ST. ALOYSIUS COLLEGE(AUTONOMOUS), JABALPUR

Reaccredited 'A++ 'Grade by NAAC(CGPA:3.58/4.00)
College with Potential for Excellence by UGC
DST-FIST Supported & STAR College Scheme by DBT

Faculty of Science

Master of Science (M.Sc.)

SUBJECT: PHYSICS

M.Sc. III Semester

Under CBCS System

Paper-I (Core Course)

Nuclear, Atomic and Molecular Physics

Course Outcomes

	Course Outcomes After completing the course students will be able to	**Cognitive Level**
CO-I	Understand the historical background and contributions of renowned discoveries in Nuclear Physics.	U, R
CO-II	understand the concepts of Nuclear Fission and Fusion	U,R
CO-III	Understand the classification schemes and conservation laws for elementary particles	U, Ap, E
CO-IV	Understand atomic and molecular spectra, including selection rules for transitions.	Ap, E,An
CO-V	Understand various spectroscopic methods	An, C

R-Recall, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Credit and Marking Scheme

	Credits	Marks		Total Marks
		Internal	External	
Theory	6	40	60	**100**

Evaluation Scheme

	Marks	
	Internal	**External**
Theory	Class Test (20 Marks) Assignment/Presentation (20 Marks)	1 External Exams (At the End of Semester) (60 Marks) **Section(A)** : Objective Type Questions 5x1=5 **Section (B) :** Short Questions 5x4=20 **Section (C) :**Long Questions 5x7=35

Content of the Course

Theory

No. of Lectures (in hours per week): 6 Hrs. per week

Total No. of Lectures: 90 Hrs. **Maximum Marks:** 60

Units	Topics	No. of Lectures
I	Historical background and contributions of Dr. Vikram Sarabhai, Dr. Homi Jehangir Bhabha and Dr. Raja Ramanna in Nuclear physics and Atomic Theory of Vaiśeṣika. Concept of Nuclear Fission and Fusion, Liquid Drop, Shell and Collective models of Nucleus, Scintillation and Solid-State Detectors, Cerenkov Detectors Activities: 1. Ask to make a poster "From Paramanu to Proton – An Indian Journey Through Matter" 2. Organize a debate on nuclear fission and fusion. 3. Arrange a group discussion on "Are ancient ideas of Paramanu compatible with modern atomic theory?"	18
II	Elementary particles, Classification of Particles, Interactions, Symmetries and Conservation laws, the quark model, Baryon and Lepton numbers, Iso-spin, hypercharge, Strangeness, Parity, Quark Model, Charm, Beauty and Truth.	18
III	Spectra of alkali elements, spin orbit interaction , Two electron system, LS coupling and JJ coupling schemes, Fine structure of hydrogen-like atoms, Hyperfine structure and isotope shifts, Selection rules for optical transitions,	18

	Zeeman effect: Normal and anomalous, Basics of ESR (Electron Spin Resonance) and NMR (Nuclear Magnetic Resonance)	
IV	Born-Oppenheimer approximation, Electronic, vibrational, and rotational energy levels of molecules, Rotational spectra of diatomic molecules (rigid and non-rigid rotator models), Vibrational spectra (harmonic and anharmonic oscillators), Vibrational-Rotational Spectra, Electronic spectra of diatomic molecules (Franck-Condon principle), Morse potential energy curve; Molecules as vibrating rotator; Vibration spectrum of diatomic molecule.	18
V	**Raman Effect:** Classical and quantum theories, Raman spectroscopy and its applications in determination of molecular structure, Molecular polarizability, Pure Vibrational and Rotational spectra of diatomic molecules, Experimental setup of Raman effect.	**18**

Keywords/Tags: Nuclear Fission and Fusion, Molecular Orbitals, Selection Rules, Zeeman Effect, Raman Spectroscopy.

