagram, describe the working principle and characteristics of UJT.
10. Draw the basic structure of an SCR. Explain its characteristics and list the applications.

UNIT IV

11. Draw and explain the basic structure of LED. Mention the applications of LED.
12. Discuss about IR Emitters and mention the applications of IR Emitters.
13. Explain the construction and working of photo diode. Write its characteristics.

UNIT V

14. Derive the expressions for Ripple Factor and Efficiency of Half Wave bridge Rectifier
15. Derive the expressions for Ripple Factor and Efficiency of Full Wave bridge Rectifier.
16. What is filter circuit? Why do we need filters? Explain the types of filters.

Short Answer Questions

UNIT I

1. Briefly explain the p- n junction diode in forward bias condition
2. Briefly explain the p- n junction diode in reverse bias condition
3. Explain the Zener diode in reverse bias condition
4. Write a short note on tunnel Diode

UNIT II

5. Distinguish the differences between CE and CB configurations of a transistor.
6. Explain the need of stability factor in BJT
7. Discuss about thermal runaway and stability factor in BJT

UNIT III

8. Draw the basic structure of N- channel enhancement MOSFET and explain it.
9. Write the differences between JFET and BJT
10. Write a short note on depletion type MOSFET
11. Explain the importance of voltage divider biasing in JFET.

UNIT IV

12. Write a short note on photo transistor
13. Explain the structure and operation of LDR.
14. What are the differences between LDR and Photo Diode?

UNIT V

15. Explain the working of a Zener diode as a Regulator.
16. Discuss the L Section Filter with neat diagram
17. Discuss the π Section Filter with neat diagram

Section-A

Answer any Five of the following Questions

5 X 4=20 M

1. Explain the Zener diode in reverse bias condition
2. Discuss about thermal runaway and stability factor in BJT
3. Draw the basic structure of N- channel enhancement MOSFET and explain it.
4. Write a short note on photo transistor
5. Explain the structure and operation of LDR
6. Explain the working of a Zener diode as a Regulator.
7. Distinguish the differences between CE and CB configurations of a transistor.
8. Explain the importance of voltage divider biasing in JFET
9. A silicon diode at room temperature (27°C) with a saturation current (I_0) of 10^{-12}A is subjected to a forward voltage (V) of 0.7V. Calculate the forward current (I) assuming an ideality factor (n) of 1.
10. A half-wave rectifier has a load resistance of $3.5\text{ k}\Omega$. If the diode and secondary of the transformer have a total resistance of $800\text{ }\Omega$ and the input voltage has an A.C. signal of 240 V (peak value). Determine its efficiency.

Section – B

Answer ALL the questions

5 X 8 = 40 M

11. (a) Explain the operation of a p-n junction diode in forward biased and reverse biased condition. Deduce the expression for reverse saturation current of diode.
Or
(b) Explain the construction and working of tunnel diode. Write its applications.
12. (a) Draw and explain the input and output characteristics of a transistor in CE configuration.
Or
(b) Justify the statement “Potential divider bias is the most commonly used biasing method” for BJT circuits. Explain how bias compensation can be done in such biasing through diodes?
13. (a) Describe working of n-channel JFET with help of constructional diagram and draw and explain its drain and transfer characteristics.
Or
(b) Draw the basic structure of an SCR. Explain its characteristics and list the applications.
14. (a) Discuss about IR Emitters and mention the applications of IR Emitters.
Or
(b) Explain the construction and working of photo diode. Write its characteristics.
15. (a) Derive the expressions for Ripple Factor and Efficiency of Full Wave bridge Rectifier.
Or
(b) What is filter circuit? Why do we need filters? Explain the types of filters.

SEMESTER-III
COURSE 8: ANALOG AND DIGITAL ELECTRONICS

Theory

Credits: 3

3hrs/week

COURSE OBJECTIVE:

The course on Analog and Digital Electronics aims to provide students with a fundamental understanding of the principles of electronic circuits and their applications in both analog and digital systems.

LEARNING OUTCOMES:

On successful completion of this course, the student will be able to:

1. Understand Principles and Working of Operational Amplifier
2. Apply their knowledge on OP-Amp in different Applications
3. To understand the number systems, Binary codes and Complements.
4. To understand the Boolean algebra and simplification of Boolean expressions.
5. To analyze logic processes and implement logical operations using combinational logic circuits.
6. To understand the concepts of sequential circuits and to analyze sequential systems in terms of state machines

UNIT-I: OPERATIONAL AMPLIFIERS

a) Block Diagram representation of Feedback Configurations, input Resistance with Feedback, Output Resistance with Feedback, advantages and disadvantages of negative feedback, Block diagram of op amp and its equivalent circuit, IC Diagram (IC 741), Ideal voltage transfer curve, Open loop Op-Amp configurations- differential, inverting and non-inverting Op-Amps.

b) Voltage Series Feedback Amplifier (Non-Inverting Op amp): Gain and Bandwidth derivations: Voltage Shunt Feedback Amplifier (Inverting Op amp): Gain and Bandwidth derivations

UNIT-II: PRACTICAL OPERATIONAL AMPLIFIER AND APPLICATIONS

a) Input offset voltage, Thermal Drift, Input bias current, Input offset current, total output offset voltage, CMRR, slew rate and concept of virtual ground.

b) Applications of Op-Amp: Linear Applications: Voltage Follower, Summing Amplifier, Subtracting Amplifier, Averaging Amplifier, Difference Amplifier, Integrator and Differentiator, Square Wave response of Integrator and Differentiator (Brief explanation only)

UNIT-III: NUMBER SYSTEMS, CODES AND LOGIC GATES

a) Conversions-Binary to Decimal and Vice versa, Binary addition, Binary subtraction using 1's and 2's complement methods, BCD code and Gray code Conversions

b) Logic Gates: Construction and truth tables of OR, AND, NOT gates, Universal gates – Basic construction and truth tables of NOR & NAND, Construction of logic gates OR, AND, NOT, XOR by using NAND and NOR Gates. De Morgan's Laws, Simplification of Boolean Expressions using Boolean Laws.

UNIT-IV: ARITHMETIC CIRCUITS & DATA PROCESSING CIRCUITS

a) Design Full Adder by using two Half Adders, Half Subtractor and Full Subtractor: Explanation of truth tables and Circuits.

b) Multiplexers, 4 to 1 multiplexer, De-multiplexers, 1 to 4 Demultiplexer, Applications of Multiplexers and Demultiplexers Decoders: 1 of 2 decoders, 2 of 4 decoders, Encoders: 4 to 2 Encoder, 8 to 3 Encoder, Applications of decoders and encoders

UNIT-V: SEQUENTIAL LOGIC CIRCUITS & CODE CONVERTERS

- a)** Combinational Logic vs Sequential Logic Circuits, Sequential Logic circuits: Flip-flops, Basic NAND, NOR Latches, Clocked SR Flip-flop, JK Flip-flop, D Flip-flop, Master-Slave Flip- flop, Conversion of Flip flops.
- b)** Code Converters: BCD to Decimal Converter, BCD to 7 segment Decoders

Reference Books:

1. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
2. Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, 2011,
3. Digital Principles and Applications, A.P. Malvino, D.P. Leach and Saha, 7th Ed., TMH
4. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
5. Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia (1994)
6. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)

SEMESTER-III
COURSE 8: ANALOG AND DIGITAL ELECTRONICS

Practical

Credits: 1

2hrs/week

COURSE OBJECTIVES:

The course objectives for a practical course in Analog and Digital Electronics might provide students with hands-on experience in designing, constructing, and testing analog and digital electronic circuits.

LEARNING OUCOMES:

1. Understand the principles of analog and digital electronic circuits and their applications in real-world scenarios.
2. Analyze and design analog electronic circuits using diodes, transistors, and operational amplifiers.
3. Analyze and design digital electronic circuits using logic gates, flip-flops, and counters.
4. Understand the importance of biasing, feedback, and stability in electronic circuits and how to achieve them.
5. Develop the skills to design and analyze amplifier circuits and digital systems.

Minimum six experiments to be done and recorded.

