Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
(AUTONOMOUS)
NODAL RESOURCE CENTRE & AU CENTRE FOR RESEARCH
Maddilapalem, Visakhapatnam – 530013, Andhra Pradesh.
0891-2553262, https://www.drvskrishnagdc.edu.in

DEPARTMENT OF PHYSICS

Curriculum for B.Sc. Honours in Physics (Major)
As per
NEP- 2020

SYLLABUS
FOR I to VIII SEMESTER
UNDERGRADUATE PROGRAMME
2024-2025 onwards

10th Board of Studies: August 2024

Pre-Approval Form

Programme: B.Sc., Physics (Honours) **Subject: Physics** **Department: Physics**

In pursuance of conferment of Autonomous status to Dr. V. S. Krishna Government Degree College (A), Visakhapatnam by UGC vide letter No…………………… dated …………… from ……………., ……………………Joint Secretary, UGC, New Delhi, and Proceedings No………………………………….. ………the 10th Board of studies in Physics subject is conducted on ……………………… …….with the following members. The changes were implemented from 2024-25 academic year onwards. The syllabus is also approved

Member	Name and Designation	Signature
Chairman of BoS	Dr. D. Sravan Kumar, HoD, Department of Physics	
Members	M.Rajeswara Rao, Lecturer in Physics	
	Dr. N.V.S. Bhagavan, Lecturer in Physics	
	Dr. B. Nageswara Rao, Lecturer in Physics	
	Smt. M. Ramya, lecturer in Physics	
	Ch. Rambabu, Lecturer in Physics	
Subject Expert (University Nominee)		
Subject Expert 1 (from outside the affiliated University)		
Subject Expert 2 (from outside the affiliated University)		
Representative member from industry/Corporate/Allied area relating to placement		
Member from alumni		
Coordinator, IQAC		
Academic Coordinator and member secretary academic council		
Principal and Chairperson Academic Council		

Resolutions adopted by the Board of Studies (BoS) of B.Sc. Honours in Physics (Major) 2024-25

Scheme of Evaluation for Practical examinations

The duration of examination for each theory course is 3Hrs.
The duration of each practical examination is 3Hrs with 50 Max. Marks
Distribution of marks
Experiment: 30M
Viva-Voce: 10M
Record: 10M

Detailed Distribution:

1. Formula and Explanation: 6M
2. Tabular Form + Graph+ Circuit Diagram: 6M
3. Observations: 12M
4. Calculation + Precautions + Result: 6M
5. Viva- Voce: 10M
6. Record: 10M
7. **Internal Evaluation**

Internal: External Evaluation is 40:60

The Internal Evaluation Method (CIA)

Mid exam	Type of Assessment	Max Marks
I	Assignment	10M
	Seminar/ Study project/Filed trip/Quiz etc	10M
	NCC/NSS (extra-curricular)	10M
	Exam (Summative)	20M
II	Assignment	10M
	Seminar/ Study project/Filed trip/Quiz etc	10M
	NCC/NSS (extra-curricular)	10M
	Exam (Formative)	20M
Grand total		100M
Total marks Scaled down to 40M		

COURSE STRUCTURE

Year	Semester	S.No	Title of the Course	Course Code	No. of Hrs /Week	No. of Credits
I	I	1	Essentials and Applications of Mathematical, Physical and Chemical Sciences	24BSPM11	3+2	4
		2	Advances in Mathematical, Physical and Chemical Sciences	24BSPM12	3+2	4
	II	3	Mechanics and Properties of Matter* (Major)	24PHYM21	3	3
			Mechanics and Properties of Matter* (Minor)	24PHYN21	3	3
			Mechanics and Properties of Matter Practical Course* (Major)	24PHYM21P	2	1
			Mechanics and Properties of Matter Practical Course* (Minor)	24PHYN21P	2	1
		4	Waves and Oscillations	24PHYM22	3	3
			Waves and Oscillations Practical Course	24PHYM22P	2	1
			Community Service Project	INTERNSHIP001	4	8 weeks
II	III	5	Optics* (Major)	24PHYM31	3	3
			Optics* (Minor)	24PHYN31	3	3
			Optics Practical Course*(Major)	24PHYM31P	2	1
			Optics Practical Course*(Minor)	24PHYN31P	2	1
		6	Heat and Thermodynamics	24PHYM32	3	3
			Heat and Thermodynamics Practical Course	24PHYM32P	2	1
		7	Electronic Devices and Circuits	24PHYM33	3	3

			Electronic Devices and Circuits Practical Course	24PHYM33P	2	1
		8	Analog and Digital Electronics	24PHYM34	3	3
			Analog and Digital Electronics Practical course	24PHYM34P	2	1
	IV	9	Electricity and Magnetism*(Major)	24PHYM41	3	3
			Electricity and Magnetism*(Minor)	24PHYN41	3	3
			Electricity and Magnetism Practical Course* (major)	24PHYM41P	2	1
			Electricity and Magnetism Practical Course* (minor)	24PHYN41P	2	1
		10	Modern Physics* (major)	24PHYM42	3	3
			Modern Physics* (minor)	24PHYN42	3	3
			Modern Physics Practical Course* (Major)	24PHYM42P	2	1
			Modern Physics Practical Course* (Minor)	24PHYN42P	2	1
		11	Introduction to Nuclear and Particle Physics	24PHYM43	3	3
			Introduction to Nuclear and Particle Physics Practical Course	24PHYM43P	2	1
			Short Term Internship	INTERNSHIP002	4	8weeks

III	V	12	Applications of Electricity & Electronics* (Major)	24PHYM51	3	3
			Applications of Electricity & Electronics* (Minor)	24PHYN51		
			Applications of Electricity & Electronics Practical Course*(Major)	24PHYM51P	2	1
			Applications of Electricity & Electronics Practical Course*(Minor)	24PHYN51P		
		13	Electronic Instrumentation* (Major)	24PHYM52	3	3
			Electronic Instrumentation* (Minor)	24PHYN52		
			Electronic Instrumentation Practical Course*(major)	24PHYM52P	2	1

			Electronic Instrumentation Practical Course*(minor)	24PHYN52P		
		14 A	Optical Instruments and Optometry	24PHYM53A	3	3
			Optical Instruments and Optometry Practical Course	24PHYM53AP	2	1
		OR				
		14 B	Optical Imaging and Photography	24PHYM53B	3	3
			Optical Imaging and Photography Practical Course	24PHYM53BP	2	1
		15 A	Low Temperature Physics & Refrigeration	24PHYM54A	3	3
			Low Temperature Physics & Refrigeration Practical Course	24PHYM54AP	2	1
		OR				
		15 B	Solar Energy and Applications	24PHYM54B	3	3
			Solar Energy and Applications Practical Course	24PHYM54BP	2	1
	VI		Internship	INTERNSHIP003	12	15 weeks
	VII	16A	Course 16A	24PHYM71A	3	3
			Course 16A Practicals	24PHYM71AP	2	1
		16B	(OR)			
			Course 16B	24PHYM71B	3	3
			Course 16B Practicals	24PHYM71BP	2	1
		17A	Course 17A	24PHYM72A	3	3
			Course 17A Practicals	24PHYM72AP	2	1
		17B	OR			3
			Course 17B	24PHYM72B	3	3
			Course 17B Practicals	24PHYM72BP	2	1
		18A	Course 18A	24PHYM73A	3	3
			Course 18A Practicals	24PHYM73AP	2	1
		18B	OR			
			Course 18B	24PHYM73B	3	3
			Course 18B Practicals	24PHYM73BP	2	1
		SEC				

		19A	Course 19A	24PHYM74A	3	3
			Course 19A Practicals	24PHYM74AP	2	1
		19B	OR			
			Course 19B	24PHYM74B	3	3
			Course 19B Practicals	24PHYM74BP	2	1
		20A	Course 20A	24PHYM75A	3	3
			Course 20A Practicals	24PHYM75AP	2	1
			OR			
		20B	Course 20B	24PHYM75B	3	3
			Course 20B Practicals	24PHYM75BP	2	1
	VIII	21A	Course 21A	24PHYM81A	3	3
			Course 21A Practicals	24PHYM81AP	2	1
		21B	OR			
			Course 21B	24PHYM81B	3	3
			Course 21B Practicals	24PHYM81BP	2	1
		22A	Course 22A	24PHYM82A	3	3
			Course 22A Practicals	24PHYM82AP	2	1
		22B	OR		3	3
			Course 22B	24PHYM82B		
			Course 22B Practicals	24PHYM82BP	2	1
		23A	Course 23A	24PHYM83A	3	3
			Course 23A Practicals	24PHYM83AP	2	1
		23B	OR	24PHYM83B	3	3
			Course 23B			
			Course 23B Practicals	24PHYM83BP	2	1
		SEC				
		24A	Course 24A	24PHYM84A	3	3
			Course 24A Practicals	24PHYM84AP	2	1
		24B	OR		3	3
			Course 24B	24PHYM84B		

			Course 24B Practicals	24PHYM84BP	2	1
		25A	Course 25A	24PHYM85A	3	3
			Course 25A Practicals	24PHYM85AP	2	1
		25B	OR			
			Course 25B	24PHYM85B	3	3
			Course 25B Practicals	24PHYM85BP	2	1

*Courses offered as major and minor

Curriculum framework BSc Single major Programme

B.Sc (Honours) with Single Major																								
Semester	**Major* (4 Cr)**			**Minor (4 Cr)**			**Languages (3 Cr)**			**Multi Disny' (2 Cr)**			**Skill Enhancement Courses (2Cr)**			**OOTC**			**Env. Edn (2 Cr)**			**Total**		
	C	***H***	***Cr***	**C**	***H***	***Cr***	**C**	***H***	***Cr***	**C**	***H***	***Cr***	**C**	***H***	***Cr***	**C**	***H***	***Cr***	**C**	***H***	***Cr***	**C**	***H***	**Cr**
Sem 1	2*	10	8				2	8	6	1	2	2	2	4	4							7	24	20
Sem 2	2	6+4	8	1	3+2	4	2	8	6				2	4	4							7	27	22
Community Service Project of 180 hours with 4 Credits. Student is eligible for Exit Option-1 with the award of Certificate in respective discipline																								
Sem 3	4	12+8	16	1	3+2	4				1	2	2	1	2	2							7	29	24
Sem 4	3	9+6	12	2	6+4	8				1	2	2	1	2	2							7	29	24
Short-Term Internship/Apprenticeship/OJT of 180 hours with 4 Credits. Student is eligible for Exit Option-2 with the award of Diploma in respective major with minor																								
Sem 5	4	12+8	16	2	6+4	8													1	2	2	7	32	26
Sem 6	**Semester Internship/Apprenticeship/OJT with 12 Credits. Student is eligible for Exit Option-3 with the award of Degree in respetive major with**																							
																			IKS#					
Sem 7	3	9+6	12										2*	6+4	8	1	2	2	1	2	0	6	29	22
Sem 8	3	9+6	12										2*	6+4	8	1	2	2	1	2	0	6	29	22
	21		84	6		24	4		12	3	6	6	10	32	28	2	4	4	2	4	0	47		**160**

20 Additional Credits for 10 month mandatory Internship/OJT/Apprenticeship
C Courses **H** Hours **Cr** Credits **OOTC** Open Online Transdisciplinary
IKS# Indian Knowledge Systems - Audit Course

Credit Requirements

- For UG Honours Degree the number of credits required is 160 along with 20 additional credits assigned for Community Service Project (4 credits), Short Term Internship (4 credits) and Semester Internship (12 credits).
- These 160 credits are apportioned as, 84 for Major Courses, 24 for Minor Courses, 12 for Languages, 6 for Multidisciplinary Courses, 28 for Skill Courses, 4 for Open Online Transdisciplinary Courses and 2 for Common Value-Added Courses.
- **The thumb rule for assigning credits is 1 hour of theory per week is equivalent to 1 credit. Similarly, 2 hours of practical per week is equivalent to 1 credit. The credits assigned for Internship/Apprenticeship/OJT are not to be equalized with the hours of work done**.
- A student can acquire a maximum of 40% of credits online

Major Courses

- Major discipline is the discipline or subject of main focus and the degree will be awarded in that discipline. Students should secure the minimum prescribed number of credits, i.e., 84 (about 50% of total credits) through core courses in the major discipline.

- A student of UG Honours Degree has to study 21 course papers with 84 credits in the chosen major.

Minor Courses

- Students have to choose a Minor in the second semester. The student can choose a minor cutting across the disciplines or from the allied disciplines.
- A student has to study 6 courses in the chosen minor with 24 credits. The minor courses start from the second semester onwards
- **A student can complete a second minor online from approved sources during the period of study and submit the credits to the institution for inclusion in the Degree certificate.**
- **Minor courses can be studied offline or online or in blended mode**.

Languages

- Two courses in English Language and two courses in Modern Indian Language are to be completed in the first two semesters.

- Each language course is taught for 4 hours with 3 credits.

- A student can opt for doing the English Language Courses online which are equivalent to IELTS/TOEFL/OET, etc. Or the minimum required scores for qualifying in IELTS/TOEFL/OET can be reckoned for the 6 credits assigned for English Language

Skill Courses

- Enhancing student employability is the top priority for higher education. Employability is a measure of a student's ability to secure their first job and remain employed throughout their working lives.

- A pool of Skill Enhancement Courses is offered in Semesters I to IV. These Skill Enhancement Courses are contemporary in nature and not major-specific.

- A student has to complete 6 such courses (2 credits each) in Semesters I to IV assigned with 12 credits. Students are offered choices for selecting skill enhancement courses of their interest.

- Major subject-specific Skill Enhancement courses with choices are offered in Semester V/VI as two of the four major courses.

- And two Skill Enhancement courses each with choices are offered in Semesters VII and VIII in the concerned major.

Semester	Skill Courses	Title of the course	Course Code	No of credits	No of hours per week
I	**A student has to choose any TWO of the following four courses**	Entrepreneurship Development	24EPDS11	2	2
		Leadership Skills	24LSSS12	2	2
		Analytical Skills	24ALSS13	2	2
		Communication Skills	24CCSS14	2	2
II	**A student has to choose any TWO of the following five courses**	Business Writing	24BNSS21	2	2
		Marketing Skills	24MKTS22	2	2
		Investment Planning	24INVS23	2	2
		Stock Market Operations	24SMOS24	2	2
		Digital Literacy	24DTLS25	2	2
III	**A student has to choose any ONE of the following four courses**	Business Forecasting	24BFCS31	2	2
		Project Management	24PJMS32	2	2
		Information and Communication Technology	24ICTS33	2	2
		Data Analysis	24DTAS34	2	2
IV	**A student has to choose any ONE of the following four courses**	Cybersecurity	24CYSS41	2	2
		Digital Marketing	24DGMS42	2	2
		Tourism Guidance	24TRGS43	2	2
		Design thinking	24DGTS44	2	2

Multidisciplinary Courses

- In consonance with NEP – 2020 all UG students are required to undergo multidisciplinary courses. These courses are intended to broaden the intellectual experience.

- **Students are not allowed to choose the courses in a major discipline or repeat courses already undergone at the higher secondary level or Intermediate level or 12th class as the multidisciplinary course.**

- A student has to complete 3 multidisciplinary courses each carrying 2 credits.

- Students are offered choices for selecting multidisciplinary courses of their interest.

Semester	Multidiscipline Course	Title of the course	Course Code	No of Credits	No of Hours per week
I	**A student has to choose ONE course from the six courses listed against the semester.**	Introduction to Social Work	24ISWD11	2	2
		Principles of Psychology	24POPD12	2	2
		Indian History	24INHD13	2	2
		Principles of Biological Sciences	24PBSD14	2	2
		Principles of Chemical Sciences	24PCSD15	2	2
		Principles of Physical Sciences	24PPSD16	2	2
III	**A student has to choose ONE course the six courses listed against the semester.**	Introduction to Public Administration	24IPAD31	2	2
		Principles of Management	24POMD32	2	2
		Principles of Accounting	24POAD33	2	2
		Basic Electronics	24BELD34	2	2
		Health and Hygiene	24HAHD35	2	2
		Basic Mathematics	24BMTD36	2	2
IV	**A student has to choose ONE course from the six courses listed against the semester.**	Fundamentals of Economics	24FOED41	2	2
		Indian Philosophy	24IPYD42	2	2
		Performing Arts	24PATD43	2	2
		Introduction to Geography	24IOGD44	2	2
		Basic Statistics	24BSTD45	2	2
		Introduction to Nanotechnology	24ITND46	2	2

Common Value-Added Courses

- Common Valued Added Course includes Environmental science/education, and shall carry 2 credits.

Semester	Common Value-added Course	Title of the course	Course Code	No of credits	No of hours per week
V		Environmental Education	**24ENEV51**	2	2

List of add on/certificate/value added program which are optional and offered outside the curriculum of the programs by the department

S.No	**Title of the Value-added course**	**Course Code**	**No of credits**

Courses on Indian Knowledge Systems (IKS)

- Courses on IKS are integrated into the curricular framework. The IKS course shall be an Audit Course which is a mandatory course with only a Pass or Fail.

- A student has to complete 2 courses on IKS one in the VII semester and one in the VIII semester.

- Students are offered choices for selecting IKS courses of their interest.

Semester	IKS	Tile of the course	No of credits	No of hours per week
VII	IKS 1	IKS 1	0	2
VIII	IKS 2	IKS 2	0	2

Open Online Transdisciplinary Courses (OOTC)

- Two mandatory Open Online Transdisciplinary Courses, with 2 credits per course, are to be done by the students, one in each of Semesters VII and VIII.

- Students are free to select courses of their interest from any discipline.

Semester	OOTC	Tile of the course	No of credits	No of hours per week
VII		OOTC 1	2	2
VIII		OOTC 2	2	2

10-month mandatory Internship

Three internships are mandatory for all students irrespective of the of the Program of study.

A. First internship (April-May after 1st year examinations): Community Service Project
   - To inculcate social responsibility and compassionate commitment among the students, the summer vacation in the intervening 1st and 2nd years of study shall be for Community Service Project.

   Learning outcomes:
   - To facilitate an understanding of the issues that confronts the vulnerable/marginalized sections of the society.
   - To initiate team processes with the student groups for societal change.
   - To provide students an opportunity to familiarize themselves with urban/rural community they live in.
   - To enable students to engage in the development of the community.
   - To plan activities based on the focused groups.
   - To know the ways of transforming society through systematic programme implementation.

B. Second Internship (April-May after 2nd year examinations): Apprenticeship / Internship / On-the-job training / In-house Project / Off-site Project

   - To make the students employable, an Apprenticeship / Internship / On the job training / In-house Project / Off-site Project shall be undertaken by the students in the intervening summer vacation between the 2nd and 3rd years.

   Learning outcomes
   - Explore career alternatives prior to graduation.
   - Integrate theory and practice.
   - Assess interests and abilities in their field of study.
   - Learn to appreciate work and its function towards future .
   - Develop work habits and attitudes necessary for job success.
   - Develop communication, interpersonal and other critical skills in the future job.
   - Build a record of work experience.
   - Acquire employment contacts leading directly to a full-time job following graduation from college.

C. Third internship (5th/6thSemester period):

During the entire 5th /6th Semester, the student shall undergo
Apprenticeship / Internship / On the Job Training. This is to ensure that the students develop hands on technical skills which will be of great help in facing the world of work.

Learning outcomes

- Explore career alternatives prior to graduation.
- Integrate theory and practice.
- Assess interests and abilities in their field of study.
- Learn to appreciate work and its function towards future .
- Develop work habits and attitudes necessary for job success.
- Develop communication, interpersonal and other critical skills in the future job.
- Build a record of work experience.
- Acquire employment contacts leading directly to a full-time job following graduation from college.

Internal Evaluation

Internal: External Evaluation is 40:60

The Internal Evaluation Method (CIA)

Mid exam	**Type of Assessment**	**Max Marks**
I	**Assignment**	**10M**
	Seminar/ Study project/Filed trip/Quiz etc	**10M**
	NCC/NSS (extra-curricular)	**10M**
	Exam (Summative)	**20M**
II	**Assignment**	**10M**
	Seminar/ Study project/Filed trip/Quiz etc	**10M**
	NCC/NSS (extra-curricular)	**10M**
	Exam (Formative)	**20M**
Grand total		**100M**
Total marks Scaled down to 40M		

Multiple Entry and Exit Options

Operative Details of ME-ME

1st year of Entry 1: **The entry requirement for the 1st year of 4-year Degree (Level – 4.5 of National Credit Framework (NCrF) of UGC) is Intermediate/12th class of CBSE/ or any other equivalent certificate approved by the Board of Intermediate Education.**

Exit 1: A Certificate will be awarded when a student exits at the end of the year 1 (Level 4.5).

Certificate in Sciences is to be awarded, if students exit after successful completion of 1 year of study in B.Sc. However, the students are required to pass all courses, Languages, Multidisciplinary, Skill Enhancement and Core Courses in Major and Minor along with completion of Community Service Project in the summer term.

2nd year:

Entry 2: **The entry requirement for 2nd year of 4-year Degree (Level – 5 of NCrF of UGC) is a Certificate obtained after completing the first two semesters of the undergraduate programme. A student can seek entry into the 2nd year of study in a college, provided there are vacancies in that particular programme in that college. The transfer admission shall be within the intake permitted to the college**.

Exit 2: A Diploma will be awarded when a student exits at the end of the 2nd year (Level 5 of NCrF).

Diploma in Sciences is to be awarded if students exit after successful completion of 2nd year of study in B.Sc. However, the students are required to pass all courses, Languages, Multidisciplinary, Skill Enhancement and Core Courses in Major and Minor along with completion of Community Service Project in the summer term between 1st and 2nd year and short-term internship in the summer term between 2nd and 3rd year.

3rd year:

Entry 3: **The entry requirement for 3rd year of 4-year Degree (Level – 5.5 of NCrF of UGC) is a Diploma obtained after completing two years (4 semesters) of the undergraduate programme. A student can seek entry into the 3rd year of study in a college, provided there are vacancies in that particular programme in that college. The transfer admission shall be within the intake permitted to the college**.

Exit 3: A Degree will be awarded when a student exits at the end of the 3rd year (Level – 5.5 of NCrF). Bachelor's Degree in Sciences B.Sc
is to be awarded if students exit after successful completion of 3rd year of study. However, the students are required to pass all courses, Languages, Multidisciplinary, Skill Enhancement and Core Courses in Major and Minor along with completion of Community Service Project in the summer term between 1st and 2nd year and short-term internship in the summer term between 2nd and 3rd year and a full-semester internship.

The Degree awarded shall include the Major and Minor/s in parenthesis. For Ex., **B.Sc (Physics with Chemistry Minor)**

4th year:

Entry 4: **The entry requirement for 4th year of 4-year Degree (Level – 6 of NCrF of UGC) is a degree obtained after completing three years (6 semesters) of the undergraduate programme. A student can seek entry into the 4th year of study in a college, provided there are vacancies in that particular programme in that college. The transfer admission shall be within the intake permitted to the college**.

Exit 4: A Degree with Honours will be awarded when a student exits at the end of the 3rd year (Level – 6 of NCrF). Bachelor's Degree with Honours in Sciences is to be awarded if students exit after successful completion of 4th year of study.

The name of the Major/s shall be indicated in parenthesis and the name of the Minor/s. For ex., B.Sc Honours (Physics with Chemistry as Minor).

If the student completes the 4th year with courses in research methodologies and a rigorous research project in one of the major courses of study, a Bachelor degree (Honours with research) is awarded.

Career Opportunities and Graduate Employability

- Career options and graduate employability are the significant program outcomes and benefits of the 4-year Honours Degree Program. The program equips students with the necessary knowledge, skills, and experiences to pursue diverse career paths and enhances their potential for successful employment after graduation.
- The 4-year Honours Degree Program provides students with specialized knowledge and expertise in their chosen field of study through advanced coursework and in-depth study.
- Graduates possess a deep understanding of their subject, making them more attractive to employers seeking candidates with specialized knowledge and skills.
- Throughout the program, students develop a range of industry-relevant skills such as critical thinking, problem-solving, data analysis, research, and communication skills.
- Graduates are well-prepared to meet the demands of the job market and can apply their skills effectively in professional settings.
- Honours Degree Program incorporate mandatory internships; hence graduates gain valuable practical experience during their studies, enhancing their employability by demonstrating hands-on skills and industry exposure.
- Honours Degree Program emphasizes critical thinking and adaptability, preparing students for the rapidly changing job market.
- Graduates are equipped to navigate and thrive in dynamic work environments, and they possess a strong foundation for continuous learning and skill development.
- As a result of the specialized knowledge, skills, and experiences gained, graduates are highly sought after by employers. And enjoy enhanced employability and marketability, increasing their chances of securing rewarding job opportunities and career advancement.

Further Education and Postgraduate Studies

- After completion of the first 3 years of study in the Honours Degree Program, if a student exits, he/she is awarded a Degree and is eligible to pursue a 2-year Postgraduate Program.
- A student getting a UG Honours Degree can do 1-year Postgraduate Program.
- A student awarded with UG Honours Degree with Research is eligible to get direct admission into Ph.D. program provided the student secures 75% and above marks

Guidelines for UG Honours with research

UG Honours with Research

1. Students have to choose after the completion of the third year of study, the Honours program for the fourth year of study.
2. They can pursue Honours program in the major/minor domain of joining in Honours with the research programme.
3. **If the student wants to join in Honours with research, he/she should pass all the courses in the first three years of the UG program and secure 75% or more marks.**

4. For Semester 7, the curricular structure includes 3 common courses on Research Methodologies and 2 discipline-specific courses in the 7th semester.
5. In the 8th Semester, the student has to complete an individual research project in one of the three subjects of his/her study in the first three years.
6. Courses on Research Methodology (7th Semester):

The course structure for the 7th Semester shall be as follows

B.Sc (Physical Sciences/Chemical Sciences)
1. Course 7.1 Research Methodology: Conceptual and Theoretical Perspectives
2. Course 7.2 Research Methodology: Observational and Empirical Perspectives
3. Course 7.3 Statistical Analysis using Computer Packages for Research Methodology
4. Course 7.4 Advanced Analytical Techniques for Science Research
5. Course 7.5 Materials Science

7. Open Online Courses

A Student shall do TWO Open Online Transdisciplinary Courses, in Semesters 7 & 8. The Online Courses can be of students' choice, either in the same domain/related domain or multidisciplinary in nature. The Online Courses can also be done either in SWAYAM or NPTEL or COURSEERA or from any other resources recognized by the APSCHE and the competent authority of the respective Universities. The Open Online Courses shall carry 4 Credits each. Students shall have a choice of choosing either two online courses of 2 credits each or one course of 4 credits or can acquire a greater number of credits. If a student is desirous of choosing Open Online Courses offered by industry or a recognized online course provider, the duration shall be not less than 60 hours for a 4-credit course.

Assessment for Online Courses:

If the Online Course is done from among the Online courses offered in SWAYAM or UGC MOOCs or NPTEL, the credits and marks awarded shall be recognised and calculated for the SGPA and CGPA. The same shall be the case if any service provider conducts an online examination (proctored). If no online examination is conducted either on SWAYAM or UGC MOOCs or NPTEL or proctored examination by the service provider, a pen and paper examination be conducted by the university.

Year	Semester	Course Code	Type of Course	Hrs/Week	Credits
4	VII	VII.1.8	Common Course	5	5
4	VII	VII.2.9	Common Course	5	5
4	VII	VII.3.10	Common Course	5	5
4	VII	VII.4.11	Discipline Specific Course	5	5
4	VII	VII.5.12	Discipline Specific Course	5	5
4	VII	VII.6.13	Transdisciplinary Online Course	15 Weeks	2
4	VII	VII. 7.14	IKS	15 Weeks	0

4	VIII				
4	VIII				
4	VIII	VIII.1.14	Research Project in major/minor	15 Weeks	25
4	VIII				
4	VIII				
4	VIII	VIII.2.15	Transdisciplinary Online Course	15 Weeks	2
4	VIII	VIII.3. 16	IKS	15 Weeks	0

Individual Research Project in Semester VIII for Students of Science:

- Guidelines for the Research Project to be done during VIII Semester
- Identification of Research Project:

The student has to select a topic which is interesting to him/her and related to subject which is relevant to society or industry. The title of the topic can be designed with the consultation of the research supervisor.

- Objectives:

The purpose of this course is to introduce students to the process of conducting science research projects. The students will be helped to conceptualise, design and execute a research project by a teacher guide. The students have to identify the objectives related to the topic of the research project proposed.

- Structure:

Most of the sessions in this semester will be designed in a seminar format. This will be supplemented by individual / group conference/supervision. The focus will be on discussions and analysis of assignments.

Learners will be encouraged to read books and research journals related to his/her research topic and share them in the seminars.

Learners will be initiated to think about research issues throughout the semester, debate these issues with teachers and classmates and synthesize these issues mentally to develop as a researcher.

Being a research degree, this course will entail (1) a much higher workload than any bachelor's degree course studied so far (2) a heavy dose of readings, and (3) a substantial amount of critical thinking.

Duration of the Project: 15 Weeks

Method of Assessment:

Continuous Internal Evaluation 100 marks (spread across the semester)

Semester-End External Evaluation

Dissertation 200 marks

Seminar 100 marks

Viva voce 100 marks

(shall be conducted at the end of the Semester)

There shall be a panel of three Examiners for the Semester End External Evaluation, comprising of Faculty Supervisor, one faculty member-internal examiner and one external examiner.

	Programme Outcome (POs)
PO 1	**Critical Thinking**: Ability to take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO 2	**Effective Communication:** Ability to speak, read, write, and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media, and technology.
PO 3	**Social Interaction:** Ability to elicit views of others, mediate disagreements and help reach conclusions in group settings.
PO 4	**Effective Citizenship:** Ability to demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO 5	**Ethics:** Ability to recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
PO 6	**Environment and Sustainability:** Ability to understand the issues of environmental contexts and sustainable development
PO 7	**Employability skills:** Equipping graduates with the essential abilities and knowledge to excel in their chosen careers
PO 8	**Entrepreneurship skills:** Seeks to empower students with the competencies needed to be successful entrepreneurs, enabling them to launch, operate, and innovate in their own businesses or entrepreneurial ventures.
PO 9	**Multidisciplinary Knowledge:** Multidisciplinary knowledge is crucial for developing graduates who can think critically, innovate, and collaborate effectively. This approach not only enhances the educational experience but also ensures that students are well-prepared to meet the challenges of an increasingly complex and interconnected world.
PO 10	**Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

	Program specific Outcomes (PSOs)
PSO 1	**Knowledge and Skills Development** Knowledge and skills development can be explained as a crucial program outcome and benefit of a 4-year Honours Degree Program. As students progress through the program, they acquire a wide range of subject-specific knowledge and general skills that prepare them for success in their chosen field and beyond.
PSO 2	**Subject-Specific Knowledge:** In-Depth Understanding: The 4-year Honours Degree Program provides students with an opportunity to develop a deep understanding of their chosen major. Through advanced coursework and specialized study, students gain expertise in their field of interest. Critical Analysis: Students learn to critically analyze complex concepts and theories within their major. They acquire the ability to evaluate and apply knowledge to real-world scenarios, fostering problem-solving skills.
PSO 3	**Interdisciplinary/Multidisciplinary Knowledge:** Holistic Perspectives: Honours Degree Programs often encourage interdisciplinary learning, allowing students to explore connections between different fields of study. This broadens their perspectives and promotes a well-rounded education. Integrative Learning: Students develop the ability to integrate knowledge from various disciplines, enabling them to address multifaceted challenges with a comprehensive approach
PSO 4	**Communication Skills:** Written Communication: Students enhance their written communication skills by preparing reports, essays, and research papers. They learn to articulate complex ideas clearly and effectively. Oral Presentation: Through presentations and seminars, students develop strong oral communication skills, enabling them to present ideas confidently and persuasively
PSO 5	**Research and Analytical Skills:** Research Experience: Honours Degree Program with Research typically include research components such as a capstone project or thesis. Students engage in research methodologies, data analysis, and independent inquiry, honing their research skills. Critical Thinking: Through research and coursework, students cultivate critical thinking abilities, enabling them to analyze data, evaluate evidence, and form well-founded arguments

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Courses mapped with Employability skills/Cross cutting issues

Year	Semester	S.No	Title of the Course	Course Code	Employability skills	Cross cutting issues
I	I	1	Essentials and Applications of Mathematical, Physical and Chemical Sciences	24BSPM11	√	
		2	Advances in Mathematical, Physical and Chemical Sciences	24BSPM12	√	
	II	3	Mechanics and Properties of Matter* (Major)	24PHYM21	√	
			Mechanics and Properties of Matter* (Minor)	24PHYN21	√	
			Mechanics and Properties of Matter Practical Course* (Major)	24PHYM21P	√	
			Mechanics and Properties of Matter Practical Course* (Minor)	24PHYN21P	√	
		4	Waves and Oscillations	24PHYM22	√	
			Waves and Oscillations Practical Course	24PHYM22P	√	
			Community Service Project	INTERNSHIP001		√
II	III	5	Optics* (Major)	24PHYM31	√	
			Optics* (Minor)	24PHYN31	√	
			Optics Practical Course*(Major)	24PHYM31P	√	
			Optics Practical Course*(Minor)	24PHYN31P	√	
		6	Heat and Thermodynamics	24PHYM32	√	√
			Heat and Thermodynamics Practical Course	24PHYM32P	√	

		7	Electronic Devices and Circuits	24PHYM33	√	
			Electronic Devices and Circuits Practical Course	24PHYM33P	√	
		8	Analog and Digital Electronics	24PHYM34	√	
			Analog and Digital Electronics Practical course	24PHYM34P	√	
	IV	9	Electricity and Magnetism*(Major)	24PHYM41	√	
			Electricity and Magnetism*(Minor)	24PHYN41	√	
			Electricity and Magnetism Practical Course* (major)	24PHYM41P	√	
			Electricity and Magnetism Practical Course* (minor)	24PHYN41P	√	
		10	Modern Physics* (major)	24PHYM42	√	
			Modern Physics* (minor)	24PHYN42	√	
			Modern Physics Practical Course* (Major)	24PHYM42P	√	
			Modern Physics Practical Course* (Minor)	24PHYN42P	√	
		11	Introduction to Nuclear and Particle Physics	24PHYM43	√	√
			Introduction to Nuclear and Particle Physics Practical Course	24PHYM43P	√	
			Short Term Internship	INTERNSHIP002	√	√

III	V	12	Applications of Electricity & Electronics* (Major)	24PHYM51	√	
			Applications of Electricity & Electronics* (Minor)	24PHYN51	√	
			Applications of Electricity & Electronics Practical Course*(Major)	24PHYM51P	√	
			Applications of Electricity & Electronics Practical Course*(Minor)	24PHYN51P	√	
		13	Electronic Instrumentation* (Major)	24PHYM52	√	
			Electronic Instrumentation* (Minor)	24PHYN52	√	

			Electronic Instrumentation Practical Course*(major)	24PHYM52P	√	
			Electronic Instrumentation Practical Course*(minor)	24PHYN52P	√	
		14 A	Optical Instruments and Optometry	24PHYM53A	√	
			Optical Instruments and Optometry Practical Course	24PHYM53AP	√	
		OR				
		14 B	Optical Imaging and Photography	24PHYM53B	√	
			Optical Imaging and Photography Practical Course	24PHYM53BP	√	
		15 A	Low Temperature Physics & Refrigeration	24PHYM54A	√	√
			Low Temperature Physics & Refrigeration Practical Course	24PHYM54AP	√	
		OR				
		15 B	Solar Energy and Applications	24PHYM54B	√	√
			Solar Energy and Applications Practical Course	24PHYM54BP	√	
	VI		Internship	INTERNSHIP003	√	√
	VII	16A	Course 16A	24PHYM71A		
			Course 16A Practicals	24PHYM71AP		
		16B	(OR)			
			Course 16B	24PHYM71B		
			Course 16B Practicals	24PHYM71BP		
		17A	Course 17A	24PHYM72A		
			Course 17A Practicals	24PHYM72AP		
		17B	OR			
			Course 17B	24PHYM72B		
			Course 17B Practicals	24PHYM72BP		
		18A	Course 18A	24PHYM73A		
			Course 18A Practicals	24PHYM73AP		

		18B	OR			
			Course 18B	24PHYM73B		
			Course 18B Practicals	24PHYM73BP		
		19A	Course 19A	24PHYM74A		
			Course 19A Practicals	24PHYM74AP		
		19B	OR			
			Course 19B	24PHYM74B		
			Course 19B Practicals	24PHYM74BP		
		20A	Course 20A	24PHYM75A		
			Course 20A Practicals	24PHYM75AP		
			OR			
		20B	Course 20B	24PHYM75B		
			Course 20B Practicals	24PHYM75BP		
	VIII	21A	Course 21A	24PHYM81A		
			Course 21A Practicals	24PHYM81AP		
		21B	OR			
			Course 21B	24PHYM81B		
			Course 21B Practicals	24PHYM81BP		
		22A	Course 22A	24PHYM82A		
			Course 22A Practicals	24PHYM82AP		
		22B	OR			
			Course 22B	24PHYM82B		
			Course 22B Practicals	24PHYM82BP		
		23A	Course 23A	24PHYM83A		
			Course 23A Practicals	24PHYM83AP		
		23B	OR	24PHYM83B		
			Course 23B			
			Course 23B Practicals	24PHYM83BP		
		24A	Course 24A	24PHYM84A		

			Course 24A Practicals	24PHYM84AP		
		24B	OR			
			Course 24B	24PHYM84B		
			Course 24B Practicals	24PHYM84BP		
		25A	Course 25A	24PHYM85A		
			Course 25A Practicals	24PHYM85AP		
		25B	OR			
			Course 25B	24PHYM85B		
			Course 25B Practicals	24PHYM85BP		

Courses Mapped with POs

Title of the Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
Essentials and Applications of Mathematical, Physical and Chemical Sciences	√	√	√	√	√	√	√	√	√	√
Advances in Mathematical, Physical and Chemical Sciences	√	√	√	√	√	√	√	√	√	√
Mechanics and Properties of Matter	√	√	√	√	√	√	√	√	√	√
Mechanics and Properties of Matter Practical Course	√	√	√	√	√	√	√	√	√	√
Waves and Oscillations	√	√	√	√	√	√	√	√	√	√
Community Service Project	√	√	√	√	√	√	√	√	√	√
Optics* (Major)	√	√	√	√	√	√	√	√	√	√
Optics* (Minor)	√	√	√	√	√	√	√	√	√	√
Optics Practical Course*(Major)	√	√	√	√	√	√	√	√	√	√
Optics Practical Course*(Minor)	√	√	√	√	√	√	√	√	√	√
Heat and Thermodynamics	√	√	√	√	√	√	√	√	√	√
Heat and Thermodynamics Practical Course	√	√	√	√	√	√	√	√	√	√

Electronic Devices and Circuits	√	√	√	√	√	√	√	√	√	√
Electronic Devices and Circuits Practical Course	√	√	√	√	√	√	√	√	√	√
Analog and Digital Electronics	√	√	√	√	√	√	√	√	√	√
Analog and Digital Electronics Practical course	√	√	√	√	√	√	√	√	√	√
Electricity and Magnetism*(Major)	√	√	√	√	√	√	√	√	√	√
Electricity and Magnetism*(Minor)	√	√	√	√	√	√	√	√	√	√
Electricity and Magnetism Practical Course* (major)	√	√	√	√	√	√	√	√	√	√
Electricity and Magnetism Practical Course* (minor)	√	√	√	√	√	√	√	√	√	√
Modern Physics* (major)	√	√	√	√	√	√	√	√	√	√
Modern Physics* (minor)	√	√	√	√	√	√	√	√	√	√
Modern Physics Practical Course* (Major)	√	√	√	√	√	√	√	√	√	√
Modern Physics Practical Course* (Minor)	√	√	√	√	√	√	√	√	√	√
Introduction to Nuclear and Particle Physics	√	√	√	√	√	√	√	√	√	√
Introduction to Nuclear and Particle	√	√	√	√	√	√	√	√	√	√

Physics Practical Course										
Short Term Internship	√	√	√	√	√	√	√	√	√	√
Applications of Electricity & Electronics* (Major)	√	√	√	√	√	√	√	√	√	√
Applications of Electricity & Electronics* (Minor)	√	√	√	√	√	√	√	√	√	√
Applications of Electricity & Electronics Practical Course*(Major)	√	√	√	√	√	√	√	√	√	√
Applications of Electricity & Electronics Practical Course*(Minor)	√	√	√	√	√	√	√	√	√	√
Electronic Instrumentation* (Major)	√	√	√	√	√	√	√	√	√	√
Electronic Instrumentation* (Minor)	√	√	√	√	√	√	√	√	√	√
Electronic Instrumentation Practical Course*(major)	√	√	√	√	√	√	√	√	√	√
Electronic Instrumentation Practical Course*(minor)	√	√	√	√	√	√	√	√	√	√
Optical Instruments and Optometry	√	√	√	√	√	√	√	√	√	√

Optical Instruments and Optometry Practical Course	√	√	√	√	√	√	√	√	√	√
Optical Imaging and Photography	√	√	√	√	√	√	√	√	√	√
Optical Imaging and Photography Practical Course	√	√	√	√	√	√	√	√	√	√
Low Temperature Physics & Refrigeration	√	√	√	√	√	√	√	√	√	√
Low Temperature Physics & Refrigeration Practical Course	√	√	√	√	√	√	√	√	√	√
Solar Energy and Applications	√	√	√	√	√	√	√	√	√	√
Solar Energy and Applications Practical Course	√	√	√	√	√	√	√	√	√	√
Internship	√	√	√	√	√	√	√	√	√	√

List of new courses introduced

S.No	Title of the course	Course code	Year of introduction
1	Essentials and Applications of Mathematical, Physical and Chemical Sciences	24BSPM11	2023-24
2	Advances in Mathematical, Physical and Chemical Sciences	24BSPM12	2023-24
3	Electronic Devices and Circuits	24PHYM33	2023-24
4	Electronic Devices and Circuits Practical Course	24PHYM33P	2023-24
5	Analog and Digital Electronics	24PHYM34	2023-24
6	Analog and Digital Electronics Practical course	24PHYM34P	2023-24
7	Electronic Devices and Circuits	24PHYM33	2024-25
8	Electronic Devices and Circuits Practical Course	24PHYM33P	2024-25
9	Analog and Digital Electronics	24PHYM34	2024-25
10	Analog and Digital Electronics Practical course	24PHYM34P	2024-25

BLUE PRINT

Programme: B.Sc. Honors in PHYSICS (Major) -2024-2025

SEMESTER-I

COURSE 1: ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

(COURSE CODE: 24BSPM 11)

Theory MARKS: 60 Credits: 4 5 hrs. /week

Blue Print for Semester End Theory Examinations

QUESTION PAPER TAXONOMY										
Level of Bloom's Taxonomy	Type of Question & m Assigned									
	MCQs		FIB		VSQ		MC		T/F	
	CIA	SEE	CIA	SEE	CIA	SEE	CIA	SEE	CIA	SEE
Remembering	4 m	8 m								
Understanding	4 m	8 m								
Applying	5 m	8 m								
Analyzing					7 m	8 m				
Evaluating							7 m	10 m	6 m	10 m
Creating			7 m	8 m						

MCQs: Multiple Choice Questions 1 mark per question. 1.5 minutes to answer

FIB: Fill in the blanks. 1 mark for question. 1.5 minute to answer

VSQ: Very short answer questions. 1 mark per question. 1.5 minute to answer

MC: Matching. 5 marks for matching of 5 items. 2.5 minutes to answer

T/F: True or False. 1 mark per question. 1.5 minutes to answer

(M: marks; CIA: Continuous Internal Assessment; SEE: Semester End Examinations)

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	2	2	3
CO 2	3	1	1	1	1	2	3	3	2	3
CO 3	3	1	1	1	1	2	3	3	2	3
CO 4	3	1	1	1	1	2	3	2	2	3
CO 5	3	1	1	1	1	2	3	3	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
(An Autonomous Institution Affiliated to Andhra University)
Reaccredited by NAAC with 'A' Grade(3rd Cycle)
District Resource Centre & Center for Research Studies
Maddilapalem, VISAKHAPATNAM 530 013, Andhra Pradesh

Programme: B.Sc. Honorus in PHYSICS (Major) -2024-2025

SEMESTER-I

COURSE 1:
ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES **(COURSE CODE: 24 BSPM11)**

Theory Credits: 4 5 hrs/week

SYLLUBUS

UNIT-I **ESSENTIALS OF MATHEMATICS**

Complex Numbers: Introduction of the new symbol (i) – General form of a complex number – Modulus- Amplitude form and conversions. **Trigonometric Ratios:** Trigonometric Ratios and their relations – Problems on calculation of angles. **Vectors:** Definition of vector addition – Cartesian form – Scalar and vector product and problems. **Statistical Measures**: Mean, Median, Mode of a data and problems.

UNIT- II **ESSENTIALS OF PHYSICS**

Definition and Scope of Physics- Measurements and Units.

Motion of objects: Newtonian mechanics and relativistic mechanics perspective.

Laws of Thermodynamics and Significance. ***Entropy definition,***

Acoustic waves and electromagnetic waves. ***Types of mechanical waves.***

Electric and Magnetic fields and their interactions. ***Lorentz force***

Behaviour of atomic and nuclear particles. ***Nuclei radii***

Wave-particle duality, the uncertainty principle. ***Heisenberg principle***

Theories and understanding of universe. ***Big-bang theory, Galaxies***

UNIT –III **ESSENTIALS OF CHEMISTRY**

Definition and Scope of Chemistry- Importance of Chemistry in daily life -Branches of chemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.

UNIT IV: **APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY**

Applications of Mathematics in Physics & Chemistry: Calculus, Differential Equations & Complex Analysis.

Application of Physics in Industry and Technology: ***Basics of electronics, types of semiconductors,*** Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

Application of Chemistry in Industry and Technology: Chemical Manufacturing, Pharmaceuticals and Drug Discovery, materials science, Food and Beverage Industry.

UNIT-V **ESSENTIALS OF COMPUTER SCIENCE**

Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications.

Ethical and social implications: - Network and security. Information Assurance

Fundamentals, Cryptography-Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques- Privacy and Data Protection.

Recommended books:

1. Functions of one complex variable by John.B.Conway, Springer- Verlag.
2. Elementary Trigonometry by H.S.Hall and S.R.Knight
3. Vector Algebra by A.R.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. Basic Statistics by B.L.Agarwal, New age international Publishers
5. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman
6. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker
7. Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway and John W. Jewett Jr.
8. Physics for Technology and Engineering" by John Bird
9. Chemistry in daily life by Kirpal Singh
10. Chemistry of bio molecules by S. P. Bhutan
11. Fundamentals of Computers by V. Raja Raman
12. Cyber Security Essentials by James Graham, Richard Howard, Ryan Olson

STUDENT ACTIVITIES

UNIT I: ESSENTIALS OF MATHEMATICS

1: Complex Number Exploration, Provide students with a set of complex numbers in both rectangular and polar forms. They will plot the complex numbers on the complex plane and identify their properties

2: Trigonometric Ratios Problem Solving

Give students a set of problems that require the calculation of trigonometric ratios and their relations. Students will solve the problems using the appropriate trigonometric functions (sine, cosine, tangent, etc.) and trigonometric identities.

3: Vector Operations and Applications. Provide students with a set of vectors in Cartesian form. Students will perform vector addition and subtraction operations to find the resultant vectors. They will also calculate the scalar and vector products of given vectors.

4: Statistical Measures and Data Analysis. Give students a dataset containing numerical values. Students will calculate the mean, median, and mode of the data, as well as other statistical measures if appropriate (e.g., range, standard deviation).

They will interpret the results and analyse the central tendencies and distribution of the data.

UNIT II: ESSENTIALS OF PHYSICS

1. Concept Mapping: Divide students into groups and assign each group one of the topics. Students will create a concept map illustrating the key concepts, relationships, and applications related to their assigned topic. Encourage students to use visual elements, arrows, and labels to represent connections and interdependencies between concepts.
2. Laboratory Experiment. Select a laboratory experiment related to one of the topics, such as motion of objects or electric and magnetic fields. Provide the necessary materials, instructions, and safety guidelines for conducting the experiment.