***Code Details**: Gender – [i], Environment & Sustainability – [ii], Human Values – [iii], Professional Ethics – [iv], Employability – [v], Entrepreneurship - [vi], Skill Development -[vii]*

References

Suggested Readings:

1. Atomic Theory of Vaiśeṣika Shashi Prabha Kumar
2. Introductory Nuclear Physics K. S. Krane
3. Introduction to Nuclear Physics H. A. Enge
4. Physics of the Nucleus M. A. Preston
5. Nuclear Physics – An Introduction. S. B. Patel
6. Introduction to Molecular Spectroscopy G. M. Barrow
7. Spectra of diatomic molecules Herzberg
8. Molecular Spectroscopy J. M. Brown
9. Spectra of Atoms and MoleculesP. F. Bemath
10. Modern Spectroscopy J. M. Holias

Suggested equivalent online courses:

1. https://www.youtube.com/watch?v=TqGJGFBq3Yg
2. http://digimat.in/nptel/courses/video/115103101/L18.html
3. https://archive.nptel.ac.in/courses/115/105/115105100/
4. https://www.classcentral.com/classroom/youtube-atomic-and-molecular-physics-47826
5. https://ocw.mit.edu/courses/8-421-atomic-and-optical-physics-i-spring-2014/video_galleries/video-lectures/

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M.Sc. III Semester

Under CBCS System

Paper-II
Material Science (Core Course)
Course Outcomes

	Course Outcomes	Cognitive Level
CO-I	Understand the historical background of Indian Metallurgy.	U, R
CO-II	Understand the phenomena of nuclear kinetics and diffusion.	U, An
CO-III	Calculate the lattice parameters using XRD.	Ap, An, E
CO-IV	Understand the concepts and applications of Nanomaterials.	U, Ap
CO-V	Utilize various tools and techniques to investigate microstructure of material.	Ap, C

R-Recall, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Credit and Marking Scheme

	Credits	Marks		Total Marks
		Internal	External	
Theory	6	40	60	**100**

Evaluation Scheme

	Marks	
	Internal	**External**
Theory	Class Test (20 Marks) Assignment/Presentation (20 Marks)	1 External Exams (At the End of Semester) (60 Marks) **Section(A)** : Objective Type Questions 5x1=5 **Section (B) :** Short Questions 5x4=20 **Section (C) :**Long Questions 5x7=35

Content of the Course

Theory

No. of Lectures (in hours per week): 6 Hrs. per week

Total No. of Lectures: 90 Hrs. **Maximum Marks:** 60

Units	Topics	No. of Lectures
I	**Phase Transition:** Ancient Indian Metallurgy: Copper metallurgy, Ferrous metallurgy, Relative stability of phase and phase rule, Single component and binary phase diagrams, Microstructural changes during cooling, Lever rule. Order, Disorder Transition **Activities:** 1. Organize a group discussion on different types of metals exported by India. 2. Prepare a chart on which metals are mined in India. 3. Prepare a Poster on Single component and binary phase diagrams.	18
II	**Kinetics and Diffusion** Nucleation Kinetics, Growth and transformation Kinetics, Application in transformation in steel, solidification and crystal growth; Diffusion in solids, Fick's law, Solution to Fick's second law, Kirkendal effect.	18
III	**X-Ray Diffraction** X-ray Diffraction process and Diffractometer, applications of XRD, Principle of powder diffraction method, Interpretation of XRD data, accurate determination of lattice parameters; least-square method	18

	(Rietveld Analysis)	
IV	**Nanomaterials** Basic concepts and applications, Types of Carbon-based nanomaterials, Fullerenes, Carbon nanotubes, Single wall and multiwall carbon tubes, Synthesis of carbon nanomaterials, Electronic and mechanical properties of nano-materials.	18
V	**Microscopy Techniques** Microstructure of materials, Scanning and Transmission Electron Microscopy techniques, compositional analysis by energy dispersive spectroscopy; surface analysis by Scanning Tunneling and Atomic Force Microscopy	**18**

***Code Details**: Gender – [i], Environment & Sustainability – [ii], Human Values – [iii], Professional Ethics – [iv], Employability – [v], Entrepreneurship - [vi], Skill Development -[vii]*

References

Suggested Readings:

1.Ancient Indian Metallurgy, Ashoka K. Mishra

2. X-Ray Crystallography, Azaroff

3. Crystallography for Solid State Physics, A. R. Verma, O. N. Shrivastava

4. The Powder method, Azaroff and Buerger

5. Crystal Structure Analysis, Buerger

6. Materials Science and Engineering, V. Raghavan

Suggested equivalent online courses:

1. https://archive.nptel.ac.in/courses/113/102/113102080/

2. http://www.digimat.in/nptel/courses/video/122102008/L01.html

3. https://archive.nptel.ac.in/courses/113/107/113107078/

4https://www.youtube.com/watch?v=z0zfJHLGJBc&list=PLL0SWcFqypCm4xCn64xO7RS62PPzyoP8

Lab-I Core Course

Credit Value 4

Total numbers of Lectures - Practical (in hours per week): 02 hours per credit per week

Total Marks Max. Marks: 100 **Min. Passing Marks:40**

	Course Outcomes On completion of the course, the students will be able to:	**Cognitive Level**
CO-I	Understand the quantum mechanical basis of spin and magnetic moments.	U, R
CO-II	Study the variation of stopping potential with frequency of incident light.	Ap
CO-III	Fabrication and study of multivibrators	Ap, An, E
CO-IV	Study the line emission spectra.	An
CO-V	Understand the principles of Phase shift Oscillator and plotting its output.	U, C

R-Recall, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

List of experiments

1. To measure the Lande's g factor using ESR.
2. Measurement of stopping potential and Planck's constant using solar cell.
3. To verify inverse square law of radiation using solar cell.
4. Determine e/m by helical method.
5. Design astable multivibrator using IC-555.
6. Hall Effect Experiment to determine charge carrier concentration and mobility.
7. Design Monostable multivibrator using IC-555.
8. Identification of unknown element from line emission spectra.
9. Determination of e/m of Electron by Thomson's Method.
10. To study Phase shift Oscillator.
11. To study Wein Bridge Oscillator.

12. To study Hartley/Colpitts Oscillator.

Text Books, Reference Books, Other resources

Suggested Readings:

1. "Experiments in Modern Physics" , Adrian C. Melissinos & Jim Napolitano

2. "Practical Physics" , G.L. Squires

3. "Atomic Physics" , J.B. Rajam

4. "Physics Lab Manual" , C.L. Arora

5. "Solid State Physics" , S.O. Pillai

6. "Electronic Instrumentation and Measurement" , H.S. Kalsi

7. "Op-Amps and Linear Integrated Circuits" , Ramakant A. Gayakwad

Suggested web links:

https://ep2-iitb.vlabs.ac.in/exp/planck-constant/index.html

https://ae-iitr.vlabs.ac.in/exp/wein-bridge-oscillator/index.html

https://www.youtube.com/watch?v=3XJez8bzU34

https://vlab.amrita.edu/index.php?sub=1&brch=195&sim=359&cnt=1

https://ph1-nitk.vlabs.ac.in/exp/phase-shift-oscillator/theory.html

Lab-II (Core)

Total numbers of Lectures - Practical (in hours per week): 02 hours per credit per week

Total Marks Max. Marks: 100 **Min. Passing Marks:4**

Credit Value 4

	Course Outcomes On completion of the course, the students will be able to:	**Cognitive Level**
CO-I	Understand concept of quantization of energy levels.	U
CO-II	Understand temperature dependence of resistivity.	U, R
CO-III	Understand the working principle of a GM counter and apply it to study different radioactivity loss	U, Ap, An
CO-IV	Study and compare dielectric constant semiconductor materials.	E
CO-V	Investigation of the splitting of spectral lines in a magnetic field.	Ap, An, C

R-Recall, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

List of experiments

1. To experimentally demonstrate the concept of quantization of energy levels by Franck-Hertz Experiment.
2. To determine band gap by four probe method.
3. To determine the resistivity of semiconductors by Four probe Method.
4. Study of GM Counter.
5. Study of statistical nature of radioactivity using G M Counter.
6. Determining the plateau and optimal operating voltage of Geiger-Muller Counter.
7. To determine dielectric constant of Semiconductor material.
8. To determine the Hall voltage developed across the sample material.
9. Zeeman Effect – Study of Splitting of Spectral Lines.
10. To study of characteristics of SCR.
11. Study of characteristics of LDR.