1. To study the operational amplifier as inverting feedback amplifier with verifying gain
2. To study the operational amplifier as non-inverting feedback amplifier with verifying gain
3. To study operational amplifier as adder
4. To study operational amplifier as subtractor
5. To study operational amplifier as differentiator
6. To study operational amplifier as integrator
7. Logic Gates- OR, AND, NOT and NAND gates. Verification of Truth Tables.
8. Verification of De Morgan's Theorems.
9. Construction of Half adder and Full Adders-Verification of truth tables
10. Flip flops
11. Multiplexer and De-multiplexer
12. Encoder and Decoder

STUDENT ACTIVITIES

UNIT-I: OPERATIONAL AMPLIFIERS

Circuit Analysis: Students can be asked to analyze different operational amplifier circuits such as inverting and non-inverting amplifiers, summing amplifiers, difference amplifiers, and integrators. They can be asked to calculate the gain, input and output impedance, and frequency response of the circuits.

Circuit Design: Students can be asked to design different operational amplifier circuits such as audio amplifiers, filters, and oscillators. They can be asked to select the appropriate op-amp and other components such as resistors, capacitors, and inductors to meet the desired specifications.

UNIT-II: PRACTICAL OPERATIONAL AMPLIFIER AND APPLICATIONS

Design an inverting amplifier circuit: Students can be asked to design and build an inverting amplifier circuit using an operational amplifier and a few passive components. They can then measure the gain and frequency response of the circuit using an oscilloscope and a function generator. They can also compare the measured values with the theoretical calculations and simulation results.

Build a summing amplifier circuit: Students can be asked to build a summing amplifier circuit using an operational amplifier and several input signals. They can then measure the output voltage of the circuit and compare it with the expected value. They can also investigate the effect of changing the input signal amplitudes and the resistor values on the circuit performance.

UNIT-III: NUMBER SYSTEMS, CODES AND LOGIC GATES

Binary to Decimal or vice versa: They can practice converting both integer and fractional numbers, and verify their results using online conversion tools or calculators.

Design a binary adder circuit: Students can be asked to design and build a binary adder circuit using logic gates such as XOR, AND, and OR gates. They can then test the circuit by adding two binary numbers and comparing the result with the expected value.

UNIT-IV: ARITHMETIC CIRCUITS & DATA PROCESSING CIRCUITS

Design a data processing circuit: Students can be asked to design and build a data processing circuit that performs a specific function, such as filtering, modulation, or demodulation. They can use op-amps, filters, modulators, and demodulators to implement the circuit and test its performance using simulated or real-world signals.

Implement a digital signal processing algorithm: Students can be asked to implement a digital signal processing algorithm, such as a Fourier transform, a discrete cosine transform, or a digital filter. They can use software tools such as MATLAB or Python to simulate the algorithm and test its performance using sample signals.

UNIT-V: SEQUENTIAL LOGIC CIRCUITS & CODE CONVERTERS

Design a flip-flop circuit: Students can be asked to design and build a flip-flop circuit using logic gates and test its operation by creating a sequence of logic signals. They can also compare the performance of different types of flip-flops, such as SR, D, JK, and T, and discuss their advantages and disadvantages in sequential circuits.

Implement a counter circuit: Students can be asked to design and build a counter circuit that counts up or down using flip-flops. They can use different types of counters, such as ripple, synchronous, or Johnson, and test their operation by connecting the output to LEDs or other indicators.

Design a code converter circuit: Students can be asked to design and build a code converter circuit that converts a binary code to another code, such as Gray code, BCD, or ASCII. They can use logic gates, multiplexers, and decoders to implement the circuit, and test its operation by inputting different codes.

SEMESTER-III
COURSE 8: ANALOG AND DIGITAL ELECTRONICS

Theory

Credits: 3

3hrs/week

COURSE 8: BLUE PRINT

Unit	Essay answer questions	Short answer questions	Numerical problem
Unit I	2 (with internal choice)	1	1
Unit II	2 (with internal choice)	2	0
Unit III	2 (with internal choice)	1	1
Unit IV	2 (with internal choice)	2	0
Unit V	2 (with internal choice)	2	0

SRR & CVR GOVT DEGREE COLLEGE (A), VIJAYAWADA
SEMESTER-III COURSE 8: ANALOG AND DIGITAL ELECTRONICS
QUESTION BANK

Theory

Credits: 3

3hrs/week

UNIT-I: OPERATIONAL AMPLIFIERS

Essay Questions:

1. Explain Op-Amp configurations with block diagrams and discuss negative feedback's advantages and disadvantages.
2. Explain about voltage series feedback amplifier circuit.
3. Explain about voltage shunt feedback amplifier circuit.

Short Questions:

1. Describe the block diagram and equivalent circuit of an Op-Amp
2. Draw and explain the IC diagram of the IC 741 operational amplifier.
3. Define the Ideal Voltage Transfer Curve for an Op-Amp and its importance.
4. Describe the basic difference between inverting and non-inverting Op-Amps in open-loop configurations.
5. Input resistor for non-inverting amplifier is $R_1 = 10k\Omega$ feedback resistor $R_f = 40k\Omega$ and input voltage is $2V$ then find output voltage.

UNIT-II: PRACTICAL OPERATIONAL AMPLIFIER AND APPLICATIONS

Essay Questions:

1. What is the concept of virtual ground in operational amplifiers?
2. Explain about Summing Amplifier and Differential Amplifier.
3. Explain about integrator and differentiator Amplifier.

Short Questions:

1. Write a short note on CMRR and slew rate in Op-Amps.
2. Define input offset voltage, input offset current and its effect on Op-Amp.
3. Explain the operation of a Subtracting Amplifier using an Op-Amp.
4. How does the square wave response of an Integrator and Differentiator differ?
5. Write a short note on thermal drift in Op-Amps.

UNIT-III: NUMBER SYSTEMS, CODES AND LOGIC GATES

Essay Questions:

1. Prove that NAND and NOR gates are universal gates.
2. Discuss BCD and Gray code conversions and their uses in digital systems.
3. Describe the construction and truth tables of OR, AND, NOT, NOR, and NAND gates.

Short Questions:

1. Convert $(35.6)_{10}$ into binary number.
2. State and prove De Morgan's Laws.
3. Describe the construction and truth tables of XOR and Ex-NOR gates.
4. Simplify the Boolean expression using Boolean Laws: $Y = AB + ABC + \bar{A}B + A\bar{B}C$ and
 $Y = A^2 + A\bar{B} + ABC$
5. Subtract $1010_{(2)}$ from $1101_{(2)}$ using 1's complement and 2's Complement methods.

UNIT-IV: ARITHMETIC CIRCUITS & DATA PROCESSING CIRCUITS

Essay Questions:

1. Explain about half subtractor and full subtractor by using their truth tables.
2. What are multiplexers and demultiplexers. Explain the applications of 4 to 1 multiplexer and 1 to 4 demultiplexer.
3. What is an Encoder and explain types of Encoders?

Short Questions:

1. Design a Full adder using two half adders.
2. What are the applications of multiplexers and demultiplexers in digital circuits?
3. What is a Decoder and explain types Decoders?
4. What are the applications of Encoders and Decoders.

UNIT-V: SEQUENTIAL LOGIC CIRCUITS & CODE CONVERTERS

Essay Questions:

1. Discuss the operation and applications of JK and Master-Slave flip-flops with diagrams.
2. Explain the design and working of BCD to Decimal converter.
3. Explain the design and working of BCD to 7-segment decoders.

Short Questions:

1. What is the difference between combinational logic circuits and sequential logic circuits.
2. What is the basic difference between a NAND latch and a NOR latch?
3. Define the concept of clocked SR flip-flop and explain its significance.
4. Explain the conversion process of flipflops.
5. What are the applications of flip-flops

S.R.R & C.V.R. GOVERNMENT DEGREE COLLEGE (A) VIJAYAWADA
B.Sc Honours (Physics Major)
CODE: SEMESTER-IV
MODEL QUESTION PAPER
COURSE 8: ANALOG AND DIGITAL ELECTRONICS

Time:3 hours

Max marks: 60M

Section-A

Answer any Five of the following Questions

5X4=20 Marks

1. Define the Ideal Voltage Transfer Curve for an Op-Amp and its importance.
2. Input resistor for non-inverting amplifier is $R_1 = 10k\Omega$ feedback resistor $R_f = 40k\Omega$ and input voltage is $2V$ then find output voltage.
3. How does the square wave response of an Integrator and Differentiator differ?
4. Write a short note on thermal drift in Op-Amps.
5. State and Prove Demorgan's laws.
6. Subtract $1010_{(2)}$ from $1101_{(2)}$ using 1's complement and 2's Complement methods.
7. Design a Full adder using two half adders.
8. What are the applications of Encoders and Decoders.
9. What is the difference between combinational logic circuits and sequential logic circuits.
10. What is the basic difference between a NAND latch and a NOR latch?