Students will work in small groups to carry out the experiment, collect data, and analyse the results.

After the experiment, students will write a lab report summarizing their findings, observations, and conclusions.

UNIT III: ESSENTIALS OF CHEMISTRY

1: Chemistry in Daily Life Presentation

Divide students into groups and assign each group a specific aspect of daily life where chemistry plays a significant role, such as food and nutrition, household products, medicine, or environmental issues.

Students will research and create a presentation (e.g., PowerPoint, poster, or video) that showcases the importance of chemistry in their assigned aspect. 2: Periodic Table Exploration

Provide students with a copy of the periodic table. Students will explore the periodic table and its significance in organizing elements based on their properties.

They will identify and analyse trends in atomic structure, such as electronic configuration, atomic size, and ionization energy.

3: Chemical Changes and Classification of Matter: Provide students with various substances and chemical reactions, such as mixing acids and bases or observing a combustion reaction. Students will observe and describe the chemical changes that occur, including changes in color, temperature, or the formation of new substances.

4: Biomolecules Investigation: Assign each student or group a specific biomolecule category, such as carbohydrates, proteins, fats, or vitamins. Students will research and gather information about their assigned biomolecule category, including its structure, functions, sources, and importance in the human body. They can create informative posters or presentations to present their findings to the class.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Interdisciplinary Case Studies

Divide students into small groups and provide them with interdisciplinary case studies that involve the interdisciplinary application of mathematics, physics, and chemistry.

Each case study should present a real-world problem or scenario that requires the integration of concepts from all three disciplines.

2: Design and Innovation Project

Challenge students to design and develop a practical solution or innovation that integrates mathematics, physics, and chemistry principles.

Students can choose a specific problem or area of interest, such as renewable energy, environmental conservation, or materials science.

3: Laboratory Experiments

Assign students laboratory experiments that demonstrate the practical applications of mathematics, physics, and chemistry.

Examples include investigating the relationship between concentration and reaction rate, analysing the behaviour of electrical circuits, or measuring the properties of materials.

.4: Mathematical Modelling

Present students with real-world problems that require mathematical modelling and analysis.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE

1. Identifying the attributes of network (Topology, service provider, IP address and bandwidth of
2. Your college network) and prepare a report covering network architecture.
3. Identify the types of malwares and required firewalls to provide security.
4. Latest Fraud techniques used by hackers.

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
(An Autonomous Institution Affiliated to Andhra University)
Reaccredited by NAAC with 'A' Grade(3rd Cycle)
District Resource Centre & Center for Research Studies
Maddilapalem, VISAKHAPATNAM 530 013, Andhra Pradesh

B.Sc. Honours in PHYSICS (Major) W.e.f. AY 2024-25

I SEMESTER Course 1 (COURSE CODE: 24 BSPM11)

Essentials and Applications of Mathematical, Physical and Chemical Sciences

MODEL PAPER

TIME: 3 HOURS MAXIMUM MARKS: 60

ANSWER ALL THE FOLLOWING QUESTIONS 60×1M=60M

SECTION-A: MULTIPLE CHOICE QUESTIONS 24×1M=24M

1. If $z = -3\ 4i$ is a complex number, what is its modulus?

a) 5 c) 3

b) 7 d) 4

2. Which form of a complex number involves both modulus and amplitude?

a) Rectangular form c) Exponential form

b) Polar form d) Logarithmic form

3. In a right-angled triangle with sides 3, 4, and 5 units, what is the sine of the angle opposite the side of length 3 units?

a) 3/5 c) 3/4

b) 4/5 d) 4/3

4. What is the result of the scalar product of two perpendicular vectors?

a) 1 c) -1

b) 0 d) They cannot be perpendicular

5. If $A = +2\ 3i \quad j$ and $B = -4\ 2i \quad j$ what is the vector product of $\vec{A}$ and $\vec{B}$

a) 10i−14j c) 14i−10j

b) 10i+14j d) 14i+10j

6. If a set of data has an even number of observations, how is the median calculated?

a) Average of two middle values c) The middle value

b) The value that occurs most frequently d) It's impossible to calculate

7. The mean of five numbers is 12. If one number is removed and the mean becomes 15, what is the value of the removed number?

a) 8
b) 10
c) 12
d) 20

8. Which of these is a derived unit?

a) Kilogram c) Newton

b) Meter d) Second

9. According to Newton's first law of motion, an object will remain at rest or in uniform motion unless acted upon by

a) a net external force c) friction

b) gravity d) air resistance

10. The second law of thermodynamics states that in an isolated system, entropy tends to

a) decrease c) increase

b) remain constant d) fluctuate randomly

11. Which type of wave requires a medium for propagation?

a) Electromagnetic waves c) Radio waves

b) Acoustic waves d) Gamma rays

12. A changing magnetic field induces an electric field, as described by

a) Faraday's law c) Gauss's law

b) Ampere's law d) Coulomb's law

13. What is the charge of a proton?

a) +1.6 x 10^-19 C c) +1.6 x 10^-10 C

b) -1.6 x 10^-19 C d) -1.6 x 10^-10 C

14. The wave-particle duality suggests that particles like electrons exhibit both wave-like and particle-like behaviour, as demonstrated by the

a) Double-slit experiment c) Photoelectric effect

b) Stern-Gerlach experiment d) Compton effect

15. Which theory proposes that the universe began from a singularity and has been expanding ever since?

a) Theory of General Relativity c) String Theory b) Big Bang Theory d) Steady-State Theory

16. According to the cosmological principle, the universe is

a) Homogeneous and isotropic

b) Cantered around our solar system

c) Constantly contracting

d) Non-uniform

17. What is the primary goal of chemistry?

a) Understanding the behaviour of living

b) Exploring historical events organisms

c) Studying the structure of planets

d) Understanding the properties and interactions of matter

18. Which of the following is an example of a chemical reaction occurring in daily life?

a) Water evaporating from a lake c) Rust forming on iron

b) Chopping wood into smaller pieces d) Cutting a piece of paper

19. Which branch of chemistry primarily deals with the study of carbon compounds?

a) Organic chemistry c) Physical chemistry

b) Inorganic chemistry d) Analytical chemistry

20. Elements in the same group of the periodic table tend to have

a) similar chemical properties and the same number of valence electrons

b) different chemical properties and the same number of valence electrons

c) similar chemical properties and different numbers of valence electrons

d) different chemical properties and different numbers of valence electrons

21. What is the electronic configuration of oxygen?

a) $1s^2\ 2s^2\ 2p^4$ c) $1s^2\ 2s^1\ 2p^6$

b) $1s^2\ 2s^2\ 2p^2$ d) $1s^2\ 2s^2\ 2p^3$

22. When iron rusts, it is an example of a

a) Physical change c) Biological change

b) Chemical change d) Nuclear change

23. Carbohydrates primarily function as

a). Energy storage molecules

b)Structural components of cell membranes

c). Enzymes in metabolic reactions

d)Signalling molecules in the body

24. Proteins are composed of:

a) Monosaccharides
b) Amino acids
c) Fatty acids
d) Nucleotides

VERY SHORT ANSWR QUESTIONS **8×1=8M**

25. Which biomolecule is a major component of cell membranes?

26. Which branch of mathematics is extensively used to describe rates of change and accumulation in physics and chemistry?

27. Differential equations find significant applications in describing?

28. In the electronics and semiconductor industry, which physics principles are fundamental for creating transistors and microchips?

29. Which industry heavily relies on robotics and automation to enhance efficiency and precision?

30. Which industry heavily relies on chemical manufacturing processes to produce a wide array of products?

31. What was the first electronic general-purpose computer called?

32. Who is credited with inventing the World Wide Web (WWW) in 1989?

SECTION-B: FILL IN THE BLANKS 8×1=8M

33. The general form of a complex number is written as ________________.

34. The calculation of angles often involves the use of trigonometric functions like ___________.

35. Vector addition involves the combination of vectors in ________________.

36. The argument or amplitude of a complex number z=a+bi is expressed as ________________.

37. Tangent in a right-angled triangle is determined by dividing the ________________ by the adjacent side.

38. The cross product or vector product yields a vector that is ________________ to both original vectors.

39. Cosine of an angle in a right-angled triangle is computed as the ________________ divided by the hypotenuse.

40. Trigonometric ratios like sine, cosine, and tangent are interrelated through ____________.

SECTION-B: TRUE or FALSE 10×1=10M

41**.** Solar panels generate electricity **True/False**

42**.** Hydrogen fuel cells convert chemical energy into electrical energy through a combustion process **True/False**

43. Quantum dots are semiconductor nanoparticles with unique electronic properties **True/False**

44. Shape memory materials can revert to their original shape when subjected to certain stimuli. **True/False**

45. Grid integration involves incorporating renewable energy sources into existing power grids. **True/False**

46. Smart grids enable real-time monitoring and control of electricity consumption. **True/False**

47. Renewable energy sources are always dispatch able, meaning they can be controlled and scheduled as needed. **True/False**

48. Shape memory materials find applications in orthopaedic implants and stents. **True/False**

49. Energy-efficient materials and devices help reduce energy consumption without compromising performance. **True/False**

50. Nanotechnology deals exclusively with structures smaller than one millimeter. **True/False**

MATCH THE FALLOWING **2×5=10M**

51 to 60 **<u>Two questions each carries 5 marks</u>**

S.No	Group-A		Group-B
1	1. wind energy	A	Captures the earth's internal heat for electricity generation
	2. Solar energy	B	Converts sunlight into electricity using photovoltaic cells
	3. Hydropower	C	Utilizes the kinetic energy of moving water to generate power
	4. Geothermal energy	D	Harness the kinetic energy of the wind to produce elctricity
2	Group-A		Group-B
	1. Photovoltaic cells	A	Produces electricity by harnessing the gravitational pull of the moon on earth's oceans
	2. Tidal energy	B	Converts sunlight directly into electricity
	3. Biomass	C	Uses mirrors or lenses to focus sunlight onto a small area for power generation
	4. Concentrated solar power (csp)	D	Generates energy from organic materials such as plant matter and waste

B.Sc. Honours in PHYSICS (Major)

W.e.f. AY 2024-25 **I SEMESTER** **Course 1:**

Essentials and Applications of Mathematical, Physical and Chemical Sciences

(COURSE CODE: 24 BSPM11)

Learning outcomes: On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures.	Level 2 (Understanding) Level 3 (applying)
CO 2	To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations.	Level 2 (Understanding) Level 3 (applying)
CO 3	To explain the basic principles and concepts underlying a broad range of fundamental areas of chemistry and to connect their knowledge of chemistry to daily life.	Level 2 (Understanding) Level 3 (applying) Level 4 (Analysing)
CO 4	Understand the interplay and connections between mathematics, physics, and chemistry in various applications. Recognize how mathematical models and physical and chemical Principles can be used to explain and predict phenomena in different contexts.	Level 1 (Understanding)
CO 5	To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.	Level 2 (Understanding) Level 3 (applying)

Course with focus on Employability/ Entrepreneurship /Skill development modules					
Skill development		Employability		Entrepreneurship	

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

COURSE CODE 24BSPM12

SEMESTER-I COURSE 2: ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

Theory Credits: 4 5 hrs/week

Course Objective:

The objective of this course is to provide students with an in-depth understanding of the recent advances and cutting-edge research in mathematical, physical, and chemical sciences.

The course aims to broaden students' knowledge beyond the foundational concepts and expose them to the latest developments in these disciplines, fostering critical thinking, research skills, and the ability to contribute to scientific advancements.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems.	Level 2 (Understanding) Level 3 (applying)
CO 2	Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations.	Level 2 (Understanding) Level 3 (applying)
CO 3	Understand the different sources of renewable energy and their generation processes and advances in nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials	Level 2 (Understanding) Level 3 (applying) Level 4 (Analysing)
CO 4	Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of nano sensors. Explore the effects of chemical pollutants on ecosystems and human health.	Level 1 (Understanding)

CO 5	Understand and convert between different number systems, such as binary, octal, decimal, and hexadecimal. Differentiate between analog and digital signals and understand their characteristics. Gain knowledge of different types of transmission media, such as wired (e.g., copper cables, fibre optics) and wireless (e.g., radio waves, microwave, satellite).	Level 2 (Understanding) Level 3 (applying)

UNIT I: ADVANCES IN BASICS MATHEMATICS

Straight Lines: Different forms – Reduction of general equation into various forms – Point of intersection of two straight lines

Limits and Differentiation: Standard limits – Derivative of a function –Problems on product rule and quotient rule

Integration: Integration as a reverse process of differentiation – Basic methods of integration
Matrices: Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose of a matrix and determinants

UNIT II: ADVANCES IN PHYSICS:

Renewable energy: Generation, energy storage, and energy-efficient materials and devices.

Recent advances in the field of nanotechnology: Quantum dots, Quantum Communication- recent advances in biophysics- recent advances in medical physics- Shape Memory Materials.

UNIT III: ADVANCES IN CHEMISTRY:

Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

Mathematical Modelling applications in physics and chemistry

Application of Renewable energy: Grid Integration and Smart Grids,

Application of nanotechnology: Nanomedicine,

Application of biophysics: Biophysical Imaging, Biomechanics, Neuro physics,

Application of medical physics: Radiation Therapy, Nuclear medicine, Solid waste management, Environmental remediation- Green Technology, Water treatment.

UNIT V: Advanced Applications of computer Science

Number System-Binary, Octal, decimal, and Hexadecimal, Signals-Analog, Digital, Modem, Codec, Multiplexing, Transmission media, error detection and correction- Parity check and CRC, Networking devices- Repeater, hub, bridge, switch, router, gateway.

Recommended books:

1. Coordinate Geometry by S.L.Lony, Arihant Publications
2. Calculus by Thomas and Finny, Pearson Publications
3. Matrices by A.R.Vasishtha and A.K.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle
5. "Energy Storage: A Nontechnical Guide" by Richard Baxter
6. "Nanotechnology: Principles and Applications" by Sulabha K. Kulkarni and Raghvendra A. Bohara
7. "Biophysics: An Introduction" by Rodney Cotterill
8. "Medical Physics: Imaging" by James G. Webster
9. "Shape Memory Alloys: Properties and Applications" by Dimitris C. Lagoudas
10. Nano materials and applications by M.N.Borah
11. Environmental Chemistry by Anil.K.D.E.
12. Digital Logic Design by Morris Mano
13. Data Communication & Networking by Bahrouz Forouzan.

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	2	3
CO 2	3	3	3	2	3
CO 3	3	3	3	2	3
CO 4	3	3	3	2	3
CO 5	3	3	3	2	3

STUDENT ACTIVITIES

UNIT I: ADVANCES IN BASIC MATHEMATICS

1: Straight Lines Exploration

Provide students with a set of equations representing straight lines in different forms, such as slope intercept form, point-slope form, or general form.

Students will explore the properties and characteristics of straight lines, including their slopes, intercepts, and point of intersection.
2: Limits and Differentiation Problem Solving

Students will apply the concept of limits to solve various problems using standard limits.

Encourage students to interpret the results and make connections to real-world applications, such as analysing rates of change or optimizing functions.

3: Integration Exploration
Students will explore the concept of integration as a reverse process of differentiation and apply basic methods of integration, such as the product rule, substitution method, or integration by parts.

Students can discuss the significance of integration in various fields, such as physics and chemistry 4: Matrices Manipulation

Students will perform operations on matrices, including scalar multiplication, matrix multiplication, and matrix transpose.

Students can apply their knowledge of matrices to real-world applications, such as solving systems of equations or representing transformations in geometry.

UNIT II: ADVANCES IN PHYSICS:

1: Case Studies

Provide students with real-world case studies related to renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.
Students will analyze the case studies, identify the challenges or problems presented, and propose innovative solutions based on the recent advances in the respective field.
They will consider factors such as energy generation, energy storage, efficiency,

sustainability, materials design, biomedical applications, or technological advancements.
2: Experimental Design

Assign students to design and conduct experiments related to one of the topics: renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.
They will identify a specific research question or problem to investigate and design an experiment accordingly.

Students will collect and analyse data, interpret the results, and draw conclusions based on their findings.

They will discuss the implications of their experimental results in the context of recent advances in the field. 3: Group Discussion and Debate

Organize a group discussion or debate session where students will discuss the ethical, social, and environmental implications of the recent advances in renewable energy, nanotechnology, biophysics, medical physics, and shape memory materials.

Assign students specific roles, such as proponent, opponent, or moderator, and provide them with key points and arguments to support their positions.

UNIT III: ADVANCES IN CHEMISTRY:

1. Experimental Design and Simulation

In small groups, students will design experiments or simulations related to the assigned topic.

For example, in the context of computer-aided drug design, students could design a virtual screening experiment to identify potential drug candidates for a specific disease target.

For nano sensors, students could design an experiment to demonstrate the sensitivity and selectivity of nano sensors in detecting specific analytes.
Chemical biology-related activities could involve designing experiments to study enzyme-substrate interactions or molecular interactions in biological systems.
Students will perform their experiments or simulations, collect data, analyze the results, and draw conclusions based on their findings.

2. Case Studies and Discussion

Provide students with real-world case studies related to the impact of chemical pollutants on ecosystems and human health.
Students will analyse the case studies, identify the sources and effects of chemical pollutants, and propose mitigation strategies to minimize their impact.

Encourage discussions on the ethical and environmental considerations when dealing with chemical pollutants.
For the dye removal using the catalysis method, students can explore case studies where catalytic processes are used to degrade or remove dyes from wastewater.
Students will discuss the principles of catalysis, the advantages and limitations of the catalysis method, and its applications in environmental remediation. 3: Group Project

Assign students to work in groups to develop a project related to one of the topics.

The project could involve designing a computer-aided drug delivery system, developing a nano sensor for a specific application, or proposing strategies to mitigate the impact of chemical pollutants on ecosystems. Students will develop a detailed project plan, conduct experiments or simulations, analyze data, and present their findings and recommendations.
Encourage creativity, critical thinking, and collaboration throughout the project.

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Mathematical Modelling Experiment

Provide students with a mathematical modelling experiment related to one of the topics. For example, in the context of renewable energy, students can develop a mathematical model to optimize the placement and configuration of solar panels in a solar farm.
Students will work in teams to design and conduct the experiment, collect data, and analyze the results using mathematical models and statistical techniques.
They will discuss the accuracy and limitations of their model, propose improvements, and interpret the implications of their findings in the context of renewable energy or the specific application area.

2: Case Studies and Group Discussions

Assign students to analyse case studies related to the applications of mathematical modelling in nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.
Students will discuss the mathematical models and computational methods used in the case studies, analyse the outcomes, and evaluate the effectiveness of the modelling approach. Encourage group discussions on the challenges, ethical considerations, and potential advancements in the field.

Students will present their findings and engage in critical discussions on the advantages and limitations of mathematical modelling in solving complex problems in these areas.

3. Group Project

Assign students to work in groups to develop a group project that integrates mathematical modelling with one of the application areas: renewable energy, nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.

The project could involve developing a mathematical model to optimize the delivery of radiation therapy in medical physics or designing a mathematical model to optimize waste management practices. Students will plan and execute their project, apply mathematical modelling techniques, analyze the results, and present their findings and recommendations.
Encourage creativity, critical thinking, and collaboration throughout the project.

UNIT V: Advanced Applications of computer Science

Students must be able to convert numbers from other number system to binary number systems

1. Identify the networking media used for your college network
2. Identify all the networking devices used in your college premises.

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

COURSE CODE 24BSPM12

SEMESTER-I COURSE 2: ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

Theory Credits: 4 5 hrs/week

Blue Print for Semester End Theory Examinations

QUESTION PAPER TAXONOMY										
Level of Bloom's Taxonomy	Type of Question & m Assigned									
	MCQs		FIB		VSQ		MC		T/F	
	CIA	SEE	CIA	SEE	CIA	SEE	CIA	SEE	CIA	SEE
Remembering	4 m	8 m								
Understanding	4 m	8 m								
Applying	5 m	8 m								
Analyzing					7 m	8 m				
Evaluating							7 m	10 m	6 m	10 m
Creating			7 m	8 m						

MCQs: Multiple Choice Questions 1 mark per question. 1.5 minutes to answer

FIB: Fill in the blanks. 1 mark for question. 1.5 minute to answer

VSQ: Very short answer questions. 1 mark per question. 1.5 minute to answer

MC: Matching. 5 marks for matching of 5 items. 2.5 minutes to answer

T/F: True or False. 1 mark per question. 1.5 minutes to answer
(m: marks; CIA: Continuous Internal Assessment; SEE: Semester End Examinations)

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

COURSE CODE 24BSPM12

SEMESTER-I COURSE 2: ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

Duration 3Hrs MODEL PAPER Max Marks

SECTION-A

(MULTIPLE CHOICE QUESTIONS)

1.Two lines with slopes m1 & m2 are perpendicular to each other if [ ]
A. m1= m2 B. m1+m2=1
C. m1m2=1 D. m1m2= -1

2. $\lim_{x\to 4}\frac{x^2-16}{x-4} =$ [ ]
A. 2 B. 4 C. 8 D. undefined

3.What is the standard form of LNG? [ ]
A. Liquefied Natural Gas B. Liquefied Nuclear Gas
C. Liquefied Natural or Nuclear Gas D.None of the above

4. Which one of the following damages the ozone layer? [ ]
A. CFCS B. Aerosols C. Freons D. All of the above

5.. In which era CADD molecular biology started? [ ]
A. 1890 B. 1795
C. 1980 D. 1675

6. In which year the GIT developed the first nanosensor? [ ]
A.1888 B. 1988 C. 1788 D. 1999

7.Which mathematical concept is the basis for error-correcting codes used in Computer Science ? [ ]
A.Group theory B. Probability theory
C. Game theory D. Differential Equations

8. In which one of the following nanomaterials quantum confinement occurs in two directions? [ ]

A. One dimensional B.Two dimensional
C.Three dimensional D.Zero dimensional

9. Which of the following number system is known as base-10 system. [ ]
A.Binary Number System B.Hexadecimal Number System
C.Octal Number System D.Decimal Number System

10. Which one of the following network devices stores the IP addresses? [ ]
A.Router B.Switch
C.Both A and B D.None of the above

11. In what ratio the x-axis divide the line segment joining the points (2,-3) and (5,6)[ ]
A. 1:2 B. 2:1
C. 1:3 D. None of these

12. If the matrices $\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix} = \begin{bmatrix} 5 & y-2 \\ 8 & 4 \end{bmatrix}$ then the values of x and y are [ ]
A. x=-1/3, y=7 B. x=-1/3, y=-2/3
C. x=-2/3, y=7 D. x=5, y=-2/3
13.The measurement range of small angle X-ray scattering is around ______________ meters? [ ]
A.5 nm B. 5-500 m
C. 20 m D.12 mm

14.The carbon nanotubes, graphene, and fullerenes are the _______________ based nanoparticles? [ ]
A. Organic B. Inorganic
C. Carbon based D. None of the above

15. Expand QSARs [ ]
A. Quantitative structure activity relationship
B. Quality strong applicable relationship
C. Quality strengthen affordable ratio
D. Quantitative sorted affinity refund

16. In which drug design structure of the target protein is known? [ ]
A. SBDD B. CBDD
C. QSAR D. GIT

17.Which of the tool is used to find favorable bioactive compounds? [ ]
A. Virtual screening B. QSAR
C. CADD D. None of the above

18.What is the primary focus of Biophysics? [ ]
A.The study of living organisms' behavior
B.The study of the physical properties of living organisms
C.The study of the chemical reactions in living organisms
D.The study of the genetics of living organisms

19. Binary equivalent of decimal number 65 is [ ]

A.1000001 B.1000000

C.1000011 D.100001

20. What is the name for converting digital signal to analog signal? [ ]

A.Modulation B.Demodulation

C.Bypass D.Encapsulation

21. If y=log(tanx), then dy/dx is [ ]

a) $\frac{1}{tanx}$ b) $\frac{sec^2x}{tanx}$ c) $-sec^2x$ d) 0

22. $\lim_{x\to 1}\frac{x^{15}-1}{x^{10}-1} =$ [ ]

A. 3/2 B. 5/2 C. 1/2 D.. 7/2

23. How does Biophysics contribute to the field of neuroscience? [ ]

A.By studying the social behavior of organisms

B.By developing new brain imaging techniques

C.By analyzing the genetic basis of neurological disorders

D. By studying the electrical signaling in neurons

24.The forces acting on a runner near the end of a race are [ ]

A.Weight B.friction

C. Air resistance D.all the above.

SECTION-B
(FILL IN THE BLANKS)

25. $\int 10^{5x}\,dx =$

26. The line which cuts off equal intercepts from the axes and pass through the point (1, -2) is____________

27. Standard form of CNT is —----------------------------++

28. The ratio of the surface of the collector receiving light divided by the total surface of the collector is known as ______________

29. Full form of CADD__________________

30.__________________ developed the first nanosensor.

31.__________________ chemical cause cancer and heart disease as well as infertility in human being.

32. Radiosotope used for estimation of plasma volume is _________________

SECTION-C
(VERY SHORT ANSWERS)

33. Find the equation of the straight line cutting off an intercept 3 from the negative direction of the y-axis and inclined at 60° to the axis of x

34. Evaluate $\int e^x(1 + x^2)dx$

35. what is Quantum Key distribution

36.How does Biophysics contribute to the field of medical imaging?

37. What is chemical biology ?

38. State chemical pollution ?

39. If x = -9 is a root of $\begin{vmatrix} x37 \\ 2x2 \\ 76x \end{vmatrix} = 0$, , then find the other roots?

40. What is the standard form of NOMFET?

SECTION-D
(MATCH THE FOLLOWING)

41.Intercept form of a straight-line A)Quantum Confinement in all directions

42. Mathematical modeling for rate of chemical reaction B) Brain and spinal cord

43. Zeo dimension C)Network Device

44. Central Nervous system D) Dye removal

45. LBDD E) Arrhenius Equation

66. Molecular docking methods F) The Address of The Web Page

47. Nano sensors G) $\frac{x}{a}+\frac{y}{b} = 1$

48. $\int \frac{f'(x)}{f(x)} dx =$ H) affinity and virtual screening

49.HUB I) ligand based drug design

50.URL J) log │f(x│+ C

K) y=mx+c

L)$e^{f(x)}$

SECTION-E
(TRUE/FALSE)

51. If ɵ is the angle between two lines with slopes $m_1$and m_2, then tanɵ $= \frac{m_1+m_2}{1+ m_1m_2}$ [ ]

52. If A = $\begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}$, B = $\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$, then $(A+B)^2 \neq A^2 + B^2$ [ ]

53. At memory Transfer temperature a shape memory alloy return to its original shape [ ]

54. Radiation kills fast-growing cells in the area of treatment [ ]

55. Carbon nanotubes, quantum dots,etc are examples of nano sensors [ ]

56. Bisphenol A (BPA) is an extremely harmful chemical. [ ]

57. Mining, agriculture and waste disposal doesn't cause any pollution [ ]

58. The high temperature phase in shape memory effect is Martensite [ ]

59. A hub connects two different LANs. [ ]

60.The computer network that began the internet was called ARPAN [ ]

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

COURSE CODE 24PHYM21/24PHYN21

SEMESTER-II COURSE 3: MECHANICS AND PROPERTIES OF MATTER

Theory Credits: 3 3 hrs/week

Course Objective:

The course on Mechanics and Properties of Matter aims to provide students with a fundamental understanding of the behaviour of physical systems, both in terms of mechanical motion and in terms of the properties of matter

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understand and apply the concepts of scalar and vector fields, calculate the gradient of a scalar field, determine the divergence and curl of a vector field	Level 2 (Understanding)
CO 2	Apply the laws of motion, solve equations of motion for variable mass systems	Level 3 (Applying)
CO 3	Define a rigid body and comprehend rotational kinematic relations, derive equations of motion for rotating bodies, analyse the precession of a top and gyroscope, understand the precession of the equinoxes	Level 2 (Understanding) Level 4 (Analysing)
CO 4	Define central forces and provide examples, understand the characteristics and conservative nature of central forces, derive equations of motion under central forces.	Level 2 (Understanding) Level 4 (Analysing)
CO 5	Differentiate between Galilean relativity and the concept of absolute frames, comprehend the postulates of the special theory of relativity, apply Lorentz transformations, understand, and solve problems	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

UNIT-I VECTOR ANALYSIS

Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and curl of a vector field with derivations and physical interpretation. Vector integration (line, surface, and volume), Statement and proof of Gauss and Stokes theorems

UNIT-II MECHANICS OF PARTICLES

Laws of motion, motion of variable mass system, Equation of motion of a rocket. Conservation of energy and momentum, Collisions in two and three dimensions, Concept of impact parameter, scattering cross-section, **Rutherford scattering angle and scattering cross section** -derivation.

UNIT-III MECHANICS OF RIGID BODIES AND CONTINUOUS MEDIA

Definition of rigid body, rotational kinematic relations, equation of motion for a rotating body, Precession of a top, Gyroscope, Precession of the equinoxes. Elastic constants of isotropic solids and their relations, Poisson's ratio, and expression for Poisson's ratio. **Classification of beams, types of bending, point load, distributed load.**

UNIT-IV CENTRAL FORCES

Central forces, definition and examples, characteristics of central forces, conservative nature of central forces, conservative force as a negative gradient of potential energy, equations of motion under a central force. Derivation of Kepler's laws. Motion of satellites, Basic idea of Global Positioning System (GPS)

UNIT-V SPECIAL THEORY OF RELATIVITY

Galilean relativity, Absolute frames. Michelson-Morley experiment, The negative result. Postulates of special theory of relativity. Lorentz transformation, time dilation, length contraction, addition of velocities, mass-energy relation, four vector formulation.

Topics added under Autonomy shown in blue colour, deleted topics are shown in red colour

REFERENCE BOOKS:

1. BSc Physics -Telugu Akademy, Hyderabad
2. Mechanics - D.S. Mathur, Sulthan Chand & Co, New Delhi
3. Mechanics - J.C. Upadhyaya, Ramprasad & Co., Agra
4. Properties of Matter - D.S. Mathur, S.Chand & Co, New Delhi ,11th Edn., 2000
5. Physics Vol. I - Resnick-Halliday-Krane ,Wiley, 2001
6. Properties of Matter – Brijlal & Subrmanyam, S. Chand &Co. 1982
7. Dynamics of Particles and Rigid bodies– Anil Rao, Cambridge Univ Press, 2006
8. Mechanics-EM Purcell, Mc Graw Hill
9. University Physics-FW Sears, MW Zemansky & HD Young, Narosa Publications, Delhi
10. College Physics-I. T. Bhima sankaram and G. Prasad. Himalaya Publishing House.
11. Mechanics, S. G. Venkata chalapathy, Margham Publication, 2003.

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	2	2	2	3
CO 2	3	1	1	1	1	2	2	2	2	3
CO 3	3	1	1	1	1	2	2	2	2	3
CO 4	3	1	1	1	1	1	2	2	2	3
CO 5	3	1	1	1	1	2	2	2	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

STUDENT ACTIVITIES

Unit I: Vector Analysis
Activity: Field Mapping

Students can choose a physical field (e.g., temperature, magnetic field) and create a field map by taking measurements at different points. They can then calculate the gradient of the field and analyse the variations. This activity helps them understand the concept of gradient in a scalar field.

Unit II: Mechanics of Particles
Activity: Collision Experiments

Students can set up simple collision experiments using marbles, carts, or other objects. They can measure the initial and final velocities, masses, and analyze the momentum conservation. By varying the conditions (e.g., masses, initial velocities), they can observe the effects on the collision outcomes.

Unit III: Mechanics of Rigid Bodies and Continuous Media
Activity: Balancing Act

Students can experiment with balancing various objects (e.g., rulers, books) on different points to understand the concept of center of mass and stability. They can analyse the equilibrium conditions and explore how the position of the center of mass affects the stability.

Unit IV: Central Forces
Activity: Pendulum Motion

Students can investigate the motion of a simple pendulum by varying its length and measuring the time period. They can analyze the relationship between the period and the length, and discuss the concept of centripetal force and its role in circular motion.

Unit V: Special Theory of Relativity
Activity: Time Measurement

Students can perform a time measurement experiment using simple devices like water clocks or sand timers. They can compare the measured time between two events at different relative speeds and discuss the concept of time dilation

Programme: B.Sc. Honours in Physics (Major/Minor)
COURSE CODE 24PHYM21/24PHYN21

SEMESTER II COURSE 3: MECHANICS AND PROPERTIES OF MATTER

Practical Credits: 1 2hrs/week

COURSE OBJECTIVE:

To develop practical skills in the use of laboratory equipment and experimental techniques for measuring properties of matter and analyzing mechanical systems.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Mastery of experimental techniques: Students should become proficient in using laboratory equipment and experimental techniques to measure properties of matter and analyze mechanical systems	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO 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.	Level 3 (Applying)
CO 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.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO 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	Level 2 (Understanding) Level 4 (Analysing) Level 5 (Evaluating)
CO 5	Understanding of physical principles: Students should develop an understanding of the physical principles governing mechanical systems and the properties of matter, including elasticity, viscosity, and thermal expansion.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)

Minimum of 6 experiments to be done and recorded

1. Viscosity of liquid by the flow method (Poiseuille's method)
2. Young's modulus of the material of a bar (scale) by uniform bending
3. Young's modulus of the material a bar (scale) by non- uniform bending
4. Surface tension of a liquid by capillary rise method
5. Determination of radius of capillary tube by Hg thread method
6. Viscosity of liquid by Searle's viscometer method
7. Bifilar suspension –moment of inertia of a regular rectangular body.
8. Determination of moment of inertia using Fly-wheel
9. Determination of the height of a building using a sextant.
10. Rigidity modulus of material of a wire-dynamic method (torsional pendulum)

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

COURSE CODE 24PHYM21/24PHYN21

SEMESTER II COURSE 3: MECHANICS AND PROPERTIES OF MATTER

Theory Credits: 3 3 hrs/week

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

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

COURSE CODE 24PHYM21/24PHYN21

SEMESTER-II COURSE 3: MECHANICS AND PROPERTIES OF MATTER

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage

Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

Chapter wise Weightage

Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	**I**	VECTOR ANALYSIS	2(one out of two)	2
2	**II**	MECHANICS OF PARTICLES	2(one out of two)	2
3	**III**	MECHANICS OF RIGID BODIES AND CONTINUOUS MEDIA	2(one out of two)	2
4	**IV**	CENTRAL FORCES	2(one out of two)	2
5	**V**	SPECIAL THEORY OF RELATIVITY	2(one out of two)	2
			5(each question has internal choice)	5 out of given 10

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COURSE CODE 24PHYM21/24PHYN21

SEMESTER II COURSE 3: MECHANICS AND PROPERTIES OF MATTER

Question Bank

UNIT I: VECTOR ANALYSIS

Long Answer Questions:

1. **Discuss the gradient of a scalar field in detail. What is its physical significance, and how is it applied in various fields such as physics?**
2. **Derive the expressions for the divergence and curl of a vector field. Explain their physical interpretations with examples where these concepts are crucial.**
3. **State and prove Gauss's theorem.**
4. **State and prove Stokes' theorem.**

Short Answer Questions:

1. **Define the gradient of a scalar field.**
2. **What is the physical significance of the divergence of a vector field?**
3. **Briefly explain the significance of Stokes' theorem in vector analysis.**

UNIT II: MECHANICS OF PARTICLES

Long Answer Questions:

1. **Explain the motion of a variable mass system and derive the equation of motion for a rocket. Discuss the principles of conservation of energy and momentum in this context.**
2. **Derive the expression for the scattering cross-section in Rutherford scattering.**

Short Answer Questions:

1. **What is the equation of motion for a variable mass system?**
2. **Define the impact parameter in the context of collisions.**
3. **What is the significance of the conservation of momentum in particle mechanics?**

UNIT III: MECHANICS OF RIGID BODIES AND CONTINUOUS MEDIA

Long Answer Questions:

1. **Explain the concept of rotational kinematic relations and derive the equations of motion for a rotating rigid body.**
2. **Discuss the elastic constants of isotropic solids. Derive the relationships between these constants and explain their importance in the study of material properties.**

Short Answer Questions:

1. **Define a rigid body in the context of mechanics.**
2. **What is Poisson's ratio, and how is it expressed mathematically?**
3. **Briefly explain the precession of a top and its significance.**

UNIT IV: CENTRAL FORCES

Long Answer Questions:

1. **Define central forces and discuss their conservative nature. Derive the equation of motion under a central force**
2. **State and prove Kepler's laws?**
3. **Explain the concept of conservative forces as the negative gradient of potential energy. How is this concept applied in the analysis of central force systems?**
4. **Discuss the motion of satellites under central forces and explain the basic idea behind the Global Positioning System (GPS).**

Short Answer Questions:

1. **What are the key characteristics of central forces?**
2. **Briefly describe Kepler's laws of planetary motion.**
3. **How does the concept of a central force apply to the motion of satellites?**

UNIT V: SPECIAL THEORY OF RELATIVITY

Long Answer Questions:

1. **Discuss the Michelson-Morley experiment and its significance in the development of the special theory of relativity. How did the negative result of this experiment challenge classical concepts of absolute frames?**
2. **Explain the Lorentz transformation and derive the expressions for time dilation and length contraction. How do these phenomena relate to the postulates of special relativity?**
3. **Discuss the mass-energy relation in the context of special relativity**

Short Answer Questions:

1. **What are the key postulates of the special theory of relativity?**
2. **Briefly explain the concept of time dilation as predicted by special relativity.**
3. **What was the result of the Michelson-Morley experiment, and why was it significant?**

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

COURSE CODE 24PHYM21/24PHYN21

SEMESTER II COURSE 3: MECHANICS AND PROPERTIES OF MATTER

Model Question Paper

Duration: 3Hrs **Max Marks: 60**

Section A

Answer any five questions from the following (4M$\times$ $5 = 20M$)

1. Show that curl of a conservative force is zero?
2. What is line integral, write its significance?
3. Explain conservation of energy and momentum?
4. Explain collisions in two dimensions?
5. Write a short note on Gyroscope?
6. Explain precession of equinoxes?
7. Show that central force can be written as negative gradient of potential energy?
8. Write a short note on GPS
9. Explain length contraction?
10. State the postulates of special theory of relativity?

Section B

Answer all the questions (8M$\times$ $5 = 40M$)

11.(a) State and prove Gauss Divergence theorem in vectors

(OR)

(b) State and prove Stokes's theorem

12.(a) Define Variable Mass System? Derive an expression for the final velocity of the Rocket?

(OR)

(b) Define impact parameter and scattering cross section? Derive an expression for Scattering Angle

13.(a) Write rotational kinematic relations of a rigid body and derive equation of motion of a rigid body?

(OR)

(b) What are elastic constants of an isotropic solids and obtain their relations?

14.(a) Define Central Force? Obtain the equation of motion of a body under central force

(OR)

(b) State Kepler's Laws? Prove Kepler's first law of Planetary Motion

15. (a) Derive equations of Lorentz Transformations of Space and Time

(OR)

(b) Derive the Einstein Mass-Energy Relationship

Programme: B.Sc. Honours in Physics (Major)
w.e.f. AY 2023-24
I Year BSC Physics
SEMESTER-II
COURSE4: COURSE CODE: 24PH7YM22

WAVES AND OSCILLATIONS

Theory Credits:3
3hrs/week

COURSE OBJECTIVE:

This course provides students with a broad understanding of the physical principles of the oscillations, to help them develop critical thinking and quantitative reasoning skills, to empower them to think creatively and critically about scientific problems and experiments.

LEARNING OUTCOMES:

	On Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	To describe the basic characteristics of waves such as frequency, wavelength, amplitude, period, and speed..	Level 1
CO 2	To utilize mathematical relationships related to wave characteristics.	Level 6
CO 3	To compare particle motion and wave motion in different types of waves.	Level 4
CO 4	To distinguish between Longitudinal and Transverse waves.	Level 1
CO 5	To get the knowledge about how to construct and analysis the square waves, saw tooth waves, etc. from Fourier analysis.	Level 3

SYLLUBUS

UNIT-I Simple Harmonic oscillations

Simple harmonic oscillator and solution of the differential equation-Physical characteristics of SHM, torsion pendulum-measurements of rigidity modulus, compound pendulum-measurement of 'g', Principle of superposition, beats, combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies. Lissajous figures.

UNIT-II Damped and forced oscillations

Damped harmonic oscillator, solution of the differential equation of damped oscillator. Energy considerations, comparison with un-damped harmonic oscillator, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance and velocity resonance.

UNIT-III Complex vibrations

Fourier theorem and evaluation of the Fourier coefficients, analysis of periodic wave functions-square wave, triangular wave, saw tooth wave, simple problems on evolution of Fourier coefficients.

UNIT-IV Vibrating Strings and Bars

Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones and harmonics. Energy transport and transverse impedance. Longitudinal vibrations in bars-wave equation and its general solution. Special cases (i) bar fixed at both ends (ii) bar fixed at the midpoint (iii) bar fixed at one end. Tuning fork.

UNIT-V Ultrasonics:

Ultrasonics, properties of ultrasonic waves, production of ultrasonics by piezoelectric and magnetostrictive methods, detection of ultrasonics, determination of wave length of ultrasonic waves. Applications and uses of ultrasonic waves.

REFERENCE BOOKS:

1. BSc Physics Vol.1,Telugu Academy, Hyderabad.
2. Fundamentals of Physics. Halliday,Resnick&Walker,Wiley India Edition 2007.
3. Waves &Oscillations .S.Badami, V.Balasubramanian and K.R.Reddy, Orient Longman.
4. College Physics-I.T. Bhimasankaram and G.Prasad. Himalaya Publishing House.
5. Science and Technology of Ultrasonics - Baldevraj,Narosa,NewDelhi,2004
6. Introduction to Physics for Scientists and Engineers. F.J.Buche. McGraw Hill.

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

Programme: B.Sc. Honours in Physics (Major)
w.e.f. AY 2023-24
I Year BSC Physics
SEMESTER-II
COURSE4: COURSE CODE: 24PH7YM22 WAVES AND OSCILLATIONS

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	**33%**	**20**	**2 (two out of four)**	**1 (one out of two**
Understanding/ Comprehension	**27%**	**16**	**2 (two out of four)**	
Application	**20%**	**12**	**1 (one out of two)**	**1 (one out of two**
Analysis	**13%**	**8**		**2 (two out of four)**
Synthesis/ Evaluate	**7%**	**4**		**1 (one out of two**
Total	**100**	**60**	**5 (each question has internal choice)**	**5 out of 10 questions**

Chapter wise Weightage

S.No	Module/ Chapter	Name of the chapter	**8 marks**	**4 marks**
1	**I**	Simple Harmonic oscillations	**2 (one out of two)**	**2**
2	**II**	Damped and forced oscillations	**2 (one out of two**	**2**
3	**III**	Complex vibrations	**2 (one out of two**	**2**
4	**IV**	Vibrating Strings and Bars	**2 (one out of two**	**2**
5	**V**	Ultrasonics	**2 (one out of two**	**2**
		TOTAL QUESTIONS	**5 (each question has internal choice)**	**5 out of given 10**

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

w.e.f. AY 2023-24

I Year BSC Physics
SEMESTER-II
COURSE4: COURSE CODE: 24PH7YM22

WAVES AND OSCILLATIONS

(QUESTION BANK)

Short Answer Questions

1. What are the characteristics of simple harmonic motion.
2. Give the theory of Torsional pendulum.
3. The displacement equation of a particle describing simple harmonic motion is x= 0.01 sin 50π (t +0.007) metre. Calculate the amplitude, time period, maximum velocity and initial phase of the particle.
4. Explain the term logarithmic decrement.
5. Explain relaxation time and Q- Factor.
7. Explain Amplitude Resonance.
8. State and explain Fourier theorem
9. How do you evaluate Fourier coefficients?
10. Explain fundamental frequency, overtones and harmonics.
11. Explain transport impedance in a stretched string.
12. A steel wire50 cm long has mass of 5 g. It is stretched with a tension of 400N. Find the frequency of the wire in fundamental mode of vibration.
13. What are the applications of ultrasonics.
14. Explain various methods used in detection of ultrasonics.
15. Calculate the fundamental frequency of a quartz crystal of thickness 3 mm. Y = 8×10^{10} N/m^2 and ρ =2.5×10^3kg/m^3.

Long answer questions

1. What is simple harmonic oscillator? Derive equation of motion of simple harmonic oscillator and find its solution.
2. Discuss the linear combination of two mutually perpendicular simple harmonic vibrations of equal frequency.
3. Define Compound pendulum. Derive the expression for acceleration due to gravity using compound pendulum.

4. Describe the equation of motion of damped harmonic oscillator and find the solution. Explain the conditions for under damped motion.
5. What is resonance? Explain Amplitude Resonance.
6. What are Forced oscillations? Obtain an expression for the amplitude of forced oscillations.
7. Analize square wave using Fourier theorem.
8. Analize saw tooth wave using Fourier theorem.
9. Analize triangle wave using Fourier theorem
10. Obtain the equation for the velocity of transverse wave in a stretched string and discuss the solution of wave equation.
11. Derive the general solution of a longitudinal wave in a bar. Discuss the modes of vibrations for the bar fixed at both ends.
12. Explain how ultrasonic waves can be produced using Piezo-electric method.
13. What is Magnetostriction? Explain how it is used to produce ultrasonic waves.
14. Discuss various methods used for the detection of ultrasonics. Discuss the applications of ultrasonics.

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Programme: B.Sc. Honours in Physics (Major)
(w.e.f. AY 2023-24)
I Year BSC Physics
SEMESTER-II
COURSE4: COURSE CODE: 24PH7YM22

TITLE: WAVES AND OSCILLATIONS (MODEL PAPER)

DURATION : 3 hrs **MAX.MARKS: 60**

SECTION-A

Answer any FIVE questions of the following **(5 X 4 = 20 M)**

1. What are the characteristics of simple harmonic motion?
2. Give the theory of torsional pendulum.
3. Explain the term logarithmic decrement.
4. Explain relaxation time and Q- Factor.
5. State and explain Fourier theorem
6. How do you evaluate Fourier coefficients?
7. Explain fundamental frequency, overtones and harmonics.
8. Explain the energy transport in a stretched string
9. What are the applications of ultrasonics.
10. Explain various methods used in detection of ultrasonics.

SECTION-A

Answer ALL the questions Of the following **(5 X 8 = 40 M)**

11. (a).What is simple harmonic oscillator? Derive equation of motion of simple harmonic oscillator and find its solution.

[OR]

(b) Discuss the linear combination of two mutually perpendicular simple harmonic vibrations of equal frequency.

12. (a) Describe the equation of motion of damped harmonic oscillator and find the solution. Explain the conditions for under damped motion

[OR]

(b) What are Forced oscillations? Obtain an expression for the amplitude of forced oscillations

13. (a)Analyze square wave using Fourier theorem.

[OR]

(b) Analyze saw tooth wave using Fourier theorem.

14. (a) Obtain the equation for the velocity of transverse wave in a stretched string and discuss the solution of wave equation.

[OR]

(b) Derive the general solution of a longitudinal wave in a bar. Discuss the modes of vibrations for (a) the bar free at both ends (b) the bar fixed at one end.

15. (a) Explain how ultrasonic waves can be produced using Piezo-electric method.

[OR]

(b) What is Magnetostriction? Explain hoe it is used to produce ultrasonic waves.

B.Sc. PHYSICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 24(PHY)M31

II Year B.Sc (Hons.)-PHYSICS

SEMESTER-III COURSE 5: OPTICS

Theory Credits:3 3 hrs/week

COURSE OBJECTIVE:

The course on Optics aims to provide students with a fundamental understanding of the behaviour and properties of light and its interaction with matter.