Text Books, Reference Books, Other resources

Suggested Readings:

1. "Material Science Laboratory Manual" – R.K. Rajput

2. "Experiments in Modern Physics" – Adrian C. Melissinos & Jim Napolitano

3. "Atomic Physics" – J.B. Rajam

4. "Fundamentals of Molecular Spectroscopy" – C.N. Banwell& E.M. McCash

5. "Solid State Physics" – S.O. Pillai

6. "Electronic Principles" – Albert Malvino& David Bates

7. "Nuclear Physics: Principles and Applications" – John Lilley

Suggested web links:

https://ep-iitb.vlabs.ac.in/exp/geiger-muller-counter/index.html

https://mintapps.org/html/mint-franckhertz.html

https://ph1-nitk.vlabs.ac.in/exp/zeeman-effect/simulation.html

https://everycircuit.com/circuit/5222043451129856/scr-simulation

https://www.youtube.com/watch?v=MIfsV765eOs

Faculty of Science

Master of Science (M.Sc.)

SUBJECT: PHYSICS

M.Sc. IV Semester

Under CBCS System

Paper-I (Core Course)

Laser and Fiber Optical Communication

Course Outcomes

	Course Outcomes On successful completion of this course, the students will be able to	Cognitive Level
CO-I	Understand the Concept of ancient Indian theory of light	U, R
CO-II	Learn about different types of lasers (e.g., He-Ne, Ruby, and Semiconductor) and their key characteristics and various applications.	U, An, Ap
CO-III	Develop the concept of Optical Fiber, its types, propagation of light and losses in optical fiber.	An, E
CO-IV	Outline the necessity of special light sources used with optical fiber and measurement of attenuation & dispersion in optical fiber.	R, Ap,
CO-V	Compare various fabrication processes of optical fiber and build an understanding of Signal Modulation & Demodulation in Optical Fiber Communication	An, Ap, C

R-Recall, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Credit and Marking Scheme

	Credits	Marks		Total Marks
		Internal	External	
Theory	6	40	60	**100**

Evaluation Scheme

	Marks	
	Internal	**External**
Theory	Class Test (20 Marks) Assignment/Presentation (20 Marks)	1 External Exams (At the End of Semester) (60 Marks) **Section(A)** : Objective Type Questions 5x1=5 **Section (B) :** Short Questions 5x4=20 **Section (C) :**Long Questions 5x7=35

Content of the Course

Theory

No. of Lectures (in hours per week): 6 Hrs. per week

Total No. of Lectures: 90 Hrs. **Maximum Marks:** 60

Units	Topics	No. of Lectures
I	Conceptual Ancient Indian Understanding of Light (Tejas) and compare it to modern laser principles. Overviews on Indian Institutes of LASER and fiber optical communication. Introduction Characteristics (Monochromaticity, Directionality, Brightness, Coherence) of a LASER beam, Interaction of radiation with Matter (Induced Absorption, Spontaneous Emission, Stimulated Emission), Einstein's A and B coefficients and expression for energy density, LASER Action and the Conditions for LASER action (Population Inversion and Pumping, metastable state), Requisites of a LASER system (Energy Source or Pumping Mechanism, Active medium and Resonant cavity (or) LASER cavity), three and four level Lasers. **Activity:** 1. Prepare a Poster or "From Tejas to Technology: How Ancient India Saw Light". 2. Organize a debate on "Compare laser principles (e.g., coherence, stimulated emission) with yogic/dharmic concepts (e.g., dharana, karma, prana)" 3. Arrange group discussions on "The Role of Indian Institutes in Advancing Laser Technology.	18
II	Line shape broadening, Optical Resonance, Longitudinal and transverse modes in laser cavity, Oscillation gain and power output, Q Switching, Mode locking, pulse shortening. Types and Applications of	18