SECTION-B

Answer all questions

5X8=40 Marks

- 11. Explain about voltage series feedback amplifier circuit. (Or)**

Explain about voltage shunt feedback amplifier circuit.

- 12. What is the concept of virtual ground in operational amplifiers? (Or)**

Explain about Summing Amplifier and Differential Amplifier.

- 13. Prove that NAND and NOR gates are universal gates. (Or)**

Discuss BCD and Gray code conversions and their uses in digital systems.

- 14. Explain about half subtractor and full subtractor by using their truth tables. (Or)**

What are multiplexers and demultiplexers. Explain the applications of 4 to 1 multiplexer and 1 to 4 demultiplexer.

- 15. Discuss the operation and applications of JK and Master-Slave flip-flops with diagrams. (Or)**

Explain the design and working of BCD to Decimal converter.

SEMESTER-IV
COURSE 9: ELECTRICITY AND MAGNETISM

Theory

Credits: 3

3 hrs/week

COURSE OBJECTIVE:

1. The course on Electricity and Magnetism aims to provide students with a fundamental understanding of the principles of electricity, magnetism
2. students with a fundamental understanding of the principles of electricity, magnetism and their interactions

LEARNING OUTCOMES:

On successful completion of this course, the students will be able to:

1. Understand the Gauss law and its application to obtain electric field in different cases and formulate the relationship between electric displacement vector, electric polarization, Susceptibility, Permittivity and Dielectric constant.
2. To learn the methods used to solve problems using loop analysis, Nodal analysis, and the Superposition theorem.
3. Distinguish between the magnetic effect of electric current and electromagnetic induction and apply the related laws in appropriate circumstances.
4. Understand Biot and Savart's law and Ampere's circuital law to describe and explain the generation of magnetic fields by electrical currents.
5. Develop an understanding on the unification of electric, and magnetic fields and Maxwell's equations governing electromagnetic waves.
6. Phenomenon of resonance in LCR AC-circuits, sharpness of resonance, Q- factor, Power factor and the comparative study of series and parallel resonant circuits

UNIT-I Electrostatics and Dielectrics

Gauss's law-Statement and its proof, Electric field intensity due to (i) uniformly charged solid sphere, Electrical potential-Equipotential surfaces, Potential due to a uniformly charged sphere. Dielectrics-Polar and Non-polar dielectrics- Effect of electric field on dielectrics, Electric displacement D, electric polarization Relation between D, E and P, Dielectric constant and electric susceptibility.

UNIT-II Current electricity

Electrical conduction-drift velocity-current density, equation of continuity, ohms law and limitations, Kirchhoff's Law's, Wheatstone bridge-balancing condition – sensitivity. Superposition Theorem, Maximum power transfer theorem.

UNIT-III Magneto statics

Biot-Savart's law and its applications: (i) circular loop and (ii) solenoid, Ampere's Circuital Law and its application to Solenoid, Hall Effect and applications.

Electromagnetic Induction:

Faraday's laws of electromagnetic induction, Lenz's law, Self-induction and Mutual induction, Self-inductance of a long solenoid, Magnetic Energy density. Mutual inductance of a pair of coils.

UNIT-IV Electromagnetic waves-Maxwell's equations:

Basic laws of electricity and magnetism- Maxwell's equations- integral and differential forms Derivation, concept of displacement current. Plane electromagnetic wave equation, Hertz Experiment-Transverse nature of electromagnetic waves. Pointing vector and propagation of electromagnetic waves.

UNIT-V Varying and alternating currents:

Alternating current - A.C. fundamentals, and A.C through pure R, L and C. Relation between current and voltage in LR and CR circuits, Phasor and Vector diagrams, LCR series and parallel resonant circuit, Q – factor, Power in ac circuits, Power factor.

REFERENCE BOOKS

1. BSc Physics, Vol.3, Telugu Akademy, Hyderabad.
2. Electricity and Magnetism, D.N. Vasudeva. S. Chand & Co.
3. Electricity, Magnetism with Electronics, K.K.Tewari, R.Chand& Co.,
4. "Electricity and Magnetism" by Brijlal and Subramanyam Ratan Prakashan Mandir, 1966
5. "Electricity and Magnetism: Fundamentals, Theory, and Applications" by R. Murugesan, Kiruthiga Siva prasath, and M. Saravanapandian
6. "Electricity and Magnetism: Theory and Applications" by Ajoy Ghatak and S. Lokanathan
7. Electricity and Magnetism: Problems and Solutions" by Ashok Kumar and Rajesh Kumar
8. Electricity and Magnetism, R. Murugesan, S. Chand & Co

SEMESTER-IV
COURSE 9: ELECTRICITY AND MAGNETISM

Practical

Credits: 1

2 hrs/week

COURSE OBJECTIVE:

The course objective for a practical course in electricity and magnetism may include to develop practical skills in handling electrical and electronic components, such as resistors, capacitors, inductors, transformers, and oscillators.

LEARNING OUTCOMES:

1. Demonstrate a thorough understanding of the fundamental concepts and principles of electricity and magnetism.
2. Apply the laws and principles of electricity and magnetism to analyze and solve electrical and magnetic problems.
3. Design, construct, and test electrical circuits using various components and measuring instruments.
4. Measure and analyze electrical quantities such as voltage, current, resistance, capacitance, and inductance using appropriate instruments.
5. Apply the principles of electromagnetism to understand and analyze the behavior of magnetic fields and their interactions with electric currents

Minimum of 6 experiments to be done and recorded

1. Figure of merit of a moving coil galvanometer.
2. LCR circuit series/parallel resonance, Q factor.
3. Determination of ac-frequency –Sonometer.
4. Verification of Kirchhoff's laws and Maximum Power Transfer theorem.
5. Verification of Kirchhoff's laws.
6. Field along the axis of a circular coil carrying current-Stewart & Gee's apparatus.
7. Charging and discharging of CR circuit-Determination of time constant
8. A.C Impedance and Power factor
9. Determination of specific resistance of wire by using Carey Foster's bridge.

STUDENT ACTIVITIES

UNIT-I Electrostatics and Dielectrics:

- Conduct a simulation to visualize equipotential surfaces for a given charge distribution.
- Conduct a group discussion on the significance of electric field lines and how they can be used to predict the motion of charged particles in electric fields.

UNIT-II Current electricity:

- Conduct a Wheatstone bridge experiment in class and discuss the balancing condition and sensitivity.
- Conduct a group activity where students are divided into groups and assigned a different circuit analysis method (nodal analysis, mesh analysis, superposition theorem, etc.) and asked to present their findings to the class.

UNIT-III Magneto statics and Electromagnetic Induction:

- Conduct a demonstration to show the Hall effect and measure the Hall coefficient of a given material.
- Conduct a group activity where students are divided into groups, and assigned a different application of Faraday's law (electromagnetic induction, transformers, etc.) and asked to present their findings to the class.

UNIT-IV Electromagnetic waves:

- Conduct a group activity where students are asked to research the history of the development of Maxwell's equations and present their findings to the class.
- Conduct a simulation to visualize the propagation of electromagnetic waves in different media (vacuum, air, water, etc.) and discuss the differences in the behaviour of waves in different media.