S.No	Course outcome	Course outcome with action verb	Level in Blooms Taxonomy
1.	**CO-1**	Explain about the different aberrations in lenses and discuss the methods of minimizing them	**Level-3**
2.	**CO-2**	Understand the phenomenon of interference of light and its formation in (i) Lloyd's single mirror due to division of wave front and (ii) Thin films, Newton's rings and Michelson interferometer due to division of amplitude	**Level-2**
3.	**CO-3**	Distinguish between Fresnel's diffraction and Fraunhoffer 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	**Level-4**
4.	**CO-4**	Explain the various methods of production of plane, circularly and polarized light and their detection and the concept of optical activity	**Level-3**
5.	**CO-5**	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 fibre optic communication and explore the field of Holography and Nonlinear optics and their applications	**Level-4**

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, **Lloyd's experiment**, Oblique incidence of a plane wave on a thin film due to reflected and **transmitted** light (cosine law) –colors of thin films- Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film). Determination of diameter of wire, Newton's rings in reflected light, Michelson Interferometer.

UNIT-III Diffraction

Introduction, distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction – Diffraction due to single slit, **double slit**, Fraunhofer diffraction pattern with N slits (diffraction grating). Resolving power of a grating. Determination of wavelength of light in normal incidence method. Fresnel's half period zones-area of the half period zones, **rectilinear propagation of light,** zone plate, **phase reversal 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 analyser, Quarter wave plate, Half wave plate, **Babinet compensator**, optical activity, **the concept of specific rotation**, Laurent's half shade Polarimeter. 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:

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

B.Sc. PHYSICS MINOR SYLLABUS UNDER CBCS

[W.E.F. AY 2023-24 Batch onwards]

Course Code: 24(PHY)M31

II Year B.Sc (Hons.)-PHYSICS MINOR

SEMESTER-III COURSE 2: OPTICS

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	2	2	1	2	2	3	2
CO 2	3	3	2	2	1	1	3	3	3	3
CO 3	3	2	2	1	1	1	3	3	2	3
CO 4	2	3	2	2	1	2	3	3	3	2
CO 5	3	3	1	1	2	2	2	2	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	3	3	2	3	2
CO 2	2	3	3	3	3
CO 3	3	3	2	2	3
CO 4	3	2	3	2	3
CO 5	3	3	2	3	2

B.Sc. PHYSICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 23(PHY)M31P

II Year B.Sc (Hons.)-PHYSICS

SEMESTER-III COURSE 5: OPTICS

Practical Credits: 1 2hrs/week

COURSE OBJECTIVE:

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. Study of optical rotation –polarimeter.
4. Dispersive power of a prism.
5. Determination of wavelength of light using diffraction grating-minimum deviation method.
6. Determination of wavelength of light using diffraction grating-normal incidence method.
7. Determination of wavelength of laser light using diffraction grating.
8. Resolving power of a telescope.
9. Refractive index of a liquid-hallow prism
10. Determination of thickness of a thin wire by wedge method
11. 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 nth 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 Polarisation:

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.

Dr V.S.Krishna Govt. Degree College(A), Visakhapatnam 2022-23
Course Code: 24(PHY)M31

BLUE PRINT (: OPTICS)
IIB.Sc. (Hons.) Physics- SEM-III/Course : 5
Max Marks-75 Time-3Hrs. Credits:3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	ABERRATIONS	2	2	30
2.	II	INTERFERENCE	2	2	30
3.	III	DFFRACTION	2	2	30
4.	IV	POLARIZATION	2	2	30
5.	V	LASERS AND HOLOGRAPHY	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

B.Sc. PHYSICS SYLLABUS UNDER CBCS
[2023-24 Batch onwards]
Course Code: 24(PHY)M31

II Year B.Sc (Hons.)-PHYSICS

SEMESTER-III COURSE 5: OPTICS

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following **[5 X 8 = 40]**

1. a) What is a Biprism? Explain about the experiment to determine the wavelength of Monochromatic light using Biprism.[OR]

   b) Explain the principle, construction and the working of a Michelson interferometer, also write about the formation of various fringes?
2. a) Explain about the Fraunhofer Diffraction due to a single slit under normal incidence.[OR]
   b) Explain the construction and the working of a Zone plate with the necessary theory.
3. a) Explain the construction and the working of a Nicol prism with a neat diagram and Write its uses.[OR]
   b) what is Optical Activity? Explain how the specific rotation of a sugar solution is determined using Laurent's Half shade Polarimeter.
4. a) what is Chromatic Aberration? Derive the conditions for Achromatism when two Lenses are (i) in contact (ii) separated by a distance.[OR]
   b) What is Spherical Aberration? Explain various methods for the minimisation of Spherical Aberration.
5. a) Explain the principle and the working of Ruby LASER.[OR]
   b) Explain the principle and applications of Holography.

SECTION – B

Answer any FIVE Questions of the following **[5 X 4 = 20]**

6. Sodium light of wavelength 5890 A^0 passes through narrow slits 2 mm apart. The interference Pattern is seen at a distance of 1.25 m away from the centre of the slits. determine the Fringe Width?
7. Explain Colours in Thin films?
8. Calculate the Resolving power of a Grating in second order given that the number of lines on the Grating is 15000?
9. Distinguish between Fraunhofer and Fresnel Diffractions?
10. Write a short note on Double Refraction?
11. For a slab of flint glass the angle of polarization is found to be $62^0 24'$. Calculate the refractive index of the flint glass?
12. Explain about Step index and Graded index Optical fibres?
13. Write a short note on Coma?
14. Explain the terms Spontaneous Emission and Stimulated Emission?
15. Obtain the relation between Einstein coefficients?

B.Sc. PHYSICS SYLLABUS UNDER CBCS
[2023-24 Batch onwards]
Course Code: 24(PHY)M31

II Year B.Sc (Hons.)-PHYSICS
SEMESTER-III COURSE 5: OPTICS

QUESTION BANK

UNIT-I: ABERRATIONS

Essay Questions:

1. Discuss monochromatic aberrations in optics. Explain spherical aberration, coma, astigmatism, curvature of field, and distortion. Include methods for minimizing spherical aberration.
2. Explain chromatic aberration and its correction using achromatic doublets. Compare and contrast achromatism for two lenses in contact and separated by a distance.
3. Compare the advantages and disadvantages of different methods used to minimize spherical aberration in optical systems.

Short Questions:

1. Define spherical aberration. How does it affect image formation in optical systems?
2. Explain the concept of coma and its impact on image quality.
3. What is astigmatism in optics? How does it differ from spherical aberration?
4. Discuss the principle of achromatism in doublet lenses.
5. Describe the construction and working principle of an achromatic doublet lens.
6. What is the significance of distortion in optical imaging? How can it be minimized?

UNIT-II: INTERFERENCE

Essay Questions:

1. Explain the principle of superposition in the context of interference. Discuss the coherence conditions required for interference of light waves.
2. Describe Fresnel's biprism experiment. How can it be used to determine the wavelength of light?
3. Discuss interference in thin films. Include topics such as change of phase on reflection, colors of thin films, and interference by a wedge-shaped film.

Short Questions:

1. Define interference in the context of optics.
2. What are the coherence conditions necessary for observing interference patterns?
3. Explain Lloyd's mirror experiment and its significance in interference phenomena.
4. Discuss the conditions under which Newton's rings are observed in reflected light.
5. Describe the principle of operation and applications of a Michelson interferometer.
6. How does interference by thin films lead to the appearance of colors?

UNIT-III: DIFFRACTION

Essay Questions:

1. Differentiate between Fresnel and Fraunhofer diffraction. Discuss the conditions under which Fraunhofer diffraction patterns are observed.
2. Explain Fraunhofer diffraction due to a single slit and a double slit. How do these patterns differ from each other?
3. Discuss the concept of diffraction gratings. How is the resolving power of a grating determined?

Short Questions:

1. Define diffraction and distinguish between Fresnel and Fraunhofer diffraction.
2. Describe the diffraction pattern produced by a single slit. What factors determine the width of the central maximum?
3. Explain how a diffraction grating works. What factors affect its resolving power?
4. What is the significance of zone plates in optics? Compare a zone plate with a convex lens.
5. Discuss the difference between interference and diffraction phenomena.
6. How can the wavelength of light be determined using diffraction patterns?

UNIT-IV: POLARISATION

Essay Questions:

1. Explain the methods of polarization of light by reflection and refraction. Discuss Brewster's law and its implications.
2. Describe double refraction and the concept of optical activity. Discuss methods to analyze and manipulate polarized light, including Nicol prisms and wave plates.
3. Discuss the principles and applications of polarimetry. Explain the working of Laurent's half shade polarimeter.

Short Questions:

1. Define polarized light and explain how it differs from unpolarized light.
2. What is Brewster's angle? How does it relate to the polarization of light?
3. Explain the principle of operation of a Nicol prism. How is it used as a polarizer?
4. Describe the function of a quarter wave plate and a half wave plate in optics.
5. What is optical activity? How is specific rotation related to it?
6. Differentiate between elliptical and circular polarization of light.

UNIT-V: LASERS AND HOLOGRAPHY

Essay Questions:

1. Describe the principles of laser operation based on stimulated emission and population inversion. Explain the types of lasers such as He-Ne and Ruby lasers.
2. Discuss the applications of lasers in various fields. How does the coherence and monochromatic nature of laser light benefit these applications?
3. Explain the basic principle of holography. Discuss the types of holograms, focusing on Gabor holograms, their limitations, and applications.

Short Questions:

1. What is laser light? Explain the process of stimulated emission.
2. Describe the concept of population inversion and its significance in laser operation.
3. Compare the characteristics and applications of He-Ne and Ruby lasers.
4. How does the coherence of laser light differ from ordinary light? Why is coherence important in holography?
5. Discuss the principle of Gabor holography and its limitations.
6. What are the main applications of holography in modern technology?

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
(An Autonomous Institution Affiliated to Andhra University)
Reaccredited by NAAC with 'A' Grade(3rd Cycle)
District Resource Centre & Center for Research Studies
Maddilapalem, VISAKHAPATNAM 530 013, Andhra Pradesh

BLUE PRINT (COURSE CODE: 24PHYM32)

Programme: B.Sc. Honors in Physics (Major) -2024-2025

SEMESTER-III COURSE 6: HEAT AND THERMODYNAMICS

MAX MARKS – 60 TIME – 3 HOURS (CREDITS- 3)

S.NO	UNIT	TOPIC	ESSAY TYPE QUESTIONS (SECTION-B) Each one 8 marks	SHORT ANSWER QUESTIONS (SECTION-A) Each one 4 marks
1	I	**KINETIC THEORY OF GASES**	1	2
2	II	**THERMODYNAMICS**	1	2
3	III	**THERMODYNAMIC POTENTIALS AND MAXWELL'S EQUATIONS**	1	2
4	IV	**LOW TEMPERATURE PHYSICS**	1	2
5	V	**QUANTUM THEORY OF RADIATION**	1	2
			5 (internal choice)	5 (five to be answered out of ten questions)

$$\textit{Percentage of choice} = \frac{120-60}{120} \times 100 = 50\%$$

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	2	3
CO 2	3	1	1	1	1	2	3	3	2	3
CO 3	3	1	1	1	1	2	3	3	2	3
CO 4	3	1	1	1	1	2	3	3	2	3
CO 5	3	1	1	1	1	2	3	3	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

SEMESTER-III COURSE 6: HEAT AND THERMODYNAMICS

(COURSE CODE: 24PHYM32)

Theory Credits: 3 3 hrs/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 Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 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	Level 2 (Understanding)
CO 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	Level 1 (Knowledge)
CO 3	Develop critical understanding of concept of Thermodynamic potentials, the formulation of Maxwell's equations and its applications.	Level 2 (Understanding) Level 4 (Analysing)
CO 4	Differentiate between principles and methods to produce low temperature, liquefy air, and understand the practical applications of substances at low temperatures.	Level 2 (Understanding)
CO 5	Examine the nature of black body radiations and the basic theories	Level 4 (Analysing)

SEMESTER-III COURSE 6: HEAT AND THERMODYNAMICS

(COURSE CODE: 24PHYM32)

Theory Credits: 3 3 hrs/week

SYLLUBUS

UNIT-I: KINETIC THEORY OF GASES:

Kinetic Theory of gases- Introduction, ***degree of freedom***, Maxwell's law of distribution of molecular velocities and ***graphical representation***. Mean free path, Principle of equipartition of energy, Transport phenomenon in ideal gases: viscosity and Thermal conductivity ***diffusion***.

UNIT-II: THERMODYNAMICS:

Introduction- Reversible and irreversible processes, ***isothermal and adiabatic process and work done equation, phase diagrams,*** Carnot's engine and its efficiency, Carnot's theorem, Thermodynamic scale of temperature, 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, Applications to (i) Clausius-Clayperon's equation (ii) Joule-Kelvin coefficient for ideal and Van der Waals' gases. ***T-dS equations***

UNIT-IV: LOW TEMPERATURE PHYSICS:

Methods for producing very low temperatures, Joule Kelvin effect, porous plug experiment, Joule expansion, ***enthalpy invariance,*** Distinction between adiabatic and Joule Thomson expansion, Expression for Joule Thomson cooling, Production of low temperatures by adiabatic demagnetization (qualitative). ***Regenerative cooling, liquification of air***

UNIT-V: QUANTUM THEORY OF RADIATION:

Thermal radiation, properties of thermal radiation, Spectral energy distribution of black body radiation, ***Kirchhoff's law,*** 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. Unified Physics Vol.2, Optics & Thermodynamics, Jai Prakash Nath & Co. Ltd., Meerut
4. Fundamentals of Physics. Halliday/Resnick/Walker. C. Wiley India Edition 2007
5. Heat and Thermodynamics -N BrijLal, P Subrahmanyam, S.Chand& Co.,2012
6. Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd, 2000
7. University Physics, HD Young, MW Zemansky,FW Sears, Narosa Publishers, New Delhi

SEMESTER-III COURSE 6: HEAT AND THERMODYNAMICS
(COURSE CODE: 24PHYM32P)

Practical Credits: 1 2 hrs/week

COURSE OBJECTIVE: The objectives for practical may apply, to develop practical skills in the use of laboratory equipment and experimental techniques for studying heat and thermodynamics.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Mastery of experimental techniques: Students should become proficient in using laboratory equipment and experimental techniques for studying heat and thermodynamics.	Level 3 (Applying) Level 4 (Analysing)
CO 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.	Level 3 (Applying)
CO 3	Accurate recording and analysis of data: Students should be able to accurately record and analyse experimental data, including understanding the significance of error analysis and statistical methods.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO 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.	Level 2 (Understanding) Level 4 (Analysing) Level 5 (Evaluating)

CO 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.	Level 2 (Understanding) Level 3 (Applying)

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 behavior 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 analyses 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.

(COURSE CODE: 24PHYM32)
Programme: B.Sc. Honorus in Physics (Major) -2024-2025

SEMESTER-III COURSE 6: HEAT AND THERMODYNAMICS

Theory Credits: 3 3 hrs/week

Model Paper **Max Marks: 60**

Section A

Answer any five questions from the following (4M$\times$ $\mathbf{5 = 20}\boldsymbol{M}$)

1. Define the Principle of Equipartition of Energy. How does it apply to the different degrees of freedom of gas molecules**?**
2. Explain the transport phenomena of viscosity in ideal gases.
3. Define reversible and irreversible processes in thermodynamics
4. Explain Carnot's theorem in thermodynamic systems.
5. Describe the entropy (T-S) diagram and its uses.
6. Define and discuss the significance of the thermodynamic potentials.
7. Derive 1st and 2nd $T - dS$ equations?
8. Explain the Joule-Thomson effect and its role in producing low temperatures
9. Derive Planck's law of black body radiation from quantum principles.
10. Discuss the spectral energy distribution of black body radiation according to Planck's law.

Section B

Answer all the questions (8M$\times$ $\mathbf{5 = 40}\boldsymbol{M}$)

11. (A) Explain the fundamental principles of the Kinetic Theory of Gases. How does it describe the behaviour of gases based on the motion of their molecules?

(OR)

(B) Describe the concept of mean free path in gases. How does it relate to the collision frequency and macroscopic properties like viscosity and thermal conductivity?

12. (A) explain Carnot's engine working principle and derive the expression for efficiency.

(OR)

(B) T-S diagram is better than P-V diagram, while calculating efficiency of Carnot’s engine. Support the statement

13. (A) Derive Maxwell's thermodynamic relations from the thermodynamic potentials. Discuss their applications.

(OR)

(B) Explain the Joule-Kelvin effect. How does it differ for ideal gas and real gas?

14. (A) Describe the process of adiabatic demagnetization and its application in achieving low temperatures.

(OR)

(B) Discuss methods for producing very low temperatures in laboratory settings. What are the key principles behind these methods?

15. (A) Explain the concept of the solar constant. How is it measured experimentally using an Angstrom Pyrheliometer?

(OR)

(B) Discuss the spectral energy distribution of black body radiation according to Planck’s law. How does it differ from the predictions of Rayleigh-Jeans law and Wien’s displacement law?

B.Sc. Honors in Physics (Major) -2024-2025 SEMESTER-III

COURSE 6: HEAT AND THERMODYNAMICS

(COURSE CODE: 24PHYM32)

QUESTION BANK

Unit-I: Kinetic Theory of Gases

Essay Questions:

1. Explain the fundamental principles of the Kinetic Theory of Gases. How does it describe the behavior of gases based on the motion of their molecules?
2. Discuss Maxwell's distribution of molecular velocities. What insights does it provide into the kinetic behavior of gases? How is this distribution related to temperature?
3. Describe the concept of mean free path in gases. How does it relate to the collision frequency and macroscopic properties like viscosity and thermal conductivity?

Short Questions:

1. Define the Principle of Equipartition of Energy. How does it apply to the different degrees of freedom of gas molecules?
2. Explain the transport phenomena of viscosity in ideal gases. What factors affect the viscosity of a gas according to kinetic theory?
3. Discuss thermal conductivity in ideal gases. How is it related to the molecular speed distribution and collision frequencies?

Unit-II: Thermodynamics

Essay Questions:

1. Define reversible and irreversible processes in thermodynamics. Discuss their significance and provide examples of each.
2. Explain Carnot's theorem and its implications in thermodynamic systems. How does it relate to the efficiency of Carnot engines?
3. Discuss entropy as a state function. How is entropy related to the Second Law of Thermodynamics? Illustrate with examples of reversible and irreversible processes.

Short Questions:

1. What is the thermodynamic scale of temperature? How does it differ from other temperature scales?
2. Describe the entropy (T-S) diagram and its uses. How can it be used to analyze phase changes like ice changing into steam?

3. Explain the change in entropy during the process of ice changing into steam. Compare the entropy change in reversible and irreversible processes.

Unit-III: Thermodynamic Potentials and Maxwell’s Equations

Essay Questions:

1. Define and discuss the significance of the thermodynamic potentials: internal energy, enthalpy, Helmholtz free energy, and Gibbs free energy. How are these potentials related to each other?
2. Derive Maxwell's thermodynamic relations from the thermodynamic potentials. Discuss their applications, particularly in the context of Claussius-Clapeyron equation and Joule-Kelvin coefficient.
3. Explain the applications of Maxwell’s equations in thermodynamics, focusing on ideal gases and Van der Waals gases.

Short Questions:

1. Describe the significance of Helmholtz Free Energy in thermodynamics. When is it particularly useful in analyzing systems?
2. Discuss the derivation and application of Claussius-Clapeyron equation. What does it describe about the equilibrium between phases of matter?
3. Explain the Joule-Kelvin effect. How does it differ for ideal gases and real gases like Van der Waals gases?

Unit-IV: Low Temperature Physics

Essay Questions:

1. Discuss methods for producing very low temperatures in laboratory settings. What are the key principles behind these methods?
2. Explain the Joule-Thomson effect and its role in producing low temperatures. How is it different from adiabatic expansion?
3. Describe the process of adiabatic demagnetization and its application in achieving low temperatures.

Short Questions:

1. What is the Joule expansion? How does it relate to the Joule-Thomson effect?
2. Differentiate between adiabatic and Joule-Thomson expansions. What are the key differences in their temperature changes?
3. Explain the expression for Joule-Thomson cooling. Under what conditions does a gas cool upon expansion?

Unit-V: Quantum Theory of Radiation

Essay Questions:

1. Discuss the spectral energy distribution of black body radiation according to Planck's law. How does it differ from the predictions of Rayleigh-Jeans law and Wien's displacement law?
2. Derive Planck's law of black body radiation from quantum principles. What insights does this law provide into the behavior of electromagnetic radiation?
3. Explain how the determination of solar constant is performed using an Angstrom Pyrheliometer. What does this measurement reveal about the Sun?

Short Questions:

1. Describe Wein's displacement law and Rayleigh-Jeans law for black body radiation. What are their limitations compared to Planck's law?
2. Explain the concept of the solar constant. How is it measured experimentally using an Angstrom Pyrheliometer?
3. Estimate the surface temperature of the Sun using the information provided by its spectral energy distribution.

B.Sc. PHYSICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 24(PHY)M33

II Year B.Sc (Hons.)-PHYSICS

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 UJTs.
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

S.No.	Course Outcome	Course Outcome with action verb	Level in Blooms Taxonomy
1.	**CO-1**	**Explain** the operational principles of different types of diodes including P-N junction, Zener, and Tunnel diodes, along with their respective V-I characteristics and applications.	**Level-3**
2.	**CO-2**	• **Analyze** the construction and working principles of Bipolar Junction Transistors (BJTs) in both PNP and NPN configurations, and evaluate their operating conditions (Active, Cutoff, Saturation).	**Level-4**
3.	**CO-3**	**Compare** the differences between Field Effect Transistors (FETs) and BJTs, and evaluate the characteristics and biasing techniques of JFETs and MOSFETs, including voltage divider biasing.	**Level-5**
4.	**CO-4**	**Describe** the construction, working principles, and applications of various photoelectric devices such as LEDs, photodiodes, phototransistors, and Light Dependent Resistors (LDRs).	**Level-4**
5.	**CO-5**	**Evaluate** the efficiency and performance characteristics of different types of rectifiers (half-wave, full-wave, bridge), analyze ripple factors, and describe the operation of Zener diodes as voltage regulators in power supply circuits.	**Level-5**

UNIT I: PN JUNCTION DIODES

P-N junction Diode, Formation of depletion region, Forward and Reverse bias Ideal Diode, Diode equation – Reverse saturation current – Tunnel Diode- Construction, working, V-I characteristics and Applications, **Effects of temperature on diode characteristics, including temperature coefficients and how they impact diode performance**. 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. Hybrid parameters of a Transistor and equivalent circuit, BJT, Transistor Biasing – Need for stabilization, Thermal runaway, Stability factor, Biasing methods - Voltage-Divider Bias. **Introduction to advanced transistor biasing techniques, such as Fixed Bias, Self-Bias, and Emitter-Stabilized Bias.**

UNIT-III: FIELD EFFECT TRANSISTORS & POWER ELECTRONIC DEVICES –

Difference between JFET and BJT, Construction and working of JFET, Drain and Transfer, Characteristics, **Overview of advanced FET technologies such as High Electron Mobility Transistors (HEMTs) and their applications**.MOSFET - Depletion-type, and Enhancement-Type MOSFETs. FET 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, **Introduction to various types of photodetectors including avalanche photodiodes (APDs) and their applications**.Structure and operation of LDR, Applications

UNIT-V: POWER SUPPLIES:

Rectifiers: Half wave, Full wave and bridge rectifiers - Efficiency (with derivations), ripple factor- Zener diode as Voltage Regulator, Filters- choke input (inductor), L-section, π-section filters. Three terminal fixed voltage IC-regulators (78XX and 79XX).

Detailed design considerations for power supplies, including load regulation, line regulation, and thermal management.

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 – Millmam & Halkias.
4. Electronic Devices & Circuits – Bogart.
5. Sedha R.S., A Text Book Of Applied Electronics, S.Chand & Company Ltd

B.Sc. PHYSICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 24(PHY)M33P

II Year B.Sc (Hons.)-PHYSICS

SEMESTER-III COURSE 7: ELECTRONIC DEVICES AND CIRCUITS

Practical Credits: 1 2 hrs/week

COURSE 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 character
4. ristics – CB configuration
5. Transistor characteristics – CE configuration
6. FET input and output characteristics
7. UJT characteristics
8. LDR characteristics
9. 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 (ID) for different gate-source voltages (VGS). They can plot the transfer characteristic curve and observe the variations in ID with VGS. 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.

B.Sc. PHYSICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 24(PHY)M33

II Year B.Sc (Hons.)-PHYSICS

SEMESTER-III COURSE 7: ELECTRONIC DEVICES AND CIRCUITS

CO-PO Mapping

1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	2	2	2	1	1	3	3	3	2
CO 2	3	3	2	2	2	1	3	2	3	3
CO 3	3	3	2	1	1	1	3	2	2	2
CO 4	2	3	1	2	2	2	2	3	2	3
CO 5	3	2	2	1	1	2	3	2	2	3

CO-PSO Mapping

1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	2	3	2	3	2
CO 2	3	2	3	2	3
CO 3	3	3	3	3	2
CO 4	3	3	2	2	3
CO 5	3	3	2	3	3

Dr V.S.Krishna Govt. Degree College(A),
Visakhapatnam 2022-2023
Course Code: 24(PHY)M33

BLUE PRINT (: ELECTRONIC DEVICES AND CIRCUITS)
IIIB.Sc. (Hons.) Physics- SEM-III/Course : 7
Max Marks-75 Time-3Hrs. Credits:3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	PN JUNCTION DIODES	2	2	30
2.	II	BIPOLAR JUNCTION TRANSISTOR AND ITS BIASING: (D.C)	2	2	30
3.	III	FIELD EFFECT TRANSISTORS & POWER ELECTRONIC DEVICES	2	2	30
4.	IV	PHOTO ELECTRIC DEVICES	2	2	30
5.	V	POWER SUPPLIES	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(PHY)M33

II Year B.Sc (Hons.)-PHYSICS

SEMESTER-III COURSE 7: ELECTRONIC DEVICES AND CIRCUITS

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following [5 X 8 = 40]

1. a) Write about the V-I characteristics of P-N junction diode?

[OR]

b) Explain about Zener-diode – V I characteristics, Applications?

2. a) Write about construction, working of PNP Transistor?

[OR]

b) Input and Output V-I Characteristics of a Transistor in CE configuration?

3. a) Write about Construction and working of JFET?

[OR]

b) Write about UJT- Construction, working, V-I characteristics?

4. a) Write about Construction, working, and V-I characteristics of Light-Emitting Diodes?

[OR]

b) Write about Photo diode - Construction, working characteristics?

5. a) Write about full wave rectifier and derive its efficiency?

[OR]

b) Write about V-I characteristics of Zener diode and its property of Voltage Regulation?

SECTION – B

Answer any FIVE Questions of the following [5 X 4 = 20]

6. a) Derive Ideal diode equation?
7. a) Discuss about V-I characteristics of Tunnel-Diode?
8. a) Write about Active, Cutoff and Saturation regions of a Transistor?

9. a) Discuss about Hybrid parameters of a Transistor?
10. a) Differentiate between JFET and BJT in terms of construction, operation?
11. a) What are the depletion-type and enhancement-type MOSFETs?
12. a) Explain the structure and operation of a Light Dependent Resistor (LDR)?
13. a) Discuss the role of Photodiodes in optical communication systems?
14. a) Write about the half wave rectifier?
15. a) Write about function of π-section filter?

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(PHY)M33

II Year B.Sc (Hons.)-PHYSICS
SEMESTER-III COURSE 7: ELECTRONIC DEVICES AND CIRCUITS
QUESTION BANK

UNIT I: PN JUNCTION DIODES

Essay Questions:

1. Explain the formation of the depletion region in a PN junction diode. How does the width of the depletion region change under forward and reverse bias conditions?
2. Discuss the characteristics of a Zener diode. How does it maintain a constant voltage across a load? Provide examples of its applications in electronic circuits.
3. Describe the operation and applications of a Tunnel Diode. How does it differ from conventional PN junction diodes in terms of its V-I characteristics?

Short Questions:

1. What is the Diode equation? Explain its significance in understanding diode behavior under different biasing conditions.
2. Compare and contrast ideal diodes under forward and reverse bias with practical diodes, considering the concept of reverse saturation current.
3. Outline the working principle and V-I characteristics of a Zener diode. How is it utilized as a voltage regulator?

UNIT II: BIPOLAR JUNCTION TRANSISTOR AND ITS BIASING

Essay Questions:

1. Describe the construction and working principle of both PNP and NPN transistors. How do these types differ in terms of current flow and operation?

2. Discuss the concept of transistor biasing. Why is it necessary? Explain the voltage-divider biasing method in detail, including its advantages and limitations.
3. Explain the different configurations of a transistor (CB, CE, CC). Compare their input and output characteristics, highlighting their applications in electronic circuits.

Short Questions:

1. Define the terms Active, Cutoff, and Saturation in relation to bipolar junction transistors (BJTs). How are these states achieved during transistor operation?
2. What are hybrid parameters (h-parameters) of a transistor? How are they useful in representing a transistor's behavior in a circuit?
3. What is thermal runaway in transistors? How can it be prevented in practical circuit designs?

UNIT III: FIELD EFFECT TRANSISTORS & POWER ELECTRONIC DEVICES

Essay Questions:

1. Compare and contrast the construction and working principles of JFET and MOSFET. How do these devices differ in terms of their characteristics and applications?
2. Describe the construction and working of a Silicon Controlled Rectifier (SCR). Discuss its applications in power control circuits.
3. Explain the operation and characteristics of a UJT (Unijunction Transistor). How is it used in relaxation oscillator circuits?

Short Questions:

1. Differentiate between JFET and BJT in terms of construction, operation, and application areas.
2. Describe the biasing methods used for FETs. Why is voltage-divider biasing commonly preferred for JFETs?
3. What are the depletion-type and enhancement-type MOSFETs? Compare their V-I characteristics and typical applications.

UNIT IV: PHOTO ELECTRIC DEVICES

Essay Questions:

1. Discuss the construction and working principles of Light-Emitting Diodes (LEDs). How do their characteristics differ from conventional diodes? Provide examples of LED applications.
2. Explain the structure and operation of a Photo diode. How is it used in light sensing applications? Compare its performance with other photodetectors.
3. Describe the construction and operating principles of Phototransistors. What are their advantages over Photo diodes in certain applications?

Short Questions:

1. What are IR Emitters? How are they different from regular LEDs in terms of construction and applications?
2. Explain the structure and operation of a Light Dependent Resistor (LDR). How does its resistance change with incident light intensity? Provide examples of its applications.

3. Discuss the role of Photodiodes in optical communication systems. How do they contribute to signal detection and recovery?

UNIT V: POWER SUPPLIES

Essay Questions:

1. Compare Half-wave, Full-wave, and Bridge rectifiers in terms of efficiency and ripple factor. Provide derivations where applicable.
2. Explain the operation of choke input and capacitor input filters in power supplies. How do these filters affect the output voltage regulation and ripple reduction?
3. 78XX and 79XX). How are these devices used for voltage regulation in electronic circuits?

Short Questions:

1. What is the efficiency of a rectifier circuit? How is it calculated for Half-wave, Full-wave, and Bridge rectifiers?
2. Discuss the role of Zener diodes as voltage regulators in electronic circuits. How do they maintain a constant output voltage despite variations in input voltage and load current?
3. What are the advantages of using IC regulators (78XX and 79XX) over traditional discrete component voltage regulators?

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Major Courses offered w.e.f. AY 2024-25

SEMESTER-III COURSE CODE:24PHYM34
COURSE 8: ANALOG AND DIGITAL ELECTRONICS

Theory Credits: 3 3 hrs/week

VARIATION OF SYLLABUS FROM THE APCHE PRESCRIBED SYLLABUS

S.No.	Unit	Name of the Unit	Syllabus Added/Deleted	Percentage Variation
1	II	PRACTICAL OPERATIONAL AMPLIFIER AND APPLICATIONS	Op-Amp Comparator – Logartithmic Amplifier	5
	III	NUMBER SYSTEMS, CODES AND LOGIC GATES	Fan-in and Fan-out of logic gates	

Programme: B.Sc. Honours in Physics (Major)
w.e.f. AY 2024-25
COURSE CODE 24PHYM34
COURSE 8: ANALOG AND DIGITAL ELECTRONICS

Theory Credits: 3 3 hrs/week

Course Objective:

The course on Mechanics and Properties of Matter aims to provide students with a fundamental understanding of the behaviour of physical systems, both in terms of mechanical motion and in terms of the properties of matter

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understand Principles and Working of Operational Amplifier	Level 2
CO 2	Apply their knowledge on OP-Amp in different Applications	Level 3
CO 3	Understand and Analyse the number systems, Binary codes and Complements	Level 4 Level 2
CO 4	Understand the Boolean algebra and simplification of Boolean expressions	Level 3 Level 2
CO 5	Analyze logic processes and implement logical operations using combinational logic circuits.	Level 4

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

w.e.f. AY 2024-25

COURSE CODE 24PHYM34

COURSE 8: ANALOG AND DIGITAL ELECTRONICS

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	2	1	2	2	2	3
CO 2	3	2	2	1	1	1	3	2	2	3
CO 3	3	2	2	2	1	2	1	2	2	3
CO 4	3	1	2	2	1	2	1	2	2	3
CO 5	3	1	2	2	1	2	1	2	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	2	3
CO 2	3	3	2	1	2
CO 3	3	3	2	2	3
CO 4	3	2	2	2	3
CO 5	3	3	2	2	3

Major Courses offered w.e.f. AY 2024-25

SEMESTER-III COURSE CODE:24PHYM34

COURSE 8: ANALOG AND DIGITAL ELECTRONICS

Theory Credits: 3 3 hrs/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) Concept of feedback in CE amplifier, negative and positive feedback, advantages and disadvantages of negative feedback, Basic concepts of differential amplifier, 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) Characteristics of an Ideal and Practical Operational Amplifier (IC 741), Input offset voltage, 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) Op-Amp Comparator – Logartithmic Amplifier

UNIT-III: NUMBER SYSTEMS, CODES AND LOGIC GATES

a) Number Systems and Codes: Decimal, Binary, Octal and Hexadecimal number systems, conversions, 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, Realization of logic gates using NAND and NOR, XOR and XNOR - Logic gates symbol and their truth tables. De Morgan's Laws, Boolean Laws, Simplification of Boolean Expressions using Boolean Laws, Fan-in and Fan-out of logic gates

UNIT-IV: ARITHMETIC CIRCUITS & DATA PROCESSING CIRCUITS

a) Half Adder and Full Adder: Explanation of truth tables and Circuits. Half Subtractor and Full Subtractor: Explanation of truth tables and Circuits, 4 - bit binary Adder/Subtractor.

b) Multiplexers - 2 to 1 Multiplexer, 4 to 1 multiplexer, De-multiplexers: 1 to 2 Demultiplexer, 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 Gray Code 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. Flyod, Digital Fundamentals, Pearson Education Asia (1994)

6. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)

Major Courses offered w.e.f. AY 2024-25

SEMESTER-III COURSE CODE:24PHYM34P

COURSE 8: ANALOG AND DIGITAL ELECTRONICS

Practical Credits: 1 2 hrs/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

Convert numbers between different bases: Students can be asked to convert numbers between binary, decimal, and hexadecimal bases. 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

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

COURSE 8: ANALOG AND DIGITAL ELECTRONICS

COURSE CODE:24PHYM34

Learning level wise Weightage

Bloom's Taxonomy level	Weightage	marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2	1(one out of two)
Understanding/ Comprehension	27%	16	2	1(one out of two)
Application/	20%	12	1	1(one out of two)
Analysis	13%	8	3	1(one out of two)
Synthesis/ Evaluate	7%	4	2	1(one out of two)
Total	100	60	5 out of 10	5 out of 10 questions

Chapter wise Weightage

Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	UNIT-I	OPERATIONAL AMPLIFIERS	2(one out of two)	2
2	UNIT-II	PRACTICAL OPERATIONAL AMPLIFIER AND APPLIC	2(one out of two)	2
3	UNIT-III	NUMBER SYSTEMS, CODES AND LOGIC GATES	2(one out of two)	2
4	UNIT-IV	ARITHMETIC CIRCUITS & DATA PROCESSING CIRCUITS	2(one out of two)	2
5	UNIT-V	SEQUENTIAL LOGIC CIRCUITS & CODE CONVERTERS	2(one out of two)	2

COURSE 8: ANALOG AND DIGITAL ELECTRONICS
COURSE CODE:24PHYM34
SEMESTER END EXAMINATIONS MODEL PAPER
SEMESTER- (_3_)

Time: 3 hours Maximum Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks. 5 X 4 = 20 Marks

1. –
2. –
3. –
4. --
5. –
6. –
7. ---
8. –
9. –
10.

PART- B

Answer **all the following** questions. Each carries **Eight** marks 5 X 8 = 40 Marks

11. (A).

(Or)

(b)

12. (A)

(Or)

(b)

12. (A)

(Or)

(b)

13. (A)

(Or)

(b)

14. (A).

(Or)

(b)

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

w.e.f. A.Y. 2024-25 **COURSE CODE: 24PHYM41/ 24PHYN41**

SEMESTER-IV (II Year) COURSE 9: ELECTRICITY AND MAGNETISM

Theory Credits: 3 3 Hrs/Week

Course Objectives: The course on Electricity and Magnetism aims to provide 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		Knowledge level (Bloom's Taxonomy)
CO 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.	Level 2 (Understanding)
CO 2	Learn the methods used to solve problems using loop analysis, Nodal analysis, Thevenin's theorem, Norton's theorem, and the Superposition theorem.	Level 2 (Understanding)
CO 3	Distinguish between the magnetic effect of electric current and electromagnetic induction and apply the related laws in appropriate circumstances.	Level 4 (Analysing)
CO 4	Understand Biot–Savart's law and Ampere's circuital law to describe and explain the generation of magnetic fields by electrical currents.	Level 2 (Understanding)
CO 5	Develop an understanding on the unification of electric, and magnetic fields and Maxwell's equations governing electromagnetic waves.	Level 6 (Creating)

SYLLABUS

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, Dielectric strength, 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. Branch current method, Nodal Analysis, star to delta & delta to star conversions. Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum power transfer theorem.

UNIT-III Magnetostatics:

Biot-Savart's law and its applications: (i) circular loop and (ii) solenoid, Ampere's Circuital Law and its application to Solenoid, Hall effect, determination of Hall coefficient 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. Coefficient of Coupling

UNIT-IV Electromagnetic waves-Maxwell's equations:

Electromagnetic Waves and its properties, 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. Electromagnetic wave equation in conducting media. Pointing vector and propagation of electromagnetic waves, *Energy contribution from the E and B fields.*

UNIT-V Varying and alternating currents:

Growth and decay of currents in LR, CR, LCR circuits-Critical damping. 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. B.Sc. Physics, Vol.3, Telugu Akademi, 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. Murugeshan, 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. Murugeshan, S. Chand & Co.

CO–PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	2	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	2	3	3	3
CO 5	3	1	1	1	1	2	3	2	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

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

w.e.f. A.Y. 2024-25 **COURSE CODE: 24PHYM41P/ 24PHYN41P**

SEMESTER-IV (II Year) COURSE 9: ELECTRICITY AND MAGNETISM Practical Course

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:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Demonstrate a thorough understanding of the fundamental concepts and principles of electricity and magnetism.	Level 2 (Understanding)
CO 2	Apply the laws and principles of electricity and magnetism to analyze and solve electrical and magnetic problems.	Level 3 (Applying)
CO 3	Design, construct, and test electrical circuits using various components and measuring instruments.	Level 6 (Designing) Level 4 (Analysing)
CO 4	Measure and analyze electrical quantities such as voltage, current, resistance, capacitance, and inductance using appropriate instruments.	Level 5 (Evaluate) Level 4 (Analysing)
CO 5	Apply the principles of electromagnetism to understand and analyze the behavior of magnetic fields and their interactions with electric currents.	Level 2 (Understanding) Level 3 (Applying)

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 Thevenin's and Norton's theorem
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 Magnetostatics 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 class.

Programme: B.Sc. Honours in Physics (Major/ Minor)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24PHYM41/ 24PHYN41**
SEMESTER-IV (II Year) COURSE 9: ELECTRICITY AND MAGNETISM

Theory Credits: 3 3 Hrs/Week

Blue Print for Semester End Theory Examinations

S. No.	Type of question	**No. of questions given**			**No. of questions to be answered**		
		No. of questions	Marks allotted to each question	Total marks	No. of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Physics (Major/ Minor)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24PHYM41/ 24PHYN41**
SEMESTER-IV (II Year) COURSE 9: ELECTRICITY AND MAGNETISM

Theory Credits: 3 3 Hrs/Week

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	33 %	20	2	1 (One out of two)
Understanding/ Comprehension	27 %	16	2	
Application	20 %	12	1	1 (One out of two)
Analysis	13 %	8		2 (Two out of four)
Synthesis/ Evaluate	7 %	4		1 (One out of two)
Total	100 %	60		5 Out of 10 questions

Chapter wise Weightage				
S. No.	**Module/ Unit**	**Name of the chapter**	**8 Marks**	**4 Marks**
1	Unit – I	Electrostatics and Dielectrics	2 (One out of two)	2
2	Unit – II	Current electricity	2 (One out of two)	2
3	Unit – III	Magnetostatics	1	1
		Electromagnetic Induction	1 (One out of two)	1
4	Unit – IV	Electromagnetic waves- Maxwell's equations	2 (One out of two)	2
5	Unit – V	Varying and alternating currents	2 (One out of two)	2

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

w.e.f. A.Y. 2024-25 **COURSE CODE: 24PHYM41/ 24PHYN41**

SEMESTER-IV (II Year) COURSE 9: ELECTRICITY AND MAGNETISM

Theory | Credits: 3 | 3 Hrs/Week

SEMESTER END EXAMINATIONS MODEL PAPER

Time: 3 Hrs | Max. Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks.

5 x 4 = 20 Marks

1. Demonstrate Polar and Non-polar dielectrics?
2. Derive the relation among $\vec{D}$, $\vec{E}$ and $\vec{P}$ vectors in Dielectrics.
3. Define ohms law and explain its limitations.
4. What are the Kirchhoff's Law's.
5. Explain the Lenz's law.
6. Explain Hall effect and its importance.
7. Define Faraday's laws of electromagnetic induction.
8. Define Pointing vector and an equation for it
9. Write the Differential and the Integral forms of the Maxwell's equations.
10. What is Q–factor and Power factor.
11. Define Q factor in an LCR circuit and Power factor in an A.C. circuit.

PART- B

Answer **all the following** questions. Each question carries **Eight** marks

5 x 8 = 40 Marks

12. (a) Derive expressions for intensity of electric field due to a uniformly charged sphere at a point outside, on the surface and inside the sphere.

OR

(b) Calculate the electric potential due to a Charged spherical conductor.

13. (a) State and explain the Thevenin's Theorem.

OR

(b) State and explain Norton's Theorem.

14. (a) Explain Biot – Savart law. Derive an expression for the Magnetic Induction due to (i) circular loop and (ii) solenoid.

OR

(b) State Faraday's Electromagnetic laws of Induction and Lenz's law. Define the coefficient of self-inductance and derive an expression for it for a long solenoid.

15. (a) Derive an equation for the Maxwell's wave equation of electromagnetic waves.

OR

(b) Describe Hertz Experiment for the detection of Transverse nature of electromagnetic waves.

16. (a) Discuss the LCR series and parallel resonance circuits.

OR

An A.C. is applied to a series RC circuit. Derive an expression for the current and impedance. Define Q-factor of the circuit and its significance.

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
(AUTONOMOUS)
NODAL RESOURCE CENTRE & AU CENTRE FOR RESEARCH
Maddilapalem, Visakhapatnam – 530013, Andhra Pradesh.
0891-2553262, https://www.drvskrishnagdc.edu.in

Question Bank

Short answer Questions

1. Demonstrate Polar and Non-polar dielectrics?
2. Derive the relation among $\vec{D}$, $\vec{E}$ and $\vec{P}$ vectors in Dielectrics.
3. Define ohms law and explain its limitations.
4. What are the Kirchhoff's Law's.
5. State and prove the Gauss's law.
6. Explain Hall effect and its importance.
7. Define Faraday's laws of electromagnetic induction.
8. Define Pointing vector and an equation for it
9. Write the Differential and the Integral forms of the Maxwell's equations.
10. What is Q–factor and Power factor.
11. Define Q factor in an LCR circuit and Power factor in an A.C. circuit.

Long answer Questions

1. Derive expressions for intensity of electric field due to a uniformly charged sphere at a point outside, on the surface and inside the sphere.
2. Calculate the electric potential due to a Charged spherical conductor.
3. Derive the boundary conditions that are obeyed by the $\vec{E}$ and $\vec{D}$ vectors at the interface of two different dielectrics.
4. State and explain the Thevenin's Theorem.
5. State and explain Norton's Theorem.
6. State and explain the Maximum power transfer theorem.
7. Explain Biot – Savart law. Derive an expression for the Magnetic Induction due to (i) circular loop and (ii) solenoid.
8. State Faraday's Electromagnetic laws of Induction and Lenz's law. Define the coefficient of self-inductance and derive an expression for it for a long solenoid.
9. Derive an equation for the Maxwell's wave equation of electromagnetic waves.
10. Describe Hertz Experiment for the detection of Transverse nature of electromagnetic waves.
11. Explain the theory of LCR series resonance circuit with neat diagrams.
12. Discuss the LCR series and parallel resonance circuits.
13. An A.C. is applied to a series RC circuit. Derive an expression for the current and impedance. Define Q-factor of the circuit and its significance.

List of Examiners

S. No.	Name of the Lecturer	Designation and College	Signature
1	Sri H. Sudheer	Lecturer in Physics, Govt. Degree College, Chodavaram	
2	Sri T. Niranjan Kumar	Lecturer in Physics, AMAL College, Anakapalli	
3	Sri K. Srimannarayana	Lecturer in Physics, Govt. Degree College, Nakkapalli	
4	Sri K. Venkanna	Lecturer in Physics, S.G.A. Govt. Degree College (A), Yellamanchili	
5	Dr. P.L. Saranya	Lecturer in Physics, Visakha Govt. Degree College for Women (A), Visakhapatnam	
6	Sri B. Prasada Rao	Lecturer in Physics, SVLNS Govt. Degree College, Bheemunipatnam	
7	Sri K. Prabhudas	Lecturer in Physics, Govt. Degree College, Sabbavaram	
8	Sri B. Mohanarao	Lecturer in Physics, Govt. Degree College (M), Srikakulam	
9	Dr. T. Swarna Latha	Lecturer in Physics, Govt. Degree College for Women, Srikakulam	
10	Sri N. Seshadri Krishna	Lecturer in Physics, Govt. Degree College, Narsipatnam	

Programme: B.Sc. Honours in Physics (Major/ Minor)
w.e.f. A.Y. 2024-25 **COURSE CODE: 23PHYM42/ 23PHYN42**
SEMESTER-IV (II Year) COURSE 9: MODERN PHYSICS

Theory Credits: 3 3 Hrs/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:

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

SYLLABUS

UNIT-I: Introduction to Atomic Structure and Spectroscopy

Bohr's model of the hydrogen atom- Derivation for radius, energy and wave number- 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

Molecular rotational and vibrational spectra, electronic energy levels and electronic transitions, Raman effect, Characteristics of Raman effect, Experimental arrangement to study Raman effect, Quantum theory of Raman effect, Applications of Raman effect. Spectroscopic techniques: IR, UV-Visible, and Raman spectroscopy.

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, Experimental results-critical temperature, critical magnetic field, Meissner effect, London's Equation and Penetration Depth, Isotope effect, Type – I and Type – II superconductors, BCS theory, high T_c super conductors, Applications of superconductors.

REFERENCE BOOKS

1. B.Sc. Physics, Vol.4, Telugu Academy, Hyderabad.
2. Atomic Physics by J.B. Rajam; S. Chand & Co.
3. Modern Physics by R. Murugeshan 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, Introduction to Nanoscience and Technology (PHI Learning Priv. Limited).
8. Nano materials, 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.