	Lasers: Principles of Ruby, Nd: YAG, He-Ne, CO_2, Semiconductor and dye Laser, Holography and its applications.	
III	Optical Fiber, types of optical fibre, Propagation of light in optical Fiber, basic structure and optical path of an Optical Fiber, Acceptance Angle, Numerical Aperture, Modes of Propagation, Attenuation in Optical Fiber, Absorption losses, Bending Losses, Radiation Losses, Pulse Dispersion, Materials Dispersion.	**18**
IV	Optical Fiber sources: Light Emitting Diode (LED) as a source; Fiber-LED coupling; Bandwidth and Spectral Emission of LED. LASER. Optical fiber cable, fiber joints, splices, couplers and connectors, measurement in optical fibers, attenuation measurement, dispersion measurement, refractive index profile measurement.	**18**
V	Fabrication Methods for Fiber fabrication, Outside Vapour Phase Oxidation, Vapour Phase Axial Deposition, Double crucible method, Modified Chemical Vapour deposition. Signal Modulation & Demodulation in Optical Fiber Communication: Intensity Modulation of the Analog & Digital Signal, Frequency Modulation (FM), Pulse Width Modulation, Sensitivity of Fiber optic link.	**18**

Keywords/Tags: LASER, Monochromaticity, Optical Fiber, Bandwidth, Radiation loss

Text Books, Reference Books, Other resources

Suggested Readings:

1. Concept of Light in classical Shastras of India with comparative review with modern science, Achutha B S, Dr. Vinay P
2. Laser Theory and Applications, A. K. Ghatak &Tyagarajan
3. Laser Fundamentals , William T. Silfvast
4. Introduction to Laser Physics, K. Shrimoda
5. Laser and Nonlinear Optics, B. B. Laud
6. Optical Fiber Communication, B. Keiser, MGH

Suggested equivalent online courses:

1. https://onlinecourses.nptel.ac.in/noc25_ph03/preview.
2. https://www.youtube.com/watch?v=FNp81kkxj5c
3. https://archive.nptel.ac.in/courses/115/102/115102124/
4. https://archive.nptel.ac.in/courses/108/106/108106167/
5. https://onlinecourses.nptel.ac.in/noc20_ee79/preview

Under CBCS System

Paper-II
Digital Electronics and Microprocessor (Core Course)
Course Outcomes

	Course Outcomes After completing the course students will be able to	**Cognitive Level**
CO-I	Understand the historical contributions of Dr. B. S. Sonde in digital electronics.	R
CO-II	Understanding Number systems and their interconversions.	U, Ap
CO-III	Understand the characteristics of the ideal OP-Amp and its applications	Ap, E
CO-IV	Understand the basics of 8085 microprocessor systems and its programming	C
CO-V	Understand the requirements to interface 8085microprocessors to various peripherals.	An, Ap

R-Recall, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Credit and Marking Scheme

	Credits	Marks		Total Marks
		Internal	External	
Theory	6	40	60	**100**

Evaluation Scheme

	Marks	
	Internal	**External**
Theory	Class Test (20 Marks) Assignment/Presentation (20 Marks)	1 External Exams (At the End of Semester) (60 Marks) **Section(A)** : Objective Type Questions 5x1=5 **Section (B) :** Short Questions 5x4=20 **Section (C) :**Long Questions 5x7=35

Content of the Course

Theory

No. of Lectures (in hours per week): 6 Hrs. per week

Total No. of Lectures: 90 Hrs. **Maximum Marks:** 60

Units	Topics	No. of Lectures
I	**Digital Electronics:** 1. Indian pioneer of digital electronics :(Dr. B.S. Sonde), Overview of Indian research Institutes in digital electronics. 2. Number systems and their inter-conversions, binary addition and subtraction using 2's complement, Codes: BCD (8421), 2412, excess-3, Gray, ASCII, alphanumeric codes, Parity generator and checker. 3. Logic gates: Logic gates and De-Morgan's theorems, Boolean laws, simplification of logic circuits. Fundamental Products: SOP, POS and Karnaugh Maps. Adder, Subtractor, multiplexer and demultiplexer. Flip flops: RS, D, JK, JK master slave flip-flops. Clocked level and edge triggered Flip-flop. ***Activities:*** *1. Prepare a poster on " Ancient Indian literature Linked to Digital Electronics: Pingala's Binary System ".* *2. Arrange group discussion on "Indian manufacturers and exporter of basic digital components "* 3. *Prepare a chart on "Number system and their interconversion"*	**18**
II	Block diagram of OP-Amp, characteristics of the ideal OP-Amp, OP-Amp Parameters: Input offset voltage, input offset current, Input bias current, CMRR, SVRR, large signal voltage gain, Slew rate, gain band width product, Output resistance, Open loop and closed loop OP-Amp configurations, differential, inverting and non – inverting amplifiers, voltage series feedback amplifier, effect of feedback on closed loop gain, Input and output resistance, bandwidth, total output voltage. Application of OP-Amp: Adder, Subtractor, Integrator and	**18**