UNIT-V Varying and alternating currents:

- Conduct a demonstration to show the resonance in an LCR circuit and measure the Q-factor.
- Conduct a group activity where students are divided into groups and assigned a different power factor correction method (capacitor banks, synchronous condensers, etc.) and asked to present their findings to the

SEMESTER-IV
COURSE 9: ELECTRICITY AND MAGNETISM

Theory

Credits: 3

3hrs/week

COURSE 9: BLUEPRINT

Unit	Essayanswerquestions	Short answerq uestions	Numerical problem
Unit I	2(with internal choice)	2	0
Unit II	2(with internalchoice)	2	0
Unit III	2(with internal choice)	1	1
Unit IV	2(with internalchoice)	2	0
Unit V	2(with internalchoice)	1	1

S.R.R & C.V.R. GOVERNMENT DEGREE COLLEGE (A) VIJAYAWADA

B.Sc Honours (Physics major)

CODE: SEMESTER-IV

QUESTION BANK

ELECTRICITY AND MAGNETISM

Time:3hours

Max marks:60M

Long Answer Questions

UNIT I

1. State Gauss's law in electrostatics and derive its differential form.
2. Define Gauss's law in electrostatics. Apply it to calculate the electric field intensity due to uniformly charged sphere at points within and outside sphere.
3. Define electric potential. Calculate the electric potential due to uniformly charged sphere.
4. Define D, E and P. Establish the relation between them. Hence, deduce the relation between dielectric constant and susceptibility.

UNIT II

5. What is wheat stone bridge? Derive the bridge balancing equation with neat sketch.
6. State and prove maximum transfer power theorem
7. State and explain superposition theorem

UNIT III

8. Calculate the magnetic induction at a point on the axis passing through the centre of a circular wire carrying current using Biot – savart's law.
9. Calculate the magnetic field inside the long solenoid using Biot – savart's law.
10. What is self-inductance? Define Coefficient of self-induction and obtain an expression for magnetic energy density of a solenoid.
11. Define coefficient of mutual inductance. Show that the coefficient of coupling of two coils is equal to $\sqrt{L_1 L_2}$.

UNIT IV

12. Derive the Maxwell's equation in differential forms.
13. identify the nature of electromagnetic wave with proper explanation through Hertz experiment
14. Write the Maxwell's equations in differential form and derive the electromagnetic wave plane equation.

UNIT V

15. Discuss LCR parallel resonant circuit with necessary theory and obtain an expression for Q-value.
16. Describe the behavior of series LCR circuit when an alternating voltage is applied to it. Explain the condition of resonance.
17. Derive an expression for current, impedance and phase angle in LR circuit with the help of phase diagram.
18. Derive an expression for current, impedance and phase angle in CR circuit with the help of phase diagram.

Short Answer Questions

UNIT I

1. Explain about equipotential surfaces.
2. Analyze the effect of electric field on dielectrics.
3. What are polar and non-polar dielectrics?

UNIT II

4. Write a short note on Kirchhoff's laws
5. What is ohm's law? Write its limitations
6. Define the terms (i) drift velocity (ii) current density
7. Discuss the equation of continuity

UNIT III

8. Explain Biot –Savart law.
9. What is Hall Effect? Mention its applications
10. Calculate the magnetic field due to long solenoid using ampere's circuital law.
11. State and explain Faraday's law.
12. State and explain Lenz's law.

UNIT IV

13. What are the basic laws of electricity and magnetism.
14. Explain the concept of displacement current
15. Write a short note on Poynting vector and propagation of electromagnetic wave.

UNIT V

16. Obtain the expression of power of ac circuit.
17. Write a short note on power factor in AC circuit.
18. Define alternating current and write its importance.
19. Discuss the AC current through pure capacitance.
20. Discuss the AC current through pure inductance.

SRR & CVR GOVERNMENT DEGREE COLLEGE (A), VIJAYAWADA
PHYSICS - SEM IV
ELECTRICITY AND MAGNETISM
MODEL QUESTION PAPER

Max.marks: 60M

Time: 3 Hrs

Section –A (Short answer type Questions)

Answer Any Five of the below Questions

5X4=20M

1. Write a short note on polar and non-polar dielectrics.
2. Define and draw relation between Dielectric constant and electric susceptibility.
3. What is ohm's law and write its limitations.
4. Define the terms (i) drift velocity (ii) current density
5. Define Hall Effect. Write its applications.
6. What are Basic laws of electricity and magnetism?
7. Explain Poynting vector and propagation of electromagnetic wave.
8. Write a short note on power factor in AC circuit.
9. A Solenoid of length 100 cm and 1000 turns wound on it. Calculate the magnetic field at the middle point of its axis when current of 2 ampere is passed through it.
10. Calculate the resonant frequency of an LCR series resonant circuit with $L = 10mH$ and $C = 1\mu F$.

Section –B (Essay type Questions)

Answer All the Questions

5X8=40M

11. Define Gauss' law. Derive electric field intensity due to uniformly charged solid Sphere
(Or)
Define D, E & P. Deduce relation between them.
12. State and explain Superposition Theorem.
(Or)
State and prove Maximum power transfer theorem.
13. State Biot - Savarts law. Derive Magnetic field induction of a long solenoid using Biot - Savarts law.
(Or)
Define Mutual inductance. Show that the coefficient of coupling of two coils is equal to $\sqrt{L_1 L_2}$.
14. Derive Maxwell's equations in differential forms.
(Or)
Identify the nature of electromagnetic wave with proper explanation through Hertz experiment.
15. Discuss LCR parallel resonant circuit with necessary theory and obtain an expression for Q-value.
(Or)
Describe the behavior of series LCR circuit when an alternating voltage is applied to it. Explain the condition of resonance.

SEMESTER-IV
COURSE 10: MODERN PHYSICS
Credits: 3

Theory

3hrs/week

COURSE OBJECTIVE:

The course on Modern Physics aims to provide students with an understanding of the principles of modern physics and their applications in various fields.

LEARNING OUTCOMES:

On successful completion of this course, the students will be able to:

1. Understand the principles of atomic structure and spectroscopy.
2. Understand the principles of molecular structure and spectroscopy
3. Develop critical understanding of concept of Matter waves and Uncertainty principle.
4. Get familiarized with the principles of quantum mechanics and the formulation of Schrodinger wave equation and its applications.
5. Increase the awareness and appreciation of superconductors and their practical applications

UNIT-I: Introduction to Atomic Structure and Spectroscopy:

Drawbacks of Bohr's atomic model, Hydrogen spectrum, Vector atom model – Stern and Gerlach experiment, Quantum numbers associated with it, Coupling schemes, Spectral terms and spectral notations, Selection rules. Zeeman effect, Experimental arrangement to study Zeeman effect.

UNIT-II: Molecular Structure and Spectroscopy

Types of molecular spectra. Molecular rotational and vibrational spectra, electronic energy levels and electronic, vibrational & rotational energy levels in a diatomic molecule diagram - Raman effect, Characteristics of Raman effect, Experimental arrangement to study Raman effect, Quantum theory of Raman effect, Applications of Raman effect. Raman spectroscopy applications in materials characterization.

UNIT-III: Matter waves & Uncertainty Principle:

Matter waves, de Broglie's hypothesis, Properties of matter waves, Davisson and Germer's experiment, Heisenberg's uncertainty principle for position and momentum & energy and time, Illustration of uncertainty principle using diffraction of beam of electrons (Diffraction by a single slit) and photons (Gamma ray microscope).

UNIT-IV: Quantum Mechanics:

Basic postulates of quantum mechanics, Schrodinger time independent and time dependent wave equations-

Derivations, Physical interpretation of wave function, Eigen functions, Eigen values, Application of Schrodinger wave equation to (one-dimensional potential box of infinite height (Infinite Potential Well))

UNIT-V: Superconductivity:

Introduction to Superconductivity, basic experimental facts about superconducting materials-critical temperature, critical magnetic field, Meissner effect, experimental demonstration of Meissner effect

superconductor susceptibility, Type I and Type II superconductors- theory, Differences between Type I & Type II superconductors - Applications of superconductors

REFERENCEBOOKS

1. BSc Physics, Vol.4, Telugu Academy, Hyderabad
2. Atomic Physics by J.B. Rajam; S.Chand & Co.,
3. Modern Physics by R. Murugesan and Kiruthiga Siva Prasath. S. Chand & Co.
4. Concepts of Modern Physics by Arthur Beiser. Tata McGraw-Hill Edition.
5. Nuclear Physics, D. C. Tayal, Himalaya Publishing House.
6. S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publ. Co.)
7. K.K. Chattopadhyay & A.N. Banerjee, Introd. to Nanoscience and Technology (PHI Learning Priv. Limited).
8. Nanomaterials, A K Bandopadhyay. New Age International Pvt Ltd (2007)
9. Textbook of Nanoscience and Nanotechnology, BS Murthy, P Shankar, Baldev Raj, BB Rath and J Murday-Universities Press-IIM

**SEMESTER-IV
COURSE10:
MODERN PHYSICS**

Practical

Credits: 12hrs/week

COURSE OBJECTIVE:

The course objective for a practical course in Modern Physics may provide hands-on experience with experimental techniques and equipment used in modern physics experiments.