Programme: B.Sc. Honours in Physics (Major/ Minor)
w.e.f. A.Y. 2024-25 **COURSE CODE: 23PHYM42P/ 23PHYN42P**
SEMESTER-IV (II Year) COURSE 9: MODERN PHYSICS Practical Course

Practical | Credits: 1 | 2 Hrs/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:

- Apply experimental techniques and equipment to investigate and analyse phenomena related to modern physics, such as quantum mechanics, relativity, atomic physics, and nuclear physics.
- Demonstrate a deep understanding of the principles and theories of modern physics through hands-on experimentation and data analysis.
- Develop proficiency in using advanced laboratory instruments and techniques specific to modern physics experiments, such as spectroscopy, interferometry, particle detectors, and radiation measurement.
- Analyse and interpret experimental data using statistical methods and error analysis, drawing meaningful conclusions and relating them to theoretical concepts.
- Design and conduct independent experiments or investigations related to modern physics, demonstrating the ability to plan, execute, and analyse 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. Energy gap of a semiconductor using junction diode.
8. 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 colours 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 behaviour 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 behaviour 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 behaviour 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.

Programme: B.Sc. Honours in Physics (Major/ Minor)
w.e.f. A.Y. 2024-25 **COURSE CODE: 23PHYM42/ 23PHYN42**
SEMESTER-IV (II Year) COURSE 9: MODERN PHYSICS

Theory Credits: 3 3 Hrs/Week

Blue Print for Semester End Theory Examinations

S. No.	Type of question	**No. of questions given**			**No. of questions to be answered**		
		No. of questions	Marks allotted to each question	Total marks	No. of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

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

w.e.f. A.Y. 2024-25 **COURSE CODE: 23PHYM42/ 23PHYN42**

SEMESTER-IV (II Year) COURSE 9: MODERN PHYSICS

Theory Credits: 3 3 Hrs/Week

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	33 %	20	2	1 (One out of two)
Understanding/ Comprehension	27 %	16	2	
Application	20 %	12	1	1 (One out of two)
Analysis	13 %	8		2 (Two out of four)
Synthesis/ Evaluate	7 %	4		1 (One out of two)
Total	100 %	60		5 Out of 10 questions

Chapter wise Weightage				
S. No.	**Module/ Unit**	**Name of the chapter**	**8 Marks**	**4 Marks**
1	Unit – I	Introduction to Atomic Structure and Spectroscopy	2 (One out of two)	2
2	Unit – II	Molecular Structure and Spectroscopy	2 (One out of two)	2
3	Unit – III	Matter waves & Uncertainty Principle	2 (One out of two)	2
4	Unit – IV	Quantum Mechanics	2 (One out of two)	2
5	Unit – V	Superconductivity	2 (One out of two)	2

Programme: B.Sc. Honours in Physics (Major/ Minor)
w.e.f. A.Y. 2024-25 **COURSE CODE: 23PHYM42/ 23PHYN42**
SEMESTER-IV (II Year) COURSE 9: MODERN PHYSICS

Theory Credits: 3 3 Hrs/Week

SEMESTER END EXAMINATIONS MODEL PAPER

Time: 3 Hrs Max. Marks: 60

PART- A

Answer any **Five** of the following questions. Each question carries **Four** marks.

5 x 4 = 20 Marks

1. Explain L-S coupling and J-J coupling.
2. Describe the Quantum numbers in Vector atom model?
3. Write any five applications of Raman effect.
4. Explain the Raman spectroscopy?
5. Write the Properties of matter waves?
6. Explain the basic postulates of Quantum Mechanics.
7. What are the Eigen functions and Eigen values?
8. Explain the Type I and Type II superconductors.
9. Calculate the de-Broglie wavelength associated with a proton moving with a speed of 5000 m/s.
10. Define (a) Meissner effect and (b) Isotope effect.

PART- B

Answer **all the following** questions. Each question carries **Eight** marks

5 x 8 = 40 Marks

11. (a) Explain the experimental arrangement of Stern and Gerlach experiment and also explain how the existence of spin Angular momentum for an electron is confirmed through the experiment with neat diagrams.

[OR]

(b) Define Zeeman effect? Describe the Experimental arrangement to study Zeeman effect?

12. (a) Explain the Raman effect and explain the experimental arrangement to study it.

OR

(b) Discuss about the Spectroscopic techniques: 1. IR, and 2. UV-Visible spectroscopy.

13. (a) Explain Davisson- Germer experiment to prove the existence of Matter waves.

[OR]

(b) Explain the construction and working of Gamma Ray microscope to verify Heisenberg's Uncertainty principle of position and momentum coordinates.

14. (a) Derive Schrodinger's Time dependent and Time Independent wave equations.

[OR]

(b) Derive expressions for allowed energy values and the corresponding wave functions for a particle in an infinite one-dimensional potential well.

15. (a) Explain the Isotope effect, Type – I and Type – II superconductors.

OR

(b) What is Superconductivity? Explain Meisner effect and the other properties of super conductors.

Question Bank

Short answer Questions

1. Explain L-S coupling and J-J coupling.
2. Describe the Quantum numbers in Vector atom model?
3. Write any five applications of Raman effect.
4. Explain the Raman spectroscopy?
5. Write the Properties of matter waves?
6. Explain the basic postulates of Quantum Mechanics.
7. What are the Eigen functions and Eigen values?
8. Explain the Type I and Type II superconductors.
9. Calculate the de-Broglie wavelength associated with a proton moving with a speed of 5000 m/s.
10. Define (a) Meissner effect and (b) Isotope effect.
11. What are the limitations of Bohr's model of the hydrogen atom.
12. Write a short note on the Spectroscopic technique of Raman spectroscopy.

Long answer Questions

1. Explain the experimental arrangement of Stern and Gerlach experiment and also explain how the existence of spin Angular momentum for an electron is confirmed through the experiment with neat diagrams.
2. Define Zeeman effect? Describe the Experimental arrangement to study Zeeman effect?
3. Explain the Raman effect and explain the experimental arrangement to study it.
4. Discuss about the Spectroscopic techniques: 1. IR, and 2. UV-Visible spectroscopy.
5. Explain Davisson- Germer experiment to prove the existence of Matter waves.
6. Explain the construction and working of Gamma Ray microscope to verify Heisenberg’s Uncertainty principle of position and momentum coordinates.
7. Derive Schrodinger’s Time dependent and Time Independent wave equations.
8. Derive expressions for allowed energy values and the corresponding wave functions for a particle in an infinite one-dimensional potential well.
9. Explain the Isotope effect, Type – I and Type – II superconductors.
10. What is Superconductivity? Explain Meisner effect and the other properties of super conductors.

Programme: B.Sc. Honours in Physics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24PHYM43**
SEMESTER-IV (II Year) COURSE 11: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS

Theory Credits: 3 3 Hrs/Week

Course Objectives: 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		Knowledge level (Bloom's Taxonomy)
CO 1	Know about high energy particles and their applications which prepares them for further study and research in particle physics	Level 2 (Understanding)
CO 2	Students can explain important concepts on nucleon-nucleon interaction, such as its short-range, spin dependence, isospin, and tensors.	Level 4 (Analysing)
CO 3	Students can show the potential shapes from nucleon nucleon interactions.	Level 2 (Understanding)
CO 4	Students can explain the single particle model, its strengths, and weaknesses	Level 4 (Analysing)
CO 5	Students can explain magic numbers based on this model.	Level 4 (Analysing)

SYLLABUS

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- Semi empirical mass formula, nuclear shell model, *nuclear excites states.*

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, *concept of quark model*, *color quantum number and gluons.*

UNIT-III: Nuclear Reactions and Nuclear Detectors

Nuclear Reactions: Types of reactions, Conservation Laws in nuclear reactions, Reaction energetic, Threshold energy, nuclear cross-section; Nuclear detectors: Geiger- Muller counter, Scintillation counter, Cloud chamber.

UNIT-IV: Nuclear Decays and Nuclear Accelerators

Nuclear Decays: Gamow's theory of alpha decay, Fermi's theory of Beta- decay, Energy release in Beta-decay, selection rules. Nuclear Accelerators: Types- Electrostatic and electrodynamics accelerators; Cyclotron-construction, working and applications; Synchrocyclotron-construction, working and applications.

UNIT-V: Applications of Nuclear and Particle Physics

Medical Applications: Radiation therapy and imaging techniques, nuclear energy: nuclear reactors and power generation, Particle physics in high-energy Astro Physics.

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).

CO–PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	2	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	2	2	3	3
CO 5	3	1	1	1	1	2	2	3	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

Programme: B.Sc. Honours in Physics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24PHYM43P**
SEMESTER-IV (II Year) COURSE 11: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS Practical Course

Practical Credits: 1 2 Hrs/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:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Gain a solid understanding of fundamental concepts in nuclear and particle physics.	Level 2 (Understanding)
CO 2	Acquire knowledge of experimental techniques and methodologies used in the field.	Level 2 (Understanding)
CO 3	Understand the principles and operation of laboratory equipment and instruments specific to nuclear and particle physics experiments.	Level 2 (Understanding)
CO 4	Develop proficiency in conducting experiments related to nuclear and particle physics. Acquire skills in data acquisition, analysis, and interpretation using appropriate software and techniques.	Level 2 (Understanding) Level 4 (Analysing) Level 6 (Create)
CO 5	Learn to design and perform experiments, including calibration, measurement, and control of variables.	Level 2 (Understanding) Level 3 (Applying) Level 6 (Create)

EXPERIMENTS LIST

1. GM counter – Determination of dead time.
2. Study of characteristic curve of GM counter and estimation of its operating voltage.
3. Estimation of efficiency for a gamma source of the GM Counter.
4. To verify inverse square law by GM counter.
5. Production and attenuation of bremsstrahlung.
6. Estimation of efficiency for a beta source of the GM Counter.
7. Study of back scattering of beta particles.

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 analyse 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, quark).
- Instruct students to create a poster 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 their 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 analyse 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 analyse the role of nuclear and particle physics in advancing medical diagnostics and treatment planning.

Programme: B.Sc. Honours in Physics (Major)
w.e.f. A.Y. 2024-25 **COURSE CODE: 24PHYM43**
SEMESTER-IV (II Year) COURSE 11: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS

Theory Credits: 3 3 Hrs/Week

Blue Print for Semester End Theory Examinations

S. No.	Type of question	**No. of questions given**			**No. of questions to be answered**		
		No. of questions	Marks allotted to each question	Total marks	No. of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

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

w.e.f. A.Y. 2024-25 **COURSE CODE: 24PHYM43**

SEMESTER-IV (II Year) COURSE 11: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS

Theory Credits: 3 3 Hrs/Week

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	33 %	20	2	1 (One out of two)
Understanding/ Comprehension	27 %	16	2	
Application	20 %	12	1	1 (One out of two)
Analysis	13 %	8		2 (Two out of four)
Synthesis/ Evaluate	7 %	4		1 (One out of two)
Total	100 %	60		5 Out of 10 questions

Chapter wise Weightage				
S. No.	**Module/ Unit**	**Name of the chapter**	**8 Marks**	**4 Marks**
1	Unit – I	Introduction to Nuclear Physics	2 (One out of two)	2
2	Unit – II	Elementary Particles and Interactions	2 (One out of two)	2
3	Unit – III	Nuclear Reactions and Nuclear Detectors	2 (One out of two)	2
4	Unit – IV	Nuclear Decays and Nuclear Accelerators	2 (One out of two)	2
5	Unit – V	Applications of Nuclear and Particle Physics	2 (One out of two)	2

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

w.e.f. A.Y. 2024-25 **COURSE CODE: 24PHYM43**

SEMESTER-IV (II Year) COURSE 11: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS

Theory Credits: 3 3 Hrs/Week

SEMESTER END EXAMINATIONS MODEL PAPER

Time: 3 Hrs Max. Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks.

5 x 4 = 20 Marks

1. Define the Binding energy and provide its significance.
2. Write any five properties of nuclear forces.
3. Write a short note on Types of interactions.
4. What are the properties of leptons.
5. What are the compound and direct nuclear reactions.
6. Describe the Geiger- Muller counter.
7. Write a short note on elementary particles.
8. Discuss the Law of conservation of Parity.
9. Explain construction & working of Synchrocyclotron.
10. Write a short note on radiation therapy.

PART- B

Answer **all the following** questions. Each question carries **Eight** marks

5 x 8 = 40 Marks

11. (a) Explain 1. Mass defect, 2. Binding energy, 3. Yukawa's meson theory.

OR

(b) Explain the Liquid drop model and Semi empirical mass formula of the nuclei?

12. (a) Explain the Conservation laws: Isospin, parity, charge conjugation.

OR

(b) Describe the properties of leptons, mesons and baryons.

13. (a) Demonstrate a. Types of reactions, and b. Conservation Laws in nuclear reactions.

OR

(b) Discuss a. Scintillation counter, and b. Cloud chamber.

14. (a) Explain the Gamow theory of α-decay process?

OR

(b) Describe the types of β decay processes with examples. Discuss Fermi's theory of Beta-decay.

15. (a) Discuss the Medical Applications of Radiation therapy and imaging techniques.

OR

(b) Write a note on nuclear energy sector, nuclear reactors and power generation.

Question Bank
Short answer Questions

1. Define the Binding energy and provide its significance.
2. Define the electric quadrupole moment.
3. Write any five properties of nuclear forces.
4. Write the Classification of elementary particles.
5. Write a short note on Types of interactions.
6. What are the properties of leptons.
7. What are the compound and direct nuclear reactions.
8. Describe the Geiger- Muller counter.
9. Define Threshold energy and nuclear cross-section
10. Write a short note on elementary particles.
11. Discuss the Law of conservation of Parity.
12. Demonstrate Cyclotron with block diagram.
13. Explain construction & working of Synchrocyclotron.
14. Write a short note on radiation therapy.

Long answer Questions

1. Explain the following: 1. Mass, 2. Radii, 3. Charge, 4. Matter density and 5. Average binding energy of the nuclei.
2. Explain 1. Mass defect, 2. Binding energy, 3. Yukawa's meson theory.
3. Explain the Liquid drop model and Semi empirical mass formula of the nuclei?
4. Explain the Conservation laws: Isospin, parity, charge conjugation.
5. Describe the properties of leptons, mesons and baryons.
6. Demonstrate a. Types of reactions, and b. Conservation Laws in nuclear reactions.
7. Discuss a. Scintillation counter, and b. Cloud chamber.
8. Explain the Gamow theory of α-decay process?
9. Describe the types of β decay processes with examples. Discuss Fermi's theory of Beta-decay.
10. Explain the Shell model of Atomic Nuclei.
11. Discuss the Medical Applications of Radiation therapy and imaging techniques.
12. Write a note on nuclear energy sector, nuclear reactors and power generation.

List of Examiners

S. No.	Name of the Lecturer	Designation and College	Signature
1	Sri H. Sudheer	Lecturer in Physics, Govt. Degree College, Chodavaram	
2	Sri T. Niranjan Kumar	Lecturer in Physics, AMAL College, Anakapalli	
3	Sri K. Srimannarayana	Lecturer in Physics, Govt. Degree College, Nakkapalli	
4	Sri K. Venkanna	Lecturer in Physics, S.G.A. Govt. Degree College (A), Yellamanchili	
5	Dr. P.L. Saranya	Lecturer in Physics, Visakha Govt. Degree College for Women (A), Visakhapatnam	
6	Sri B. Prasada Rao	Lecturer in Physics, SVLNS Govt. Degree College, Bheemunipatnam	
7	Sri K. Prabhudas	Lecturer in Physics, Govt. Degree College, Sabbavaram	
8	Sri B. Mohanarao	Lecturer in Physics, Govt. Degree College (M), Srikakulam	
9	Dr. T. Swarna Latha	Lecturer in Physics, Govt. Degree College for Women, Srikakulam	
10	Sri N. Seshadri Krishna	Lecturer in Physics, Govt. Degree College, Narsipatnam	

Programme: B.Sc. Honours in Physics (Major)
w.e.f. AY 2023-24

III Year BSC Physics
SEMESTER-V COURSE CODE: 24PH7Y51
COURSE12: APPLICATIONS OF ELECTRICITY AND MAGNETISM

Theory **Credits:3** **3hrs/week**

COURSE OBJECTIVE:

The objective of the course on Applications of Electricity and Magnetism is to provide students with a comprehensive understanding of the practical applications of electricity and magnetism in various fields. The course aims to develop students' knowledge and skills in applying electrical and magnetic principles to real-world problems and technologies.

LEARNING OUTCOMES:

	On Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Identify various components present in Electricity& Electronics Laboratory.	Level 1
CO 2	Acquire a critical knowledge of each component and its utility (like resistors, capacitors, inductors, power sources etc.).	Level 6
CO 3	Demonstrate skills of constructing simple electronic circuits consisting of basic circuit elements.	Level 2
CO 4	Understand the need & Functionality of various DC & AC Power sources.	Level 1
CO 5	Comprehend the design, applications and practices of various electrical & Electronic devices and also their trouble shooting.	Level 5

SYLLUBUS

Unit-I: Introduction to Passive Elements

Passive elements Resistor - Types of Resistors, Color coding, Combination of Resistors – Series combination (Voltage division), Parallel combination (Current division), Ohms Law and its limitation. Inductor - Principle, EMF induced in an Inductor, Energy stored in Inductor, Phase relation between V and I, Combinations of Inductors, Types of Inductors. Capacitor - Principle, Charging and discharging of a Capacitor, Types of Capacitors, Color coding

Applications of Passive elements:

Applications of a Resistor as a heating element in heaters and as a fuse element. Open circuit, Short circuit, Applications of Inductors, Application of choke in a fan and in a radio tuning circuit, Series resonance circuit as a Radio tuning circuit. Applications of Capacitor in power supplies, motors (Fans) etc.

Unit-II Power Sources (Batteries)

Types of power sources-DC & AC sources, Different types of batteries, Rechargeable batteries –Lead acid batteries, Li-ion batteries Series, Parallel & Series-Parallel configuration of batteries, b)Network Theorems for DC circuits.

Thevenin's theorem, Norton's theorem, Maximum Power transfer theorem, Constant Voltage source- Constant Current Source-Applications of Current sources & Voltage sources, SMPS used in computers.

Unit-III Alternating & Direct Currents

A.C Generator, Construction and its working principle, Types of AC Generators, DC Generator, Construction and its working principle, advantages and disadvantages, Applications, Types of DC Generators, Losses associated with DC generators, Differences between DC and AC generators

Transformers- Construction and its working principle, EMF equation, Open circuit and short circuit tests, Types of Transformers - Step-down and Step-up Transformers, Relation between primary turns and secondary turns of the transformer with emf, Use of a Transformer in a regulated Power supplies, Single phase motor – working principle, Applications of motors (like water pump, fan etc).

Unit-IV Modulation Circuits

Need for modulation, Types of modulation, Amplitude modulation, modulation index, Waveforms, Power relations, Demodulation, Diode detector, AM transmitter, AM Receiver, Frequency modulation, modulation index, Waveforms, FM Transmitter, FM Receiver

Transmitters and Receivers:AM transmitter, AM Receiver, Frequency modulation, modulation index, Waveforms, FM Transmitter, FM Receiver .

Unit-V-Applications of EM Induction & Power Supplies

DC motor – Construction and operating principle, Calculation of power, voltage and current in a DC motor, Design of a simple Motor (for example Fan) with suitable turns of coil .

Working of a DC regulated power supply, Construction of a 5 volts regulated power supply, Design of a step-down (ex:220-12V) and step-up (ex:120-240V) transformers-Simple Design of FM Radio circuit using LCR series resonance (tuning) circuit, Checking the output voltage of a battery eliminator using a Multimeter. (Trouble shooting), Design of a simple 5 volts DC charger, Power supply for computers (SMPS)

References:

1. Grob's Basic Electronics by Mitchel Schultz, TMH or McGraw Hill
2. Electronic and Electrical Servicing by Ian Robertson Sinclair, John Dunton, Elsevier Publications
3. Troubleshooting Electronic Equipment by R.S.Khandapur ,TMH
4. Web sources suggested by the teacher concerned and the college librarian including reading material.

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

Programme: B.Sc. Honours in Physics (Major)
w.e.f. AY 2023-24

III Year BSC Physics
SEMESTER-V COURSE CODE: 24PH7Y51
COURSE12: APPLICATIONS OF ELECTRICITY AND MAGNETISM

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Physics (Major)
w.e.f. AY 2023-24
III Year BSC Physics
SEMESTER-V COURSE CODE: 24PH7Y51
COURSE12: APPLICATIONS OF ELECTRICITY AND MAGNETISM

Blue Print for Semester End Theory Examinations

Max Marks-60 **Time-3Hrs.** **Credits:3**

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	1(one out of two
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	1(one out of two)	1(one out of two
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		1(one out of two
Total	100	60	5(each question has internal choice)	5 outb of 10 questions

Chapter wise Weightage

S.No	Module/ Chapter	Name of the chapter	8 marks	4 marks
1	I	Introduction to Passive Elements	2(one out of two)	2
2	II	Power Sources(Batteries)	2(one out of two	2
3	III	Alternating & Direct Currents	2(one out of two	2
4	IV	Modulation Circuits	2(one out of two	2
5	V	Applications of EM Induction & Power Supplies	2(one out of two	2
		TOTAL QUESTIONS	5(each question has internal choice)	5 out of given 10

Programme: B.Sc. Honours in Physics (Major)
w.e.f. AY 2023-24
III Year BSC Physics
SEMESTER-V COURSE CODE: 24PH7Y51
APPLICATIONS OF ELECTRICITY AND MAGNETISM

Model Question Paper

DURATION:: 3 hrs **MAX.MARKS :: 60**

SECTION-A

Answer any FIVE questions of the following **(5 X 4 = 20 M)**

1. What is Ohm's Law, and what are its limitations?
2. Briefly explain the voltage division rule in series resistor combinations.
3. How does a lead-acid battery work, and where is it commonly used?
4. Briefly explain the principle of maximum power transfer in electrical circuits.
5. Define the EMF equation of a transformer.
6. How does a step-up transformer differ from a step-down transformer?
7. What is the role of a diode detector in AM demodulation?
8. How does an FM transmitter differ from an AM transmitter?
9. Briefly explain the principle of electromagnetic induction in the context of motor design.
10. What is the purpose of a battery eliminator, and how is its output voltage measured?

SECTION-B

Answer ALL the questions Of the following **(5 X 8 = 40 M)**

11. (a)Describe the process of charging and discharging a capacitor. What are the different types of capacitors, and how does color coding apply to them?

[OR]

(b)Analyze the applications of resistors, inductors, and capacitors in practical circuits, such as heaters, fuse elements, fans, and radio tuning circuits.

12. (a)Discuss the applications of Thevenin’s, Norton’s, and Maximum Power Transfer theorems in DC circuits. How do these theorems simplify circuit analysis?

[OR]

(b)Evaluate the importance of SMPS (Switch Mode Power Supply) in computers and other electronic devices. How does it differ from traditional power supplies?

13. (a) Analyze the construction and working principle of transformers. How do step-up and step-down transformers work, and what is their role in power supplies?

[OR]

(b)Discuss the working principle of single-phase motors and their applications in household appliances such as water pumps and fans.

14. (a)Discuss the process of demodulation in AM systems, focusing on the role of a diode detector. How does an AM transmitter and receiver work?

[OR]

(b) Analyze the significance of the modulation index in both AM and FM modulation. How does it affect the transmitted signal and the efficiency of communication?

15. (a) Discuss the working of a DC regulated power supply. How is a 5-volt regulated power supply designed, and what are its applications?

[OR]

(b) Explain the design process for step-down and step-up transformers. How are these transformers used in power supplies and other electrical applications?

Programme: B.Sc. Honours in Physics (Major)
w.e.f. AY 2023-24
III Year BSC Physics
SEMESTER-V COURSE CODE: 24PH7Y51
APPLICATIONS OF ELECTRICITY AND MAGNETISM

Question Bank

Unit I: Introduction to Passive Elements

Essay Questions:

1. Discuss the various types of resistors and their applications in electrical circuits. How does color coding assist in identifying resistor values?
2. Explain the principle of operation of inductors, including the energy stored and phase relationship between voltage and current. Discuss the different types of inductors and their applications.
3. Describe the process of charging and discharging a capacitor. What are the different types of capacitors, and how does color coding apply to them?
4. Analyze the applications of resistors, inductors, and capacitors in practical circuits, such as heaters, fuse elements, fans, and radio tuning circuits.

Short Answer Questions:

1. What is Ohm's Law, and what are its limitations?
2. Briefly explain the voltage division rule in series resistor combinations.
3. How does an inductor store energy, and what is the EMF induced in it?
4. What is the purpose of a capacitor in a power supply circuit?

Unit II: Power Sources (Batteries) and Network Theorems for DC Circuits

Essay Questions:

1. Compare and contrast different types of power sources, including DC and AC sources. Discuss the role of rechargeable batteries, such as lead-acid and Li-ion batteries, in modern electronics.
2. Explain the configuration of batteries in series, parallel, and series-parallel arrangements.

How do these configurations impact the overall voltage and current?

3. Discuss the applications of Thevenin’s, Norton’s, and Maximum Power Transfer theorems in DC circuits. How do these theorems simplify circuit analysis?
4. Evaluate the importance of SMPS (Switch Mode Power Supply) in computers and other electronic devices. How does it differ from traditional power supplies?

Short Answer Questions:

1. What is the difference between a constant voltage source and a constant current source?
2. Define Thevenin’s theorem and its application in circuit analysis.
3. How does a lead-acid battery work, and where is it commonly used?
4. Briefly explain the principle of maximum power transfer in electrical circuits.

Unit III: Alternating & Direct Currents

Essay Questions:

1. Describe the construction and working principle of an AC generator. What are the different types of AC generators, and how are they applied in industry?
2. Explain the differences between DC and AC generators, including their advantages and disadvantages. Discuss the types of DC generators and the losses associated with them.
3. Analyze the construction and working principle of transformers. How do step-up and step-down transformers work, and what is their role in power supplies?
4. Discuss the working principle of single-phase motors and their applications in household appliances such as water pumps and fans.

Short Answer Questions:

1. What are the primary differences between DC and AC generators?
2. Define the EMF equation of a transformer.
3. How does a step-up transformer differ from a step-down transformer?
4. What are the main applications of single-phase motors?

Unit IV: Modulation Circuits

Essay Questions:

1. Explain the need for modulation in communication systems. Compare and contrast amplitude modulation (AM) and frequency modulation (FM), including their waveforms and power relations.
2. Discuss the process of demodulation in AM systems, focusing on the role of a diode

detector. How does an AM transmitter and receiver work?

3. Analyze the significance of the modulation index in both AM and FM modulation. How does it affect the transmitted signal and the efficiency of communication?
4. Evaluate the key components and operation of FM transmitters and receivers. How do they differ from their AM counterparts?

Short Answer Questions:

1. What is amplitude modulation, and why is it necessary?
2. Define the modulation index in the context of frequency modulation.
3. What is the role of a diode detector in AM demodulation?
4. How does an FM transmitter differ from an AM transmitter?

Unit V: Applications of Electromagnetic Induction & Power Supplies

Essay Questions:

1. Describe the construction and operating principle of a DC motor. How can power, voltage, and current be calculated in a DC motor, and what are the key design considerations for a simple motor?
2. Discuss the working of a DC regulated power supply. How is a 5-volt regulated power supply designed, and what are its applications?
3. Explain the design process for step-down and step-up transformers. How are these transformers used in power supplies and other electrical applications?
4. Analyze the design and operation of a simple FM radio circuit using an LCR series resonance circuit. How does a multimeter assist in checking the output voltage of a battery eliminator?

Short Answer Questions:

1. What are the primary components of a DC motor?
2. How does a step-down transformer operate in a power supply?
3. Briefly explain the principle of electromagnetic induction in the context of motor design.
4. What is the purpose of a battery eliminator, and how is its output voltage measured?

B.Sc. PHYSICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 24(PHY)M52

III Year B.Sc (Hons.)-PHYSICS

SEMESTER-V COURSE 13: ELECTRONIC INSTRUMENTATION

Theory Credits: 3 3 hrs/week

COURSE OBJECTIVE:

The objective of the course on Electronic Instrumentation is to provide students with a comprehensive understanding of various electronic instruments used for measurement, data acquisition, and control applications. The course aims to develop students' knowledge and skills in the design, operation, calibration, and application of electronic instruments.

LEARNING OUTCOMES:

Students after successful completion of the course will be able to:

1. Identify various facilities required to set up a basic Instrumentation Laboratory.
2. Acquire a critical knowledge of various Electrical Instruments used in the Laboratory.
3. Demonstrate skills of using instruments like CRO, Function Generator, Multimeter etc. through hands on experience.
4. Understand the Principle and operation of different display devices used in the display systems and different transducers
5. Comprehend the applications of various biomedical instruments in daily life like B.P.
   meter, ECG, Pulse oximeter etc. and know the handling procedures with safety and security.

S.No.	Course Outcome	Course Outcome with action verb	Level in Blooms Taxonomy
1.	**CO-1**	**Describe** the operational principles and characteristics of Analog and Digital Multimeters, including accuracy, sensitivity, and display types.	**Level-3**
2.	**CO-2**	**Explain** the working principles and applications of Cathode Ray Oscilloscope (CRO), including its controls for voltage measurement, frequency analysis, and time-domain observations.	**Level-5**
3.	**CO-3**	**Discuss** the principles and applications of various transducers such as LVDT, Resistive, Capacitive, Inductive, and Piezoelectric transducers, along with the operational principles of DC and AC Bridges for measurement of resistance, capacitance, and inductance.	**Level-4**
4.	**CO-4**	**Analyze** the functioning and types of A/D and D/A converters, focusing on Binary ladder and successive approximation types, and discuss the operational principles and limitations of Display devices like LED Displays, Seven Segment Displays, and Liquid Crystal Displays (LCDs).	**Level-4**
5.	**CO-5**	**Evaluate** the classification and operational characteristics of amplifiers, including RC Coupled amplifiers and feedback mechanisms (Positive and Negative feedback), and **explain** the operating principles and applications of selected Biomedical Instruments such as ECG machines, Radiography, Ultrasound scanning, Ventilators, and Pulse oximeters.	**Level-5**

UNIT-I INTRODUCTION TO INSTRUMENTS: (12Hours)

a) Basic of measurements:

Instruments accuracy, precision, sensitivity, resolution, range, errors in measurement, Classification of Instruments, Analog instruments & Digital Instruments, Construction and working of an Analog Multimeter and Digital Multimeter (Block diagram approach), DC Voltmeter and AC Voltmeter, Sensitivity, 3½ display and 4½ display Digital Multimeter, Sources of errors in the Measurement of resistance, voltage and current, Specifications of Multimeter and their significance.

b) Balancing and damping Moving iron instruments & PMMC instruments.

UNIT-II OSCILLOSCOPE: (12Hourse)

a) Cathode ray oscilloscope – Principle and block diagram of CRO - Cathode Ray Tube – functioning – various controls

b) Applications CRO: Measurement of voltage (dc and ac), frequency & time period, Different types of oscilloscopes and their uses, Digital storage Oscilloscope

UNIT-III TRANSDUCERS AND BRIDGES: (12Hourse)

a) Linear Variable Differential Transformer (LVDT), Resistive, Capacitive & Inductive transducers, Piezoelectric transducer.

b) DC Bridge -Wheatstone's bridge, AC Bridges - Measurement of Inductance and Capacitance –

Maxwell's bridge, Schering Bridge, Measurement of frequency – Wien's bridge.

UNIT-IV ADC AND DAC & DISPLAY INSTRUMENTS: (12Hourse)

a) A/D & D/A converters - Binary ladder, A/D converters –successive approximation type.

b) Introduction to Display devices, LED Displays, Seven Segment Displays, Construction and operation (Display of numbers), Types of SSDs (Common Anode & Common Cathode type), Limitations of SSDs, Liquid Crystal Displays, Principle and working, Applications of LCD modules.

UNIT-V AMPLIFIERS, OSCILLATORS & BIOMEDICAL INSTRUMENTS: (12Hrs.)

a) Amplifiers – Classification of amplifiers, Coupling amplifiers – RC Coupled amplifier – frequency response characteristics (no derivation), Feedback in Electronic circuits – Positive and Negative feedback, expressions for gains, advantages of negative feedback, Barkhausen criteria, RC phase shift oscillator.

b) Basic operating principles and uses of (i) ECG machine (ii) Radiography (iii) Ultrasound scanning (iv) Ventilator (v) Pulse oximeter.

REFERENCE BOOKS:

1. Electronic Instrumentation by H.S.Kalsi ,TMH Publishers
2. Electronic Instrument Hand Book by Clyde F. Coombs ,McGraw Hill
3. Introduction to Biomedical Instrumentation byMandeep Singh, PHI Learning.
4. Electronic Instrumentation – WD Cooper
5. Electrical and Electronic Instrumentation – AK Sawhany
6. A text book in electrical technology by B.L.Thereja (S.Chand&Co)
7. *Biomedical Instrumentation* and Measurements by Leslie *Cromwell ,Prentice Hall India.*
8. Electronic Measurements and Instrumentation by Kishor, K Lal, Pearson, New Delhi
9. Electrical and Electronic Measurements by Sahan, A.K., Dhanpat Rai, New Delhi
10. Electronic Instruments and Measurement Techniques by Cooper, W.D. Halfrick, A.B., PHI Learning, New Delhi
11. Web sources suggested by the teacher concerned and the college librarian including reading material.

Course Code: 23(PHY)M52P

SEMESTER-V

COURSE 13: ELECTRONIC INSTRUMENTATION

Practical Credits: 1 2 hrs/week

COURSE OBJECTIVE:

The objective of the practical course on Electronic Instrumentation is to provide students with hands-on experience in using electronic instruments for measurement, data acquisition, and control applications. The course aims to develop students' practical skills in operating, calibrating, and troubleshooting electronic instruments commonly used in scientific, engineering, and industrial settings.

LEARNING OUTCOMES:

1. Familiarize students with a range of electronic instruments, including multimeters, oscilloscopes, signal generators, and data acquisition systems.
2. Learn the basic operation, functions, and features of each instrument.
3. Gain hands-on experience in connecting, configuring, and using different instruments for various measurement tasks.
4. Develop proficiency in performing common electrical measurements, such as voltage, current, resistance, frequency, and temperature measurements.
5. Learn specialized measurement techniques, including impedance measurements, time and frequency measurements, and power measurements.
6. Gain practical experience in selecting appropriate measurement techniques and instruments for specific applications.

PRACTICAL SYLLABUS

1. Familiarization of digital multimeter and its usage in the measurements of (i) resistance (ii) current, (iii) AC & DC voltages
2. Measure the AC and DC voltages, frequency using a CRO and compare the values measured with other instruments like Digital multimeter.
3. Formation of Sine, Square wave signals on the CRO using Function Generator and measure their frequencies. Compare the measured values with actual values.
4. Display the numbers from 0 to 9 on a single Seven Segment Display module by applying voltages.
5. Displacement transducer-LVDT
6. A.C - Impedance and Power Factor.
7. Maxwell's Bridge – Determination of Inductance.
8. Measurement of body temperature using a digital thermometer and list out the error and corrections.
9. Measurement of Blood Pressure of a person using a B.P. meter and record your values and analyze them.
10. Display the letters **a** to **h** on a single Seven Segment Display module by applying voltages.
11. Get acquainted with an available ECG machine and study the ECG pattern to understand the meaning of various peaks
12. Observe and understand the operation of a Digital Pulseoxymeter and measure the pulse rate of different people and understand the working of the meter.

VI. Lab References:

1. Electronic Measurement and Instrumentation by J.P. Navani. ,S Chand & Co Ltd

2. Principles of Electronic Instrumentation by A De Sa, Elsevier Science Publ.

3.Electronic Measurements and Instrumentation by S.P.Bihari,

YogitaKumari, Dr. Vinay Kakka, Vayu Education of India .

4. Laboratory Manual For Introductory Electronics Experiments by Maheshwari, New Age

International (P) Ltd., Publishers.

5. Electricity-Electronics Fundamentals: A Text-lab Manual by Paul B. Zbar ,Joseph

Sloop, & Joseph G. Sloop , McGraw-Hill Education.

6. Web sources suggested by the teacher concerned.

STUDENT ACTIVITIES

Co-Curricular Activities

(a) Mandatory:(*Training of students by teacher in field related skills: (lab:10 + field:05*) 1. **For Teacher**: Training of students by the teacher in the in the laboratory/field for not less than 15 hours on the field techniques/skills of understanding the operation, Maintenance and utility of various electrical and electronic instruments both in the Laboratory as well as in daily life.

For Student: Students shall (individually)visit a local electrical and electronics shop or small firm to familiarize with the various electrical and electronic instruments available in the market and also to understand their functionality, principle of operation and applications as well as the troubleshooting of these instruments.(Or) Student shall visit a diagnostic centre and observe the ECG machine and the ECG pattern(Or) Student shall visit a diagnostic centre and observe the CT scan and MRI scan.(Or) Student shall visit a mobile smart phone repair shop and observe the different components on the PCB(Motherboard), different ICs (chips) used in the motherboard and trouble shooting of touch screen in smart phones. Observations shall be recorded in a hand-written Fieldwork/Project work not exceeding 10 pages in the given format to be submitted to the teacher.

2. Max marks for Fieldwork/Project work: 05.
3. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations, findings and acknowledgements*. 4. Unit tests (IE)

(b) Suggested Co-Curricular Activities

1. Training of students by related industrial / technical experts.
2. Assignments (including technical assignments like identifying different measuring instruments and tools and their handling, operational techniques with safety and security.
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Making your own stethoscope at home.
5. Making seven segment display at home.
6. Preparation of videos on tools and techniques in various branches of instrumentation.
7. Collection of material/figures/photos related to products of Measuring Instruments, Display Modules and Biomedical Instruments and arrange them in a systematic way in a file.
8. Visits to Instrumentation Laboratories of local Universities or Industries like Cement, Chemical or Sugar Plants etc. or any nearby research organizations, private firms, etc.
9. Invited lectures and presentations on related topics by Technical /industrial experts

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B.Sc. PHYSICS SYLLABUS UNDER CBCS

[2023-24 Batch onwards]

Course Code: 24(PHY)M52

III Year B.Sc (Hons.)-PHYSICS

SEMESTER-V COURSE 13: ELECTRONIC INSTRUMENTATION

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	2	1	2	2	2	3	3
CO 2	3	3	2	2	1	2	3	3	3	2
CO 3	3	2	2	1	2	1	3	3	2	3
CO 4	3	3	2	1	2	1	3	3	2	3
CO 5	2	3	2	2	1	1	3	2	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	3	2	2	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	2	2	3
CO 5	2	3	2	2	2

Dr V.S.Krishna Govt. Degree College(A), Visakhapatnam 2022-2023
Course Code: 24(PHY)M52

BLUE PRINT (ELECTRONIC INSTRUMENTATION)
IIIB.Sc. (Hons.) Physics- SEM-V/Course : 13
Max Marks-75 Time-3Hrs. Credits:3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	UNIT-I INTRODUCTION TO INSTRUMENTS	2	2	30
2.	II	UNIT-II OSCILLOSCOPE	2	2	30
3.	III	UNIT-III TRANSDUCERS AND BRIDGES	2	2	30
4.	IV	UNIT-IV ADC AND DAC & DISPLAY INSTRUMENTS	2	2	30
5.	V	UNIT-V AMPLIFIERS, OSCILLATORS & BIOMEDICAL INSTRUMENTS	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE

(AUTONOMOUS)

NODAL RESOURCE CENTRE & AU CENTRE FOR RESEARCH

Maddilapalem, Visakhapatnam – 530013, Andhra Pradesh.

0891-2553262, https://www.drvskrishnagdc.edu.in

B.Sc. PHYSICS SEMESTER END EXAMINATION

[2023-24 Batch onwards]

Course Code: 24(PHY)M52

III Year B.Sc (Hons.)- PHYSICS

SEMESTER-V COURSE 13: ELECTRONIC INSTRUMENTATION

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following [5 X 8 = 40]

1. a) Explain the construction and working principles of Analog Multimeter? [OR]

   b) Describe the sources of errors in the measurement of resistance, voltage, and current using multimeters. How are these errors minimized?

2. a) Describe the principle and block diagram of a Cathode Ray Oscilloscope (CRO). Explain the functioning of a Cathode Ray Tube (CRT) in a CRO? [OR]

   b) Discuss the various controls and adjustments available on a CRO. How are these controls used to measure voltage (DC and AC), frequency, and time period?

3. a) Explain the working principles of Linear Variable Differential Transformer (LVDT), Resistive, Capacitive, Inductive, and Piezoelectric transducers? [OR]

   b) Discuss the operation of Wheatstone Bridge and its application in measuring unknown resistances?

4. a) Describe the operation of Binary ladder A/D converters and successive approximation type A/D converters? [OR]

   b) Discuss the principle and working of Liquid Crystal Displays (LCDs). How are LCD modules used in instrumentation?

5. a) Classify amplifiers and discuss the frequency response characteristics of RC Coupled amplifiers? [OR]

   b) Explain the Barkhausen criteria for oscillation and discuss the working principle of RC phase shift oscillator?

SECTION – B

Answer any FIVE Questions of the following **[5 X 4 = 20]**

6. a) Define accuracy, precision, sensitivity, resolution, and range in the context of instrumentation?
7. a) Discuss the construction and working principle of a Digital Multimeter?
8. a) Discuss the various controls and adjustments available on a CRO?
9. a) Differentiate between an Analog Oscilloscope and a Digital Oscilloscope?
10. a) Define LVDT. How does it convert mechanical motion into electrical signals?
11. a) Discuss the working principle of Piezoelectric transducers.?
12. a) Describe the construction of Seven Segment Displays?
13. a) Explain the working principle of Liquid Crystal Displays (LCDs)?
14. a) Discuss the role of feedback in electronic amplifiers?
15. a) Explain the principle of operation of ECG machines?

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
Course Code: 24(PHY)M52

III Year B.Sc (Hons.)- PHYSICS
SEMESTER-V COURSE 13: ELECTRONIC INSTRUMENTATION

Question Bank

Unit I: Introduction to Instruments

Essay Questions:

1. Discuss the importance of accuracy, precision, sensitivity, and resolution in the context of measurement instruments. How are these parameters crucial for reliable measurements?
2. Compare and contrast Analog and Digital Instruments. Discuss their respective advantages and limitations in various measurement applications.
3. Explain the construction and working principles of Analog Multimeter and Digital Multimeter using block diagrams. Highlight the differences between 3½ display and 4½ display Digital Multimeters.

Short Type Questions:

1. Define and differentiate between accuracy and precision in measurement.
2. Explain the sources of errors in the measurement of resistance, voltage, and current with Multimeters.
3. Describe the functions and significance of sensitivity in Multimeters.

Unit II: Oscilloscope

Essay Questions: 4. Describe the principle of operation of a Cathode Ray Oscilloscope (CRO). Draw a labeled block diagram and explain the function of each component.

5. Discuss the applications of CRO in measuring voltage (DC and AC), frequency, and time period. Compare different types of oscilloscopes and their specific uses.
6. Explain the working principle and advantages of Digital Storage Oscilloscopes (DSOs) over traditional CROs.

Short Type Questions:

4. Explain the functioning of a Cathode Ray Tube (CRT) in a CRO.

5. Discuss the various controls and adjustments available on a CRO.
6. Differentiate between an Analog Oscilloscope and a Digital Oscilloscope.

Unit III: Transducers and Bridges

Essay Questions:

7. Explain the working principles and applications of Linear Variable Differential Transformer (LVDT), Resistive, Capacitive, Inductive, and Piezoelectric transducers.

8. Describe the operation of Wheatstone Bridge in measuring unknown resistances. How do AC Bridges (Maxwell's Bridge and Schering Bridge) measure inductance, capacitance, and frequency?
9. Compare the advantages and disadvantages of different types of transducers used in instrumentation.

Short Type Questions:

7. Define LVDT. How does it convert mechanical motion into electrical signals?

8. Explain the principle behind Wheatstone's Bridge. When is it used?
9. Discuss the working principle of Piezoelectric transducers.

Unit IV: ADC and DAC, Display Instruments

Essay Questions:

10. Describe the operation and applications of A/D converters (Binary ladder and successive approximation type) and D/A converters.

11. Explain the construction and operation of LED Displays, Seven Segment Displays (SSDs), and Liquid Crystal Displays (LCDs). What are the limitations of SSDs?
12. Discuss the significance of display devices in instrumentation. How are they used to present measurement data effectively?

Short Type Questions:

10. Compare Binary ladder and successive approximation A/D converters.

11. Describe the construction of Seven Segment Displays. What are the types of SSDs?
12. Explain the working principle of Liquid Crystal Displays (LCDs).

Unit V: Amplifiers, Oscillators, and Biomedical Instruments

Essay Questions:

13. Classify amplifiers based on their configurations. Discuss the frequency response characteristics of RC Coupled amplifiers. What is the significance of feedback in electronic circuits?

14. Explain the advantages of negative feedback in amplifiers. Discuss the Barkhausen criteria for oscillation.
15. Describe the basic operating principles and applications of Biomedical Instruments such as ECG machines, Radiography, Ultrasound scanning, Ventilators, and Pulse Oximeters.

Short Type Questions:

13. Define RC phase shift oscillator. How does it generate oscillations?

14. Discuss the role of feedback in electronic amplifiers.
15. Explain the principle of operation of ECG machines and their significance in healthcare.

(COURSE CODE: 24PHYM53A)

BLUE PRINT

Programme: B.Sc. Honors in Physics (Major) -2024-2025

SEMESTER-V

COURSE 14A: OPTICAL INSTRUMENTS AND OPTOMETRY

MAX MARKS – 60 TIME – 3 HOURS (CREDITS- 3)

S.NO	UNIT	TOPIC	ESSAY TYPE QUESTIONS (SECTION-B) Each one 8 marks	SHORT ANSWER QUESTIONS (SECTION-A) Each one 4 marks
1	I	Optical microscopes	1	2
2	II	Telescopes	1	2
3	III	Applications of optical instruments	1	2
4	IV	Optical vision	1	2
5	V	Ophthalmic techniques and optometry	1	2
			5 (internal choice)	5 (five to be answered out of ten questions)

$$\textbf{\textit{Percentage of choice}} = \frac{\mathbf{120 - 60}}{\mathbf{120}} \times \mathbf{100 = 50\%}$$

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

CO-PO Mapping
1- Low, 2- Moderate, 3- High, ‘-‘ No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	2	2	3
CO 2	3	1	1	1	1	2	3	3	2	3
CO 3	3	1	1	1	1	2	3	3	2	3
CO 4	3	1	1	1	1	2	3	2	2	3
CO 5	3	1	1	1	1	2	3	3	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, ‘-‘ No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

(COURSE CODE: 24PHYM53A)

SEMESTER-V COURSE 14A: OPTICAL INSTRUMENTS AND OPTOMETRY

Theory | Credits: 3 | 3 hrs/week

Course Objective:

The objective of the course on Optical Instruments and Optometry is to provide students with a comprehensive understanding of the principles, design, and application of optical instruments used in various fields, with a specific focus on optometry

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understand the construction and working principles of various optical instruments used in daily life.	Level 2 (Understanding)
CO 2	Acquire a critical knowledge on the various defects of eye and their correcting methods with suitable lenses.	Level 3 (Applying)
CO 3	Demonstrate skills of using biological microscope through hands on experience.	Level 2 (Understanding)
CO 4	Understand the various techniques used in optometry and computer based eye testing.	Level 2 (Understanding) Level 3 (Applying)
CO 5	Comprehend the various applications of microscopes and telescopes.	Level 3 (Applying)

SYLLUBUS

UNIT-I Optical Microscopes

Introduction of eye piece, RAMSDON eye piece. Simple Microscope-Construction, Magnifying power, normal adjustment; Compound Microscope-Construction, Magnifying power, normal adjustment, Phase contrast microscope-Operating principle, travelling microscope-Construction, ***lest count calculation,*** working and uses

UNIT-II Telescopes

Introduction to Telescopes, ***Types of Telescopes***, Refracting Telescopes and Reflecting telescopes, Construction, ***Telescope Optics and Components***, working and magnifying power of Astronomical Telescope and Terrestrial Telescopes, Binoculars – working principle and applications. ***Observational Techniques (Qualitative).***

UNIT-III Applications of Optical Instruments

Introduction to Optical Instruments,

Microscopy: Types of microscopes:

Applications in biology and material science

Introductory ideas and applications of various microscopes *viz*., (i) Optical microscopes (Compound microscope, Stereo microscope, confocal microscope) (ii) Electron microscopes (TEM, SEM), (iii) Scanning Probe microscope (iv) Scanning Acoustic microscope and (v) X-ray microscope. Introductory ideas and applications of various telescopes *viz*., (i) Optical telescopes (ii) Radio telescopes (iii) Solar telescopes (iv) Infrared telescope (v) Ultraviolet telescope

Principles of spectroscopy: Absorption, emission, and scattering (qualitative only)

UNIT-IV Optical Vision

Introduction to optical Vision, Eye as an optical instrument, Formation of image in the eye and the camera, Ophthalmic lenses, ***Camera Systems: Principles and Design***, Myopia and Hyper-metropia defects, Removal of defects in vision using ophthalmic lenses, Contact lenses-Working principle, Different types of Contact lenses.