	differentiator	
III	Signal processing elements, DAC weighted resistor network, R-2R ladder network, ADC- Simultaneous, Counter type, Successive Approximation, single and dual slope; ADC and DAC specifications.	**18**
IV	**Microprocessor:** Introduction to microprocessor systems, Architecture of 8085, Buses, Registers, Arithmetic logic unit, Trends in microprocessor developments. **Microprocessor programming:** Assembly and higher level languages, Addressing schemes, Instruction set for 8085, Assembly language programming using data transfer, Arithmetic and logic instructions, Stack and subroutine, Assemblers, Interpreters and Compilers, debugging.	**18**
V	**Microprocessor Interfacing:** Interfacing, Dip switches, Seven segment display to 8085, General purpose programmable peripheral IC. 8255, Temperature controller, 8085 Interrupts, Simple examples using SIM and RIM instructions. **Data Communication:** Basic concepts transmission format, Error Checks, Data Communication over telephone line), Standards in serial I/O. Software controlled serial I/O. 8085 SID and SOD lines.	**18**

Keywords/Tags: Diodes, Number system, Solar cells, LED, Flipflop.

Text Books, Reference Books, Other resources

Suggested Readings:

1. Introduction to System Design Using Integrated Circuits, B.S. Sonde
2. Electronic devices and circuit theory, Robert Boylested& Louis
3. Op-Amps and Linear integrated circuits, Ramakant Gaikwad
4. Digital Principle and Application , A. P. Malvino& D. P. Leach
5. Semiconductor Devices- Physics and Technology, S. M. Sze
6. Introduction to Semiconductor Devices, M. S. Tyagi
7. Optical Electronics , Ajay Ghatak and K. Tyagarajan
8. Microprocessors, Ramesh Gaonkar
9. Microprocessors and Interfacing Douglas V. Hall

Suggested equivalent online courses:

1. https://www.youtube.com/watch?v=pHNbm-4reIc
2. https://www.youtube.com/playlist?list=PL803563859BF7ED8C
3. https://archive.nptel.ac.in/courses/108/105/108105132/
4. https://onlinecourses.nptel.ac.in/noc25_ee48/preview
6. https://www.youtube.com/watch?v=wUmi3roAqmk
7. http://digimat.in/nptel/courses/video/108105102/L21.html

Lab-I (Core Course)

Credit Value 4

Total numbers of Lectures - Practical (in hours per week): 02 hours per credit per week

Total Marks Max. Marks: 100 **Min. Passing Marks:40**

	Course Outcomes On completion of the course, the students will be able to:	**Cognitive Level**
CO-I	Determine wavelength of He-Ne laser.	U, R
CO-II	Understand the concept of quantization of charge and measure the e/m by Millikan oil drop method.	Ap
CO-III	Determine wavelength of LASER beam by diffraction grating using spectrometer.	Ap, An, E
CO-IV	Study the principles of amplitude and Frequency modulation.	An
CO-V	Study the characteristics of loudspeaker system.	U, C

R-Recall, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

List of experiments

1. To determine the wavelength of He-Ne laser light using single slit diffraction
2. To Determine e/m by Millikan oil drop method.
3. Using Michelson Interferometer, one can determine the wavelength of light from a monochromatic source.
4. To obtain velocity profile of flow in a pipe and verify Poiseuille Formula using He-Ne LASER.
5. To determine wavelength of LASER beam by diffraction grating using spectrometer.
6. Study of Amplitude Modulation & Demodulation.
7. Study of Frequency Modulation & Demodulation
8. Measurement of optical power using optical power meter.
9. To study the characteristics of loudspeaker system.
10. To determine the numerical aperture (NE) of optical fibres.