LEARNING OUTCOMES:

1. Apply experimental techniques and equipment to investigate and analyze phenomena related to modern physics, such as quantum mechanics, atomic physics, and nuclear physics.
2. Demonstrate a deep understanding of the principles and theories of modern physics through hands-on experimentation and data analysis.
3. Develop proficiency in using advanced laboratory instruments and techniques specific to modern physics experiments, such as spectroscopy, interferometry, particle detectors, and radiation measurement.
4. Analyze and interpret experimental data using statistical methods and error analysis, drawing meaningful conclusions and relating them to theoretical concepts.
5. Design and conduct independent experiments or investigations related to modern physics, demonstrating the ability to plan, execute, and analyze experimental procedures and results.

Minimum of 6 experiments to be done and recorded

1. e/m of an electron by Thomson method.
2. Determination of Planck's Constant (photocell).
3. Verification of inverse square law of light using photovoltaic cell.
4. Determination of the Planck's constant using LEDs of at least 4 different colours.
5. Determination of work function of material of filament of directly heated vacuum diode
6. Determination of $M \& H$.
7. Franck-Hertz Experiment Virtual Lab
8. Energy gap of a semiconductor using junction diode.
9. Energy gap of a semiconductor using thermistor.

STUDENT ACTIVITIES:

UNIT-I: Introduction to Atomic Structure and Spectroscopy

Spectroscopy Experiment:

- Divide the students into small groups and provide each group with a spectrometer or spectroscope, a light source, and different samples or elements for analysis.
- Instruct the students to carefully observe the spectra produced by the samples using the spectrometer. Encourage them to note the presence of specific spectral lines or patterns.

Data Collection:

- Have the students record their observations in their lab notebooks or worksheets. They should note the wavelengths or colors of the observed spectral lines and any patterns they observe.

Analysis and Discussion:

- Guide a class discussion on the observed spectra and their significance. Discuss how the observed spectral lines correspond to specific energy transitions in the atoms.
- Ask students to compare the spectra of different samples or elements and identify any similarities or differences.
- Discuss the concept of energy levels and how electrons transition between them, emitting or absorbing photons of specific wavelengths.

UNIT-II: Molecular Structure and Spectroscopy

- Begin the activity with a brief introduction to molecular structure, discussing concepts such as chemical bonds, molecular geometry, and the importance of molecular structure in determining the properties and behavior of substances.
- Explain the principles of spectroscopy, focusing on vibrational and rotational spectra and how they relate to molecular vibrations and rotations.

UNIT-III: Matter waves & Uncertainty Principle:

- Begin the activity by introducing the concept of matter waves and the uncertainty principle. Discuss how the wave-particle duality of matter is a fundamental principle in quantum mechanics.
- Provide a brief overview of the historical development of the uncertainty principle and its implications for our understanding of the behavior of particles on a microscopic scale.

UNIT-IV: Quantum Mechanics:

- Begin the activity by providing an overview of quantum mechanics and its significance in understanding the behavior of particles on a microscopic scale.
- Discuss key concepts such as wave-particle duality, superposition, quantization, and the probabilistic nature of quantum systems.

UNIT-V: Superconductivity:

- Begin the activity by providing an overview of superconductivity, including its definition, properties, and significance in scientific and technological applications.
- Discuss key concepts such as zero electrical resistance, Meissner effect, critical temperature, and type I and type II superconductors.
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SEMESTER-IV

COURSE 10: MODERN PHYSICS

Theory

Credits: 3

3hrs/week

COURSE 10: BLUE PRINT

Unit	Essay answer questions	Short answer questions	Numerical problem
Unit I	2 (with internal choice)	2	0
Unit II	2 (with internal choice)	2	0
Unit III	2 (with internal choice)	1	1
Unit IV	2 (with internal choice)	2	0
Unit V	2 (with internal choice)	2	0

**SEMESTER-IV COURSE 10: MODERN PHYSICS
QUESTION BANK**

Theory

Credits: 3

3hrs/week

UNIT-I: Introduction to Atomic Structure and Spectroscopy

Essay Questions:

1. Mention the necessity of proposing the Vector atom model. What are the quantum numbers associated with it? Explain in detail.
2. Describe the Stern- Gerlach experiment and the importance of the results obtained.
3. Define Zeeman effect. Explain the experimental arrangement to study the Zeeman effect.

Short Questions:

1. Explain L-S coupling and j-j coupling schemes.
2. What are the drawbacks of Bohr's atomic model
3. Write note on spectral terms and spectral notations
4. Write a note on selection rules.

UNIT-II: Molecular Structure and Spectroscopy

Essay Questions:

1. Draw electronic, vibrational & rotational energy levels in a diatomic molecule diagram
2. What is the Raman effect? Describe an experimental set up to study Raman effect.
3. What are the characteristics of Raman effect. Explain Quantum theory of Raman effect.

Short Questions

1. Explain stoke & anti stoke lines in Raman Spectrum.
2. Write a short note on Types of molecular spectra.
3. Write the applications of Raman effect.

UNIT-III: Matter Waves & Uncertainty Principle.

Essay Questions:

1. How de- Broglie hypothesis is experimentally demonstrated by the Davisson and Germer experiment?
2. State Heisenberg uncertainty principle for 1) position and momentum 2) energy and time. Give any one experiment to prove its validity.

Short Questions:

1. Explain de-Broglie Hypothesis and give the formulas for wavelength of Matter Waves.
2. What are the properties of matter waves.

UNIT-IV: Quantum Mechanics

Essay Questions:

1. Derive Schrodinger time independent equation?
2. Derive Schrodinger time dependent equation?
3. Derive the expression for energy of a particle in 1- D potential box of infinite Height (infinite potential well)

Short Questions:

1. What is the physical significance of wave functions.
2. What are the eigen functions and eigen values.

UNIT-V: Superconductivity

Essay Questions:

1. Define superconductivity & give the basic experimental facts about super conducting materials?
2. What is Meissner effect. Classify Type-I and type-II superconductors.
3. Discuss basic experimental facts of superconductivity with critical temperature and critical magnetic field.

Short Questions:

1. Explain Meissner effect?
2. Write the differences between Type-I and Type-II super conductors.
3. Write the applications of superconductors.

B.Sc Honours (Physics Major)
CODE: SEMSESTER-IV
MODEL QUESTION PAPER
COURSE 10: MODERN PHYSICS

Time:3 hours

Max marks: 60M

Section-A

Answer any Five of the following Questions

5X4=20 Marks

- 1.Explain L-S coupling and j-j coupling schemes.
2. What are the drawbacks of Bohr's atomic model
3. Write a short note on Types of molecular spectra.
4. Write the applications of Raman effect.
- 5.An electron is accelerated through a potential difference of 100 volts. Calculate the de Broglie wavelength of the electron.
6. What are the properties of matter waves.
- 7.What is the physical significance of wave functions.
8. What are the eigen functions and eigen values.
9. Write the differences between Type-I and Type-II super conductors.
10. Give the applications of superconductors.

SECTION-B

Answer all questions

5X8=40 Marks

11. Mention the necessity of proposing the Vector atom model. What are the quantum numbers associated with it? Explain in detail. (or)
Describe the Stern- Gerlach experiment and the importance of the results obtained.
12. Draw electronic, vibrational & rotational energy levels in a diatomic molecule diagram (or)
What is the Raman effect? Describe an experimental set up to study Raman effect.
13. How de- Broglie hypothesis is experimentally demonstrated by the Davisson and Germer experiment?
(or)
State Heisenberg uncertainty principle for 1) position and momentum2) energy and time. Give any one experiment to prove its validity.
14. Derive Schrodinger time dependent equation? (or)
Derive the expression for energy of a particle in 1- D potential box of infinite Height (infinite potential well)
15. Define superconductivity & give the basic experimental facts about super conducting materials?
(or)
What is Meissner effect. Classify Type-I and type-II superconductors.