UNIT-V Ophthalmic Techniques and Optometry

Ophthalmoscope and keratometer and their working principles, Evaluation of eye disorders, Guidelines for standardized eye chart preparation, Simple phoropter and its working principle and its uses, Principles of Computer based eye testing. ***Types of Contact Lenses, Role and Responsibilities of an Optometrist.***

Reference Books

1. Optics and Optical Instruments: An Introduction by B. K. Johnson, Dover Publications. 2. Modern Optical Instruments and their construction by or ford Henry-Publisher: Biblio Life, LLC.

3. A Text Book of Optics by Brj Lal and N.Subramanyam, S.Chand & Co.
4. Practical Optics by Menn Naftly, Elsevier Science Publishing.
5. Applications of Optics in daily life | CK-12 Foundation. https://flexbooks.ck12.org ›
6. Web sources suggested by the teacher concerned and the college librarian including Reading material.

SEMESTER-V COURSE 14 A: OPTICAL INSTRUMENTS AND OPTOMETRY

(COURSE CODE: 24PHYM53AP)

Practical Credits: 1 2 hrs/week

COURSE OBJECTIVE:

The objective of the practical course on Optical Instruments and Optometry is to provide students with hands-on experience and practical skills in the operation, calibration, and application of optical instruments used in optometry

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	List out, identify and handle various equipment like binoculars, telescopes and microscopes	Level 2 (Understanding) Level 3 (Applying) Level 1 (Knowledge)
CO 2	Learn the procedures of operation of various optical instruments.	Level 2 (Understanding)
CO 3	Demonstrate skills on testing the power of lenses, improving the resolution of telescopes and microscopes.	Level 2 (Understanding) Level 3 (Applying) Level 4 (Analysing)
CO 4	Acquire skills in observing and measuring the power, focal length and different refractive errors of eye.	Level 2 (Understanding) Level 4 (Analysing) Level 5 (Evaluating)
CO 5	Perform some techniques related to testing the blood and other biological samples. Understand the technique of operation of Computer eye testing and evaluation.	Level 3 (Applying) Level 4 (Analysing) Level 2 (Understanding)

Practical (Laboratory) Syllabus:

1. Evaluation of magnifying power of simple microscope.
2. Measurement of reflection and transmission coefficient of certain materials using a microscope.
3. Resolving power of telescope
4. Determination of radii of different capillary tubes using travelling microscope.
5. Refractive index of a liquid (water) using (i) concave mirror and (ii) convex lens and a plane mirror.
6. Removal of refractive errors of eye using combination of lenses.
7. Determination of power of a convex lens by finding its focal length.

Lab References:

1. A Practical Guide to Experimental Geometrical Optics byYuriy A. Garbovskiy-Cambridge Univ. Press
2. https://physics.columbia.edu/sites/default/files/content/Lab%20Resources/1292%20Lab

   %20Manual.pdf
3. https://www.lnmiit.ac.in/Department/Physics/uploaded_files/lab-manual.pdf
4. Basic Optics Experiments -http://www.phys.unm.edu › Optics Lab › Basics
5. A Practical Guide to Experimental Geometrical Optics by Yuriy A. Garbovskiy, Anatoliy V. Glushchenko, Cambridge Univ. Press
6. Web sources suggested by the teacher concerned. http://www.phy.olemiss.edu/~thomas/weblab/Optics_lab_Items/Telescope_Microscope _PROCED_Spring_2018.pdf

STUDENT ACTIVITIES

Co-Curricular Activities

(a) Mandatory: (*Training of students by teacher in field related skills: (lab:10 + field: 05*)

1. **For Teacher**: Training of students by the teacher (if necessary, by a local expert) in laboratory/field for a total of not less than 15 hours on the field techniques/skills on the familiarization of various optical instruments available in the laboratory; construction of different types of telescopes and their comparison in construction, operation and their utility and limitations; the details of construction of eye and various defects in the eye sight, emerging techniques in the design of eye lenses including contact lenses and making the student to understand on the testing of a biological sample using a clinical microscope.

For Student: Students shall (individually) visit and observe the functioning of optical instruments at any one of the following places /centres like (a) pathological laboratory **or** (b) a local ophthalmologist **or** (c) a local optician to understand the various types of eye lenses **or** (d) a local computer based eye testing centre **or** (e) an optician, who fixes contact lenses **or** (f) a local cinema theatre **or** (g) a planetarium. Student shall write the observations and submit a hand-written Fieldwork/Project work not exceeding 10 pages in the given format to the teacher.

2. Max marks for Fieldwork/Project work: 05.
3. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations, findings and acknowledgements*.
4. Unit tests (IE).

(b) Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments (including technical assignments like identifying tools in the lens grinding, frame fitting, lens cleaning culture and other operational techniques with safety and security, IPR)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques in optical instruments and optical lenses, contact lenses.
5. Making a model microscope and measuring its magnification.
6. Making a simple astronomical telescope using two convex lenses.
7. Checking the power of your spectacles or lenses at home.
8. Students shall take up making their own (i) Telescope and (ii) Binoculars with the accessories available at home.

https://paksc.org/pk/science-experiments/physics-experiments/how-to-make-astronomical- telescope

https://kids.nationalgeographic.com/nature/article/make-a-telescope

https://learning-center.homesciencetools.com/article/how-to-make-a-telescope-optical- science-project/

http://scipop.iucaa.in/Amateurs/telemaking.html

9. Collection of material/figures/photos related to various types of lenses and their power.
10. Visit to any eye research laboratories, if available
11. Invited lectures and presentations on related topics by field/industrial experts

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Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
(An Autonomous Institution Affiliated to Andhra University)
Reaccredited by NAAC with 'A' Grade(3rd Cycle)
District Resource Centre & Center for Research Studies
Maddilapalem, VISAKHAPATNAM 530 013, Andhra Pradesh

Programme: B.Sc. Honorus in Physics (Major) -2024-2025

<u>SEMESTER-V</u>

(COURSE CODE: 24PHYM53A)

COURSE 14A: OPTICAL INSTRUMENTS AND OPTOMETRY

Theory Credits: 3 3 hrs/week

<u>Model Paper</u> **Max Marks: 60**

Section A

Answer any five questions from the following (4M$\times 5 = 20M$)

1. **What are the key differences between a simple microscope and a compound microscope?**
2. **How does a phase contrast microscope enhance the visualization of transparent specimens?**
3. **How does the magnifying power of an astronomical telescope compare to that of a terrestrial telescope?**
4. **Explain the basic principle of how binoculars enhance visual observation.**
5. **What are the key applications of a confocal microscope compared to a traditional compound microscope?**
6. **How does a scanning probe microscope differ from an electron microscope in terms of imaging and applications?**
7. **What is the main function of ophthalmic lenses in correcting vision defects?**
8. **How does the image formation in a camera compare to that in the human eye?**
9. **What is the primary purpose of an ophthalmoscope in eye examinations?**
10. **What role does a computer-based eye testing system play in modern optometry?**

Section B

Answer all the questions (8M$\times 5 = 40M$)

11. (A) Describe the construction and working principle of a compound microscope. Discuss how the magnifying power is achieved and the normal adjustment procedure.

(OR)

(B) Explain the operating principle of a phase contrast microscope. How does it differ from a standard optical microscope in terms of image formation and application?

12. (A) Compare the construction, working principles, and magnifying powers of astronomical and terrestrial telescopes. How does each type of telescope serve its specific purpose?

(OR)

(B) Describe the working principle of binoculars. Discuss their various applications and how they differ from other types of telescopes.

13. (A) Discuss the working principles and applications of various types of electron microscopes (TEM and SEM). How do they contribute to advancements in material science?

(OR)

(B) Explain the principles and uses of different types of telescopes including radio, solar, infrared, and ultraviolet telescopes. How do these telescopes complement each other in astronomical observations?

14. (A) Describe the structure of the human eye as an optical instrument. Explain the process of image formation in the eye and how it is similar to a camera.

(OR)

(B) Explain the working principle of contact lenses. Compare the different types of contact lenses available and their specific uses.

15. (A) Discuss the guidelines for preparing a standardized eye chart. Why is standardization important in optometry?

(OR)

(B) Explain the principles behind a simple phoropter and its uses in eye testing. How does it contribute to diagnosing and correcting vision problems?

Programme: B.Sc. Honors in Physics (Major) -2024-2025

SEMESTER-V COURSE CODE: 24PHYN53A

COURSE 14A: OPTICAL INSTRUMENTS AND OPTOMETRY

UNIT-I: Optical Microscopes

Essay-Type Questions:

1. **Describe the construction and working principle of a compound microscope. Discuss how the magnifying power is achieved and the normal adjustment procedure.**
2. **Explain the operating principle of a phase contrast microscope. How does it differ from a standard optical microscope in terms of image formation and application?**
3. **Compare and contrast the construction, working, and applications of a traveling microscope with those of a simple microscope. Include details on their respective uses in scientific research.**

Short Answer Questions:

1. **What are the key differences between a simple microscope and a compound microscope?**
2. **How does a phase contrast microscope enhance the visualization of transparent specimens?**
3. **List the main uses of a traveling microscope in practical applications.**

UNIT-II: Telescopes

Essay-Type Questions:

1. **Discuss the construction and working of refracting telescopes. Explain the principles that allow them to achieve high magnifying power and their main applications.**
2. **Compare the construction, working principles, and magnifying powers of astronomical and terrestrial telescopes. How does each type of telescope serve its specific purpose?**
3. **Describe the working principle of binoculars. Discuss their various applications and how they differ from other types of telescopes.**

Short Answer Questions:

1. **What is the primary difference in construction between a refracting telescope and a reflecting telescope?**
2. **How does the magnifying power of an astronomical telescope compare to that of a terrestrial telescope?**
3. **Explain the basic principle of how binoculars enhance visual observation.**

UNIT-III: Applications of Optical Instruments

Essay-Type Questions:

1. **Provide an overview of the different types of optical microscopes (compound, stereo, confocal) and their applications in scientific research.**
2. **Discuss the working principles and applications of various types of electron microscopes (TEM and SEM). How do they contribute to advancements in material science?**
3. **Explain the principles and uses of different types of telescopes including radio, solar, infrared, and ultraviolet telescopes. How do these telescopes complement each other in astronomical observations?**

Short Answer Questions:

1. **What are the key applications of a confocal microscope compared to a traditional compound microscope?**
2. **How does a scanning probe microscope differ from an electron microscope in terms of imaging and applications?**
3. **List two major advantages of using radio telescopes in astronomical studies.**

UNIT-IV: Optical Vision

Essay-Type Questions

1. **Describe the structure of the human eye as an optical instrument. Explain the process of image formation in the eye and how it is similar to a camera.**
2. **Discuss the causes and correction methods for myopia and hypermetropia. How do ophthalmic lenses and contact lenses address these vision defects?**
3. **Explain the working principle of contact lenses. Compare the different types of contact lenses available and their specific uses.**

Short Answer Questions:

1. **What is the main function of ophthalmic lenses in correcting vision defects?**
2. **How does the image formation in a camera compare to that in the human eye?**
3. **What are the primary differences between rigid and soft contact lenses?**

UNIT-V: Ophthalmic Techniques and Optometry

Essay-Type Questions

1. **Describe the working principles of an ophthalmoscope and a keratometer. How are these instruments used in the evaluation of eye disorders?**
2. **Discuss the guidelines for preparing a standardized eye chart. Why is standardization important in optometry?**
3. **Explain the principles behind a simple phoropter and its uses in eye testing. How does it contribute to diagnosing and correcting vision problems?**

Short Answer Questions:

1. **What is the primary purpose of an ophthalmoscope in eye examinations?**
2. **How does a keratometer measure the curvature of the cornea?**
3. **What role does a computer-based eye testing system play in modern optometry?**

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

COURSE CODE 24PHYM53B

SEMESTER-V COURSE 14B: OPTICAL IMAGING AND PHOTOGRAPHY

Theory Credits: 3 3 hrs/week

Course Objective:

- The objective of the course on Optical Imaging and Photography is to provide students with a comprehensive understanding of the principles, techniques, and applications of optical imaging and photography.
- The course aims to develop students' theoretical knowledge and practical skills in capturing, processing, and interpreting images using optical devices and imaging technologies.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Identify the different types of cameras and camera lenses according to different purposes	Level 2 (Understanding)
CO 2	Identify and understand the focal length of the different types of lenses	Level 2 (Understanding)
CO 3	Acquire a critical knowledge on natural and artificial sources of light and their application in photography.	Level 2 (Understanding) Level 3 (Applying)
CO 4	Demonstrate skills of camera usage especially Digital Cameras. To understand the various Image development and editing techniques.	Level 2 (Understanding)
CO 5	Comprehend the concept of different types of common shooting techniques.	Level 2 (Understanding)

Unit-I: Introduction to Photography:

Working principle of a camera, Image formation in simple camera and human eye, Types of cameras Pin-hole camera, Single Lens Reflex (SLR) camera, Twin Lens Reflex (TLR) camera, Digital Single-lens reflex camera (DSLR), Digital camera, Drone flying cameras, Care, and maintenance of camera.

Unit-II: Digital Photography:

Different types of Digital cameras and their parts, Working of DSLR camera, Types of lenses- Normal, Wide angle, telephoto, Zoom lenses, Digital Image formation, Digital camera image sensors, Size of the image, Depth of focus, Depth of field, Exposure time, Aperture, Shutter speed, ISO, filters, knowledge on pixels and their uses, resolution.

Unit-III: Photographic Light Sources:

Need for the light in photography, Light sources- Natural light, Sun light, Moon light, Ambient light, Artificial light sources-Flood light, Spot light, Halogen light, Halogen flash light, Digital lights, Exposure, Studio photography

Unit-IV: Photographic Shooting Techniques:

Significance and role of Camera lens in photo shooting, Arrangement of lenses in a Camera- Positioning, Techniques involved in the use of DSLR cameras, Usage of Filters, Techniques of Photomicrography, High speed Photography with motor driven camera, Basic ideas on Underwater Photography, Medical Photography, Astronomical Photography.

Unit-V: Photo Manipulation:

Developing and printing the photographs, equipment and materials used in developing and printing, image mixing and printing, Image editing through image editing software's like Adobe Photoshop – Adjustment of Brightness, Contrast, Tonal and Colour Values, Methods of storing and processing, Image transportation through Pendrive, CD, HDD and CLOUD [Internet]

Reference Books:

1. Object and image; An introduction to photography by George M Craven, PHI
2. An Introduction to Digital Photo Imaging Agfa, 1994
3. Advance Photography by M. Langford.
4. Digital Photography-A hands on Introduction by Phillip Krejcarek, Delmer Publishers

5. Multimedia – An Introduction by John Villamil, PHI
6. https://www.adobe.com/in/creativecloud/photography/discover/dslr-camera.html

Web sources suggested by the teacher concerned and the college librarian including reading material

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	1	3
CO 2	3	3	3	1	3
CO 3	3	3	3	1	3
CO 4	3	3	3	1	3
CO 5	3	3	3	1	3

COURSE CODE 24PHYM53B STUDENT ACTIVITIES

Co-Curricular Activities

(a) Mandatory:(*Training of students by teacher in field related skills: (lab:10 + field: 05*):

1. **For Teacher**: Training of students by the teacher (if necessary, by a local expert) in laboratory/field for not less than 15 hours on the field techniques/skills of Image formation by using lenses and mirrors. Also to make students to understand the construction, operation and the Physics principles involved in a normal Camera and Digital Camera.

2. **For Student**: Students shall (individually) visit a local Photo studio or any such facility in a university/research organization/private and observe (i) the operation of different digital cameras, compact and SLR and in taking photographs using different types of lenses by varying aperture, shutter speed for still camera, video camera, CCTV and spy camera **or**

(ii) The use of natural light, tungsten light, fluorescent light, electronic flash reflectors, exposure meters, studio flash and its accessories **or** (iii) the usage of various lighting techniques for different lenses and will do practice on special areas of photography in outdoor and indoor conditions **or** (iv) the different processes viz., Audio video recording, mixing, editing, dubbing of sound, using different types of microphones **or** (v) the handling of the digital video cameras, DVD, HDD, accessories and exposure to take different common shots, dimension of images and movements as per requirement **or** (v) the computer system by digital editing software, printing the photographs taken by digital cameras and the image transportation to the storage media, sending photographs through E- mail and Scanning the photographs, capture frames and analysis of images and record their observations and submit a hand-written Fieldwork/Project work not exceeding 10 pages in the given format to the teacher.

3. Max marks for Fieldwork/Project work: 05.
4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations, findings and acknowledgements*.
5. Tests (IE).

(b) Suggested Co-Curricular Activities:

1. Training of students by a related skilled person from a Photo studio.
2. Assignments (including technical assignments like identifying the tools &techniques involved in photography and handling, operational techniques of different Cameras with safety and security)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques related to Image formation and Photographic Techniques.
5. Practice taking outdoor photographs with a digital camera in (i) Black & White and (ii) Colour in the following conditions**:**

Landscapes – Street / Building – Sculpture – Insect / Animal movement – Industrial plant (outside view) – Children, birds (close up / long shot / model photography)- slow and fast moving objects-Night photography etc.

6. Shooting of different areas and topics such as sports, wildlife, modeling, drama, documentary, serial, story board making, news, interview, seminar/ workshop, industrial, live broadcasting, musical event, advertisement, etc.
7. Collection of material/figures/
8. photos related to various components of a Camera, writing and organizing them in a systematic way in a file.
9. Visits to any local Photo Studio or any Lab in universities, research organizations, private firms, etc.
10. Invited lectures and presentations on related topics by field/industrial experts.

COURSE CODE 24PHYM53BP

SEMESTER-V COURSE 14B: OPTICAL IMAGING AND PHOTOGRAPHY

Practical Credits: 1 2hrs/week

COURSE OBJECTIVE:

- The objective of the practical course on 0ptical Imaging and Photography is to provide students with hands-on experience and practical skills in capturing, processing, and interpreting optical images using various imaging techniques and equipment.
- The course aims to develop students' proficiency in operating optical imaging devices, utilizing image processing software, and analyzing images for different applications.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	List out, identify and understand various image formation techniques including Eye.	Level 4
CO 2	Learn the procedures of using Analog and Digital cameras.	Level 2
CO 3	Demonstrate the focusing techniques of Analog and Digital cameras.	Level 6
CO 4	Acquire skills in the editing and development of photos and videos	Level 4
CO 5	Perform some experimental skills related to images, videos using the equipment available in the lab or in a local studio	Level 3

Minimum of 6 experiments to be done and recorded

1. Construction of a simple pin hole Camera and study it's working.
2. Capture an image using a Digital Camera and apply editing techniques.
3. Understanding various image formats and convert one image format in to other (For ex: JPEG to BMP)
4. Convert a video stream into image stream by using a suitable editing software.
5. Evaluate the number of pixels and size of digital Image.
6. Comparison of the quality of a 8-bit, 16-bit and 32 bit images.
7. Perform the reduction and enlargement of a given Digital Image.
8. Change the appearance of an image by applying the filters (For ex: from the IR image of the given digital Image by suitable IR filter)

Lab References:

1. DSLR Photography for Beginners by Brian Black
2. The Art of Photography by Bruce Barnbaum
3. Photoshop for Photographers by John Slavio
4. https://www.youtube.com/channel/UCwWyFRy2l6aUFMsRemP51Sw. You Tube resource.
5. https://www.udemy.com/course/complete-photography-course/ 6. Web sources suggested by the teacher concerned.

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NODAL RESOURCE CENTRE & AU CENTRE FOR RESEARCH
Maddilapalem, Visakhapatnam – 530013, Andhra Pradesh.
0891-2553262, https://www.drvskrishnagdc.edu.in

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

COURSE CODE 24PHYM53B

COURSE 14B: OPTICAL IMAGING AND PHOTOGRAPHY

Theory Credits: 3 3 hrs/week

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

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

COURSE CODE 24PHYM53B

COURSE 14B: OPTICAL IMAGING AND PHOTOGRAPHY

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	**I**		2(one out of two)	2
2	**II**		2(one out of two)	2
3	**III**		2(one out of two)	2
4	**IV**		2(one out of two)	2
5	**V**		2(one out of two)	2
			5(each question has internal choice)	5 out of given 10

Question bank

Unit I: Introduction to Photography

Long Answer Questions:

1. Discuss the working principle of a camera and compare the image formation process in a simple camera with that in the human eye.
2. Explain the evolution of camera technology, focusing on the differences between traditional cameras (e.g., SLR, TLR) and modern digital cameras, including DSLR and drone flying cameras.
3. Describe the essential care and maintenance practices for cameras. Why is proper maintenance crucial for the longevity and performance of different types of cameras?

Short Answer Questions:

1. What is the working principle of a pin-hole camera?
2. Briefly describe the differences between an SLR camera and a DSLR camera.
3. What are the basic components of a digital camera?

Unit II: Digital Photography

Long Answer Questions:

1. Explain the working of a DSLR camera, detailing the role of various lenses, image sensors, and camera settings such as aperture, shutter speed, ISO, and exposure time.
2. Discuss the concept of digital image formation, including the role of pixels, resolution, and image sensors. How does the size of the image and depth of field affect the final photograph?
3. Compare and contrast different types of lenses used in digital photography, including normal, wide-angle, telephoto, and zoom lenses.

Short Answer Questions:

1. What is the function of the aperture in a DSLR camera?
2. Define depth of focus and depth of field in the context of digital photography.
3. What is the significance of ISO in controlling image exposure?

Unit III: Photographic Light Sources

Long Answer Questions:

1. Discuss the importance of light in photography. Compare and contrast natural light sources, such as sunlight and moonlight, with artificial light sources, including floodlights, spotlights, and digital lights.
2. Explain the concept of exposure in photography. How do different lighting conditions affect exposure, and what techniques can photographers use to achieve optimal exposure in studio photography?
3. Describe the role of artificial light sources in different photography settings. How do tools like halogen flashlights and digital lights enhance photographic outcomes in challenging lighting environments?

Short Answer Questions:

1. What is ambient light, and how is it used in photography?

2. How does artificial lighting impact studio photography?
3. Define the term "exposure" in the context of photography.

Unit IV: Photographic Shooting Techniques

Long Answer Questions:

1. Analyze the significance of camera lenses in photography, including the arrangement and positioning of lenses in a DSLR camera.
2. Discuss the techniques involved in specialized photography, such as underwater photography, medical photography, and astronomical photography. What are the unique challenges and considerations in each of these areas?
3. Explain the role of filters in photography. How do different types of filters, such as polarizing and neutral density filters, affect the final image, and in what scenarios are they most useful?

Short Answer Questions:

1. What is the role of a filter in a DSLR camera?
2. Briefly explain the technique of photomicrography.
3. What are the challenges of underwater photography?

Unit V: Photo Manipulation

Long Answer Questions:

1. Discuss the process of developing and printing photographs, including the equipment and materials used. How has digital technology influenced the traditional methods of photo processing?
2. Explain the steps involved in image editing using software like Adobe Photoshop. How do adjustments to brightness, contrast, tonal, and color values impact the final image?
3. Describe the methods of storing and transporting digital images, including the use of Pendrives, CDs, HDDs, and cloud services. What are the advantages and disadvantages of each method?

Short Answer Questions:

1. What are the basic tools used in photo editing software like Adobe Photoshop?
2. How has cloud storage changed the way photographers store and share their images?
3. What materials are commonly used in the process of developing photographs?

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Programme: B.Sc. Honours in Physics (Major)
COURSE CODE 24PHYM53B
COURSE 14B: OPTICAL IMAGING AND PHOTOGRAPHY
Max Marks: 60

Section A

Answer any five questions from the following (4M$\times$ $5 = 20M$)

1. What is the working principle of a pin-hole camera?
2.Briefly describe the differences between an SLR camera and a DSLR camera.
3.Define depth of focus and depth of field in the context of digital photography.
4.What is the significance of ISO in controlling image exposure
5.How does artificial lighting impact studio photography?
6.Define the term "exposure" in the context of photography
7.What is the role of a filter in a DSLR camera?
8.Briefly explain the technique of photomicrography
9.What are the basic tools used in photo editing software like Adobe Photoshop?
10.How has cloud storage changed the way photographers store and share their images?

Section B

Answer all the questions (8M$\times$ $5 = 40M$)

11. (a) Discuss the working principle of a camera and compare the image formation process in a simple camera with that in the human eye.

(OR)

(b) Describe the essential care and maintenance practices for cameras. Why is proper maintenance crucial for the longevity and performance of different types of cameras?

12.(a) Explain the working of a DSLR camera, detailing the role of various lenses, image sensors, and camera settings such as aperture, shutter speed, ISO, and exposure time.

(OR)

(b) Compare and contrast different types of lenses used in digital photography, including normal, wide-angle, telephoto, and zoom lenses.

13.(a) Discuss the importance of light in photography. Compare and contrast natural light sources, such as sunlight and moonlight, with artificial light sources, including floodlights, spotlights, and digital lights.

(OR)

(b) Describe the role of artificial light sources in different photography settings. How do tools like halogen flashlights and digital lights enhance photographic outcomes in challenging lighting environments?

14.(a) Analyze the significance of camera lenses in photography, including the arrangement and positioning of lenses in a DSLR camera.

(OR)

(b) Discuss the techniques involved in specialized photography, such as underwater photography, medical photography, and astronomical photography. What are the unique challenges and considerations in each of these areas?

15.a) Discuss the process of developing and printing photographs, including the equipment and materials used. How has digital technology influenced the traditional methods of photo processing?

(OR)

(b) Describe the methods of storing and transporting digital images, including the use of Pendrives, CDs, HDDs, and cloud services. What are the advantages and disadvantages of each method?

Programme: B.Sc. Honours in Physics (Major)
(w.e.f. AY 2023-24)

SEMESTER- V COURSE CODE: 24PH7YM54A

III Year BSC Physics
SEMESTER-V
LOW TEMPERATURE PHYSICS & REFRIGIRATION

Theory **Credits:3** **3hrs/week**

COURSE OBJECTIVE:

The objective of the course on Low Temperature Physics & Refrigeration is to provide students with a comprehensive understanding of the fundamental principles, concepts, and applications of low-temperature physics and refrigeration systems. The course aims to develop students' theoretical knowledge and practical skills in working with low temperatures, understanding cryogenic phenomena, and operating refrigeration systems.

LEARNING OUTCOMES:

	On Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Identify various methods and techniques used to produce low temperatures in the Laboratory.	Level 1
CO 2	Acquire a critical knowledge on refrigeration and air conditioning.	Level 2
CO 3	Demonstrate skills of Refrigerators through hands on experience and learns about refrigeration components and their accessories.	Level 5
CO 4	Understand the classification, properties of refrigerants and their effects on environment.	Level 1
CO 5	Comprehend the applications of Low Temperature Physics and refrigeration.	Level 4

SYLLABUS

UNIT-I Production Of Low Temperature

Production of low temperatures-Introduction, Freezing mixtures, Joule-Thomson effect, Regenerative cooling, Different methods of liquefaction of gases, liquefaction of air, Production of liquid hydrogen and nitrogen, Adiabatic demagnetization, Properties of materials at low temperatures

UNIT-II Measurement of Low Temperature

Gas thermometer and its correction and calibration, Secondary thermometers, resistance thermometers, thermocouples, Vapour pressure thermometers, Magnetic thermometers, Advantages and drawbacks of each type of thermometer.

UNIT-III Principles of Refrigeration

Introduction to Refrigeration- Natural and artificial refrigeration , Stages of refrigeration, Types of refrigeration - Vapor compression and vapor absorption refrigeration systems, Refrigeration cycle and explanation with a block diagram, Introductory ideas on air- conditioning.

Refrigerants-Introduction, Ideal refrigerant, Properties of refrigerant, Classification of refrigerants, commonly used refrigerants, Eco-friendly refrigerants

UNIT-IV Components of Refrigerator

Refrigerator and its working, Block diagram, Coefficient of Performance (COP), Tons of refrigeration (TR) and Energy Efficiency Ratio (EER), Refrigerator components: Types of compressors, evaporators, condensers, and their functional aspects, defrosting in a refrigerator, Refrigerant leakage and detection

UNIT-V Applications of Low Temperature & Refrigeration

Applications of Low temperatures: Preservation of biological material, Food freezing, liquid nitrogen and liquid hydrogen in medical field, Superconducting magnets in MRI- Tissue ablation (cryosurgery) - Cryogenic rocket propulsion system. *Applications of refrigeration*: Domestic refrigerators, Water coolers, Cold storages, Ice plants, Food preservation methods, Chemical and Process industries, Cold treatment of metals, Construction field, Desalination of water, Data centers.

References

1. Heat and Thermodynamics by BrijLal&N.Subramanyam, S.Chand Publishers.
2. Thermal Physics by S C Garg, R M Bansal & C K Ghosh, McGrawHill Education, India
3. Heat and Thermodynamics by M MZemansky,McGrawHill Education (India).
4. Low-Temperature Physics by Christian E. & Siegfried H., Springer.
5. Thermal Engineering by S. Singh, S.Pati, Ch:18 Introduction to Refrigeration.
6. The Physics Hyper Text Book. Refrigerators.https://physics.info/refrigerators/
7. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi
8. A course in Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpatrai and sons, Delhi
9. https://trc.nist.gov/cryogenics/Papers/Review/2017-Low_Temperature_Applications_and_Challenges.pdf
10. https://nptel.ac.in/content/storage2/courses/112105129/pdf/RAC%20Lecture%203.pdf
11. Other Web sources suggested by the teacher concerned and the reading material.
12. https://nptel.ac.in

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

Programme: B.Sc. Honours in Physics (Major)
(w.e.f. AY 2023-24)
SEMESTER- V COURSE CODE: 24PH7YM54A
III Year BSC Physics
SEMESTER-V
LOW TEMPERATURE PHYSICS & REFRIGIRATION

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: B.Sc. Honours in Physics (Major)
(w.e.f. AY 2023-24)
SEMESTER- V COURSE CODE: 24PH7YM54A

III Year BSC Physics
SEMESTER-V
LOW TEMPERATURE PHYSICS & REFRIGIRATION
Blue Print for Semester End Theory Examinations

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	**33%**	**20**	**2 (two out of four)**	**1(one out of two**
Understanding/ Comprehension	**27%**	**16**	**2 (two out of four)**	
Application	**20%**	**12**	**1 (one out of two)**	**1 (one out of two)**
Analysis	**13%**	**8**		**2 (two out of four)**
Synthesis/ Evaluate	**7%**	**4**		**1 (one out of two**
Total	**100**	**60**	**5 (each question has internal choice)**	**5 out of 10 questions**

Chapter wise Weightage

S.No	Module/ Chapter	Name of the chapter	8 marks	4 marks
1	**I**	**Production of Low temperature**	**2(one out of two)**	**2**
2	**II**	**Measurement of Low temperature**	**2(one out of two**	**2**
3	**III**	**Principles of Refrigeration**	**2(one out of two**	**2**
4	**IV**	**Components of Refrigerator**	**2(one out of two**	**2**
5	**V**	**Applications of Low Temperature & Refrigeration**	**2(one out of two**	**2**
		TOTAL QUESTIONS	**5(each question has internal choice)**	**5 out of given 10**

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Programme: B.Sc. Honours in Physics (Major)
(w.e.f. AY 2023-24)
SEMESTER- V COURSE CODE: 24PH7YM54A

III Year BSC Physics
SEMESTER-V

LOW TEMPERATURE PHYSICS & REFRIGIRATION
(MODEL PAPER)

DURATION::3 hrs **MAX. MARKS :: 60**

SECTION-A

Answer any FIVE Questions of the following (5 X 4 = 20 M)

1. Explain the principle of regenerative cooling.
2. Discuss the properties of substances at low temperatures.
3. What are the advantages of Gas Thermometers
4. What are the advantages and disadvantages of Thermo couple?
5. Mention the properties of ideal refrigerant?
6. Write a note on refrigerant leakage and detection.
7. Write about different methods of defrosting in a refrigerator?
8. Explain Tons of Refrigeration (TR) and Energy Efficiency Ratio (EER).
9. What are the advantages of liquid nitrogen in medical field?
10. Explain the cryogenic rocket propulsion systems.

SECTION-B

Answer ALL the questions of the following (5 X 8 = 40 M)

11. (a)State and explain Joule- Kelvin effect and obtain an expression for Joule- Kelvin coefficient for Vander Waals gas.

    [OR]

    (b)Explain Adiabatic demagnetization method for producing very low temperature?
12. (a)Explain the principle and working of a Resistance thermometer. Mention its advantages

    [OR]

    (b)What is Vapour pressure Thermometer? Explain its working principle.
13. (a)Describe Vapour absorption refrigeration systems.

    [OR]

    (b)Describe Vapour compression refrigeration systems.
14. (a)Explain the working of a refrigerator with block diagram?

    [OR]

    (b)Explain the different types of Compressors.
15. (a)Explain the preservations of biological materials in medical field.

    [OR]

    (b)What are the different food preservation methods?

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SEMESTER- V COURSE CODE: 24PH7YM54A
III Year BSC Physics
SEMESTER-V
LOW TEMPERATURE PHYSICS & REFRIGIRATION
Question Bank

Section A

Unit I

1. State and explain Joule- Kelvin effect and obtain an expression for Joule- Kelvin coefficient for Vander Waals gas.
2. Explain Adiabatic demagnetization method for producing very low temperature?
3. Describe liquefaction of helium by Kapitza's helium air liquefier method

Unit II

4. Explain the principle and working of a Resistance thermometer. Mention its advantages
5. What is Thermocouple and give its working principles and applications
6. What is Vapour pressure Thermometer? Explain its working principle.

Unit III

7. Describe Vapour compression refrigeration systems.
8. Describe Vapour absorption refrigeration systems.
9. What is refrigeration cycle? Explain it with a block diagram.

Unit IV

10. Explain the working of a refrigerator with block diagram?
11. Explain the different types of Compressors.
12. Explain different types of Evaporators.

Unit V

13. Explain the preservations of biological materials in medical field.
14. What are the different food preservation methods?
15. What is a Domestic Refrigerator? And how it works?

Section B

1. Explain the principle of regenerative cooling.

2. What is Superconductivity?

3. Discuss the properties of substances at low temperatures.

4. What are the advantages of Gas Thermometers?

5. What are the advantages and disadvantages of Thermo couple?

6. Mention the advantages and disadvantages of Magnetic Thermometers?

7. Mention the properties of ideal refrigerant?

8. Write a brief notes on different types of refrigerants.

9. Write about Natural Refrigeration**.**

10. Explain Tons of Refrigeration (TR) and Energy Efficiency Ratio (EER).

11. Write a note on refrigerant leakage and detection.

12. Write about different methods of defrosting in a refrigerator?

13. Explain the cryogenic rocket propulsion systems.

14. Write a note on cold storage.

15. What are the advantages of liquid nitrogen in medical field?

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Major Courses offered w.e.f. AY 2024-25

SEMESTER-III **COURSE CODE: 24PHYM54B**

COURSE 15B: SOLAR ENERGY AND ITS APPLICATIONS

Theory Credits: 3 3 hrs/week

VARIATION OF SYLLABUS FROM THE APCHE PRESCRIBED SYLLABUS

S.No.	Unit	Name of the Unit	Syllabus Added/Deleted	Percentage Variation
1	I	Basic Concepts of Solar Energy	Determination of Solar Constant using Pyrheliometer	5
	II	Solar Thermal Collectors	Evacuated tube collector,collector	

Programme: B.Sc. Honours in Physics (Major)
w.e.f. AY 2024-25
COURSE CODE 24PHYM54
COURSE 15B: SOLAR ENERGY AND ITS APPLICATIONS

Theory Credits: 3 3 hrs/week

Course Objective:

The course on Mechanics and Properties of Matter aims to provide students with a fundamental understanding of the behaviour of physical systems, both in terms of mechanical motion and in terms of the properties of matter

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Understand Sun structure, forms of energy coming from the Sun and its measurement.	Level 2
CO 2	Acquire a critical knowledge on the working of thermal and photovoltaic collectors	Level 3
CO 3	Demonstrate skills related to callus culture through hands on experience	Level 5
CO 4	Understand testing procedures and fault analysis of thermal collectors and PV modules	Level 3 Level 4
CO 5	Comprehend applications of thermal collectors and PV modules	Level 5 Level 3

Programme: B.Sc. Honours in Physics (Major)
w.e.f. AY 2024-25
COURSE CODE 24PHYM54
COURSE 15B: SOLAR ENERGY AND ITS APPLICATIONS

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	2	1	2	2	2	2	2	3
CO 2	3	2	1	1	2	1	3	2	2	3
CO 3	3	2	3	2	1	1	3	2	2	3
CO 4	3	1	1	2	2	2	2	2	2	3
CO 5	3	2	2	1	1	2	2	2	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	2	3
CO 2	3	3	2	1	3
CO 3	3	3	2	2	3
CO 4	3	3	2	1	3
CO 5	3	3	2	2	3

Major Courses offered w.e.f. AY 2024-25

SEMESTER-III **COURSE CODE: 24PHYM54B**

COURSE 15B: SOLAR ENERGY AND ITS APPLICATIONS

Theory Credits: 3 3 hrs/week

COURSE OBJECTIVE:

The objective of the course on Solar Energy and Its Applications is to provide students with a comprehensive understanding of solar energy technologies, their principles, and their applications. The course aims to develop students' knowledge and skills in harnessing solar energy for various purposes, including electricity generation, heating, and cooling.

LEARNING OUTCOMES:

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

- ❖ Understand Sun structure, forms of energy coming from the Sun and its measurement.
- ❖ Acquire a critical knowledge on the working of thermal and photovoltaic collectors.
- ❖ Demonstrate skills related to callus culture through hands on experience
- ❖ Understand testing procedures and fault analysis of thermal collectors and PV modules.
- ❖ Comprehend applications of thermal collectors and PV modules
- ❖

Unit - I: Basic Concepts of Solar Energy

Spectral distribution of solar radiation, Solar constant , zenith angle and Air-Mass, standard time, local apparent time, equation of time, direct, diffuse and total radiations. Pyrheliometer - working principle, direct radiation measurement, Determination of Solar Constant using Pyrheliometer -Pyranometer-working Principle, diffuse radiation measurement, Distinction between the two meters.

Unit - II: Solar Thermal Collectors

Solar Thermal Collectors-Introduction, Types of Thermal collectors, Flat plate collector – liquid heating type, Vacuum Tube Solar Collectors -Energy balance equation and efficiency, Evacuated tube collector,collector overall heat loss coefficient, Definitions of collector efficiency factor, collector heat-removal factor and collector flow factor, Testing of flat-plate collector, solar water heating system, natural and forced circulation types.Concentrating collectors, Solar cookers, Solar dryers, Solar desalinators.

Unit - III: Fundamentals of Solar Cells

Semiconductor interface, Types, homo junction, hetero junction and Schottky barrier, advantages and drawbacks, Photovoltaic cell, equivalent circuit, output parameters, conversion efficiency, quantum efficiency, Measurement of I-V characteristics, series and shunt resistance, their effect on efficiency, Effect of light intensity, inclination and temperature on efficiency

Unit -IV: Types of Solarcells and Modules

Types of solar cells, Crystalline silicon solar cells, I-V characteristics, poly-Si cells, Amorphous silicon cells, Thin film solar cells-CdTe/CdS and CuInGaSe2/CdS cell configurations, structures, advantages and limitations, Multi junction cells – Double and triple junction cells. Module fabrication steps, Modules in series and parallel, Bypass and blocking diodes

Unit – V: Solar Photovoltaic Systems

Energy storage in PV systems, Energy storage modes, electrochemical storage, Batteries, Primary and secondary, Solid-state battery, Molten solvent battery, lead acid battery and dry batteries, Mechanical storage – Flywheel, Electrical storage –Super capacitor **References:**

1. Solar Energy Utilization by G. D. Rai, Khanna Publishers
2. Solar Energy- Fundamentals, design, modelling and applications by G.N. Tiwari, Narosa Publications, 2005.
3. Solar Energy-Principles of thermal energy collection & storage by S.P. Sukhatme, TataMc- Graw Hill Publishers, 1999.
4. Science and Technology of Photovoltaics, P. Jayarama Reddy, CRC Press (Taylor & Francis Group), Leiden &BS Publications, Hyderabad, 2009.
5. Solar Photovoltaics- Fundamentals, technologies and applications, Chetan Singh Solanki, PHI Learning Pvt. Ltd.,
6. Web sources suggested by the teacher concerned and the college librarian including reading material.
   (a) https://courses.edx.org/c4x/DelftX/ET.3034TU/asset/solar_energy_v1.1.pdf
   (b) https://www.sku.ac.ir/Datafiles/BookLibrary/45/John%20A.%20Duffie,%20William%2 0A.%20Beckman(auth.)-

Solar%20Engineering%20of%20Thermal%20Processes,%20Fourth%20Edition%20 (20 13).pdf

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Major Courses offered w.e.f. AY 2024-25

SEMESTER-V COURSE CODE:24PHYM54BP

COURSE 15B: SOLAR ENERGY AND ITS APPLICATIONS

Theory	Credits: 2	2 hrs/week

COURSE OBJECTIVE:

The objective of the practical course on Solar Energy and Its Applications is to provide students with hands- on experience and practical skills in working with solar energy systems, performing measurements and analysis, and implementing solar energy projects. The course aims to develop students' proficiency in solar energy system installation, maintenance, performance analysis, and practical application.

LEARNING OUTCOMES:

On successful completion of this practical course, studentshall be able to:

1. List out and identify various components of solar thermal collectors and systems, solar photovoltaic modules and systems.
2. Learn the procedures for measurement of direct, global and diffuse solar radiation, I -V characteristics and efficiency analysis of solar cells and modules.
3. Demonstrate skills acquired in evaluating the performance of solar cell / module in connecting them appropriately to get required power output.
4. Acquire skills in identification and elimination of the damaged panels without affectingthe output power in a module / array.
5. Perform procedures and techniques related to general maintenance of solar thermal and photovoltaic modules.

Practical (Laboratory) Syllabus:

1. Measurement of direct radiation using pyrheliometer.
2. Measurement of global and diffuse radiation using pyranometer.
3. Evaluation of performance of a flat plate collector
4. Evaluation of solar cell / module efficiency by studying the I – V measurements.
5. Determination of series and shunt resistance of a solar cell / module.
6. Determination of efficiency of two solar cells / modules connected in series.
7. Determination of efficiency of two solar cells / modules connected in parallel.
8. Study the effect of input intensity on the performance of solar cell / module.

9. Study the influence of cell / module temperature on the efficiency.
10. Study the effect of cell / module inclination on the efficiency.

Lab References:

1. Solar Photo voltaic- Alab training manual, C.S. Solanki et al., Foundation Books Publishers, 2012.
2. Laboratory Manual on Solar thermal experiments, HP Garg, TC Kandpal, Narosa Publishing House 2000.
3. Web sources suggested by the teacher concerned.
https://renewablelab.niu.edu/experiments/solarPanel Development of simple solar hot water collector: https://www.youtube.com/watch?v=WP8H5IOTwYU
https://www.instructables.com/Solar-Water-Heater-From-Scratch/

Co-Curricular Activities

(a) Mandatory: (*Training of students by teacher in field related skills: (lab:10 + field: 05*)

1. **For Teacher**: Training of students by the teacher in the in the laboratory/field for not lessthan 15 hours on the field techniques/skills related to measurement of direct, diffused and global solar radiation; demonstration of procedures used in the performance evaluation of solar flat plate collectors, solar photovoltaic cells and modules measurement of different parameters in the calculation of efficiency.

2. **For Student**: Students shall visit to solar thermal and photovoltaic laboratories in universities/research organizations/ nearby industries to observe and understand the techniques and procedures used for evaluation of solar collector, solar cell and module efficiencies. They shall write their observations and submit to the teacher hand-written Fieldwork/Project work not exceeding 10 pages in the given format.
3. Max marks for Fieldwork/Project work: 05.
4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations, findings and acknowledgements*.
5. Unit tests (IE).

(b) Suggested Co-Curricular Activities

1. Training of students by related industrial/ technical experts using guest lectures/ invited talks.
2. Assignments (including technical assignments like identifying components of a solar hot water and solar photovoltaic systems and their handling, operational techniques and maintenance procedures with safety and security)
3. Seminars, Group discussions, Quiz, Debates etc. on related topics.
4. Preparation of videos on thermal and photovoltaic systems and technical procedures.
5. Collection of brochures/figures/photos related to products and applications of solar energy and organizing them in a systematic way in a file.
6. Making a (i) solar panel (ii) solar light (iii) solar cooker (iv) solar oven (v) solar inverter at Home.
7. Visits to nearby solar thermal system as well as solar photovoltaic power stations, firms,research organizations etc.

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

COURSE 15B: SOLAR ENERGY AND ITS APPLICATIONS

COURSE CODE:24PHYM54

Learning level wise Weightage

Bloom's Taxonomy level	Weightage	marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2	1(one out of two)
Understanding/ Comprehension	27%	16	2	1(one out of two)
Application/	20%	12	1	1(one out of two)
Analysis	13%	8	3	1(one out of two)
Synthesis/ Evaluate	7%	4	2	1(one out of two)
Total	100	60	5 out of 10	5 out of 10 questions

Chapter wise Weightage

Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	UNIT-I	Basic Concepts of Solar Energy	2(one out of two)	2
2	UNIT-II	Solar Thermal Collectors	2(one out of two)	2
3	UNIT-III	Fundamentals of Solar Cells	2(one out of two)	2
4	UNIT-IV	Types of Solarcells and Modules	2(one out of two)	2
5	UNIT-V	Solar Photovoltaic Systems	2(one out of two)	2

COURSE 15B: SOLAR ENERGY AND ITS APPLICATIONS
COURSE CODE:24PHYM54

SEMESTER END EXAMINATIONS MODEL PAPER
SEMESTER- (5)

Time: 3 hours Maximum Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks. 5 X 4 = 20 Marks

1. –
2. –
3.
4. –
5. --
6. –
7. –
8. ---
9. –
10. –

PART- B

Answer **all the following** questions. Each carries **Eight** marks 5 X 8 = 40 Marks

11. (A).

(Or)

(b)

12. (A)

(Or)

(b)

13. (A)

(Or)

(b)

14. (A)

(Or)

(b)

15. (A).

(Or)

(b)

Major Courses offered w.e.f. AY 2024-25

SEMESTER-7 COURSE CODE: 24PHYM71

8A: CLASSICAL AND STATISTICAL MECHANICS

Theory CREDITS :5 Hrs:6

Course Objectives: To equip students with a strong foundation of the Lagrangian and Hamiltonian formalisms for one and many particle systems, as well as the concepts of phase space, ensembles, and partition functions and their applications in Statistical Mechanics.

Course Outcomes

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

CO1: Describe the principles and the mathematical techniques used in Newtonian Mechanics of one and many particle systems and their applications.

CO2: Solve problems using Canonical Transformations and Hamilton - Jacobi theory

CO3: Explain motion in central force fields, Kepler's laws of planetary motion and gyroscopes.

CO4: Calculate the translational, rotational, and vibrational partition functions for molecules in different energy states.

CO5: Summarize the concepts of Maxwell – Boltzmann, Bose – Einstein and Fermi – Dirac Statistics and Black body radiation using Planck's radiation law.