Text Books, Reference Books, Other resources

Suggested Readings:

1. "Advanced Practical Physics for Students", B.L. Worsnop and H.T. Flint
2. "Practical Physics for B.Sc. and M.Sc." , K. S. Mani
3. "Practical Physics" By G. L. Squires
4. "B.Sc. Practical Physics" , C.L. Arora.
5. "Optics" , Eugene Hecht.
6. "Introduction to Modern Optics" , Grant R. Fowles
7. "Electronic Communication Systems ", George Kennedy & Bernard Davis
8. "Electroacoustics" , M. E. Egan
9. "Fluid Mechanics", Frank M. White"
10. Practical Physics , H. C. Verma

Suggested web links

https://bop2-iitk.vlabs.ac.in/exp/single-slit-diffraction/simulation.html

https://vlab.amrita.edu/index.php?sub=1&brch=195&sim=357&cnt=4

https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=1106&cnt=4

https://kcgcollege.ac.in/Virtual-Lab/Electronics-and-Communication-Engineering/index.html

https://oc-iitr.vlabs.ac.in/exp/optical-power-measurements/simulation.html

Lab-II (Core Course)

Credit Value 4

Total numbers of Lectures - Practical (in hours per week): 02 hours per credit per week

Total Marks Max. Marks: 100 **Min. Passing Marks:40**

	Course Outcomes On completion of the course, the students will be able to:	**Cognitive Level**
CO-I	Understand the principle and circuit operation of a zero crossing detector.	U, R
CO-II	Learn how an op-amp with positive feedback functions as a Schmitt Trigger.	Ap
CO-III	Analyze Op-Amp as Integrator and Differentiator using 741 IC.	Ap, An, E
CO-IV	Write assembly language program using 8085 for 8 bit numbers.	An
CO-V	Write assembly language program using 8085 for 16 bit numbers.	U, C

R-Recall, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

List of experiments

1. To study Op-Amp as Zero crossing Detector using 741 IC 02 hours per
2. To Study Op-Amp as Schmitt Trigger using 741 IC credit per week
3. To study Op-Amp as Comparator using 741 IC
4. Study of OP-AMP as voltage follower using 741 IC
5. Study of OP-AMP as Integrator and Differentiator using 741 IC
6. To draw a flow chart & write assembly language program for
7. Addition and Subtraction of two 8-bit numbers using 8085
8. To draw a flow chart & write assembly language program to find sum of first 10 natural numbers using 8085 Microprocessor
9. To draw a flow chart & write assembly language program to add two 16 bit numbers with carry using 8085 Microprocessor
10. To draw a flow chart & write assembly language program to find the smaller number of two given numbers using 8085
11. To draw a flow chart & write assembly language program to find greater number from array using 8085 Microprocessor.

Text Books, Reference Books, Other resources

Suggested Readings:

1. "Op-Amps and Linear Integrated Circuits" , Ramakant A. Gayakwad.
2. "Linear Integrated Circuits" , Roy Choudhury & Shail Jain.
3. "Operational Amplifiers and Linear Integrated Circuits" , Coughlin & Driscoll
4. "Microprocessor Architecture, Programming and Applications with the 8085", Ramesh S. Gaonkar
5. "Fundamentals of Microprocessors and Microcontrollers" , B. Ram.
6. "Advanced Microprocessors and Peripherals" , A.K. Ray & K.M. Bhurchandi

Suggested web links

https://www.youtube.com/watch?v=k0LzxGMJpBg

https://www.youtube.com/watch?v=gFp9vttbFLQ

https://ae-iitr.vlabs.ac.in/exp/voltage-regulator/simulation.html

https://be-iitkgp.vlabs.ac.in/exp/operationalamplifier/simulation/rcdifferentiator_opamp.html

https://www.youtube.com/watch?v=NRdmIe9Afcs

https://www.youtube.com/watch?v=9zXvFPufgpU