SEMESTER-IV

COURSE 11: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS

Theory

Credits: 3

3 hrs/week

COURSE OBJECTIVE:

The course aims to provide students with an understanding of the principles of Nuclear and Particle physics and their applications in various fields.

LEARNING OUTCOMES

By successful completion of the course, students will be able to

1. know about high energy particles and their applications which prepares them for further study and research in nuclear physics
2. Students can explain important concepts on nucleon-nucleon interaction, such as its short-range, spin dependence, isospin, and tensors.
3. Students can show the potential shapes from nucleon nucleon interactions.
4. Students can explain the single particle model, its strengths, and weaknesses
5. Students can explain magic numbers based on this model

UNIT-I: Introduction to Nuclear Physics

Nuclear Structure: General Properties of Nuclei, Mass defect, Binding energy; Nuclear forces: Characteristics of nuclear forces- Yukawa's meson theory; Nuclear Models- Liquid drop model– magic numbers.

UNIT-II: Elementary Particles and Interactions

Discovery and classification of elementary particles, properties of leptons, mesons and baryons; Types of interactions- strong, electromagnetic and weak interactions; Conservation laws – Isospin, parity, charge conjugation

UNIT-III: Nuclear Reactions and Nuclear Detectors

Nuclear Reactions: Types of reactions, Conservation Laws in nuclear reactions, energy balance in nuclear reactions & the Q (energy balance) value- nuclear cross-section definition & formula; Nuclear detectors: Geiger- Muller counter, Scintillation counter, Cloud chamber

UNIT-IV: Nuclear Decays and Nuclear Accelerators

Nuclear Decays: Gamow's theory of alpha decay, Geiger – Nuttall Law – β - decay process, Fermi's theory of Beta- decay, Nuclear Accelerators: Types- Electrostatic and electrostatic accelerators; Cyclotron-construction, working and applications; Synchrocyclotron-construction, working and applications.

UNIT-V: Applications of Nuclear and Particle Physics

Medical Applications: Radiation therapy & imaging techniques: NMRI (Nuclear Magnetic Resonance Imaging), nuclear energy: Types of Nuclear Reactors: PWR, Safety Measures in Nuclear Reactors-, Medical Applications of Particle Physics: Proton Therapy

Reference Books:

1. Nuclear Physics, Irving Kaplan, Narosa Pub. (1998).
2. Nuclear Physics, Theory and experiment – P.R. Roy and B.P. Nigam, New Age Int.1997.
3. Atomic and Nuclear Physics (Vol.2), S.N. Ghoshal, S. Chand & Co. (1994).
4. Nuclear Physics, D.C. Tayal, Himalaya Pub. (1997).
5. Atomic and Nuclear Physics, R.C. Sharma, K. Nath & Co., Meerut.
6. Nuclei and Particles, E. Segre.
7. Introduction to Nuclear Physics, H.A. Enge, Addison Wesley (1975).

SEMESTER-IV**COURSE 11: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS**

Practical

Credits: 12hrs /week

COURSE OBJECTIVE:

To familiarize students with experimental techniques and methodologies used in nuclear and particle physics.

To provide hands-on experience in conducting experiments related to nuclear and particle physics.

LEARNING OUTCOMES:

1. Gain a solid understanding of fundamental concepts in nuclear and particle physics.
2. Acquire knowledge of experimental techniques and methodologies used in the field.
3. Understand the principles and operation of laboratory equipment and instruments specific to nuclear and particle physics experiments.
4. Develop proficiency in conducting experiments related to nuclear and particle physics.
5. Acquire skills in data acquisition, analysis, and interpretation using appropriate software and techniques.
6. Learn to design and perform experiments, including calibration, measurement, and control of variables.

Minimum of 6 experiments to be done and recorded

1. Geiger-Muller counter – Determination of deadtime
https://www.gigaphysics.com/gmtube_lab.html
2. Nuclear fission – virtual lab
<https://phet.colorado.edu/en/simulations/nuclear-fission>
3. α -decay simulation
<https://phet.colorado.edu/en/simulations/alpha-decay>
4. β -decay simulation
<https://phet.colorado.edu/en/simulations/beta-decay>
5. Monte Carlo Simulation of Nuclear Reactions
6. Particle Interaction Simulation
<https://geant4.web.cern.ch/>

STUDENT ACTIVITIES

UNIT-I: INTRODUCTION TO NUCLEAR PHYSICS

Provide students with a computer simulation or interactive app that allows them to explore radioactive decay processes.

Ask students to observe and analyze the decay patterns of different isotopes, including the concept of half-life.

Guide students to make connections between the simulation results and the fundamental principles of nuclear physics.

UNIT-II: ELEMENTARY PARTICLES AND INTERACTIONS

Divide students into small groups and assign each group a specific elementary particle (e.g., proton, electron, neutrino, and quark).

Instruct students to create posters showcasing their assigned particle, including its properties, classification, and interactions.

Encourage creativity in the presentation of information, such as diagrams, illustrations, and concise explanations.

Have each group present their posters to the class, promoting discussion and comparisons between different particles.

UNIT-III: NUCLEAR REACTIONS AND NUCLEAR DETECTORS

Divide students into small groups and assign each group a specific scenario that requires radiation shielding, such as a nuclear power plant, a medical facility, or a space mission.

Instruct students to research and design an effective radiation shielding system for their assigned scenario, considering factors such as the type of radiation, the intensity of radiation, and the materials available for shielding.

Encourage students to calculate and compare the attenuation properties of different materials and discuss the trade-offs between effectiveness, cost, and practicality in their designs.

Have each group present their shielding design to the class, explaining the rationale and addressing potential challenges or limitations.

UNIT-IV: NUCLEAR DECAYS AND NUCLEAR ACCELERATORS

Provide students with a radioactive decay chain involving multiple decays, such as alpha decay, beta decay, and gamma decay.

Instruct students to analyze the decay chain and determine the sequence of decays, including the types of particles emitted and the resulting daughter nuclei.

Ask students to calculate the half-lives of the parent and daughter nuclei based on the decay data and explore the concept of radioactive equilibrium.

Encourage students to discuss the practical applications and significance of decay chains in fields such as radiometric dating or medical imaging.

UNIT-V: APPLICATIONS OF NUCLEAR AND PARTICLE PHYSICS

Assign students specific medical imaging techniques based on nuclear and particle physics, such as positron emission tomography (PET), single-photon emission computed tomography (SPECT), or computed tomography (CT).

Instruct students to research and present on the principles behind their assigned imaging

technique, including the interaction of particles or radiation with matter, detector technology, and image reconstruction methods. Ask students to discuss the advantages, limitations, and specific medical applications of their assigned imaging technique. Encourage students to critically analyze the role of nuclear and particle physics in advancing medical diagnostics and treatment planning.

SEMESTER-IV
COURSE 11: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS

Theory

Credits: 3

3hrs/week

COURSE 11: BLUE PRINT

Unit	Essay answer questions	Short answer questions	Numerical problem
Unit I	2 (with internal choice)	1	1
Unit II	2 (with internal choice)	2	0
Unit III	2 (with internal choice)	1	1
Unit IV	2 (with internal choice)	2	0
Unit V	2 (with internal choice)	2	0

**SEMESTER-IV
QUESTION BANK**

COURSE 11: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS

Time: 3 hours

Max marks: 60M

UNIT-I: Introduction to Nuclear Physics

Essay Questions:

1. Discuss the general properties of nuclei. Explain their significance.
2. Explain Yukawa's meson theory.
3. Explain about the liquid drop model.

Short Questions:

1. What is mass defect and how is it calculated?
2. Define binding energy and explain its importance in nuclear physics.
3. Describe the characteristics of nuclear forces.
4. Explain the concept of magic numbers in nuclear physics.

UNIT-II: Elementary Particles and Interactions

Essay Questions:

1. Overview the classification of elementary particles, including leptons, mesons, and baryons.
2. Describe strong, electromagnetic, and weak interactions with examples.
3. Explain conservation laws in particle physics.