UNIT – I: Lagrangian Mechanics and Hamiltonian Mechanics 14 Hrs

Newtonian mechanics of one and many particle systems: Conservation laws, Constraints and their classification, Degrees of freedom: Generalized coordinates: Principle of virtual work, D'Alembert's principle, Lagrange's equations of motion.

Applications: Inclined plane, Linear harmonic oscillator and simple pendulum, Hamiltonian principle, Lagrange's equation from Hamilton's principle, Hamilton's equation of motion, Applications, Simple pendulum, Compound pendulum.

UNIT – II: Canonical Transformations and Hamilton - Jacobi Theory 14 Hrs

Canonical Transformations, Generating function and their properties, Condition for transformation to be canonical, Illustration of canonical transformation, Poisson – Brackets, Canonical equations in terms of Poisson, Bracket notation-Lagrange-Brackets and their properties.

Hamiltonian - Jacobi equation, one dimensional harmonic oscillator, Small oscillations and normal modes, Action Angle variables, Kepler problem in action angle variables.

UNIT –III: Motion in a Central Force Field 12 Hrs

Reduction to the equivalent one body problem; Motion in a central force field: Conditions for closed orbits: Inverse square law of forces: Kepler's laws of planetary motion; Rutherford scattering. Rotations – Space and body fixed axes: Angular momentum and Torque; Eulerian angles – Euler's equations of a rigid body: Motion of symmetrical top; Expression for slow and fast precessions; Larmour precision; Gyroscope.

UNIT- IV: Ensembles and Partition Functions **12 Hrs**

Phase space – Concept of ensembles – Types of ensembles - Ensemble average - Liouville's Theorem – Micro canonical ensemble: ideal gas – Gibb's paradox Canonical partition function – Molecular partition function – Transnational partition function – Rotational partition function – Vibrational partition function

UNIT – V: Maxwell – Boltzmann, Bose – Einstein and Fermi – Dirac Statistics

12 Hrs Maxwell - Boltzmann distribution - Equipartition energy. Bose – Einstein distribution,

Bose – Einstein condensation, Black body radiation and the Planck's radiation law - Fermi - Dirac distribution – One dimensional random walk – Random walk and Brownian motion.

List of Activities:

1. Assignments
2. Student Seminars

Recommended Books

1. Classical Mechanics, N.C. Rana and P.S. Joag - Tata Mc-Graw Hill, 1991.
2. Classical Mechanics, J.C. Upadyaya - Himalaya Publishing House, 2005.
3. Classical Mechanics, Gupta, Kumar and Sharma –Pragathi Prakashan, 2012.
4. Introduction to Classical Mechanics, R.G. Takwale and P.S. Puranic -Tata McGraw-Hill, 1989.
5. Statistical Mechanics, B.K. Agarwal, Melvin Eisner, 2nd Edition, New Age International (P)Ltd.
6. Statistical Mechanics and properties of Matter by ESR Gopal, Student Edition (Ellis Horwood)

Reference Books

1. Classical Mechanics, H. Goldstein - Addison Wesley, 1980.
2. Classical Dynamics of Particles, J.B.Marion Academic Press -Saunders College Publications, 4th edition, 1995.
3. Statistical and Thermal Physics , F. Reif, 4th Edition, McGraw Hill
4. Elementary Statistical Mechanics, C. Kittel, Dover Publications
5. Foundations of Classical mechanics by P. C. Deshmukh, Cambridge University Press

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

SEMESTER-7 COURSE CODE: 24PHYM71

8A: CLASSICAL AND STATISTICAL MECHANICS

Learning level wise Weightage

Bloom's Taxonomy level	Weightage	marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2	1(one out of two)
Understanding/ Comprehension	27%	16	2	1(one out of two)
Application	20%	12	1	1(one out of two)
Analysis	13%	8	3	1(one out of two)
Synthesis/ Evaluate	7%	4	2	1(one out of two)
Total	100	60	5 out of 10	5 out of 10 questions

Chapter wise Weightage

Sl. No.	Module/ Chapter	Name of the chapter	10 Marks	5 Marks
1	UNIT-I	Lagrangian Mechanics and Hamiltonian Mechanics	2(one out of two)	2
2	UNIT-II	Canonical Transformations and Hamilton - Jacobi Theory	2(one out of two)	2
3	UNIT-III	Motion in a Central Force Field	2(one out of two)	2
4	UNIT-IV	Ensembles and Partition Functions	2(one out of two)	2
5	UNIT-V	Maxwell – Boltzmann, Bose – Einstein and Fermi – Dirac Statistics	2(one out of two)	2

SEMESTER-7 **COURSE CODE: 24PHYM71**

8A: CLASSICAL AND STATISTICAL MECHANICS

SEMESTER END EXAMINATIONS MODEL PAPER

SEMESTER- (_7_)

Time: 3 hours Maximum Marks: 75

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks. 5 X 5 = 25 Marks

1. –
2. –
3. –
4. --
5. –
6. –
7.
8. ---
9. –
10. –

PART- B

Answer **all the following** questions. Each carries **Eight** marks 5 X 10 = 50 Marks

11. (A).

(Or)

(b)

12. (A)

(Or)

(b)

13. (A)

(Or)

(b)

14. (A)

(Or)

(b)

15. (A).

(Or)

(b)

Major Courses offered w.e.f. AY 2024-25

SEMESTER-7 COURSE CODE: 24PHYM72

9A: ATOMIC AND MOLECULAR SPECTROSCOPY

Theory CREDITS :5 Hrs:6

Course Objectives: To provide students with a strong foundation in the principles and theories of atomic and molecular physics, and their industrial applications for material characterization.

Course Outcomes

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

CO1: Discuss atomic structure using vector atom model, coupling schemes, and Absorption, emission and excitation spectra.

CO2: Interpret experimental results related to Zeeman effect, Paschen-Back effect, and Stark effect and evaluate electron transitions and energy levels in atoms.

CO3: Describe origin of X-ray radiations, measurements, reflection, refraction and diffraction of X-rays and their applications.

CO4: Analyze the rotational, vibrational, and electronic spectra of molecules using spectroscopic techniques, energy levels and spectrum – PQR branches, Frank Condon principle and applications of vibrational spectroscopy.

CO5: Explain the theory of Raman Scattering, rotational and vibrational Raman spectra and industrial applications of Raman spectroscopy.

SYLLABUS

UNIT I: Atomic Spectra **14 Hrs**

Introduction: Vector atom model –Spectra of Alkali elements-fine structure- Spectral terms and term symbols, Ground states based on electron configuration - Coupling schemes - LS coupling - JJ coupling- Hund's rule of multiplicity - Equivalent and non-equivalent electronic systems. Spectral terms for equivalent and non-equivalent electrons - Width of spectral lines –Absorption, emission and excitation spectra-Spectrophotometer – Applications of atomic spectra – Photo Electron Spectroscopy-Atomic absorption spectroscopy.

UNIT II: Zeeman and Stark Effects **13 Hrs**

Introduction: Zeeman effect- Normal and anomalous Zeeman effects - Experimental details - Magnetic moment of atom and Lande's 'g'-factor - Zeeman effect in sodium atom - Lande g-formula for LS and JJ couplings - Paschen-Back effect - Splitting of sodium lines and selection rules - Stark effect - Experimental details - Weak and strong field effects – linear and quadratic Stark effects -Width of spectral lines.

UNIT III: X-ray Spectra **12 Hrs**

Production of X-rays-Origin of X-ray radiations-X-rays Light and electromagnetic spectrum-Measurement of X-radiations-polarization of X-radiations-Diffraction of X-radiations-Braggs law-Laue spots-Bragg's spectrometer-Reflection and Refraction of X-ray-X-ray scattering-Applications of X-rays

UNIT IV: Molecular Spectroscopy – Rotational – Vibrational Spectra 14 Hrs

Introduction – Rotational, vibrational and electronic spectra of diatomic molecules – Rotational spectra of a diatomic molecule as rigid rotator and non-rigid rotor – Intensity of rotational lines

- Rotational analysis of electronic spectra- Evaluation of rotational constants - Effect of isotopic substitution on rotational levels – Applications of rotational spectroscopy. Vibrational spectra of diatomic molecule – Diatomic molecule as a simple harmonic oscillator and anharmonic oscillator – Energy levels and spectrum – PQR branches – Progressions and sequences – Vibrational analysis of electronic spectra - DE slander's table – Evaluation of vibrational constants – Morse potential energy curve – Frank-Condon principle – Intensity distribution in absorption and emission spectra –IR and FTIR spectrometers - Applications of vibrational spectroscopy.

UNIT-V: Raman Spectroscopy 12 Hrs

Introduction-Theory of Raman Scattering-Rotational and Vibrational Raman spectra-Mutual Exclusion Principle-Raman spectrometer-Fiber Coupled Raman Spectrometer-FT Raman Spectrometer- Structure determination using IR and Raman Spectroscopy-Industrial applications of Raman spectroscopy

List of Activities:

1. Assignments
2. Student Seminars

Recommended Books

1. Introduction to Molecular Spectroscopy, G.M. Barrow, McGraw - Hill Book company, Inc., (1962).
2. Molecular Structure and Spectroscopy, G. Aruldhas, Prentice- Hall of India, Pvt., New Delhi, (2005).
3. Elements of spectroscopy atomic, molecular and Laser physics, Gupta, Kumar, Sharma, Pragathi Prakashan, Meerut.
4. Atomic and Molecular Spectroscopy by Rita Kakkar, Cambridge University Press

Reference Books

1. Introduction to Atomic Spectra, H.E. White, McGraw-Hill Kogakusha. Ltd., New Delhi (1934).
2. Fundamentals of Molecular Spectroscopy, C.N. Banwell, E.M. Mc Cash, Tata McGraw-Hill Pub.. (1994)
3. Spectroscopy, Vol. I & III, B.P. Straughan and S. Walker, John Wiley & Sons Inc., New York. (1976).

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

SEMESTER-7 COURSE CODE: 24PHYM72

9A: ATOMIC AND MOLECULAR SPECTROSCOPY

Learning level wise Weightage

Bloom's Taxonomy level	Weightage	marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2	1(one out of two)
Understanding/ Comprehension	27%	16	2	1(one out of two)
Application	20%	12	1	1(one out of two)
Analysis	13%	8	3	1(one out of two)
Synthesis/ Evaluate	7%	4	2	1(one out of two)
Total	100	60	5 out of 10	5 out of 10 questions

Chapter wise Weightage

Sl. No.	Module/ Chapter	Name of the chapter	10 Marks	5 Marks
1	UNIT-I	**Atomic Spectra**	2(one out of two)	2
2	UNIT-II	**Zeeman and Stark Effects**	2(one out of two)	2
3	UNIT-III	**X-ray Spectra**	2(one out of two)	2
4	UNIT-IV	**Molecular Spectroscopy – Rotational – Vibrational Spectra**	2(one out of two)	2
5	UNIT-V	**Raman Spectroscopy**	2(one out of two)	2

SEMESTER-7 **COURSE CODE: 24PHYM72**

9A: ATOMIC AND MOLECULAR SPECTROSCOPY

SEMESTER END EXAMINATIONS MODEL PAPER

SEMESTER- (_7_)

Time: 3 hours Maximum Marks: 75

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks. 5 X 5 = 25 Marks

1. –
2. –
3. –
4. --
5. –
6. –
7.
8. ---
9. –
10. –

PART- B

Answer **all the following** questions. Each carries **Eight** marks 5 X 10 = 50 Marks

11. (A).

(Or)

(b)

12. (A)

(Or)

(b)

13. (A)

(Or)

(b)

14. (A)

(Or)

(b)

15. (A).

(Or)

(b)

Major Courses offered w.e.f. AY 2024-25

SEMESTER-7 **COURSE CODE: 24PHYM73**

10 A: MATHEMATICAL PHYSICS

Theory CREDITS :5 Hrs:6

Course Objectives: To provide students with a strong foundation in the Mathematical principles, and and enable students to apply the knowledge of special functions, integral transforms, tensors, numerical techniques and complex variables in Physics.

Course Outcomes

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

CO1: Develop proficiency in solving Legendre, Bessel, and Hermite differential equations using various techniques, including power series, generating functions, and recurrence relations.

CO2: Summarize the properties of Fourier transforms, Laplace transform, their significance in analyzing Square wave, sawtooth wave and triangular waves, linear differential equations and their applications**.**

CO3: Apply tensor theory to model and analyze physical phenomena, including strain, thermal expansion, and piezoelectricity.

CO4: Analyze the physical significance of various Numerical methods and techniques in solving differential equations.

CO5: Discuss the basic concepts of complex functions, complex differentiation, and complex integration in evaluating definite integrals

SYLLABUS

UNIT-I: Special Functions **12 Hrs**

Beta and Gamma Functions – Definitions and properties – Evaluation of integrals, Legendre, Bessel and Hermite differential equations– Solutions– Generating functions– Orthogonal properties of Legendre, Bessel and Hermite Functions (Proof not necessary) – Recurrence relations– (Proof for Legendre polynomials only).

UNIT-II: Integral Transforms **15 Hrs**

Fourier Transforms: Properties of Fourier transforms – Fourier sine and cosine transforms-Power in Fourier series – Modulation theorem, Fourier transform of impulse function, Constants, Unit step function and Periodic functions.

Laplace Transforms: Definition and notation – Properties of Laplace transforms – Laplace transforms of Dirac delta function and periodic functions (Square wave, sawtooth wave and triangular wave) –Inverse Laplace transforms– properties– Solution of linear differential equations with constant coefficients - Applications to LCR circuits and resonance of simple pendulum.

UNIT III: Tensors **12 Hrs**

Definition – Contravariant, Covariant and Mixed tensors – Dummy suffix notation- Addition, subtraction, contraction, inner product, outer product, symmetric and anti-symmetric tensors - Application of Tensor theory to strain, thermal expansion and piezoelectricity.

UNIT-IV: Numerical Techniques **14 Hrs**

Solution of an equation – Bisection method, Regular False method, Newton – Rhapson method Solutions of simultaneous– Gauss elimination method and Gauss-Seidel method – Interpolations- Newton's interpolation and Lagrange's interpolation, Curve fitting – Method of Least squares Numerical differentiation and integration – Trapezoidal rule and Simpson's 1/3 rule – Solutions of differential equations– Euler's method and Runga-kutta Methods.

UNIT–V: Complex Variables **13 Hrs**

Functions–Complexdifferentiation-Analyticfunction-Cauchy–Riemannequations – Derivatives of elementary functions – Singular points and classification. Complex integration -Cauchy's theorem – Integrals of special functions – Cauchy's integral formula – Taylor's and Lorentz theorem (statements only) – Residues, calculations of residues - Residue theorem – evaluation of definite integrals.

List of Activities:

1. Assignments
2. Student Seminars
3. Problem solving Sessions

Recommended Books

1. Mathematical physics,B.D.Gupta,4th edition,Vikaspublishinghouse,2010
2. Mathematical physics, B.S. Rajput,Pragati PrakashanMeerut,2017
3. Theory and Properties of Complex Variables, Schaum'soutline series, Murray R.Spiegel, Seymour Lipschutz, John J. Schiller, Dennis Spellman, McGraw-Hill, 1976
4. Applied Fourier analysis, Hweipiao Hsu, UnitechDivision,1984
5. An Introduction to Mathematical Physics, Suresh Chandra, Mohit Kumar Sarma Alpha Science International, 2013.

Reference Books

1. Special Functions for Scientists and Engineers, W.W. Bell, Dover Publications,2013
2. Laplace Transforms, Murray Spiegle, Schaum' soutline series, Mc Graw Hill, International Book Company, NY, 2005
3. Applied Mathematics for Engineers, Louis A. Pipes, Lawrence R. Harvill, Courier Corporation,2014
4. Complex Variables and Applications, Brown and Churchill, McGraw–Hill,2013
5. Mathematical Methods for Physics and Engineering ... K. F. Riley, University of Cambridge,

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

SEMESTER-7 **COURSE CODE: 24PHYM73**

10 A: MATHEMATICAL PHYSICS

Learning level wise Weightage

Bloom's Taxonomy level	Weightage	marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2	1(one out of two)
Understanding/ Comprehension	27%	16	2	1(one out of two)
Application	20%	12	1	1(one out of two)
Analysis	13%	8	3	1(one out of two)
Synthesis/ Evaluate	7%	4	2	1(one out of two)
Total	100	60	5 out of 10	5 out of 10 questions

Chapter wise Weightage

Sl. No.	Module/ Chapter	Name of the chapter	10 Marks	5 Marks
1	UNIT-I	**Special Functions**	2(one out of two)	2
2	UNIT-II	**Integral Transforms**	2(one out of two)	2
3	UNIT-III	**Tensors**	2(one out of two)	2
4	UNIT-IV	**Numerical Techniques**	2(one out of two)	2
5	UNIT-V	**Complex Variables**	2(one out of two)	2

SEMESTER-7 **COURSE CODE: 24PHYM73**

10 A: MATHEMATICAL PHYSICS

SEMESTER END EXAMINATIONS MODEL PAPER

SEMESTER- (_7_)

Time: 3 hours Maximum Marks: 75

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks. 5 X 5 = 25 Marks

1. –
2. –
3. –
4. --
5. –
6. –
7.
8. ---
9. –
10. –

PART- B

Answer **all the following** questions. Each carries **Eight** marks 5 X 10 = 50 Marks

11. (A).

(Or)

(b)

12. (A)

(Or)

(b)

13. (A)

(Or)

(b)

14. (A)

(Or)

(b)

15. (A).

(Or)

(b)

Major Courses offered w.e.f. AY 2024-25

SEMESTER-7 **COURSE CODE: 24PHYM74**

11A: SOLID STATE PHYSICS (Skill Oriented)

Theory	CREDITS :3	Hrs:3

Course Objectives: To provide students with a strong foundation of theory of crystallography, defects in crystals, transport phenomena, semiconductors and superconductivity and prepare them for careers in academic or industrial research.

Course Outcomes

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

CO1: Explain the structure of crystals using Bravis lattices, types of binding and binding forces, elastic properties of crystals, lattice vibrations and phonons.

CO2: Discuss various types of defects in crystal structures, and their effects on material properties and behavior**.**

CO3: Outline the significance of transport phenomena and distinguish metals, insulators and semiconductors based on band theory.

CO4: Describe the nature of intrinsic and extrinsic semiconductors, fermi levels and its variation with temperature and direct and indirect band gap semiconductors.

CO5: Summarize the concepts of superconductivity and analyze the potential applications of superconductors.

SYLLABUS

UNIT–I: Crystallography, Lattice Energies and Lattice Vibrations **12 Hrs**

Bravais lattices – Reciprocal lattice –X-ray diffraction – structural factor. Origin of chemical binding in ionic and van der Waals crystals – Elastic properties – Stress and strain –Elastic moduli -– Lattice vibrations: Mono and diatomic one dimensional infinitely long lattices – Phonons – properties.

UNIT-II: Defects in Crystals **12 Hrs**

Impurities-vacancies-Schottky and Frenkel vacancies-Extrinsic vacancies- Kirkendall effect-Color centers and colaration of crystals – F-Centers, V-Centers, Line Defects (the dislocations)-Geometry of dislocations, Screw dislocations

UNIT– III: Transport Phenomena and Band Theory **14 Hrs**

Concept of electrical and thermal resistivity – Expression for thermal and electrical conductivities for metals – Lorenz number - Matheissens rule- Distribution function –Formulation of Boltzmann transport equation

Bloch function –Kroning - Penny model – Formation of energy bands in solids –Brillouin zones

UNIT–IV: Semiconductor Physics **12 Hrs**

Intrinsic and extrinsic semiconductors–Expression for position of Fermi levels and carrier concentrations – Variation of Fermi level with temperature – np product –Direct and indirect band gap semiconductors–Hall effect Heyness- Schockley experiment – Determination of lifetime, diffusion length of minority charge carriers.

UNIT–V: Superconductivity **13 Hrs**

Concept of zero resistance – Magnetic behavior– Meissner effect – Isotope effect – Specific heat behavior – London's equations – BCS theory –Josephson junctions – SQUIDS and its applications - Applications of superconductors –High TC superconductors

List of Activities:

1. Assignments
2. Student Seminars

Recommended Books

1. Elementary Solid State Physics, M. Ali Omar, 1993, Addison - Wesley.
2. Solid State Physics, M. A.Wahab, Edition: 3rd, 2020, Narosa Publishing House.
3. High TC Superconductivity, C.N.R. Rao and S.V. Subramanyam, world scientific publishing company, 1989
4. Solid State Physics, S.O. Pillai. Edition: 6th, 2009, New Academic Science Ltd
5. Solid State Physics, S.L. Kakani and C. Hemarajan, Edition: 4^{th}, 2005, Sultan Chand and Sons
6. Electrons in Solids, Richard H. Bube, Edition 3rd, 1992 Elsevier,
7. Solid State Physics by R.K. Puri V.K. Babbar Edition: 1st 2017. S. Chand.

Reference Books

1. Solid State Physics, C. Kittel, Edition: 8th 2012, John Wiley & Sons.
2. Solid State Physics, A.J. Dekkar, Edition: 1st, 2000. Macmillan India Ltd.
3. Solid State Electronic Devices, B.G. Streetman. Edition 7th, 2018, Pearson Education India

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

SEMESTER-7 COURSE CODE: 24PHYM74

11A: SOLID STATE PHYSICS (Skill Oriented)

Learning level wise Weightage

Bloom's Taxonomy level	Weightage	marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2	1(one out of two)
Understanding/ Comprehension	27%	16	2	1(one out of two)
Application	20%	12	1	1(one out of two)
Analysis	13%	8	3	1(one out of two)
Synthesis/ Evaluate	7%	4	2	1(one out of two)
Total	100	60	5 out of 10	5 out of 10 questions

Chapter wise Weightage

Sl. No.	Module/ Chapter	Name of the chapter	10 Marks	5 Marks
1	UNIT-I	**Crystallography, Lattice Energies and Lattice Vibrations**	2(one out of two)	2
2	UNIT-II	**Defects in Crystals**	2(one out of two)	2
3	UNIT-III	**Transport Phenomena and Band Theory**	2(one out of two)	2
4	UNIT-IV	**Semiconductor Physics**	2(one out of two)	2
5	UNIT-V	**Superconductivity**	2(one out of two)	2

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SEMESTER-7 **COURSE CODE: 24PHYM74**

11A: SOLID STATE PHYSICS (Skill Oriented)

SEMESTER END EXAMINATIONS MODEL PAPER

SEMESTER- (_7_)

Time: 3 hours Maximum Marks: 75

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks. 5 X 5 = 25 Marks

1. –
2. –
3. –
4. --
5. –
6. –
7.
8. ---
9. –
10. –

PART- B

Answer **all the following** questions. Each carries **Eight** marks 5 X 10 = 50 Marks

11. (A).

(Or)

(b)

12. (A)

(Or)

(b)

13. (A)

(Or)

(b)

14. (A)

(Or)

(b)

15. (A).

(Or)

(b)

Semester wise Revised Syllabus under CBCS 2020-21
Four Year – B.Sc. (Hons), STREAM A (VII-SEMESTER)
Domain Subject: PHYSICS

12A: ANALOG AND DIGITAL ELECTRONICS (Skill Oriented)

Hours/Week: 3
Credits: 3

Course Objectives: To develop students' skills in designing, analyzing, and testing both analog and digital circuits and modulation techniques in Communication Electronics.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	**Analyze** the structure and working of FET, JFET, MOSFET, CMOS circuits, And characteristics and applications of UJT as a relaxation oscillator.	Level 4 (Analyze)
CO 2	Explain the block diagram of a typical Op-Amp and its role in various applications and determine various parameters.	Level 2 (Understand)
CO 3	Analyze and design basic circuits using various types of diodes, solar cells, LEDs and semiconductor lasers, and know the principles of operation and applications.	Level 4 (Analyze)
CO 4	Develop and analyze the functioning of basic combinational and sequential logic circuits, and know their functioning and applications.	Level 4 (Analyze)
CO 5	Describe basic digital communication systems using modulation, and sampling techniques, and know the principles of functioning and applications.	Level 2 (Understand)

SYLLABUS

UNIT–I: Introduction to Electronic Devices: 7 Hrs

Field Effect Transistor (FET): Structure and working - JFET Structure and working, Structure of MOSFET and Characteristics, , Concept of CMOS Structure and working -Characteristics of UJT. Application of UJT as a Relaxation oscillator.

UNIT–II: Operational Amplifiers: 8 Hrs

Block diagram of a typical Op-Amp, differential Amplifier, Comparator open loop configuration, inverting and non-inverting amplifiers. Op-amp with negative feedback, voltage shunt feedback, effect of feedback on closed loop gain, input resistance, output resistance, CMRR, frequency response, slew rate.

UNIT- III: Junction Diodes 7 Hrs

Tunnel diode- I-V characteristics, Schottky barrier diode - operation and applications. Varactor diode, Gunn diode, IMPATT diode, TRAPATT diode, BARITT diode - Solar cell – Structure - Principle of operation – Light Emitting Diodes (LEDs), Semiconductor lasers – principle of operation and applications.

UNIT–IV: Digital Electronics 8 Hrs

Combinational Logic: Multiplexers, Decoder, Demultiplexer, Data selector, Multiplexer, Encoder. Sequential Logic: Flip–Flops, A1-bit memory, The RS Flip-Flop, JK Flip – Flop, JK Master Slave Flip–Flops, T Flip-Flop, D Flip-Flop, Shift Registers,- Asynchronous and Synchronous Counters.

UNIT–V: Communication Electronics 8 Hrs

Introduction to Modulation (AM & FM), Sampling Theorem, Low pass and Band pass signals, PAM, Channel BW for a PAM signal. Natural sampling, Flattop sampling. Signal recovery through holding. Differential PCM, Delta Modulation, Adaptive Delta modulation CVSD. Signal to noise ratio in PCM and Delta Modulations.

List of Activities:

1. Assignments
2. Student Seminars

Recommended Books

1. OP-Amps & Linear Integrated Circuits, by Ramakanth A. Gayakwad, PHI, 2nd Edition, 1991.
2. Digital Systems by Ronald J. Tocci, 6thEdition, PHI, 1999.
3. Principles of Communications by Taub and Schilling, Mc-Graw Hill Publication.
4. Electronic Principles by Malvino, 6thEd.TMH, 2017
5. Linear Integrated circuits by Roy Choudhry, Pearson,2018
6. Op-Amps – D.K. Mahesh, PHI
7. Basic Electronics by Chinmoy Saha , Cambridge University press

Reference Books

8. Micro Electronics by Milliman and Halkias. TMH Publications
9. Digital Principles and Applications by A.P. Malvino and Donald P.Leach, Tata McGrawHill, New Delhi, 1993
10. Electronic Devices and Circuit Theory by Robert Boylested and Louis Nashdsky–Jose Kanedy & Division. PHI, New Delhi, 1991

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	1	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	1	3	3	3	3
CO 5	3	1	1	1	1	1	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	2	3
CO 2	3	3	3	1	3
CO 3	3	3	3	1	3
CO 4	3	3	2	1	3
CO 5	3	3	3	1	3

Semester wise Revised Syllabus under CBCS 2020-21
Four Year – B.Sc. (Hons), STREAM A (VII-SEMESTER)
Domain Subject: PHYSICS

12A: ANALOG AND DIGITAL ELECTRONICS (Skill Oriented)

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Semester wise Revised Syllabus under CBCS 2020-21
Four Year – B.Sc. (Hons), STREAM A (VII-SEMESTER)
Domain Subject: PHYSICS

12A: ANALOG AND DIGITAL ELECTRONICS (Skill Oriented)

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	**I**		2(one out of two)	2
2	**II**		2(one out of two)	2
3	**III**		2(one out of two)	2
4	**IV**		2(one out of two)	2
5	**V**		2(one out of two)	2
			5(each question has internal choice)	5 out of given 10

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Semester wise Revised Syllabus under CBCS 2020-21
Four Year – B.Sc. (Hons), STREAM A (VII-SEMESTER)
Domain Subject: PHYSICS

12A: ANALOG AND DIGITAL ELECTRONICS (Skill Oriented)

Max Marks: 60

Model Paper

Section A

Answer any five questions from the following (4M$\times 5 = 20M$)

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Section B

Answer all the questions (8M$\times 5 = 40M$)

11. (a)

(OR)

(b)

12.(a)

(OR)

(b)

13.(a)

(OR)

(b)

14.(a)

(OR)

(b)

15.a)

(OR)

(b)

SEMESTER – VII – Practical Lab Course-1

11-A- LAB-1: Solid State Physics- Practical

Hours/Week: 3
Credits: 2

Course Objectives

- To equip, students with experimental skills, by applying the learnt concepts from Solid State Physics.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Determine Planck's constant using a photo Cell	Level 5 (Evaluate)
CO 2	Estimate Thermo emf of bulk samples.	Level 5 (Evaluate)
CO 3	Study the characteristics of a Photo Transistor and determine the required parameters	Level 2 (Understand) and Level 4 (Analyse)
CO 4	Measure the efficiency of a GM counter using the given radiation source	Level 5 (Evaluate)
CO 5	Evaluate the lattice constant, grain size of the given material using X-ray Diffraction- technique.	Level 5 (Evaluate)
CO 6	Determine the coefficient of Young's modulus of the given material	Level 3 (Apply)
CO 7	Study the variation of magnetic field due to a current carrying conductor using Biot Savart Law.	Level 2 (Understand)
CO 8	Study the I -V characteristics of Solar cell and draw a graph	Level 2 (Understand)
CO 9	Study the Zeeman Effect using a monochromatic source of light	Level 2 (Understand)

Any six of the following experiments:
List of Experiments:

1. Plank's constant determination
2. Thermo emf of bulk samples
3. Photo Transistor characteristics
4. GM counter
5. X-ray Diffraction-Determination of lattice constant, grain size
6. Young's modulus
7. Study of Biot - Severt Law
8. I V characteristics of Solar cell
9. Study of Zeeman effect

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	1	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	1	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	3	1	3
CO 3	3	3	3	1	3
CO 4	3	3	2	1	3
CO 5	3	3	3	1	3

SEMESTER – VII – Practical Lab Course-2

12-A- LAB-2: Analog and Digital Electronics - Practical

Hours/Week: 3
Credits: 3

Course Objectives

To equip, students with experimental skills, by applying the learnt concepts from Analog and Digital Electronics.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Study the FET Characteristics and determine the respective parameters	Level 2 (Understand)
CO 2	Study the UJT Characteristics and determine and determent the respective parameters.	Level 2 (Understand)
CO 3	Design Astable Multivibrator using 555-Timer and determine the frequency of oscillation and duty cycle.	Level 6 (Design)
CO 4	Determine the resonant frequency of oscillation of a Wien's Bridge Oscillator using Op-Amp	Level 3 (Apply)
CO 5	Study the characteristics of operational amplifier and determine the following parameters (a) Input offset voltage, (b) Input bias current, (c) CMRR (d) Slew rate.	Level 2 (Understand)
CO 6	Study the characteristics of Op-Amp as an integrator, Differentiator & Summation performer	Level 2 (Understand)
CO 7	Design and verify the truth tables of half adder and full adder circuits.	Level 6 (Design)
CO 8	Design and verify the truth tables of various flip flops circuits (RS, D, JK, T).	Level 6 (Design)

Any six of the following experiments:

List of Experiments:

1. FET Characteristics
2. UJT Characteristics
3. 555-Timer – Astable Multivibrator
4. Wien Bridge Oscillator-using Op-Amp
5. Op-amp parameters
   (a) Input offset voltage
   (b) Input bias current
   (c) CMRR
   (d) Slew rate
6. OP-AMP-offset null adjustment-inverting Amplifiers
7. Op-Amp-integration, Differentiation & Summation
8. Design and study of full adder and half adder circuits
9. Design and study of various flip flops circuits (RS, D, JK, T)

CO-PO Mapping

1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	1	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	1	3	3	3	3

CO-PSO Mapping

1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	3	1	3
CO 2	3	3	3	1	3
CO 3	3	3	3	1	3
CO 4	3	2	3	1	3
CO 5	3	3	3	1	3

Semester wise Revised Syllabus under CBCS 2020-21
Four Year – B.Sc. (Hons), STREAM B (VII-SEMESTER)

Domain Subject: PHYSICS

8B: MATERIALS SCIENCE FOR INDUSTRIAL APPLICATIONS

Hours/Week: 6 **Credits: 5**

Course Objectives:

- To familiarize students with the types of materials commonly used in industrial applications such as organic, liquid crystals, dielectrics, ferroelectrics and thin films, and discuss their structure, properties, behaviour, performance and their applications.

- To prepare students for careers in materials-related industries, such as aerospace, automotive, energy, and biomedical engineering, etc.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	**Describe** the structure and properties and behaviour of polymers and ceramic materials, and their industrial applications.	Level 2 (Understand)
CO 2	**Classify & analyse** liquid crystals, properties, and their applications.	Level 4 (Analyse)
CO 3	**Explain** the polarisation theories in dielectrics and **analyse** its applications in electronic and electrical devices.	Level 2 (Understand) and Level 4 (Analyse)
CO 4	**Discuss** the types of magnetic materials and theories of ferroelectricity, properties, classification and their industrial applications	Level 2 (Understand)
CO 5	**Outline** the theories of thin film nucleation and growth and methods of preparing thin Films, its measurements, properties and various applications.	Level 4 (Analyse)

SYLLABUS

UNIT– I: Basic Concepts in Polymers — 8 Hrs

Definition of monomer & polymer; Classification of polymers; Mechanism of polymerization - Addition (Free radical) and Condensation polymerization; Polymerization techniques - Bulk, Solution, Suspension and Emulsion; Definition of Copolymer (Random, Alternate, Block and Graft) and blends

UNIT–II: Liquid Crystals — 7 Hrs

Introduction to different types of liquid crystals, microscopic and optical properties of different types of nematic, smectic and cholesteric liquid crystal; blue phases. Electrical and dielectric properties of liquid crystal; Chiral liquid crystals. Ferroelectric liquid crystals. Electro-optic and magneto-optic effect of liquid crystals. Display and memory devices. Applications of liquid crystals

UNIT-III: Dielectrics — 7 Hrs

Introduction – Dipole moment – various types of polarization – electronic, ionic and orientational polarization – Langevin's theory – Lorentz field– Clausius- Mosotti equation– Measurement of dielectric constant – Applications of dielectrics.

UNIT–IV: Ferroelectrics — 8 Hrs

Classification of magnetic materials- domain structure. Soft and hard magnetic materials, Ferrites, ceramic magnets. Piezo-, Pyro- and ferroelectric crystals– General properties of ferroelectric materials. Theories of ferroelectricity. Thermodynamic of Ferroelectric transitions. Spontaneous polarization – Classification and properties of ferroelectrics - Ferroelectric domains – Oxygen ion displacement theory –Applications of ferroelectrics.

UNIT–V: Thin films — 8 Hrs

Theories of thin film nucleation and growth. Thin film preparation – Rf sputtering. Chemical vapor deposition. Thickens measurements. Electrical and optical properties of thin films - Applications. Photolithography: Photoresists, Thin film resistors – Thin film capacitors – Thin film diodes and transistors – Thin film solar cells, Thin film micro batteries – Thin film sensors: Gas sensors, Bolometers

List of Activities:

1. Assignments
2. Student Seminars

Recommended Books

1. Fundamentals of Solid State Physics, Saxena, Gupta, Saxena, Pragathi Publications, Meerut.
2. Solid State Physics, R.L. Singhal, Kedar Nath Ram Nath&Co.Pub.
3. Science of Engineering Materials, C.M. Srivastsava and C. Srinivasan, New Age Inter. Pub.
4. Crystal Growth, B.R. Pamplin, Pergmon Press.
5. Introduction to Liquid Crystals, Chemistry and Physics by PJ Collings and Michael Hird,

Reference Books

6. Introduction to Solid State Physics, Charles Kittel VII edition, John Wiley & Sons.
7. Solid State Physics, A.J. Dekker, Mc Millan Publications.
8. Solid State Physics, M.A. Wahab, Narosa Publishing House.

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	1	3
CO 2	3	3	3	1	3
CO 3	3	3	3	1	3
CO 4	3	3	3	1	3
CO 5	3	3	3	1	3

Semester wise Revised Syllabus under CBCS 2020-21
Four Year – B.Sc. (Hons), STREAM B (VII-SEMESTER)

Domain Subject: PHYSICS
8B: MATERIALS SCIENCE FOR INDUSTRIAL APPLICATIONS

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

wise Revised Syllabus under CBCS 2020-21
Four Year – B.Sc. (Hons), STREAM B (VII-SEMESTER)

Domain Subject: PHYSICS

8B: MATERIALS SCIENCE FOR INDUSTRIAL APPLICATIONS

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	**I**		2(one out of two)	2
2	**II**		2(one out of two)	2
3	**III**		2(one out of two)	2
4	**IV**		2(one out of two)	2
5	**V**		2(one out of two)	2
			5(each question has internal choice)	5 out of given 10

wise Revised Syllabus under CBCS 2020-21
Four Year – B.Sc. (Hons), STREAM B (VII-SEMESTER)

Domain Subject: PHYSICS
8B: MATERIALS SCIENCE FOR INDUSTRIAL APPLICATIONS

Max Marks: 60

Model Paper

Section A

Answer any five questions from the following (4M$\times 5 = 20M$)

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Section B

Answer all the questions (8M$\times 5 = 40M$)

11. (a)
(OR)
(b)
12.(a)
(OR)
(b)
13.(a)
(OR)
(b)
14.(a)
(OR)
(b)
15.a)
(OR)
(b)

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M72B

SEMESTER-VII COURSE 9B: ANALYTICAL TECHNIQUES

Theory Credits: 5 6 hrs/week

Course Objectives: To enable students to summarize the principles, concepts, interpretation of the data and applications of various analytical techniques.

Course Outcomes Upon the successful completion of the course, students will be able to:

S.No.	Course outcome	Course outcome with action verb	Level in Blooms Taxonomy
1.	CO-1	Analyze the electromagnetic spectrum and types of molecular energies using the basic principles and concepts of spectroscopy.	Level-4
2.	CO-2	Evaluate the molecular structures using the respective tools and techniques of Ultraviolet–visible spectroscopy, IR spectroscopy and Fourier transform infrared (FTIR) spectroscopy.	Level-5
3.	CO-3	Outline the principles, operation and applications of spectrophotometers and colorimeters for chemical analysis, TEM and SEM microscopes for structural analysis.	Level-4
4.	CO-4	Describe the principles, salient features, experimental techniques, working and applications of ESR, NMR, Mossbauer spectrometers in Modern Science.	Level-4
5.	CO-5	Explain materials characterization using spectral data obtained from by EDS, XPS, XRF, AES, SIMS, SEM, TEM, AFM and XRD applying advanced spectroscopic and microscopic techniques.	Level-5

SYLLABUS

UNIT I: Basic Elements of Spectroscopy **12 Hrs**

Introduction – Electromagnetic spectrum-Types of molecular energies-Different spectroscopic Methods-An overview-Spectral line width-Absorption and Emission of radiation-Einstein's coefficients-Lasers

UNIT– II: Spectrophotometry **14 Hrs**

Introduction – Beer's law – Absorptivity – UV and visible absorption – Instrumentation – Essential parts of spectrophotometer – Gratings and prisms – Radiant energy sources – Filters – Photosensitive detectors – Barrier layer cells – Photo emissive cells – Photomultiplier tubes – Relationship between absorption in the visible and UV region and molecular structure – IR Spectrophotometry – Fourier Transform Infrared (FTIR) Spectrometer – Molecular structure – Qualitative and Quantitative analysis – Importance of photography in the spectrochemical analysis.

UNIT–III : Colorimeters, spectrophotometers and microscopes **14 Hrs**

Colorimeter – Principle - Applications of colorimeters in Solid State Physics and biomedical purposes Spectrophotometer – Principle and working with block diagram – Salient features of individual blocks – Specifications and operation of spectrophotometers – Applications of spectrophotometers to chemical analysis Electron microscope – Transmission electron microscope - Principle and working with block diagram –Salient features of individual blocks – Scanning electron microscope - Principle and working with block diagram – Description of individual blocks– Applications of electron microscopes.

UNIT–IV : Resonance spectrometers and Mass Spectrometer 14 Hrs

Electron spin resonance – theory – ESR spectrometer – Principle and working with block diagram – Experimental techniques – Salient features of individual blocks – Applications of ESR. Nuclear magnetic resonance – theory – NMR spectrometer – Principle and working with block diagram– Experimental techniques – Description of individual blocks – Applications of NMR. Mossbauer effect – theory – Mossbauer spectrometer – Principle and working of Mossbauer spectrometerExperimental methods – Explanation of block diagram– Applications of Mossbauer studies.

UNIT–V: Advanced Spectroscopic and Microscopic Techniques 13 Hrs

Spectroscopic Techniques: Energy Dispersive Spectroscopy, X-ray Photo Electron Spectroscopy, X ray Fluorescence Spectroscopy and Auger Electron Spectroscopy, Secondary Ion Mass Spectrometry. Imaging Techniques: Scanning Electron Microscopy, Transmission Electron Microscopy, Atomic Force Microscopy, Diffraction Techniques: X-Ray diffraction –Laue method – Powder method.

List of Activities: 1. Assignments 2. Student Seminars

Recommended Books

1. Instrumental methods of Chemical analysis by Chatwal and Anand, Himalaya Publisher, 2003

2. Spectroscopy by B.K. Sarma, Goel publishing House, Meerut, 1993.

3. Spectroscopy Vol I by Straughan and Walker, John Wiley and Sons,1976

4. Molecular Structure and Spectroscopy by G. Aruldas, Prentice Hall ofIndia,2001

Reference Books

5. Introduction to Atomic Spectra, H.E. White, McGraw –Hill Kogakusha. Ltd., New Delhi (1934). 6. Elements of Spectroscopy by Gupta, Kumar, Sarma, Pragati Prakasan, 2012. 7. Spectro chemical Analysis, L. H. Ahrens and S.R. Tayler, Addison-Wesley, London, 1961. 8. Basic principles of Spectroscopy by Raymond Chang, McGraw Hill,1971.

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	2	3	2	2	1	1	2	3	3	2
CO 2	3	3	2	2	1	2	3	3	3	3
CO 3	3	3	2	1	2	1	3	3	3	3
CO 4	3	3	2	1	2	2	3	2	2	3
CO 5	3	2	2	2	1	1	3	2	2	2

2

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	3	3	2	2	3
CO 2	3	2	3	3	3
CO 3	2	3	2	2	3
CO 4	3	3	3	3	2
CO 5	3	3	2	2	3

Dr V.S.Krishna Govt. Degree College(A),
Visakhapatnam 2023-2024
Course Code: 24(PHY)M72B

BLUE PRINT (:ANALYTICAL TECHNIQUES)
IV B.Sc. (Hons.) PHYSICS- SEM-VII/Course : 9B
Max Marks-75 Time-3Hrs. Credits:5

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	Basic Elements of Spectroscopy	2	2	30
2.	II	Spectrophotometry	2	2	30
3.	III	Colorimeters, spectrophotometers and microscopes	2	2	30
4.	IV	Resonance spectrometers and Mass Spectrometer	2	2	30
5.	V	Advanced Spectroscopic and Microscopic Techniques	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

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B.Sc. PHYSICS SEMESTER END EXAMINATION

[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M72B

SEMESTER-VII COURSE 9B: ANALYTICAL TECHNIQUES

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following **[5 X 8 = 40]**

1. a) Explain the different types of molecular energies relevant to spectroscopy. How are these energies related to the absorption and emission of radiation? [OR]

   b) Provide an overview of different spectroscopic methods. Compare their applications and limitations in modern scientific research?

2. a) Explain Beer's law and its significance in spectrophotometry. Discuss its applications and limitations?

   [OR]

   b) Discuss the relationship between absorption in the UV-visible region and molecular structure. How can this relationship be utilized in qualitative and quantitative analysis?

3. a) Discuss the principle and applications of colorimeters in Solid State Physics and biomedical sciences. [OR]

   b) Describe the working principle of a spectrophotometer with a block diagram. Discuss the importance of each block in the instrument's functionality?

4. a) Explain the principles underlying electron spin resonance (ESR) spectroscopy. Discuss its applications in material characterization and biomedical research.

   [OR]

   b) Discuss the principles and applications of Mossbauer spectroscopy in materials science and physics?

5. a) Compare and contrast Energy Dispersive Spectroscopy (EDS) and X-ray Photoelectron Spectroscopy (XPS) in terms of their principles and applications?

   [OR]

   b) Explain the principles of X-ray diffraction techniques (both Laue method and powder method). How are these techniques used in determining crystal structures?

SECTION – B

Answer any FIVE Questions of the following [5 X 4 = 20]

6. a) Define the term "spectral line width" and explain its importance in spectroscopy?
7. a) Describe the electromagnetic spectrum and its relevance to spectroscopy?
8. a) Describe the essential parts of a spectrophotometer. Explain the function of each part?
9. a) What are gratings and prisms in the context of spectrophotometry?
10. a) What are barrier layer cells and how are they used in spectrophotometry?
11. a) How do photo emissive cells work in spectrophotometric measurements?
12. a) What are the experimental techniques used in ESR spectrometry?
13. a) How does the Mossbauer effect contribute to the study of solid-state physics?
14. a) What is Secondary Ion Mass Spectrometry (SIMS) and how is it used in materials science?
15. a) Describe the process of X-ray fluorescence spectroscopy (XRF) and its applications in elemental analysis?

B.Sc. PHYSICS SEMESTER END EXAMINATION

[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M72B

SEMESTER-VII COURSE 9B: ANALYTICAL TECHNIQUES
QUESTION BANK

UNIT I: Basic Elements of Spectroscopy

Essay-type Questions:

1. Explain the different types of molecular energies relevant to spectroscopy. How are these energies related to the absorption and emission of radiation?
2. Discuss the significance of Einstein's coefficients in the context of spectroscopy. How do they relate to the processes of absorption and stimulated emission?
3. Provide an overview of different spectroscopic methods. Compare their applications and limitations in modern scientific research.

Short-answer Questions:

1. Define the term "spectral line width" and explain its importance in spectroscopy.
2. What are lasers and how are they utilized in spectroscopic techniques?
3. Describe the electromagnetic spectrum and its relevance to spectroscopy.

UNIT II: Spectrophotometry

Essay-type Questions:

1. Explain Beer's law and its significance in spectrophotometry. Discuss its applications and limitations.
2. Describe the principles and working of Fourier Transform Infrared (FTIR) spectrometer. Compare it with conventional IR spectrophotometers.
3. Discuss the relationship between absorption in the UV-visible region and molecular structure. How can this relationship be utilized in qualitative and quantitative analysis?

Short-answer Questions:

1. Describe the essential parts of a spectrophotometer. Explain the function of each part.
2. What are gratings and prisms in the context of spectrophotometry? How do they affect the performance of a spectrophotometer?
3. Explain the working principle of photomultiplier tubes. Where are they commonly used in spectrophotometric instrumentation?

UNIT III: Colorimeters, Spectrophotometers, and Microscopes

Essay-type Questions:

1. Discuss the principle and applications of colorimeters in Solid State Physics and biomedical sciences.
2. Explain the principle of electron microscopes (both transmission and scanning). Compare their applications in materials science.
3. Describe the working principle of a spectrophotometer with a block diagram. Discuss the importance of each block in the instrument's functionality.

Short-answer Questions:

1. What are barrier layer cells and how are they used in spectrophotometry?
2. Differentiate between transmission electron microscopy (TEM) and scanning electron microscopy (SEM) in terms of their imaging capabilities.
3. How do photo emissive cells work in spectrophotometric measurements?

UNIT IV: Resonance Spectrometers and Mass Spectrometers

Essay-type Questions:

1. Explain the principles underlying electron spin resonance (ESR) spectroscopy. Discuss its applications in material characterization and biomedical research.
2. Describe the theory and applications of nuclear magnetic resonance (NMR) spectroscopy. How does NMR spectroscopy provide information about molecular structure?
3. Discuss the principles and applications of Mossbauer spectroscopy in materials science and physics.

Short-answer Questions:

1. What are the experimental techniques used in ESR spectrometry?
2. Explain the working principle of a NMR spectrometer with a block diagram.
3. How does the Mossbauer effect contribute to the study of solid-state physics?

UNIT V: Advanced Spectroscopic and Microscopic Techniques

Essay-type Questions:

1. Compare and contrast Energy Dispersive Spectroscopy (EDS) and X-ray Photoelectron Spectroscopy (XPS) in terms of their principles and applications.
2. Describe the principles and applications of Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) in materials characterization.
3. Explain the principles of X-ray diffraction techniques (both Laue method and powder method). How are these techniques used in determining crystal structures?

Short-answer Questions:

1. What is Secondary Ion Mass Spectrometry (SIMS) and how is it used in materials science?
2. Explain the principle of Atomic Force Microscopy (AFM). What are its advantages over conventional microscopy techniques?
3. Describe the process of X-ray fluorescence spectroscopy (XRF) and its applications in elemental analysis.

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M73B

SEMESTER-VII COURSE 10B: ADVANCES IN PHYSICS

Theory Credits: 5 6 hrs/week

Course Objectives: To inspire students with the latest developments in major branches of physics in addressing important societal challenges, using micro,& nano devices, ceramics, functional materials, microcontrollers and application of remote sensing in Environmental Management, Natural resource management.

Course Outcomes Upon the successful completion of the course, students will be able to:

S.No.	Course outcome	Course outcome with action verb	Level in Blooms Taxonomy
1.	CO-1	Outline the structure and applications of MEMS and Nano devices.	Level-3
2.	CO-2	Explain the types of ceramics, phase diagrams, fabrication and their processing techniques.	Level-4
3.	CO-3	Describe the structure, properties of amorphous semiconductors and polymers, classification and their applications.	Level-5
4.	CO-4	Summarize the basic architecture of microprocessors and microcontrollers, logical instructions, Boolean Variable Manipulation Instructions and their differences	Level-4
5.	CO-5	Discuss the concepts and systems, sources of remote sensing information, advantages and application of remote sensing in Environmental and natural resource management.	Level-5

SYLLABUS

UNIT–I: Micro and Nano devices 12Hrs

Introduction to Microelectromechanical systems (MEMS), Basic MEM structure. Applications of MEMS: Pressure sensors, Accelerometers Mass flow sensors. Nano devices: Quantum well and quantum dot devices: Infrared Detectors –Quantum Dot Lasers. Carbon nanotube emitters - Plasmon's propagation in wave guides.

Unit-II: Ceramics 12Hrs

Types and Applications – Glasses, Glasss-cermaics, Clay products, Refractories, Abrasives, Cements, Advanced ceramics, Ceramic Phase diagrams; Fabrication and Processing of Glasses and Glass-Ceramics, Fabrication and Processing of Clay Products, Powder Pressing, Tape Casting

UNIT- III: Functional Materials 12 Hrs

Amorphous semiconductors: Band structure – Electronic conduction – Optical absorption – Applications. Polymers: Classification – Structural property correlation – Molecular weight – Crystalline in polymers – Applications.

UNIT–IV: 8051 Microcontrollers 14 Hrs

Introduction of Microprocessors and Microcontrollers, Microcontroller: 8051 Internal Architecture, Register Structure, I/O pins, Memory Organization, 8051 addressing modes. 8051 Assembly Language Programming Tools. 8051 Instruction set: Data Transfer Instructions, Arithmetic instructions, Logical instructions, Boolean Variable Manipulation Instructions-Bit Addressability, Single-Bit instructions, Program Branching Instructions-Jump, Loop, and Call instructions, Rotate Instructions, Stack Pointer.

UNIT -V: Remote Sensing 14 Hrs

Definition of remote sensing; introduction to concepts and systems; Electromagnetic radiation; electromagnetic spectrum; image characteristics; remote sensing systems; remote sensing platform; Sources of remote sensing information; Advantages of remote sensing. Application of Remote sensing in Environmental Management, Natural resource management – forest resources, water resources, land resources and mineral resources.

List of Activities: 1. Assignments 2. Student Seminars

Recommended Books 1. Introduction to Nanotechnology, By Charles P. Poole, Jr and Frank J. Owens, Willey India (2006).

2. An Introduction to Micro electromechanical Systems Engineering by Nadim Maluf, Artech House Publishers, 2004

3. Nanomaterials Synthesis Properties and Applications, by Alen. S.Edelsteinand Robert C. Cammarata, 1998.

4. Floyd F. Sabins Jr., Remote Sensing Principles and interpretation, .H.Freeman and Company, 2 ndEd., New York, 1987.

5. Remote Sensing and Image Interpretation', T.M. Lilles and R.W. Kiefer, John Wiley&Sons, New York, 1994.

6. Material Science & Engineering by V. Raghavan, Prentice Hall of India

7. Material Science and Engineering by Callistar

8. Text Book of polymer science by Gowarikar, Sreedhar and Viswanathan, Wiley-Eastern Publications. India

9. An Introduction to composite materials by Derek Hull, Cambridge University Press, Cambridge, U.K. ((1981)

Reference Books

1. An Introduction to GIS by Ian Heywood et al., Addision Wesley, Longmont Limited, England,2011.

2. Nano structures and Nanomaterials : Synthesis, Properties and application by Guozliong Cao, Imperial College Press (2004).

3. The8051Microcontroller and Embedded systems, by Mahammad Ali Mazidi and Janice Gillispie Mazidi, Pearson Education Asia, Pvt.Ltd.,2000.

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	1	1	1	3	3	2	2
CO 2	3	3	2	2	1	1	3	3	2	3
CO 3	3	3	2	2	2	1	3	3	3	3
CO 4	2	2	1	2	2	1	2	2	3	3
CO 5	3	3	2	1	1	2	3	2	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	3	3	2	2	3
CO 2	2	3	2	3	2
CO 3	3	3	2	3	3
CO 4	3	2	3	2	3
CO 5	3	3	2	2	3

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Dr V.S.Krishna Govt. Degree College(A),
Visakhapatnam 2023-2024
Course Code: 24(PHY)M73B

BLUE PRINT (:ADVANCES IN PHYSICS)
IV B.Sc. (Hons.) PHYSICS- SEM-VII/Course : 10B
Max Marks-75 Time-3Hrs. Credits:5

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	Micro and Nano devices	2	2	30
2.	II	Ceramics	2	2	30
3.	III	Functional Materials	2	2	30
4.	IV	8051 Microcontrollers	2	2	30
5.	V	Remote Sensing	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M73B

SEMESTER-VII COURSE 10B: ADVANCES IN PHYSICS

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following **[5 X 8 = 40]**

1. a)
[OR]
b)

2. a)
[OR]
b)

3. a)
[OR]
b)

4. a)
[OR]
b)

5. a)
[OR]
b)

SECTION – B

Answer any FIVE Questions of the following **[5 X 4 = 20]**

6. a)
7. a)
8. a)
9. a)
10. a)
11. a)
12. a)
13. a)
14. a)
15. a)

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M73B

SEMESTER-VII COURSE 10B: ADVANCES IN PHYSICS
QUESTION BANK

UNIT I: Micro and Nano Devices

Essay-type Questions:

1. Explain the structure and working principles of Microelectromechanical Systems (MEMS). Discuss their applications with specific examples such as pressure sensors and accelerometers.
2. Describe the principles of Quantum Dot Devices. How are quantum wells and quantum dot lasers utilized in modern technological applications?
3. Discuss the propagation of plasmons in waveguides. What are the advantages of utilizing plasmonic devices in nanotechnology?

Short-answer Questions:

1. Define Carbon Nanotube Emitters. How are they used in electronic devices?
2. Explain the concept of Infrared Detectors based on nanostructures. What are their advantages over conventional infrared sensors?
3. What are the basic characteristics of Nano Devices? Provide examples of their applications in current technology.

UNIT II: Ceramics

Essay-type Questions:

1. Discuss the types and applications of ceramics, including glasses, glass-ceramics, and refractories. Highlight their importance in different industries.
2. Explain the fabrication processes of ceramic products like clay products and advanced ceramics. How do fabrication techniques influence their properties?
3. Describe the phase diagrams of ceramics. How are phase diagrams used in understanding and designing ceramic materials?

Short-answer Questions:

1. What are the different types of refractories? Provide examples of their applications.
2. Describe the fabrication techniques of glass and glass-ceramics. How are these processes different from traditional ceramic processing methods?
3. Explain the importance of powder pressing and tape casting in ceramic manufacturing.

UNIT III: Functional Materials

Essay-type Questions:

1. Discuss the properties and applications of amorphous semiconductors. How do their electronic and optical properties differ from crystalline semiconductors?
2. Classify polymers based on their structure and properties. How are these classifications relevant to their applications in various industries?
3. Explain the band structure of amorphous semiconductors. How does it affect their electronic conductivity and optical absorption properties?

Short-answer Questions:

1. What are the structural properties of polymers? How does molecular weight influence these properties?
2. Describe the applications of polymers in everyday life and industry.
3. How does crystallinity affect the properties of polymers? Give examples of crystalline and amorphous polymers.

UNIT IV: 8051 Microcontrollers

Essay-type Questions:

1. Introduce microprocessors and microcontrollers. Discuss the internal architecture and key components of the 8051 microcontroller.
2. Explain the memory organization in the 8051 microcontroller. How are registers and I/O ports utilized in programming?
3. Discuss the addressing modes and instruction set of the 8051 microcontroller. Provide examples of their practical applications in embedded systems.

Short-answer Questions:

1. Describe the register structure of the 8051 microcontroller. How are registers used for data manipulation?
2. Explain the role of I/O pins in the 8051 microcontroller. How are they configured and controlled?
3. What are the different types of addressing modes supported by the 8051 microcontroller? Give examples of their usage in programming.

UNIT V: Remote Sensing

Essay-type Questions:

1. Define remote sensing and explain its importance in environmental and natural resource management. Discuss the types of remote sensing platforms and their applications.
2. Describe the electromagnetic spectrum and its relevance to remote sensing. How are different wavelengths utilized for specific sensing applications?
3. Discuss the advantages of remote sensing in monitoring and managing forest, water, land, and mineral resources. Provide examples of successful applications.

Short-answer Questions:

1. What are the key characteristics of remote sensing images? How are these characteristics utilized in image interpretation?
2. Explain the sources of remote sensing information. How are satellite and aerial platforms used?
3. Write about Natural resource management?

B.Sc. PHYSICS SYLLABUS UNDER CBCS PATTERN
[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M74B

SEMESTER-VII COURSE 11B: CONDENSED MATTER PHYSICS

Theory Credits: 3 3 hrs/week

Course Objectives: To introduce the fundamental concepts and principles, elastic, thermal properties of solids, energy bands and Fermi Surfaces, Ferro and anti- ferromagnetism, photoconductivity and luminescence mechanisms in Condensed Matter Physics.

Course Outcomes Upon the successful completion of the course, students will be able to:

S.No.	Course outcome	Course outcome with action verb	Level in Blooms Taxonomy
1.	CO-1	Evaluate elastic constants using experimental techniques and discuss their applications.	Level-3
2.	CO-2	Outline the thermal properties of solids using the concept of quantum theory of lattice vibrations, properties of phonons and their role in determining thermal expansion.	Level-4
3.	CO-3	Describe the importance and characteristics of Fermi surfaces in determining Energy band calculations.	Level-5
4.	CO-4	Summarize the basics of ferromagnetism, anti-ferromagnetism, theories and models, used to study these phenomena and their applications.	Level-4
5.	CO-5	Discuss the principles, techniques used to study photoconductivity, various luminescence and their applications.	Level-5

SYLLABUS

UNIT-I: Elastic Properties of Solids **7 Hrs**

Lattice as a homogeneous and continuous medium - Analysis of stress and strain tensors – Hooke's law - Elastic compliances and stiffness constants – Elastic energy density – Cauchy's relations – Bulk modulus and compressibility – Experimental determination of elastic constants – Pulse-echo technique.

UNIT-II: Thermal Properties of Solids **8 Hrs**

Quantum theory of lattice vibrations – Properties of phonons – Lattice specific heat at low temperatures – Einstein and Debye models – Inelastic scattering of neutrons by phonons– Experimental study of dispersion curves – Thermal expansion – Gruneisen parameter- Lattice thermal

UNIT-III: Energy bands and Fermi Surfaces **8 Hrs**

Energy band calculations: Plane Wave method and Augmented Plane Wave (APW) method. Importance of Fermi surface – Characteristics of Fermi surface – Construction of Fermi surface - Experimental study of Fermi surface: Anomalous skin effect –Cyclotron resonance – deHaas van Alphen effect.

UNIT-IV: Ferromagnetism and Anti-ferromagnetism **8 Hrs**

Ferromagnetism: Introduction – Weiss molecular field theory – Temperature dependence of spontaneous magnetization – Heisenberg model – Ferromagnetic domains – Blochwall – Thickness and energy – Ferromagnetic spin waves – Magnons–Dispersion relations. Anti-ferromagnetism: Introduction of anti-ferromagnetism – Ferrimagnetism - Ferrites – Structure – Applications– Multiferroics.

UNIT-V: Photoconductivity and Luminescence **7 Hrs**

Photoconductivity – Simple model – Influence of traps – Space charge effects – Determination of photoconductivity. Luminescence – Various types–Thermo luminescence, Electroluminescence, Photoluminescence, Cathodoluminescence and Chemiluminescence.

List of Activities: 1. Assignments 2. Student Seminars

Recommended Books

1. Solid State Physics, M.A. Wahab, Edition: 3rd, 2020, Narosa Publishing House.
2. Fundamentals of Solid State Physics, Saxena, Gupta, Saxena, Edition: 31st, 2019,Pragathi
3. Solid State Physics, R.L. Singhal, Kedar Nath, RamNath &Co. Publications, Meerut,2018.

Reference Books

1. Solid State Physics, C. Kittel, Edition: 8th 2012, John Wiley & Sons.
2. Solid State Physics, A.J. Dekkar, Edition: 1st, 2000. Macmillan India Ltd.

SEMESTER – VII – Practical Lab Course-1 11-B- LAB-1: Condensed Matter Physics -

Practical Hours/Week: 3 **Credits: 2**

Course Objectives : To equip, students with experimental skills, by applying the learnt concepts from Condensed Matter Physics.

Course Outcomes Upon the successful completion of this practical course, students will be able to:

CO1: Trace B-H Curve and determine the magnetization properties.

CO2: Obtain the cut-off frequency and the optical band gap of the given materials from the study of Lattice Dynamics.

CO3: Determine the Hall coefficient for the given semiconductor material using Hall effect.

CO4: Measure the magneto resistance of the given semiconductor.

CO5: Evaluate the Curie temperature for the given Ferromagnetic Material.

CO6: Determine the magnetic susceptibility of the given material by Guoy method.

CO7: Determine the Dielectric constant of the given material.

CO8: Measure the resistance of the given semiconductor by four probe method.

CO9: Measure the magnetic susceptibility by Quinke's method.

Any six of the following experiments: List of Experiments:

1. BH Curve Tracer
2. Lattice Dynamics
3. Hall effect
4. Magneto resistance
5. Curie temperature
6. Magnetic susceptibility Gouy's method
7. Dielectric constant
8. Measurement of Resistance by using four probe method
9. Measurement of Magnetic susceptibility by Quinke's method

B.Sc. PHYSICS SYLLABUS UNDER CBCS PATTERN
[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M74B

SEMESTER-VII COURSE 11B: CONDENSED MATTER PHYSICS

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	2	1	2	2	3	2	3
CO 2	2	3	2	2	2	2	3	3	3	3
CO 3	3	3	2	2	1	2	3	2	3	3
CO 4	3	2	2	1	2	1	3	2	3	2
CO 5	3	3	2	1	1	2	3	3	2	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	2	3	2
CO 3	2	3	2	3	3
CO 4	3	3	3	2	3
CO 5	3	2	2	2	3

Dr V.S.Krishna Govt. Degree College(A),
Visakhapatnam 2023-2024
Course Code: 24(PHY)M74B

BLUE PRINT (:CONDENSED MATTER PHYSICS**)**
IV B.Sc. (Hons.) PHYSICS- SEM-VII/Course : 11B
Max Marks-75 Time-3Hrs. Credits:3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	Elastic Properties of Solids	2	2	30
2.	II	Thermal Properties of Solids	2	2	30
3.	III	Energy bands and Fermi Surfaces	2	2	30
4.	IV	Ferromagnetism and Anti-ferromagnetism	2	2	30
5.	V	Photoconductivity and Luminescence	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

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B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M74B

SEMESTER-VII COURSE 11B: CONDENSED MATTER PHYSICS

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following **[5 X 8 = 40]**

1. a)
[OR]
b)

2. a)
[OR]
b)

3. a)
[OR]
b)

4. a)
[OR]
b)

5. a)
[OR]
b)

SECTION – B

Answer any FIVE Questions of the following **[5 X 4 = 20]**

6. a)
7. a)
8. a)
9. a)
10. a)
11. a)
12. a)
13. a)
14. a)
15. a)

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M74B

SEMESTER-VII COURSE 11B: CONDENSED MATTER PHYSICS
QUESTION BANK

UNIT-I: Elastic Properties of Solids

Essay Questions:

1. Discuss the lattice model as a homogeneous and continuous medium in the context of elastic properties of solids. How does this model help in understanding stress and strain tensors?
2. Explain Hooke's law in detail, and describe how elastic compliances and stiffness constants are related to it. Include a discussion on the experimental methods used to determine these constants.
3. Describe the pulse-echo technique for measuring elastic constants. What are its advantages and limitations compared to other experimental techniques?

Short Questions:

1. Define elastic energy density and explain its significance in the study of elastic properties.
2. What are Cauchy's relations? Provide a brief explanation of how these relations connect different elastic constants.
3. Explain the concept of bulk modulus and compressibility. How are these properties related to the behavior of materials under different pressure conditions?

UNIT-II: Thermal Properties of Solids

Essay Questions:

1. Compare and contrast the Einstein and Debye models for lattice specific heat. How do these models account for the behavior of solids at low temperatures?
2. Discuss the quantum theory of lattice vibrations and its impact on the understanding of phonon properties. How does this theory contribute to the study of thermal properties of solids?
3. Explain the concept of the Gruneisen parameter and its role in understanding thermal expansion in solids. Provide examples of how it is used in practical applications.

Short Questions:

1. What is the significance of phonons in the thermal properties of solids?
2. Briefly describe the experimental technique used for studying dispersion curves in solids.
3. Define lattice thermal conductivity and discuss its dependence on temperature and phonon scattering mechanisms.

UNIT-III: Energy Bands and Fermi Surfaces

Essay Questions:

1. Describe the Plane Wave method and Augmented Plane Wave (APW) method for energy band calculations. How do these methods differ in their approach and accuracy?
2. Discuss the importance of the Fermi surface in solid-state physics. How is the Fermi surface constructed, and what information does it provide about the electronic properties of a material?
3. Explain the experimental techniques used to study the Fermi surface, such as the anomalous skin effect and cyclotron resonance. What are the key findings that these techniques reveal about Fermi surfaces?

Short Questions:

1. What is the role of the Fermi surface in determining the electrical conductivity of metals?
2. Briefly explain the concept of cyclotron resonance and its application in studying the Fermi surface.
3. What is the de Haas-van Alphen effect, and how does it help in understanding the electronic structure of a material?

UNIT-IV: Ferromagnetism and Anti-ferromagnetism

Essay Questions:

1. Explain Weiss molecular field theory of ferromagnetism. How does this theory account for the temperature dependence of spontaneous magnetization?
2. Describe the Heisenberg model of ferromagnetism and discuss its significance in understanding ferromagnetic domains and spin waves.
3. Compare and contrast ferromagnetism and anti-ferromagnetism. Discuss the key differences in their magnetic properties, and give examples of materials that exhibit each type of magnetism.

Short Questions:

1. What are ferromagnetic spin waves, and how are they related to magnons?
2. Define ferrimagnetism and provide examples of materials that exhibit this property.
3. What are multiferroics, and how do they differ from traditional ferromagnetic and anti-ferromagnetic materials?

UNIT-V: Photoconductivity and Luminescence

Essay Questions:

1. Discuss the basic principles of photoconductivity. How do traps and space charge effects influence photoconductivity in semiconductors?
2. Explain the different types of luminescence, including thermoluminescence, electroluminescence, photoluminescence, cathodoluminescence, and chemiluminescence. Provide examples and applications of each type.
3. Analyze the impact of photoconductivity on modern electronic and optoelectronic devices. How is it used in practical applications?

Short Questions:

1. What is the role of traps in influencing photoconductivity?
2. Define and distinguish between photoluminescence and cathodoluminescence.
3. How does the simple model of photoconductivity explain the changes in electrical conductivity under illumination?

B.Sc. PHYSICS SYLLABUS UNDER CBCS PATTERN
[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M75B

SEMESTER-VII COURSE 12B: VLSI DESIGN (SKILL)

Theory   Credits: 3   3 hrs/week

Course Objectives: To introduce students with the fundamental concepts, principles, characteristics of MOSFET, CMOS Logic Networks in VLSI Design and applications.

S.No.	Course outcome	Course outcome with action verb	Level in Blooms Taxonomy
1.	CO-1	Outline the overview of VLSI and Logic Design with MOSFET	Level-3
2.	CO-2	Describe the physical structure and fabrication, silicon processing for material growth and deposition, lithography using the process flow and design rules of CMOS technology.	Level-5
3.	CO-3	Summarize the basic concepts, electrical characteristics, layout techniques for basic structures, cell concepts, physical design of logic gates and optimization of the performance of MOSFETs.	Level-4
4.	CO-4	Describe the DC & inverter switching, power dissipation characteristics and optimal transient performance of CMOS logic gates.	Level-3
5.	CO-5	Design High-speed CMOS Logic Networks and their functioning.	Level-5

SYLLABUS

UNIT-I:

An Overview of VLSI and Logic Design with MOSFET **8 Hrs**

Complexity and Design, Basic concepts, Ideal switches and Boolean operations, MOSFETs as switches, Basic logics gates in CMOS, and Complex logic gates in CMOS

UNIT-II:

Physical Structure and Fabrication of CMOS ICs **7 Hrs**

Integrated Circuit layers, MOSFETs, CMOS layers, Designing FET arrays, Overview of silicon processing, Material growth and deposition, Lithography, The CMOS process flow, Design rules.

UNIT-III:

Elements of Physical Design and Electrical Characteristics of MOSFETs **8 Hrs**

Basic concepts, Layout of basic structures, Cell concepts, FET sizing and the unit transistor, Physical design of logic gates, Design hierarchies, MOS physics, nFET current-voltage equations, FET RC model, pFET characteristics, Modeling of small MOSFETs.

UNIT-IV: Electronic analysis of CMOS logic gates **7 Hrs**

DC characteristics of the CMOS inverter, Inverter switching characteristics, Power dissipation, DC characteristics: NAND and NOR gates, NAND and NOR transient response, Analysis of complex logic gates,

UNIT V: Designing High-speed CMOS Logic Networks- **7 Hrs**

Gate delays, Driving Large capacitive loads, Logical effort, BiCMOS drivers.

List of Activities: 1. Assignments 2. Student Seminars

RecommendedBooks

1. S.K.Ghandhi,“VLSIFabricationprinciples”,2/e,JohnWiley&Sons(Asia)Pte.Ltd.,2003.
2.S.M.Sze,“VLSITechnology”,2/e,McGraw-Hill,1988.
3.YuanTaurandT.H.Ning,“FundamentalsofModernVLSIdevices”,CambridgeUniversity,Press, 1998.

Reference Books

1. John P. Uyemura, “Introduction to VLSI circuits and Systems”, John Wiley & Sons Asia PetLtd., 2003.
2.N.H.E.WesteandK.Eshraghian,“PrinciplesofCMOSVLSIdesign”,PearsonEducation,Inc., 1999.
3. .L.Geiger,P.E.AllenandN.R.Strader,“VLSIdesignTechniquesforAnalogandDigitalCircuits”, McGraw-Hill, 1990.

SEMESTER – VII – Practical Lab Course-2 12-B- LAB-2: VLSI design - Practical Hours/Week: 3 Credits: 2 Practical - VLSI design - (Steam B)

Course Objectives To equip, students with experimental skills, by applying the learnt concepts from VLSI design.

Course Outcomes Upon the successful completion of this practical course, students will be able to:

1. Write a VLSI program for verification of Logic Gates
2. Write a VLSI program for verification of T flip flop
3. Write a VLSI program for verification of Full Adder
4. Write a VLSI program for verification of Half Adder
5. Write a VLSI program for verification of Decoder
6. Write a VLSI program for verification of Encoder
7. Write a VLSI program for verification of Demultiplexer
8. Write a VLSI program for verification of Multiplexer
9. Write a VLSI program for verification of R-S flip flop
10. Write a VLSI program for verification of J-K flip flop

B.Sc. PHYSICS SYLLABUS UNDER CBCS PATTERN
[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M75B

SEMESTER-VII COURSE 12B: VLSI DESIGN (SKILL)

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	3	2	2	1	1	2	2	2	3
CO 2	3	3	2	2	1	1	3	3	3	3
CO 3	3	3	2	1	2	1	3	3	3	3
CO 4	2	2	2	2	1	2	3	3	3	3
CO 5	3	3	1	2	2	2	3	2	2	2

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	3	3	2	3	3
CO 2	3	2	3	2	3
CO 3	3	3	2	2	3
CO 4	3	3	3	3	2
CO 5	2	3	2	2	3

Dr V.S.Krishna Govt. Degree College(A),
Visakhapatnam 2023-2024
Course Code: 24(PHY)M75B

BLUE PRINT (:VLSI DESIGN (SKILL ORIENTED)**)**
IV B.Sc. (Hons.) PHYSICS- SEM-VII/Course : 12B
Max Marks-75 Time-3Hrs. Credits:3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	An Overview of VLSI and Logic Design with MOSFET	2	2	30
2.	II	Physical Structure and Fabrication of CMOS ICs	2	2	30
3.	III	Elements of Physical Design and Electrical Characteristics of MOSFETs	2	2	30
4.	IV	Electronic analysis of CMOS logic gates	2	2	30
5.	V	Designing High-speed CMOS Logic Networks	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

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B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M75B

SEMESTER-VII COURSE 12B: VLSI DESIGN (SKILL ORIENTED)

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following **[5 X 8 = 40]**

1. a)
[OR]
b)

2. a)
[OR]
b)

3. a)
[OR]
b)

4. a)
[OR]
b)

5. a)
[OR]
b)

SECTION – B

Answer any FIVE Questions of the following **[5 X 4 = 20]**

6. a)
7. a)
8. a)
9. a)
10. a)
11. a)
12. a)
13. a)
14. a)
15. a)

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M75B

SEMESTER-VII COURSE 12B: VLSI DESIGN (SKILL ORIENTED)
QUESTION BANK

UNIT-I: An Overview of VLSI and Logic Design with MOSFET

Essay Questions:

1. Discuss the role of MOSFETs as switches in VLSI design. How do MOSFETs function as ideal switches, and what are the implications of this for CMOS logic design?
2. Explain the basic and complex logic gates in CMOS technology. How do these gates operate, and what are the advantages of using CMOS technology for logic gates compared to other technologies?
3. Analyze the complexity involved in VLSI design. How do basic concepts such as Boolean operations and ideal switches impact the overall design and functionality of VLSI circuits?

Short Questions:

1. What are the key differences between basic and complex CMOS logic gates?
2. Define Boolean operations and explain their importance in digital logic design with MOSFETs.
3. Describe the concept of an ideal switch in the context of MOSFETs and its significance for logic design.

UNIT-II: Physical Structure and Fabrication of CMOS ICs

Essay Questions:

1. Describe the CMOS process flow from material growth to final device fabrication. What are the key steps involved, and how do they contribute to the overall performance of CMOS ICs?
2. Discuss the importance of lithography in the fabrication of CMOS ICs. How does this process influence the design and performance of integrated circuits?
3. Explain the design rules for CMOS ICs and their significance in the physical structure and fabrication process. How do these rules ensure the reliability and manufacturability of CMOS devices?

Short Questions:

1. What are the main layers involved in the fabrication of CMOS ICs?
2. Explain the role of material growth and deposition in the CMOS fabrication process.
3. What is the purpose of designing FET arrays in CMOS technology, and how does it affect the performance of integrated circuits?

UNIT-III: Elements of Physical Design and Electrical Characteristics of MOSFETs

Essay Questions:

1. Analyze the layout considerations for basic structures in VLSI design. How do cell concepts and FET sizing impact the physical design of logic gates?
2. Discuss the MOS physics and its relevance to the current-voltage characteristics of nFETs and pFETs. How do these characteristics influence the design and performance of MOSFETs in VLSI circuits?
3. Explain the concept of design hierarchies in physical design. How do hierarchical design approaches simplify the design process and improve efficiency in VLSI systems?

Short Questions:

1. What is the significance of the FET RC model in understanding the performance of MOSFETs?
2. Define the concept of unit transistor in the context of MOSFET sizing.
3. How do the current-voltage equations for nFETs and pFETs help in modeling the behavior of MOSFETs in integrated circuits?

UNIT-IV: Electronic Analysis of CMOS Logic Gates

Essay Questions:

1. Discuss the DC characteristics of the CMOS inverter and how these characteristics affect its performance. Include a description of the inverter switching characteristics and power dissipation.
2. Analyze the transient response of NAND and NOR gates. How do these responses influence the overall speed and power consumption of CMOS logic circuits?
3. Explain the methods used for analyzing complex logic gates in CMOS technology. What are the key factors considered in this analysis, and how do they impact the design of high-speed digital circuits?

Short Questions:

1. What are the key DC characteristics of CMOS inverters?
2. Describe the power dissipation factors in CMOS logic gates and their impact on circuit performance.
3. How do NAND and NOR gate transient responses affect the timing and speed of CMOS logic circuits?

UNIT-V: Designing High-Speed CMOS Logic Networks

Essay Questions:

1. Explain the concept of gate delays in CMOS logic networks. How do gate delays impact the overall speed of digital circuits, and what strategies can be used to minimize them?
2. Discuss the challenges and solutions associated with driving large capacitive loads in CMOS circuits. What design considerations are important for ensuring reliable performance in such scenarios?
3. Analyze the concept of logical effort and its role in the design of high-speed CMOS logic networks. How does logical effort help in optimizing the performance of digital circuits?

Short Questions:

1. What are the primary factors contributing to gate delays in CMOS circuits?
2. Define logical effort and explain how it is used to improve the speed of CMOS logic networks.
3. What are BiCMOS drivers, and how do they enhance the performance of CMOS logic circuits?

Programme: Four Year – B.Sc. (Hons) [STREAM-B]
w.e.f. A.Y. 2024-25 **COURSE CODE:**
SEMESTER-VII (IV Year) COURSE 11B: Condensed Matter Physics Practical

11-B- LAB-1: Practical Lab Course-1

Practical Credits: 2 3 Hrs/ Week

COURSE OBJECTIVES:

To equip, students with experimental skills, by applying the learnt concepts from Condensed Matter Physics.

COURSE OUTCOMES:

Upon the successful completion of this practical course, students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Trace B–H Curve and determine the magnetization properties. Obtain the cut-off frequency and the optical band gap of the given materials from the study of Lattice Dynamics.	Level 2 (Understanding) Level 4 (Analysing) Level 5 (Evaluating)
CO 2	Determine the Hall coefficient for the given semiconductor material using Hall effect. Measure the magneto resistance of the given semiconductor.	Level 4 (Analysing) Level 5 (Evaluating)
CO 3	Evaluate the Curie temperature for the given Ferromagnetic Material. Determine the magnetic susceptibility of the given material by Guoy method.	Level 4 (Analysing) Level 5 (Evaluating)
CO 4	Determine the Dielectric constant of the given material. Measure the resistance of the given semiconductor by four probe method.	Level 4 (Analysing) Level 5 (Evaluating)
CO 5	Measure the magnetic susceptibility by Quinke's method.	Level 2 (Understanding) Level 5 (Evaluating)

List of Experiments: (Any six of the following experiments)

1. B-H Curve Tracer.
2. Lattice Dynamics.
3. Hall effect.
4. Magneto resistance.
5. Curie temperature.
6. Magnetic susceptibility Gouy’s method.
7. Dielectric constant.
8. Measurement of Resistance by using four probe method.
9. Measurement of Magnetic susceptibility by Quinke’s method.

Programme: Four Year – B.Sc. (Hons) [STREAM B]
w.e.f. A.Y. 2024-25 **COURSE CODE:**
SEMESTER-VII (IV Year) COURSE 12B: VLSI design - Practical

12-B- LAB-2: Practical Lab Course-2

Practical Credits: 2 3 Hrs/ Week

COURSE OBJECTIVES:

To equip, students with experimental skills, by applying the learnt concepts from VLSI design.

COURSE OUTCOMES:

Upon the successful completion of this practical course, students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Write a VLSI program for verification of Logic Gates. Write a VLSI program for verification of T flip flop.	Level 2 (Understanding) Level 6 (Create)
CO 2	Write a VLSI program for verification of Full Adder. Write a VLSI program for verification of Half Adder.	Level 2 (Understanding) Level 6 (Create)
CO 3	Write a VLSI program for verification of Decoder. Write a VLSI program for verification of Encoder.	Level 2 (Understanding) Level 6 (Create)
CO 4	Write a VLSI program for verification of Demultiplexer. Write a VLSI program for verification of Multiplexer.	Level 2 (Understanding) Level 6 (Create)
CO 5	Write a VLSI program for verification of R–S flip flop. Write a VLSI program for verification of J–K flip flop.	Level 2 (Understanding) Level 6 (Create)

List of Experiments:

1. Design XOR gate by using NAND and NOR gate and verify its characteristics.

2. Design a MOS based SRAM cell using 90 nm technology and verify its characteristics.

3. Design NOR gate using Domino logic CMOS inverter and verify its characteristics.

4. Design CMOS transmission gate and perform all the analysis to verify its characteristics.

5. Design XNOR gate using dynamic CMOS logic circuits and verify its characteristics.

6. Design Layout of CMOS inverter and perform post layout analysis, Monte Carlo analysis, Corner analysis and etc.

Programme: Four Year – B.Sc. (Hons) [STREAM A]
w.e.f. A.Y. 2024-25 **COURSE CODE:**
SEMESTER-VIII (IV Year) COURSE 14A: QUANTUM MECHANICS

Theory | Credits: 5 | 6 Hrs/Week

Course Objectives: To provide students with a comprehensive understanding of postulates, Eigen values and Eigen functions, approximate methods, relativistic quantum theory, and quantization of wave fields in Quantum Mechanics.

Course Outcomes:

Upon the successful completion of the course, students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Outline postulates of quantum mechanics and the significance of operators	Level 2 (Understanding)
CO 2	Describe orbital and spin angular momentum, commutation of operators, eigenvalues and eigen functions of angular momentum and related concepts.	Level 4 (Analysing)
CO 3	Explain time independent nondegenerate perturbation, WKB approximation, Quantization & tunnelling and time dependent perturbation.	Level 2 (Understanding) Level 4 (Analysing)
CO 4	Discuss the inadequacies of the Klein-Gordon equation, Dirac's relativistic equation, Negative energy states and spin of electrons.	Level 4 (Analysing)
CO 5	Summarize the concepts of field, various quantization techniques, quantization of nonrelativistic Schrodinger equation, commutation and anti-commutation relations, system of fermions and bosons and creation and annihilation.	Level 2 (Understanding) Level 3 (Applying)

SYLLABUS

Unit-I: Postulates of Quantum Mechanics **12 Hrs**

Postulates of quantum mechanics, Eigen values and Eigen functions for finite well and barrier, Simple harmonic oscillator by operator method.

Liner vector space–Ket and Bra notations, Observables as Hermitian operators, Properties of Hermitian operators, Matrix representation *of State Vectors* and operators, Unitary transformation, *Relation between a State Vector and its Wave function*.

Unit-II: Angular Momentum **12 Hrs**

Orbital angular momentum – L_x, L_y, L_z, L^2, L_+, L_- operators; Commutation of operators, Eigen functions and Eigen values of J^2 and J_z, Spin angular momentum, Eigen functions and Eigen values of Spin angular momentum and matrices, Addition of angular momenta, Clebsch-Gordon coefficients for $J_1=J_2 = ½$.

UNIT-III: Approximate Methods **12 Hrs**

Time independent nondegenerate perturbation- Anharmonic oscillator, Variation Method-He atom, Harmonic perturbation, WKB approximation- Connecting formulae - Application to potential well and potential barrier, Quantization and tunnelling, Time dependent perturbation, Transition – Harmonic perturbation and Fermi Golden rule.

UNIT-IV: Relativistic Quantum Theory **12 Hrs**

Klein – Gorden equation, Probability current density, Inadequacy of K. G. equation, Dirac's linear equation plane wave solution; Negative energy states and spin of electrons, *negative probability density, Energy of the real Klein Gordon field, and Charge of quantum complex Klein-Gordon field*.

UNIT-V: Quantization of Wave Fields **12 Hrs**

Concept of Field – Method of Canonical Quantization: Lagrangian Formulation of Field, Hamilton Formulation of Field – Second Quantization – Field equation – Quantization of Non-relativistic Schrodinger equation – Commutation and Anti-Commutation Relations, The N-representation System of Fermions and Bosons– Creation and Annihilation.

List of Activities:

1. Assignments.
2. Student Seminars.

Recommended Books

1. Quantum Mechanics: G. Aruldhas, PHI learning private limited, New Delhi, Second edition, 2018.

2. Quantum Mechanics: S.L. Kakani and H.M. Chandalia, Sultan Chand and Sons, First Edition, 2004.

3. Advanced Quantum Mechanics: B.S. Rajput, Pragati Prakasan, 2019.

4. Quantum Mechanics: V.K. Thankappan, New Age International (P) Ltd. Publishers,1993.

5. A Textbook of Quantum Mechanics: P.M. Mathews and K. Venkatesan, Tata McGraw Hill

Publishing Company, 2008.

6. Quantum Mechanics: S.L. Gupta, V. Kumar, H.V. Sharma and R.C. Sharma, Jai Prakash Nath and Company, 2007.

Reference Books

1. Quantum Mechanics: Concepts and Applications by Nouredine Zettili, Wiley, Second Edition, 2021.

2. Introduction to Quantum Mechanics by David J. Griffiths and Darrell F. Schroeter, Third Edition, Cambridge University Press, 2018.

3. An Introduction to Quantum Mechanics by P.T. Mathews, McGraw Hill Publishing Company, 1974.

CO–PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	2	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	2	3	3	3
CO 5	3	1	1	1	1	2	2	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

Programme: Four Year – B.Sc. (Hons) [STREAM A]
w.e.f. A.Y. 2024-25 **COURSE CODE:**
SEMESTER-VIII (IV Year) COURSE 14A: QUANTUM MECHANICS

Theory Credits: 5 6 Hrs/Week

Blue Print for Semester End Theory Examinations

S. No.	Type of question	No. of questions given			No. of questions to be answered		
		No. of questions	Marks allotted to each question	Total marks	No. of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: Four Year – B.Sc. (Hons) [STREAM A]

w.e.f. A.Y. 2024-25 **COURSE CODE:**

SEMESTER-VIII (IV Year) COURSE 14A: QUANTUM MECHANICS

Theory Credits: 5 6 Hrs/Week

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	33 %	20	2	1 (One out of two)
Understanding/ Comprehension	27 %	16	2	
Application	20 %	12	1	1 (One out of two)
Analysis	13 %	8		2 (Two out of four)
Synthesis/ Evaluate	7 %	4		1 (One out of two)
Total	100 %	60		5 Out of 10 questions

Chapter wise Weightage				
S. No.	**Module/ Unit**	**Name of the chapter**	**8 Marks**	**4 Marks**
1	Unit – I	Solid State Spectroscopy I – Transition Metal Ions	2 (One out of two)	2
2	Unit – II	Solid State Spectroscopy II – Rare Earth Ions	2 (One out of two)	2
3	Unit – III	Fluorescence and Phosphorescence Spectroscopy	2 (One out of two)	2
4	Unit – IV	High Resolution Spectroscopy	2 (One out of two)	2
5	Unit – V	Two Photon Spectroscopy	2 (One out of two)	2

Programme: Four Year – B.Sc. (Hons) [STREAM A]
w.e.f. A.Y. 2024-25 **COURSE CODE:**
SEMESTER-VIII (IV Year) COURSE 14A: QUANTUM MECHANICS

Theory	Credits: 5	6 Hrs/Week

SEMESTER END EXAMINATIONS MODEL PAPER

Time: 3 Hrs Max. Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks.

5 x 4 = 20 Marks

1. What are Ket and Bra notations, and how are they used in quantum mechanics?
2. Why are observables represented by Hermitian operators in quantum mechanics?
3. What are the eigenvalues and eigenfunctions of the J^2 and J_z operators?
4. How is spin angular momentum different from orbital angular momentum?
5. What is the Fermi Golden Rule, and what is its significance in quantum mechanics?
6. How is the anharmonic oscillator treated using time-independent nondegenerate perturbation theory.
7. What are negative energy states in the context of Dirac's equation?
8. How does Dirac's equation account for the spin of electrons?
9. What is the N-representation system in quantum field theory?
10. How is the non-relativistic Schrödinger equation quantized.

PART- B

Answer **all the following** questions. Each question carries **Eight** marks

5 x 8 = 40 Marks

11. (a) Discuss the postulates of quantum mechanics and their significance in the formulation of quantum theory.

OR

(b) Explain the operator method for solving the simple harmonic oscillator problem in quantum mechanics.

12. (a) Describe the quantum mechanical treatment of angular momentum and its significance.

OR

(b) Discuss the addition of angular momenta in quantum mechanics and the role of Clebsch-Gordon coefficients.

13. (a) Explain the WKB approximation and its application to potential wells and barriers?

OR

(b) Discuss the Variation Method in quantum mechanics with an application to the helium atom.

14. (a) Discuss the inadequacies of the Klein-Gordon equation and the introduction of Dirac's equation in relativistic quantum mechanics?

OR

(b) Explain the concept of probability current density in relativistic quantum mechanics?

15. (a) Explain the process of canonical quantization of fields and its importance in quantum field theory?

OR

(b) Discuss the concept of second quantization and its application to fermions and bosons.

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Question Bank
Short answer Questions

1. What are Ket and Bra notations, and how are they used in quantum mechanics?
2. Why are observables represented by Hermitian operators in quantum mechanics?
3. What are the eigenvalues and eigenfunctions of the J^2 and J_z operators?
4. How is spin angular momentum different from orbital angular momentum?
5. What is the Fermi Golden Rule, and what is its significance in quantum mechanics?
6. How is the anharmonic oscillator treated using time-independent nondegenerate perturbation theory.
7. What are negative energy states in the context of Dirac's equation?
8. How does Dirac's equation account for the spin of electrons?
9. What is the N-representation system in quantum field theory?
10. How is the non-relativistic Schrödinger equation quantized.
11. Write the Properties of Hermitian operators.
12. Find the following: $[L_x, L_y]$, $[L_z, L^2]$.
13. Find the value of the commutator $[L_+, L_-]$.
14. Write a short note on WKB approximation.
15. Write and explain the Klein – Gorden equation.

Long answer Questions

1. Discuss the postulates of quantum mechanics and their significance in the formulation of quantum theory.
2. Explain the operator method for solving the simple harmonic oscillator problem in quantum mechanics.
3. Describe the quantum mechanical treatment of angular momentum and its significance.
4. Discuss the addition of angular momenta in quantum mechanics and the role of Clebsch-Gordon coefficients.
5. Explain the WKB approximation and its application to potential wells and barriers?
6. Discuss the Variation Method in quantum mechanics with an application to the helium atom.
7. Discuss the inadequacies of the Klein-Gordon equation and the introduction of Dirac's equation in relativistic quantum mechanics?
8. Explain the concept of probability current density in relativistic quantum mechanics?
9. Explain the process of canonical quantization of fields and its importance in quantum field theory?
10. Discuss the concept of second quantization and its application to fermions and bosons.

List of Examiners

S. No.	Name of the Lecturer	Designation and College	Signature
1	Sri H. Sudheer	Lecturer in Physics, Govt. Degree College, Chodavaram	
2	Sri T. Niranjan Kumar	Lecturer in Physics, AMAL College, Anakapalli	
3	Sri K. Srimannarayana	Lecturer in Physics, Govt. Degree College, Nakkapalli	
4	Sri K. Venkanna	Lecturer in Physics, S.G.A. Govt. Degree College (A), Yellamanchili	
5	Dr. P.L. Saranya	Lecturer in Physics, Visakha Govt. Degree College for Women (A), Visakhapatnam	
6	Sri B. Prasada Rao	Lecturer in Physics, SVLNS Govt. Degree College, Bheemunipatnam	
7	Sri K. Prabhudas	Lecturer in Physics, Govt. Degree College, Sabbavaram	
8	Sri B. Mohanarao	Lecturer in Physics, Govt. Degree College (M), Srikakulam	
9	Dr. T. Swarna Latha	Lecturer in Physics, Govt. Degree College for Women, Srikakulam	
10	Sri N. Seshadri Krishna	Lecturer in Physics, Govt. Degree College, Narsipatnam	

Programme: Four Year – B.Sc. (Hons) [Stream-A]
w.e.f. A.Y. 2024-25 **COURSE CODE:**
SEMESTER-VIII (IV Year) COURSE 15A: APPLIED SPECTROSCOPY

Theory Credits: 5 6 Hrs/Week

Course Objectives: To provide students with knowledge of the principles and applications of the theoretical and practical aspects of various spectroscopic techniques in research fields.

Learning Outcomes:

Upon the successful completion of the course, students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	Explain crystal and ligand fields, crystal field theory, energy level diagrams, and correlation diagrams for transition metal ions.	Level 5 (Evaluating)
CO 2	Outline the properties of rare earth ions, Judd-Ofelt theory, radiative and non-radiative processes, and the applications of rare earth doped luminescent materials.	Level 2 (Understanding) Level 3 (Applying)
CO 3	Describe fluorescence and phosphorescence spectroscopy, normal and resonance fluorescence, non-radiative decay, and time-resolved emission spectroscopy.	Level 2 (Understanding)
CO 4	Discuss high-resolution spectroscopy techniques such as laser optogalvanic spectroscopy, matrix isolation spectroscopy, and laser cooling and their applications.	Level 6 (Create)
CO 5	Summarize the two-photon spectroscopy, selection rules, Photo acoustic spectroscopy and experimental methodology for applications in physics, chemistry, biology, and medicine.	Level 2 (Understanding) Level 6 (Create)

SYLLABUS

UNIT - I: Solid State Spectroscopy I – Transition Metal Ions 14 Hrs

Introduction – Crystal fields and ligand fields-Concept of ligand field – Scope of ligand field theory – 'd' and other orbitals (s, p, f) – Quantitative basis of crystal fields – Crystal field theory – Octahedral crystal field potential on the d-wave functions – The evaluation of 10 Dq - Effect of weak field on S, P, D and F terms. Term energy level diagrams – Correlation diagram for d^2 configuration in octahedral coordination – Tanabe-Sugano diagrams for d^2 configuration in octahedral field.

UNIT - II: Solid State Spectroscopy II – Rare Earth Ions 14 Hrs

Introduction – Intensity of absorption and emission bands – Oscillator strengths – Intra configurational f-f transitions –Selection rules – Electric and Magnetic dipole transitions – Judd - Ofelt theory and evaluation of Judd-Ofelt parameters – Radiative transition probabilities of excited states of rare earth ions – branching ratios, stimulated emission cross-sections – Non-radiative process – Energy transfer – Possible mechanisms of energy transfer – Resonance energy transfer – Process of IR to visible up-conversion – Applications of rare earth doped luminescent materials.

UNIT-III: Fluorescence and Phosphorescence Spectroscopy 13 Hrs

Introduction – Normal and Resonance Fluorescence – *Atomic beam fluorescence spectroscopy* - Intensities of Transitions – Non-radiative decay of fluorescent molecules – Phosphorescence and the nature of the triplet state – Population of the triplet state–Delayed Fluorescence – Excitation spectra – Experimental methods –Emission life time measurements – Time resolved emission spectroscopy – Applications of Fluorescence and Phosphorescence.