Short Questions:

1. What are leptons, and what are their properties?
2. Define mesons and baryons and explain their differences.
3. Briefly describe strong interactions in particle physics.
4. What is charge conjugation and why is it important in particle physics?

UNIT-III: Nuclear Reactions and Nuclear Detectors

Essay Questions:

1. Discuss types of nuclear reactions and applicable conservation laws.
2. Describe the working principles and applications of Wilson Cloud Chamber.
3. Describe the working principles and applications of Geiger-Muller Counter.

Short Questions:

1. Define nuclear cross-section and provide the formula.
2. Explain energy balance in nuclear reactions & the Q-Value.
3. What is a scintillation counter, and how does it work?

UNIT-IV: Nuclear Decays and Nuclear Accelerators

Essay Questions:

1. Explain Gamow's theory of alpha decay.
2. Describe construction, working, and applications of cyclotrons.
3. Describe construction, working, and applications of synchrocyclotrons.

Short Questions:

1. Explain Geiger-Nuttall Law?

2. Briefly explain the process of beta decay.
3. Discuss Fermi's theory of beta decay.

UNIT-V: Applications of Nuclear and Particle Physics

Essay Questions:

1. Describe the working principle of a PWR nuclear reactor.
2. Explain the concept of proton therapy and its benefits in medical treatment.

Short Questions:

1. Write a short note on medical applications of radiation therapy & image techniques.
2. What are the safety measures in nuclear reactors to prevent accidents?
3. Explain medical applications like proton therapy.
4. Write a short note on NMRI (Nuclear Magnetic Resonance Imaging)

S.R.R & C.V.R. GOVERNMENT DEGREE COLLEGE (A) VIJAYAWADA
B.Sc Honours (Physics Major)
CODE: SEMESTER-IV
MODEL QUESTION PAPER
COURSE 11: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS

Time: 3 hours

60M

Max marks:

Section-A

Answer any Five of the following Questions

5X4=20 Marks

1. A nucleus of mass number 125 has radius 0.8 fermi. Find the radius of nuclear having mass number 64.
2. Explain the concept of magic numbers in nuclear physics.
3. What are leptons, and what are their properties?
4. Define mesons and baryons and explain their differences.
5. Define nuclear cross-section and provide the formula.?
6. The G. M. Counter wire collects 10^8 electrons per discharge when the counting rate is 600 counts/minute. What will be the average current in the circuit.
7. Explain Geiger-Nuttall Law?
8. Briefly explain the process of beta decay.
9. Write a short note on medical applications of radiation therapy & image techniques.
10. What are the safety measures in nuclear reactors to prevent accidents?

SECTION-B

Answer all questions
Marks

5X8=40

11. Explain Yukawa's meson theory. (Or)
Explain about the liquid drop model
12. Describe strong, electromagnetic, and weak interactions with examples. (Or)
Explain conservation laws in particle physics.
13. Describe the working principles and applications of Wilson Cloud Chamber. (Or)
Describe the working principles and applications of Geiger-Muller Counter.
14. Describe construction, working, and applications of cyclotrons. (Or)
Describe construction, working, and applications of synchrocyclotrons.
15. Describe the working principle of a PWR nuclear reactor. (Or)
Explain the concept of proton therapy and its benefits in medical treatment.



ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

Multidisciplinary Courses Offered for B.A./B.Com./BBA/BCA Majors w.e.f. AY 2023 24

SEMESTER IV INTRODUCTION TO NANOTECHNOLOGY

Credits: 2

2 hrs/week

Course Objective:

The objective of the course "Introduction to Nanotechnology" is to provide students with a comprehensive understanding of the principles, applications, and implications of nanotechnology from a multidisciplinary perspective.

Programme Outcomes:

By the end of the course, students will be able to:

1. Define and describe the fundamentals of nanotechnology: Students will develop a clear understanding of the basic concepts and principles of nanotechnology, including nanoscale materials, structures, and phenomena. They will grasp the unique properties and behavior of materials at the nanoscale and how they differ from macroscopic systems.
2. Understand the fabrication and characterization techniques in nanotechnology: Students will learn about the techniques and tools used to fabricate, manipulate, and characterize nanoscale materials and devices. They will explore techniques such as lithography, self assembly, microscopy, spectroscopy, and nanofabrication methods.
3. Evaluate the ethical and societal implications of nanotechnology: Students will critically assess the ethical, social, and environmental implications of nanotechnology. They will explore issues related to privacy, health and safety, sustainability, and public perception, enabling them to make informed judgments and decisions regarding the responsible development and deployment of nanotechnology.

Syllabus:

Unit 1: Introduction to Nanotechnology

Nanotechnology Overview: Definition, scope and interdisciplinary nature. Historical Development: key milestones and background. Nanoscale science: Unique properties and quantum effects at the nanoscale. Nano Technology Applications: Medicine and Health care, Electronics and Computing, Energy, Environmental Remediation, Textiles and Fabrics, Agriculture, Food Industry, Construction and infrastructure.

Unit 2: Nanomaterials and Fabrication Techniques

Nanomaterials: Introduction to various types like nanoparticles, nanotubes, and nanocomposites. Synthesis, characterization, and properties. Top-Down Fabrication, Bottom-Up Fabrication, Characterization Techniques: Methods for analyzing nanomaterials, including electron microscopy, scanning probe microscopy, spectroscopy (FTIR and Raman), and X-ray diffraction.

Unit 3: Implications and Ethics of Nanotechnology

Environmental and Health Impacts: Assessing risks of nanoparticles and nanomaterials on the environment and health. Ethical Considerations: Addressing privacy, Regulatory Framework: Overview of safety standards and regulatory frameworks for nanotechnology products. Future Perspectives: Exploring trends, challenges, and prospects in nanomedicine, nanoelectronics, and nanomanufacturing.

Reference Books:

1. "Introduction to Nanotechnology" by Charles P. Poole Jr. and Frank J. Owens: This book provides a comprehensive introduction to the field of nanotechnology. It covers the basics of nanoscale science and engineering, fabrication techniques, nanomaterials, and various applications of nanotechnology.
2. "Nanotechnology: Principles and Applications" by Sulabha K. Kulkarni and Prakash C. Ghosh: This book offers an overview of the principles and applications of nanotechnology. It covers nanomaterials, nanofabrication methods, characterization techniques, and the role of nanotechnology in different sectors such as electronics, medicine, energy, and environmental remediation.
3. "Introduction to Nanoscience and Nanotechnology" by Gabor L. Hornyak, Joydeep Dutta, et al.: This textbook provides a comprehensive introduction to nanoscience and nanotechnology. It covers the fundamental concepts, fabrication techniques, characterization methods, and applications of nanotechnology. It also discusses societal and ethical considerations related to nanotechnology.
4. "Nanotechnology: Basic Science and Emerging Technologies" by Mick Wilson, Kamali Kannangara, et al.: This book presents the fundamental concepts and emerging technologies in nanotechnology. It covers nanoscale physics, chemistry, materials science, and engineering aspects of nanotechnology. It also explores the potential impact of nanotechnology on various fields, including medicine, electronics, and energy.
5. "Introduction to Nanotechnology" by Poole and Owens: This introductory textbook covers the basics of nanotechnology, including nanoscale phenomena, nanomaterials, fabrication techniques, and applications in electronics, medicine, and energy. It provides a solid foundation for understanding the principles and potential of nanotechnology.

Student Activity

1. Assign students to create a timeline that highlights the key milestones and discoveries in the field of nanotechnology. They should include significant events, breakthroughs, and contributions from different scientists and researchers. Encourage students to incorporate visuals and descriptions to depict the historical development of nanotechnology.
2. Organize a class discussion or debate where students compare and contrast top--down and bottom--up fabrication techniques for creating nanostructures and devices. Assign students to research and present the advantages, limitations, and real--world applications of each technique. Encourage students to critically analyze and discuss the suitability of each technique for different scenarios.
3. Assign students to research and prepare a report on the potential environmental and health impacts of nanotechnology. Students should explore the risks associated with nanoparticles and nanomaterials, such as their release into the environment, bioaccumulation, and potential toxicological effects. They should analyze case studies and scientific literature to assess the current understanding of these impacts and propose strategies for risk assessment and mitigation.

S. R.R & C.V.R. GOVERNMENT DEGREE COLLEGE (A) VIJAYAWADA

Multi-Disciplinary Course

SEMESTER-IV

Introduction to Nano Technology

Time : 2 hours

Max marks: 50M

BLUE PRINT

Unit	Essay answer questions
Unit I	3
Unit II	3
Unit III	4

S.R.R & C.V.R. GOVERNMENT DEGREE COLLEGE (A) VIJAYAWADA

Multi-Disciplinary Course

SEMESTER-IV

QUESTION BANK

Introduction to Nano Technology

Time:2 hours

Max marks: 50M

Unit 1: Introduction to Nanotechnology

Essay Questions:

1. Define nanotechnology and discuss its interdisciplinary nature. Highlight key historical milestones.
2. Discuss the applications of nanotechnology in textiles, fabrics, Agriculture, Food Industry, Construction and infrastructure.
3. Discuss applications of nanotechnology in medicine and healthcare with examples.
4. Discuss applications of nanotechnology in Electronics and Computing.
5. Describe nanotechnology's impact on energy and environmental remediation with specific examples.

Unit 2: Nanomaterials and Fabrication Techniques

Essay Questions:

1. Explain briefly different types of nanomaterials (nanoparticles, nanotubes, nanocomposites) and their properties.
2. Compare top-down and bottom-up fabrication techniques with examples.
3. Explain the significance of electron microscopy and scanning probe microscopy.
4. Discuss FTIR and Raman spectroscopy's role in analyzing nanomaterials.
5. Describe the process and importance of X-ray diffraction in studying nanomaterials.

Unit 3: Implications and Ethics of Nanotechnology

Essay Questions:

1. How do nanoparticles affect the environment and what are the potential health risks of nanomaterials.
2. Discuss ethical considerations of nanotechnology, focusing on privacy and security.
3. What are the key safety standards for nanotechnology products?
4. How can societal acceptance impact the growth of nano technology?
5. Describe a regulatory framework for nanotechnology.

S.R.R & C.V.R. GOVERNMENT DEGREE COLLEGE (A) VIJAYAWADA

Multi-Disciplinary Course

SEMESTER-IV

MODEL QUESTION PAPER

Introduction to Nano Technology

Time:2 hours

Max marks: 50M

Answer any Five of the following Questions

5X10=50 Marks

1. Define nanotechnology and discuss its interdisciplinary nature. Highlight key historical milestones.
2. Discuss applications of nanotechnology in medicine and healthcare with examples.
3. Discuss applications of nanotechnology in Electronics and Computing.
4. Explain briefly different types of nanomaterials (nanoparticles, nanotubes, nanocomposites) and their properties.
5. Compare top-down and bottom-up fabrication techniques with examples.
6. Describe the process and importance of X-ray diffraction in studying nanomaterials.
7. How do nanoparticles affect the environment and what are the potential health risks of nanomaterials.
8. Discuss ethical considerations of nanotechnology, focusing on privacy and security.
9. How can societal acceptance impact the growth of nano technology?
10. Describe a regulatory framework for nanotechnology.



**S.R.R. & C.V.R. GOVT. DEGREE
COLLEGE (A) VIJAYAWADA, N.T.R. DT.**
AFFILIATED TO KRISHNA UNIVERSITY, MACHILIPATNAM
Department of PHYSICS & ELECTRONICS
Academic Year-2024-25

ACADEMIC YEAR 2024-2025
DEPARTMENT OF PHYSICS & ELECTRONICS

Smt P. Sailaja, In charge of the Department of Physics & Electronics requests the Academic Council to Consider and approve the changes in the syllabi recommended by the Board of Studies for the academic year 2024-25.

The BOS meeting held on 30-04-2024.

The resolutions were seconded by Prof.M.Rami Reddy, Member of the Board of studies.

The Academic council is also requested to accord permission to appoint Examiners for theory and Practical for the academic year 2024-25.

Chairman BOS

Members present

1. Smt.P.Sailaja , Assoc.Prof of Physics (**Board of studies chairperson**) :
2. Prof. M.RamiReddy, (**University Nominee**) :
Registrar, Krishna University, Machilipatnam
3. SriK. Ajay Kumar, Assist. Prof. of Physics (**Subject Expert**) :
4. Dr.P.Gopi Krishna, Asst. Prof. of Dept of ECM (**Subject Expert**) :
5. Sri Novara Prasad (**Industrialist**) :
6. T. Poojitha Masc. (Physics)(**Alumni**) :

	S.R.R. & C.V.R. GOVT. DEGREE COLLEGE (A) VIJAYAWADA, N.T.R. DT. AFFILIATED TO KRISHNA UNIVERSITY, MACHILIPATNAM Department of PHYSICS & ELECTRONICS Academic Year-2023-24
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List of Examiners and Paper Setters:

S.NO	Name of the Lecturer	Address
1.	Sri. K. Ajay Kumar, Asst. Prof. of Physics Mob:9493474612	GDC,Eluru,W.G.Dt
1	Sri M. Aruna, Lecturer in physics, Mob.no-9490881096	GDC, Kanchikacherla, Krishna Dt
2	Smt.Ch.Komala Lakshmi, Lecturer in Physics, Mob.no-9440151266	GDC(A), Rajamahendravaram, E.G.Dt
3	Kum.G.Sirisha, Lecturer in Physics Mob.no-8121925246	GDC(W),Guntur, Guntur Dt.
4	Sri. Ch.Venkatswara Rao, Asst. Prof. of Physics	GDC(A), Rajamahendravaram, E.G.Dt
5	Dr.P. Gopi Krishna, Asst.Prof. of ECM	K.L. Education Foundation, Vaddeswaram, Guntur.
	Dr. K.Jayadev, Asst. Prof. of Physics	PR GDC(A), Kakinada
7	Sri.SK.Basha, Lecturer in Physics Mob no.9705964213	GDC, Rajamahendravaram,E.G.Dt

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After thorough Discussion the following Resolutions are made:

1. It is resolved to follow the same syllabus prescribed by the APSCHE; Andhra Pradesh for UG students of B.Sc (Physics) honours in all semesters from the Academic Year 2024-25 with some additional inputs and some deletions.
2. It Is resolved to Approve the syllabus of **Semester III and semester IV.**
3. It is resolved and approved the **Multi-disciplinary Course** with 20% modifications in semester I for Commerce and Humanities programmes.
4. It is resolved and approved the Syllabus for Certificate Courses of
5. Certificate course on “**Basics of Film making**”
6. Certificate course on “**System Maintenance and Networking Management**”
7. Resolved and approved the model question paper pattern for all semester examinations.
8. It is resolved to take 40% marks are eligible to treat as pass both in internal and external examinations.
9. It is resolved to take 60% of marks for external examinations and 40% for internal examinations as same as the BOS of last academic year 2023-24.
10. It is approved blueprint for theory and practical examinations without modifications.
11. It is resolved to consider 25 Marks for External evaluation and 25 Marks for internal evaluation in Practical examination in all semesters.
12. It is resolved to suggest student “study projects”, Extension activities, and Field trips, curricular and co-curricular activities.

Signatures of the BOS members:

7. Smt.P.Sailaja , Assoc.Prof of Physics (**Board of studies chairperson**) :
8. Prof.M.RamiReddy, (**University Nominee**) :
Registrar, Krishna University, Machilipatnam
9. Sri K. AjayKumar, Assist. Prof. of Physics (**Subject Expert**) :
10. Dr.P.Gopi Krishna, Asst. Professor, Dept. of ECM (**Subject Expert**) :
11. Sri N.Vara Prasad (**Industrialist**) :
12. Ms. T. Poojitha ,Asst.Prof of Physics (**Alumni**) :

Members of the Department:

7. Dr..B.Nagamani, Asst.Prof.of Physics :
8. Smt. T.V.Vakula Priya, Ast.Prof. of Physics :
9. Dr. J. Nageswara Rao, Asst.Prof.of Physics :
10. Sri.T.Devender Reddy, Asst.Prof.of Physics :
11. Dr. Asirvadam, Asst.Prof.of Physics :
12. Sri G.V.Gangadhara Rao, Asst.Prof.of Physics :
13. P.Durga Dinesh , Student :
14. Geetha Kumari ,Student :