UNIT – IV: High Resolution Spectroscopy 12 Hrs

Introduction – Light detectors – Single photon counting technique – Phase sensitive detectors – Laser optogalvanic spectroscopy – Matrix isolation spectroscopy – Laser cooling and its applications.

UNIT – V: Two Photon Spectroscopy 12 Hrs

Introduction – two-photon absorption spectroscopy – Selection rules – *Doppler-free two-photon spectroscopy* - Expression for the two-photon absorption cross section – Photo acoustic spectroscopy – Experimental methodology and applications to Physics, Chemistry, Biology and Medicine.

List of Activities:

1. Assignments
2. Student Seminars

Recommended Books

1. Molecular spectra and Molecular Structure Vol. I, G. Herzberg, 2nd Ed, Van. Nostrand, (1950).

2. Molecular Structure and Spectroscopy, G. Aruldhas, Printice-Hall Pvt. Ltd., (2001).

3. Instrumental Methods of Analysis Willard, Merritt, Dean & Settle, CBS Pub., (2001).

4. Spectro chemical Analysis, L.H. Ahrens and S.R. Taylor, Addison Wesley, London, Pergamon, (1961).

5. Elements of Spectroscopy, Gupta, Kumar and Sharma, Pragati Prakasan, New Delhi, (2012).

6. Elements of Diatomic Molecular Spectra, H. Dunford, Addison Wesly Publishing company, (1965).

Reference Books

1. Principles of Fluorescence Spectroscopy, Joseph R. Lakowicz – Plenum Press, (1983).

2. Fundamentals of Molecular Spectroscopy, C.N. Banwell, Tata Mc Graw-Hill, (1983).

3. Spectroscopy Straughan and Walker (Vol. 2 & 3), John Wiley & Sons, (1976).

CO–PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	2	2	3	3
CO 2	3	1	1	1	1	2	3	2	3	3
CO 3	3	1	1	1	1	2	3	2	3	3
CO 4	3	1	1	1	1	2	2	2	3	3
CO 5	3	1	1	1	1	2	2	2	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	2	1	3
CO 3	3	3	2	1	3
CO 4	3	3	2	1	3
CO 5	3	3	2	1	3

Programme: Four Year – B.Sc. (Hons)
w.e.f. A.Y. 2024-25 **COURSE CODE:**
SEMESTER-VIII (IV Year) COURSE 15A: APPLIED SPECTROSCOPY

Theory Credits: 5 6 Hrs/Week

Blue Print for Semester End Theory Examinations

S. No.	Type of question	**No. of questions given**			**No. of questions to be answered**		
		No. of questions	Marks allotted to each question	Total marks	No. of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Programme: Four Year – B.Sc. (Hons)

w.e.f. A.Y. 2024-25 **COURSE CODE:**

SEMESTER-VIII (IV Year) COURSE 15A: APPLIED SPECTROSCOPY

Theory Credits: 5 6 Hrs/Week

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	**Weightage**	**Marks**	**Essay type**	**Short answer type**
Knowledge/ Remember	33 %	20	2	1 (One out of two)
Understanding/ Comprehension	27 %	16	2	
Application	20 %	12	1	1 (One out of two)
Analysis	13 %	8		2 (Two out of four)
Synthesis/ Evaluate	7 %	4		1 (One out of two)
Total	100 %	60		5 Out of 10 questions

Chapter wise Weightage				
S. No.	**Module/ Unit**	**Name of the chapter**	**8 Marks**	**4 Marks**
1	Unit – I	Solid State Spectroscopy I – Transition Metal Ions	2 (One out of two)	2
2	Unit – II	Solid State Spectroscopy II – Rare Earth Ions	2 (One out of two)	2
3	Unit – III	Fluorescence and Phosphorescence Spectroscopy	2 (One out of two)	2
4	Unit – IV	High Resolution Spectroscopy	2 (One out of two)	2
5	Unit – V	Two Photon Spectroscopy	2 (One out of two)	2

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Programme: Four Year – B.Sc. (Hons)
w.e.f. A.Y. 2024-25 **COURSE CODE:**
SEMESTER-VIII (IV Year) COURSE 15A: APPLIED SPECTROSCOPY

Theory Credits: 5 6 Hrs/Week

SEMESTER END EXAMINATIONS MODEL PAPER

Time: 3 Hrs Max. Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks.

5 x 4 = 20 Marks

1. What is the scope of ligand field theory, and how does it differ from crystal field theory?
2. Describe the effect of a weak field on S, P, D, and F terms in transition metal ions.
3. What are the selection rules for electric and magnetic dipole transitions in rare earth ions?
4. How does resonance energy transfer differ from other non-radiative processes in rare earth ions?
5. What is the difference between normal fluorescence and resonance fluorescence?
6. Describe the role of non-radiative decay processes in the fluorescence of molecules.
7. What are the key features of phase-sensitive detectors used in high-resolution spectroscopy?
8. How does laser optogalvanic spectroscopy differ from conventional spectroscopy techniques?
9. What are the advantages of two-photon absorption spectroscopy over traditional spectroscopic methods?
10. Briefly describe the experimental setup required for photoacoustic spectroscopy.

PART- B

Answer **all the following** questions. Each question carries **Eight** marks

5 x 8 = 40 Marks

11. (a) Discuss the principles of Crystal Field Theory (CFT) and explain how the octahedral crystal field potential affects the d-wave functions. Include a detailed explanation of the evaluation of the crystal field splitting parameter (10 Dq) and its significance.

    OR

    (b) Explain the correlation diagrams for a d^2 configuration in octahedral coordination. Discuss the construction and significance of Tanabe-Sugano diagrams for understanding electronic transitions in transition metal complexes.
12. (a) Explain the Judd-Ofelt theory and its importance in the evaluation of radiative transition probabilities for rare earth ions. Discuss the significance of branching ratios and stimulated emission cross-sections in the context of luminescent materials.

    OR

    (b) Describe the possible mechanisms of energy transfer in rare earth ions. Discuss the process of IR to visible up-conversion and its applications in rare earth doped luminescent materials.

13. (a) Discuss the principles of fluorescence and phosphorescence, including the nature of the triplet state and the mechanisms of delayed fluorescence. How are these phenomena utilized in time-resolved emission spectroscopy?

OR

(b) Explain the experimental methods used in fluorescence and phosphorescence spectroscopy, focusing on excitation spectra, emission lifetime measurements, and their applications in scientific research.

14. (a) Discuss the role of light detectors and single photon counting techniques in high-resolution spectroscopy. How do these methods enhance the accuracy and sensitivity of spectroscopic measurements?

OR

(b) Explain the principles and applications of laser cooling in high-resolution spectroscopy. How does matrix isolation spectroscopy contribute to the study of transient species?

15. (a) Discuss the selection rules for two-photon absorption spectroscopy and derive the expression for the two-photon absorption cross-section. How does this technique differ from single-photon absorption spectroscopy?

OR

(b) Explain the methodology of photoacoustic spectroscopy and its applications in various fields such as Physics, Chemistry, Biology, and Medicine.

Question Bank

Short answer Questions

1. What is the scope of ligand field theory, and how does it differ from crystal field theory?
2. Describe the effect of a weak field on S, P, D, and F terms in transition metal ions.
3. What are the selection rules for electric and magnetic dipole transitions in rare earth ions?
4. How does resonance energy transfer differ from other non-radiative processes in rare earth ions?
5. What is the difference between normal fluorescence and resonance fluorescence?
6. Describe the role of non-radiative decay processes in the fluorescence of molecules.
7. What are the key features of phase-sensitive detectors used in high-resolution spectroscopy?
8. How does laser optogalvanic spectroscopy differ from conventional spectroscopy techniques?
9. What are the advantages of two-photon absorption spectroscopy over traditional spectroscopic methods?
10. Briefly describe the experimental setup required for photoacoustic spectroscopy.
11. Describe the Crystal field theory.
12. Write the applications of rare earth doped luminescent materials.
13. What are the applications of Phosphorescence.
14. Define Laser cooling and write its applications.

Long answer Questions

1. Discuss the principles of Crystal Field Theory (CFT) and explain how the octahedral crystal field potential affects the d-wave functions. Include a detailed explanation of the evaluation of the crystal field splitting parameter (10 Dq) and its significance.
2. Explain the correlation diagrams for a d^2 configuration in octahedral coordination. Discuss the construction and significance of Tanabe-Sugano diagrams for understanding electronic transitions in transition metal complexes.
3. Explain the Judd-Ofelt theory and its importance in the evaluation of radiative transition probabilities for rare earth ions. Discuss the significance of branching ratios and stimulated emission cross-sections in the context of luminescent materials.
4. Describe the possible mechanisms of energy transfer in rare earth ions. Discuss the process of IR to visible up-conversion and its applications in rare earth doped luminescent materials.
5. Discuss the principles of fluorescence and phosphorescence, including the nature of the triplet state and the mechanisms of delayed fluorescence. How are these phenomena utilized in time-resolved emission spectroscopy?
6. Explain the experimental methods used in fluorescence and phosphorescence spectroscopy, focusing on excitation spectra, emission lifetime measurements, and their applications in scientific research.

7. Discuss the role of light detectors and single photon counting techniques in high-resolution spectroscopy. How do these methods enhance the accuracy and sensitivity of spectroscopic measurements?
8. Explain the principles and applications of laser cooling in high-resolution spectroscopy. How does matrix isolation spectroscopy contribute to the study of transient species?
9. Discuss the selection rules for two-photon absorption spectroscopy and derive the expression for the two-photon absorption cross-section. How does this technique differ from single-photon absorption spectroscopy?
10. Explain the methodology of photoacoustic spectroscopy and its applications in various fields such as Physics, Chemistry, Biology, and Medicine.

Dr.V.S.KRISHNA GOVT. DEGREE COLLEGE
(AUTONOMOUS)
NODAL RESOURCE CENTRE & AU CENTRE FOR RESEARCH
Maddilapalem, Visakhapatnam – 530013, Andhra Pradesh.
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List of Examiners

S. No.	Name of the Lecturer	Designation and College	Signature
1	Sri H. Sudheer	Lecturer in Physics, Govt. Degree College, Chodavaram	
2	Sri T. Niranjan Kumar	Lecturer in Physics, AMAL College, Anakapalli	
3	Sri K. Srimannarayana	Lecturer in Physics, Govt. Degree College, Nakkapalli	
4	Sri K. Venkanna	Lecturer in Physics, S.G.A. Govt. Degree College (A), Yellamanchili	
5	Dr. P.L. Saranya	Lecturer in Physics, Visakha Govt. Degree College for Women (A), Visakhapatnam	
6	Sri B. Prasada Rao	Lecturer in Physics, SVLNS Govt. Degree College, Bheemunipatnam	
7	Sri K. Prabhudas	Lecturer in Physics, Govt. Degree College, Sabbavaram	
8	Sri B. Mohanarao	Lecturer in Physics, Govt. Degree College (M), Srikakulam	
9	Dr. T. Swarna Latha	Lecturer in Physics, Govt. Degree College for Women, Srikakulam	
10	Sri N. Seshadri Krishna	Lecturer in Physics, Govt. Degree College, Narsipatnam	

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

Semester wise Revised Syllabus under CBCS 2020-21

SEMESTER- VIII

NUCLEAR AND PARTICLE PHYSICS

Theory Credits: 5 6 hrs/week

Course Objectives:

The course aims to provide a comprehensive understanding of nuclear forces and models, nuclear reactions and decays, nuclear accelerators and reactors, elementary particles, and cosmic rays.

Course Outcomes:

	On Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Understand the characteristics of nuclear forces and the different nuclear models.	Level 2
CO 2	Explain the different types of nuclear reactions, nuclear transformations through nuclear decays, interaction of gamma radiation with matter, Photoelectric effect ,Compton scattering and Pair production.	Level 4
CO 3	Describe the functioning of nuclear accelerators, nuclear reactors and classification.	Level 2
CO 4	Summarize the classification of elementary particles, their interactions, conservation laws, CPT theorem, symmetries, and Quark model.	Level 2
CO 5	Discuss cosmic rays, their origin, high energy interactions, and the interpretation of geomagnetic effects.	Level 4

SYLLUBUS

UNIT– I:

Nuclear Forces and Models 12 Hrs

Nuclear Forces: Characteristics of nuclear forces – Ground state of Deuteron – Proton – Proton scattering – Neutron – Proton scattering–Meson theory of nuclear forces.

Nuclear Models: Introduction–The liquid drop model – Bethe-Weizackersemi- empirical binding energy equation and its applications – Nuclear shell model – Energy levels and calculation of angular momentum– Collective model.

UNIT–II:

Nuclear Reactions and Decays 14 Hrs

Nuclear Reactions: Types of nuclear reactions – Compound nuclear reactions–Nuclear cross section–Resonance theory– Briet Wigner formula.

Nuclear Decays: Nuclear transformations – Radioactive decay – Alpha decay – Gamow's theory – Beta decay – Fermi theory – Selection rules – Interaction of gamma radiation with matter – Photoelectric effect – Compton scattering – Pair production.

UNIT–III:

Nuclear Accelerators and Reactors 12 Hrs

Nuclear Accelerators: Introduction – Linear accelerators – Drift tube and Wave guide accelerators –Low energy circular accelerators – Cyclotron and Betatron – High-energy circular accelerators– Synchrotron and Microtron.

Nuclear Reactors: Nuclear fission and fusion reactions – Nuclear chain reactions – Four factor formula –The critical size of a reactor – General aspects of reactor design – Classification of reactors – Power reactors (elementary aspects only).

UNIT–IV: **Elementary Particles 13 Hrs**

Discovery and classification of elementary particles–Types of interactions –Conservation laws–Iso spin, parity, charge conjugation – Time reversal – CPT theorem – Properties of leptons, mesons and baryons – Elementary particle symmetries (SU2 and SU3 symmetries) – Quark model – Search for Higg's particle –elementary ideas.

UNIT-V: Cosmic Rays 12 Hrs

Introduction, Secondary cosmic rays, geometric effects, Interpretation of geomagnetic effects, Absorption of cosmic rays, Showers, Cosmic ray primaries, high energy nuclear interactions, Extensive air showers, Origin of Cosmic rays.

Recommended Books

1. Atomic and Nuclear Physics (Vol.2), S. N. Ghoshal, S. Chand & Co.(1994).
2. Nuclear Physics, D.C.Tayal, Himalaya Pub.(1997).
3. Atomic and Nuclear Physics ,R.C. Sharma, K. Nath & Co.,Meerut(2007).
4. Nuclei and Particles, E.Segre, WABenjamin. Inc.,(1965).

Reference Books

1. Nuclear Physics, Irving Kaplan, Narosa Pub.(1998).
2. Nuclear Physics, Theory and experiment–P.R.Roy and B.P. Nigam, New AgeInt.1997.
3. Introduction to Nuclear Physics, H. A. Enge, Addison Wesley(1975).
4. Introduction to Nuclear Physics, K.S. Krane, John Wiley &Sons(1988).

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

Programme: B.Sc. Honours in Physics (Major)
Semester wise Revised Syllabus under CBCS 2020-21

SEMESTER- VIII

COURSE CODE: 24PH7YM71A
NUCLEAR AND PARTICLE PHYSICS

Theory Credits: 5 6 hrs/week

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

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

Semester wise Revised Syllabus under CBCS 2020-21

SEMESTER- VIII

COURSE CODE: 24PH7YM71A

NUCLEAR AND PARTICLE PHYSICS

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2 (two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2 (two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2 (two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5 (each question has internal choice)	5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	I	Nuclear Forces and Models	2 (one out of two)	2
2	II	Nuclear Reactions and Decays	2 (one out of two)	2
3	III	Nuclear Accelerators and Reactors	2 (one out of two)	2
4	IV	Elementary Particles	2 (one out of two)	2
5	V	Cosmic Rays	2 (one out of two)	2
			5 (each question has internal choice)	5 out of given 10

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

Semester wise Revised Syllabus under CBCS 2020-21

SEMESTER- VIII

COURSE CODE: 24PH7YM71A

NUCLEAR AND PARTICLE PHYSICS

Question Bank

Unit I: Nuclear Forces and Models

Essay Questions:

1. Discuss the characteristics of nuclear forces and their importance in maintaining the stability of atomic nuclei. How do nuclear forces differ from other fundamental forces in nature?
2. Explain the ground state of the deuteron and analyze its significance in understanding proton-proton and neutron-proton scattering. How does meson theory contribute to our understanding of nuclear forces?
3. Compare and contrast the liquid drop model and the nuclear shell model. How does the Bethe-Weizsäcker semi-empirical binding energy equation apply to these models?
4. Explore the collective model of nuclear structure. How does it account for the rotational and vibrational spectra observed in certain nuclei?

Short Questions:

1. What are the main characteristics of nuclear forces?
2. Briefly describe the ground state of the deuteron.
3. What is the Bethe-Weizsäcker semi-empirical binding energy equation used for?
4. How does the nuclear shell model explain the distribution of energy levels in a nucleus?

Unit II: Nuclear Reactions and Decays

Essay Questions:

1. Discuss the different types of nuclear reactions and their significance in nuclear physics. How does the compound nucleus concept help in understanding these reactions?
2. Explain the resonance theory and derive the Breit-Wigner formula for nuclear cross sections. How is this formula applied in the analysis of nuclear reactions?
3. Analyze the process of alpha decay and Gamow's theory. How does this theory explain the phenomenon of tunneling in alpha decay?

4. Explore the interaction of gamma radiation with matter, focusing on the photoelectric effect, Compton scattering, and pair production. How do these interactions differ in terms of energy transfer and application?

Short Questions:

1. What are the main types of nuclear reactions?
2. Briefly explain Gamow's theory of alpha decay.
3. What is the significance of the Breit-Wigner formula in nuclear physics?
4. How does Compton scattering differ from the photoelectric effect?

Unit III: Nuclear Accelerators and Reactors

Essay Questions:

1. Discuss the working principles of linear accelerators, including drift tube and waveguide accelerators. How do these devices accelerate particles to high energies?
2. Explain the operation of low-energy circular accelerators such as the cyclotron and betatron. What are their applications in nuclear physics and medicine?
3. Analyze the principles of nuclear fission and fusion reactions. How do nuclear chain reactions sustain themselves, and what role does the four-factor formula play in reactor design?
4. Explore the classification of nuclear reactors, focusing on the basic aspects of power reactors. How are these reactors designed to ensure safety and efficiency?

Short Questions:

1. What is the basic principle behind a cyclotron?
2. Briefly describe the four-factor formula used in nuclear reactor design.
3. What is the difference between nuclear fission and fusion reactions?
4. How do synchrotrons differ from cyclotrons in terms of particle acceleration?

Unit IV: Elementary Particles

Essay Questions:

1. Discuss the discovery and classification of elementary particles. How do conservation laws and quantum numbers help in categorizing these particles?
2. Explain the concepts of isospin, parity, and charge conjugation in particle physics. How do these properties influence the interactions and decays of elementary particles?

3. Analyze the importance of elementary particle symmetries, focusing on SU(2) and SU(3) symmetries. How do these symmetries contribute to our understanding of the strong interaction?
4. Explore the quark model and the search for the Higgs particle. How has the discovery of the Higgs boson impacted our understanding of the Standard Model of particle physics?

Short Questions:

1. What are the main types of interactions in particle physics?
2. Briefly explain the significance of the CPT theorem.
3. What is the quark model, and how does it classify baryons and mesons?
4. How does the discovery of the Higgs boson support the Standard Model?

Unit V: Cosmic Rays

Essay Questions:

1. Discuss the origin and composition of cosmic rays. How do primary cosmic rays differ from secondary cosmic rays?
2. Explain the geometric and geomagnetic effects observed in cosmic ray studies. How do these effects influence the detection and interpretation of cosmic rays?
3. Analyze the phenomenon of extensive air showers produced by high-energy cosmic rays. How do these showers contribute to our understanding of high-energy nuclear interactions?
4. Explore the absorption of cosmic rays in the Earth's atmosphere. How does this process help in studying the properties and origins of cosmic rays?

Short Questions:

1. What are secondary cosmic rays, and how are they formed?
2. Briefly describe the geomagnetic effects observed in cosmic ray studies.
3. What is an extensive air shower in the context of cosmic rays?
4. How do cosmic rays interact with the Earth's atmosphere?

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

Semester wise Revised Syllabus under CBCS 2020-21

SEMESTER- VIII

COURSE CODE: 24PH7YM71A

NUCLEAR AND PARTICLE PHYSICS

Theory | Credits: 5 | 6 hrs/week

Model Question Paper

Duration: 3Hrs | **Max Marks: 60**

Section A

Answer any five questions from the following (4M$\times$ $5 = 20M$)

1. What are the main characteristics of nuclear forces?
2. Briefly describe the ground state of the deuteron.
3. Briefly explain Gamow's theory of alpha decay.
4. What is the significance of the Breit-Wigner formula in nuclear physics?
5. Briefly describe the four-factor formula used in nuclear reactor design.
6. What is the difference between nuclear fission and fusion reactions?
7. What is the quark model, and how does it classify baryons and mesons?
8. How does the discovery of the Higgs boson support the Standard Model?
9. Briefly describe the geomagnetic effects observed in cosmic ray studies.
10. What is an extensive air shower in the context of cosmic rays?

Section B

Answer all the questions (8M$\times$ $5 = 50M$)

11. (a)Discuss the characteristics of nuclear forces and their importance in maintaining the stability of atomic nuclei. How do nuclear forces differ from other fundamental forces in nature?

(OR)

(b)Explore the collective model of nuclear structure. How does it account for the rotational and vibrational spectra observed in certain nuclei?

12. (a)Explain the resonance theory and derive the Breit-Wigner formula for nuclear cross sections. How is this formula applied in the analysis of nuclear reactions?

(OR)

(b)Analyze the process of alpha decay and Gamow's theory. How does this theory explain the phenomenon of tunneling in alpha decay?

13. (a)Explain the operation of low-energy circular accelerators such as the cyclotron and betatron. What are their applications in nuclear physics and medicine?

(OR)

(b)Analyze the principles of nuclear fission and fusion reactions. How do nuclear chain reactions sustain themselves, and what role does the four-factor formula play in reactor design?

14. (a)Explain the concepts of isospin, parity, and charge conjugation in particle physics. How do these properties influence the interactions and decays of elementary particles?

(OR)

(b)Explore the quark model and the search for the Higgs particle. How has the discovery of the Higgs boson impacted our understanding of the Standard Model of particle physics?

15. (a)Analyze the phenomenon of extensive air showers produced by high-energy cosmic rays. How do these showers contribute to our understanding of high-energy nuclear interactions?

(OR)

(b)Explore the absorption of cosmic rays in the Earth's atmosphere. How does this process help in studying the properties and origins of cosmic rays?

Programme: B.Sc. Honours in Physics (Major)
(w.e.f. AY 2023-24)
SEMESTER- VIII

MICROPROCESSOR & MICROCONTROLLERS

Theory Credits: 5 6 hrs/week

Course Objectives:

To provide students with the knowledge of Microprocessors and Microcontrollers, their architecture, programming, memory and I/O interface, interrupts and impart practical skills using assembly language programming tools.

Learning Outcomes:

	On Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Describe the internal architecture of microprocessors, memory addressing modes, and instruction sets.	Level 1
CO 2	Create programs for microprocessors and explain hardware specifications.	Level 6
CO 3	Develop interface with memory devices, decode addresses, and explain basic I/O interface concepts.	Level 6
CO 4	Discuss interrupt processing, hardware interrupts, direct memory access, and bus interfaces.	Level 1
CO 5	Outline the internal architecture, and use assembly language programming tools for the 8051 microcontroller	Level 3

SYLLABUS

UNIT- I: Microprocessors and its Architecture 8 Hrs

Internal microprocessor architecture, Real mode and protected modes of memory addressing, Memory paging. Addressing modes -Data addressing modes, program memory – addressing modes, Stack – memory addressing modes. Instruction Set - Data movement instruction, Arithmetic and logic Instruction, Program control instructions, Assembler details. Instruction Pipelining and Hazards in Microprocessors

UNIT–II: Programming the Microprocessor 8 Hrs

Modular programming, using the keyboard and video display, Data conversions. Hardware Specifications - Pin - outs and the pin functions, clock - generator (8284A), Bus buffering and latching, Bus timing, Ready and Wait state, Minimum mode versus maximum mode. Debugging Techniques and Tools for Microprocessor Programming

UNIT–III: Memory Interface 8 Hrs

Memory devices, Address decoding, 8088 and 80188 (8-bit) memory interface, 8086, 80186, 80286 and 80386 (16-bit) memory interface.Basic I/O Interface - Introducing to I/interface, I/O port address decoding, 8255, 8279, 8254, ADC and DAC (excluding multiplexed display & keyboard display using 8255). Cache Memory and its Interface with Microprocessors

UNIT–IV: Interrupts 7 Hrs

Basic interrupt processing, Hardware interrupts, expanding the interrupt structure, 8259 APIC. Direct Memory Access - Basic DMA operation, 8237 DMA controller. Bus Interface –PCI bus.

UNIT–V: 8051 Microcontrollers 8 Hrs

Introduction of Microprocessors and Microcontrollers, Microcontroller: 8051 Internal Architecture, Register Structure, I/O pins, Memory Organization, 8051 addressing modes. 8051 Assembly Language Programming Tools.

List of Activities:

Assignments

Student Seminars

Reference Books:

1. Yu Cheng Lin and Glenn A. Gibson, "Microcomputer Systems: The8086/8088 Family Architecture, Programming and Design", PHI,1992.
2. B.B. Brey, "The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486,Pentium and Pentium pro processor architecture, programming and interfacing", 4/e, PHI,1999.
3. K.J.Ayala, "The 8086 Microprocessor : Programming & Interfacing the PC" Penram International Publishing(India) Pvt.Ltd., 1995.
4. Douglas V.Hall, "Micro processors and Interfacing, Programming and Hardware", 2/e, McGraw Hill, International Edition, 1992.
5. Muhammad Ali Mazidi and Janice Gillispie Mazidi,"The80x86IBMPC and Compatible Computers,(VolumesI&II)". 2/e, Printice–Hall,Inc., 1998.
6. WalterA. Triebel and Avatar Singh, "Software, Hardware and Applications"PHI,1995.

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

SEMESTER- VIII

COURSE CODE: 24PH7YM72A

MICROPROCESSOR & MICROCONTROLLERS

Theory Credits: 5 6 hrs/week

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

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

(w.e.f. AY 2023-24)

SEMESTER II

COURSECODE: 24ELEM22

CIRCUIT THEORY AND ELECTRONIC DEVICES

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2 (two out of four)	I (one out of two)
Understanding/Comprehension	27%	16	2 (two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2 (two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5 (each question has internal choice)	5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	I	Microprocessors and its Architecture	2 (one out of two)	2
2	II	Programming the Microprocessor	2 (one out of two)	2
3	III	Memory Interface	2 (one out of two)	2
4	IV	Interrupts	2 (one out of two)	2
5	V	8051 Microcontrollers	2 (one out of two)	2
			5 (each question has internal choice)	5 out of given 10

Programme: B.Sc. Honours in Physics (Major)
w.e.f. AY 2023-24
SEMESTER- VIII
COURSE CODE: 24PH7YM72A

MICROPROCESSOR & MICROCONTROLLERS

Question Bank

Unit I: Microprocessors and Its Architecture

Essay Questions

1. Describe the internal architecture of a microprocessor, highlighting the key components and their functions. Discuss how these components interact to perform basic operations.
2. Explain the differences between real mode and protected mode memory addressing in microprocessors. Include examples of scenarios where each mode would be utilized.
3. Discuss the concept of memory paging in microprocessors. How does memory paging enhance memory management, and what are its advantages and disadvantages?
4. Analyze the different types of addressing modes in microprocessors, including data addressing modes, program memory addressing modes, and stack memory addressing modes. Provide examples for each type.

Short Answer Questions

1. What is the function of the control unit in a microprocessor?
2. Define real mode memory addressing and provide an example of its use.
3. Explain the purpose of stack memory addressing modes in microprocessors.
4. What is the significance of the instruction set in a microprocessor, and what are its main categories?

Unit II: Programming the Microprocessor

Essay Questions

1. Describe the principles of modular programming in the context of microprocessor programming. How does modular programming improve code organization and maintainability?
2. Explain the process of data conversions in microprocessor programming. Discuss the importance of data conversions and provide examples of common conversion operations.

3. Detail the pin-out configuration and functions of the clock generator 8284A. How does the clock generator contribute to the overall operation of a microprocessor?
4. Compare and contrast the minimum mode and maximum mode configurations of the 8086 microprocessor. Discuss the scenarios in which each mode would be preferable.

Short Answer Questions

1. What is modular programming and why is it beneficial in microprocessor programming?
2. Name the key components of the clock generator 8284A and their functions.
3. Describe the purpose of bus buffering and latching in a microprocessor system.
4. What is the difference between the Ready and Wait states in microprocessor operations?

Unit III: Memory Interface

Essay Questions

1. Explain the different types of memory devices used in microprocessor systems. Discuss the advantages and limitations of each type.
2. Describe the process of address decoding in memory interfacing. Why is address decoding crucial for memory operations in microprocessor systems?
3. Analyze the memory interfacing techniques for 8-bit microprocessors (8088 and 80188) and 16-bit microprocessors (8086, 80186, 80286, and 80386). Highlight the key differences and similarities.
4. Discuss the role and functionality of I/O port address decoding in basic I/O interfacing. Provide examples of how specific I/O devices are interfaced with a microprocessor.

Short Answer Questions

1. What is address decoding and why is it important in memory interfacing?
2. List the key differences between 8-bit and 16-bit memory interfaces in microprocessors.
3. What is the function of the 8255 Programmable Peripheral Interface in microprocessor systems?
4. Explain the purpose of the ADC (Analog-to-Digital Converter) in microprocessor interfacing.

Unit IV: Interrupts

Essay Questions

1. Describe the basic interrupt processing mechanism in microprocessors. How do hardware interrupts differ from software interrupts?

2. Explain the structure and functionality of the 8259 Programmable Interrupt Controller (PIC). How does it enhance interrupt handling in microprocessor systems?
3. Discuss the concept and operation of Direct Memory Access (DMA). How does the 8237 DMA controller facilitate DMA operations in microprocessors?
4. Analyze the PCI bus interface in microprocessor systems. What are its key features and advantages compared to other bus interfaces?

Short Answer Questions

1. What is the primary function of hardware interrupts in a microprocessor system?
2. How does the 8259 Programmable Interrupt Controller (PIC) improve interrupt management?
3. Describe the basic operation of Direct Memory Access (DMA).
4. What are the main advantages of using the PCI bus interface in microprocessor systems?

Unit V: 8051 Microcontrollers

Essay Questions

1. Describe the internal architecture of the 8051 microcontroller. Highlight the key components and their roles in microcontroller operations.
2. Explain the memory organization in the 8051 microcontroller. How is memory divided and accessed in this microcontroller?
3. Discuss the different addressing modes available in the 8051 microcontroller. Provide examples of instructions for each addressing mode.
4. Analyze the tools and techniques used for assembly language programming in the 8051 microcontroller. How do these tools aid in the development and debugging of microcontroller programs?

Short Answer Questions

1. What are the key components of the 8051 microcontroller's internal architecture?
2. Define the register structure of the 8051 microcontroller.
3. List and briefly describe the different addressing modes of the 8051 microcontroller.
4. What is the significance of assembly language programming in the context of 8051 microcontrollers?

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

w.e.f. AY 2023-24

SEMESTER- VIII

COURSE CODE: 24PH7YM72A

MICROPROCESSOR & MICROCONTROLLERS

Theory | Credits: 5 | 6 hrs/week

Model Question Paper

Duration: 3Hrs **Max Marks: 60**

Section A

Answer any five questions from the following (4M$\times$ $5 = 20M$)

1. What is the function of the control unit in a microprocessor?
2. Define real mode memory addressing and provide an example of its use.
3. Name the key components of the clock generator 8284A and their functions.
4. Describe the purpose of bus buffering and latching in a microprocessor system.
5. List the key differences between 8-bit and 16-bit memory interfaces in microprocessors.
6. What is the function of the 8255 Programmable Peripheral Interface in microprocessor systems?
7. What is the primary function of hardware interrupts in a microprocessor system?
8. How does the 8259 Programmable Interrupt Controller (PIC) improve interrupt management?
9. List and briefly describe the different addressing modes of the 8051 microcontroller.
10. What is the significance of assembly language programming in the context of 8051 microcontrollers?

Section B

Answer all the questions (8M$\times$ $5 = 50M$)

11. **(a)** Describe the internal architecture of a microprocessor, highlighting the key components and their functions. Discuss how these components interact to perform basic operations.

(OR)

(b). Explain the differences between real mode and protected mode memory addressing in microprocessors. Include examples of scenarios where each mode would be utilized.

12. (a) Describe the principles of modular programming in the context of microprocessor programming. How does modular programming improve code organization and maintainability?

(OR)

(b). Explain the process of data conversions in microprocessor programming. Discuss the importance of data conversions and provide examples of common conversion operations.

13. (a). Describe the process of address decoding in memory interfacing. Why is address decoding crucial for memory operations in microprocessor systems?

(OR)

(b) Analyze the memory interfacing techniques for 8-bit microprocessors (8088 and 80188) and 16-bit microprocessors (8086, 80186, 80286, and 80386). Highlight the key differences and similarities.

14. (a). Discuss the concept and operation of Direct Memory Access (DMA). How does the 8237 DMA controller facilitate DMA operations in microprocessors?

(OR)

(b). Analyze the PCI bus interface in microprocessor systems. What are its key features and advantages compared to other bus interfaces?

15. (a). Explain the memory organization in the 8051 microcontroller. How is memory divided and accessed in this microcontroller?

(OR)

(b) Discuss the different addressing modes available in the 8051 microcontroller. Provide examples of instructions for each addressing mode.

(COURSE CODE: 24PHYM53A)

Dr. VS KRISHNA GOVT. DEGREE COLLEGE (A), VISHAKAPATNAM

BLUE PRINT

Semester wise Revised Syllabus under CBCS 2020-21
Four Year – B.Sc. (Hons), STREAM A (VIII-SEMESTER)
Domain Subject: PHYSICS
PROGRAMME: 18A: MODERN OPTICS (Skill Oriented)

MAX MARKS – 60 TIME – 3 HOURS (CREDITS- 3)

S.NO	UNIT	TOPIC	ESSAY TYPE QUESTIONS (SECTION-B) Each one 8 marks	SHORT ANSWER QUESTIONS (SECTION-A) Each one 4 marks
1	I	**Interaction of Radiation with Matter**	1	2
2	II	**Lasers**	1	2
3	III	**Non-Linear Optics**	1	2
4	IV	**Holography and Fourier Optics**	1	2
5	V	**Fiber Optics**	1	2
			5 (internal choice)	5 (five to be answered out of ten questions)

$$\boldsymbol{Percentage\ of\ choice} = \frac{\mathbf{120-60}}{\mathbf{120}} \times \mathbf{100} = \mathbf{50\%}$$

(COURSE CODE: 24PHYM53A)

Semester wise Revised Syllabus under CBCS 2020-21
Four Year – B.Sc. (Hons), STREAM A (VIII-SEMESTER)
Domain Subject: PHYSICS

18A: MODERN OPTICS (Skill Oriented)

Hours/Week: 3
Credits: 3

Course Objectives:

To provide students with the knowledge of the interaction of radiation with matter, working principles of lasers and their applications, non-linear optics, holography, Fourier optics, fiber optics, and their applications in modern optics.

Course Outcomes:

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

CO1: Explain the interaction of radiation with matter through time-dependent perturbation theory, Quantum electrodynamics, and creation and annihilation operators.

CO2: Describe various concepts of lasers, threshold conditions for laser oscillation, working of various lasers and applications.

CO3: Outline basic principles of non-linear optics, optical mixing, and self-focusing of light guided wave optics and pulse compression.

CO4: Discuss recording and reconstruction of holograms, basics of Fourier optics, and Fraunhouffer diffraction.

CO5: Summarize the principles, modes and configuration of optical fibers, fiber materials and fabrication, properties, and applications of optical fibers in communication and medicine.

SYLLABUS

UNIT– I: Interaction of Radiation with Matter

8 Hrs

Types of Radiation , Time dependent Perturbation Theory, Electric Dipole interaction-Quantum electrodynamics, creation and annihilation operators- Fock states-Quantation of the field-Zero Point Energy- Coherent-state description of the electromagnetic field-interaction of radiation with matter. ***Interaction Mechanisms, ionization, excitation, Compton scattering, photo-electric effect , pair production. Applications and Implications.***

(COURSE CODE: 24PHYM53A)

UNIT–II: Lasers

7 Hrs

Introduction to lasers – Spontaneous and stimulated emission – Laser beam properties – Einstein coefficients – Population inversion – Pumping schemes – Losses in laser radiation – Threshold condition for laser oscillation – Laser cavity - Q factor– different experimental methods – Ruby laser- He-Ne laser– Argon ion laser– CO_2 laser–Laser applications. ***Types of LASER (Qualitative only).***

UNIT-III: **Non-Linear Optics**

7 Hrs

Basic Principles – Origin of optical nonlinearity - ***Key Concepts in Nonlinear Optics*** - Harmonic generation – Second harmonic generation–Phase matching condition–Third harmonic generation– Optical mixing–Parametric generation of light –Parametric light oscillator – Frequency up conversion – Self focusing of light –Guided wave optics-Pulse compression -Optical solutions. ***Applications of Nonlinear Optics***

UNIT–IV: Holography and Fourier Optics

8 Hrs

Introduction to Holography- Recording: ***Setup, Reference and Object Beams, Interference Pattern,*** and reconstruction: ***Illumination, 3D Image Formation of Hologram***– Speckle pattern–Fresnel and Fourier transform Holography–Applications of Holography- Introduction to Fourier optics – Two-dimensional Fourier transforms – Transforms of Dirac-delta function- Fraunhouffer diffraction. ***Connection Between Holography and Fourier Optics.***

UNIT–V: Fiber Optics

8 Hrs

Total internal reflection - Basic Structure, Optical fiber modes and configuration – ***Types of Optical Fibers:*** Single mode fibers – Graded index fiber structure – Fiber materials and fabrication – Mechanical properties of fibers – Attenuation - Erbium doped fiber amplifiers – Solitons in optical fibers -–Applications of optical fibers in communication and medicine. ***Fiber Optic Communication.*** Block diagram of fiber optic communication system

List of Activities:

(COURSE CODE: 24PHYM53A)

1. Assignments
2. Student Seminars
3. Applications related to theory

Recommended Books

1. Lasers and Non-Linear Optics, B. B. Laud, Wiley Eastern Ltd.,1983
2. Optics,E.Hecht,AddisonWiley,1974
3. Laser Fundamentals –By William T. Silfvast. , Cambridge University Press

Reference Books

1. Introduction to Modern Optics, G.R. Fowels,2012
2. LasersandtheirApplications,M.J.Beesly,TaylorandFrancis,1976
3. Optical Fiber Communications,G.Keiser,McGrawHillBook,2000
4. Optical Physics by Stephen G Lipson, Ariel Lipson, Henry Lipson, Cambridge University Press

(COURSE CODE: 24PHYM53A)

Semester wise Revised Syllabus under CBCS 2020-21
Four Year – B.Sc. (Hons), STREAM A (VIII-SEMESTER)

Domain Subject: PHYSICS

18A: MODERN OPTICS (Skill Oriented)

Theory Credits: 3 3 hrs/week

Model Paper

Max Marks: 60

Section A

Answer any five questions from the following **(4M$\times 5 = 20M$)**

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

Section B

Answer all the questions (8M$\times 5 = 40M$)

11. (A)

(OR)

(B)

12. (A)

(OR)

(COURSE CODE: 24PHYM53A)

(B)

13. (A)

(OR)

(B)

14. (A)

(OR)

(B)

15. (A)

(OR)

(B)

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

Semester wise Revised Syllabus under CBCS 2020-21

SEMESTER- VIII

MODERN OPTICS

Theory Credits: 3 3 hrs/week

Course Objectives:

To provide students with the knowledge of the interaction of radiation with matter, working principles of lasers and their applications, non-linear optics, holography, Fourier optics, fiber optics, and their applications in modern optics.

Course Outcomes:

	On Completion of the course, the students will be able to	Knowledge level (Bloom's Taxonomy)
CO 1	Explain the interaction of radiation with matter through time dependent perturbation theory, Quantum electrodynamics, and creation and annihilation operators.	Level 1
CO 2	Understand various concepts of lasers, threshold conditions for laser oscillation, working of various lasers and applications.	Level 2
CO 3	Outline basic principles of non-linear optics, optical mixing, and self-focusing of light guided wave optics and pulse compression.	Level 1
CO 4	Analyze recording and reconstruction of holograms, basics of Fourier optics, and Fraunhofer diffraction	Level 4
CO 5	Summarize the principles, modes and configuration of optical fibers, fiber materials and fabrication, properties, and applications of optical fibers in communication and medicine.	Level 3

SYLLABUS

UNIT– I: Interaction of Radiation with Matter 8 Hrs

Time dependent Perturbation Theory, Electric Dipole interaction-Quantum electrodynamics, -creation and annihilation operators- Fock states-Quantation of the field-Zero Point Energy Coherent-state description of the electromagnetic field-interaction of radiation with matter.

UNIT–II: Lasers 7 Hrs

Introduction to lasers – Spontaneous and stimulated emission – Laser beam properties – Einstein coefficients – Population inversion – Pumping schemes – Losses in laser radiation – Threshold condition for laser oscillation – Laser cavity - Q factor– different experimental methods – Ruby laser- He-Ne laser– Argon ion laser– CO2 laser–Laser applications.

UNIT-III: **Non-Linear Optics 7 Hrs**

Basic Principles – Origin of optical nonlinearity - Harmonic generation – Second harmonic generation–Phase matching condition–Third harmonic generation– Optical mixing– Parametric generation of light – Parametric light oscillator – Frequency up conversion – Self focusing of light .

UNIT–IV: Holography and Fourier Optics 8 Hrs

Introduction to Holography- Recording and reconstruction of Hologram– Speckle pattern– Frenel and Fourier transform Holography– Applications of Holography- Introduction to Fourier optics – Two-dimensional Fourier transforms.

UNIT–V: Fiber Optics 8 Hrs

Total internal reflection - Optical fiber modes and configuration – Single mode fibers – Graded index fiber structure – Fiber materials and fabrication – Mechanical properties of fibers – Attenuation - Erbium doped fiber amplifiers – Solitons in optical fibers - Block diagram of fiber optic communication system –Applications of optical fibers in communication and medicine.

List of Activities:

Assignments

Student Seminars

Applications related to theory

Recommended Books

1. Lasers and Non-Linear Optics, B. B. Laud, Wiley Eastern Ltd.,1983
2. Optics,E.Hecht,AddisonWiley,1974
3. Laser Fundamentals –By William T. Silfvast. , Cambridge University Press

Reference Books

1. Introduction to Modern Optics, G.R. Fowels,2012
2. LasersandtheirApplications,M.J.Beesly,TaylorandFrancis,1976
3. Optical Fiber Communications,G.Keiser,McGrawHillBook,2000
4. Optical Physics by Stephen G Lipson, Ariel Lipson, Henry Lipson, Cambridge University Press

CO-PO Mapping
1- Low, 2- Moderate, 3- High, ‘-‘ No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	2	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	2	3	3	3	3

CO-PSO Mapping					
1- Low, 2- Moderate, 3- High, ‘-‘ No Correlation					
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	2
CO 2	3	3	2	1	2
CO 3	3	3	2	1	2
CO 4	3	3	2	1	2
CO 5	3	3	2	1	2

Programme: B.Sc. Honours in Physics(Major)
Semester wise Revised Syllabus under CBCS 2020-21

SEMESTER- VIII
COURSE CODE: 24PHYM73A
MODERN OPTICS
Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

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

Semester wise Revised Syllabus under CBCS 2020-21

SEMESTER- VIII
COURSE CODE: 24PHYM73A
MODERN OPTICS

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2 (two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2 (two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2 (two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5 (each question has internal choice)	5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	I	**Interaction of Radiation with Matter**	2 (one out of two)	2
2	II	**Lasers**	2 (one out of two)	2
3	III	**Non-Linear Optics**	2 (one out of two)	2
4	IV	**Holography and Fourier Optics**	2 (one out of two)	2
5	V	**Fiber Optics**	2 (one out of two)	2
			5 (each question has internal choice)	5 out of given 10

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

Semester wise Revised Syllabus under CBCS 2020-21

SEMESTER- VIII
COURSE CODE: 24PHYM73A
MODERN OPTICS
Question Bank

Unit I: Interaction of Radiation with Matter

Essay Questions:

1. Discuss the principles of time-dependent perturbation theory and its application to understanding the interaction of radiation with matter.
2. Explain the concept of electric dipole interaction in quantum electrodynamics. How do creation and annihilation operators contribute to the quantization of the electromagnetic field?
3. Analyze the concept of Zero Point Energy and its significance in the coherent-state description of the electromagnetic field.
4. Explore the role of Fock states in the quantization of the electromagnetic field and their interaction with matter. How do these concepts apply to real-world phenomena?

Short Questions:

1. What is the significance of time-dependent perturbation theory in quantum mechanics?
2. Briefly describe the role of creation and annihilation operators in quantum electrodynamics.
3. What are Fock states, and how do they relate to the quantization of the electromagnetic field?
4. Explain the concept of Zero Point Energy in the context of quantum electrodynamics.

Unit II: Lasers

Essay Questions:

1. Discuss the principles of spontaneous and stimulated emission in lasers. How do these processes contribute to the operation of a laser?
2. Explain the importance of the Einstein coefficients in laser physics. How do these coefficients relate to population inversion and the threshold condition for laser oscillation?
3. Compare the construction and operation of different types of lasers, such as Ruby, He-Ne, Argon ion, and CO_2 lasers. What are their specific applications?
4. Analyze the factors that influence the Q factor and losses in laser cavities. How do these factors affect the efficiency and stability of laser oscillations?

Short Questions:

1. What is the difference between spontaneous and stimulated emission?
2. Briefly explain the concept of population inversion in lasers.
3. What is the significance of the threshold condition for laser oscillation?
4. Name two key applications of CO2 lasers in industry.

Unit III: Non-Linear Optics

Essay Questions:

1. Discuss the origin of optical nonlinearity and its impact on the propagation of light in nonlinear optical media.
2. Explain the process of harmonic generation, including second and third harmonic generation. How does phase matching condition play a crucial role in these processes?
3. Analyze the principles of parametric generation of light and the operation of parametric light oscillators. How do these devices contribute to frequency upconversion?
4. Explore the phenomenon of self-focusing of light in nonlinear optics. How does this effect influence the design and application of guided wave optics and pulse compression techniques?

Short Questions:

1. What is the basic principle behind second harmonic generation?
2. Briefly describe the concept of optical mixing in nonlinear optics.
3. What is parametric generation of light, and how is it achieved?
4. Explain the significance of phase matching in harmonic generation.

Unit IV: Holography and Fourier Optics

Essay Questions:

1. Discuss the principles of holography, focusing on the process of recording and reconstructing a hologram. How does this technology differ from traditional photography?
2. Explain the concepts of Fresnel and Fourier transform holography. How are these techniques applied in modern imaging systems?
3. Analyze the applications of holography in various fields, such as data storage, security, and medical imaging. What are the advantages of using holography in these applications?
4. Explore the role of Fourier optics in the analysis of optical systems. How does the Fourier transform of a Dirac-delta function relate to Fraunhofer diffraction?

Short Questions:

1. What is the basic principle of holography?
2. How does Fourier transform holography differ from Fresnel holography?
3. Briefly describe a common application of holography in the medical field.
4. What is the significance of Fraunhofer diffraction in Fourier optics?

Unit V: Fiber Optics

Essay Questions:

1. Discuss the principles of total internal reflection and how it enables light transmission in optical fibers. How do single-mode and graded-index fibers differ in structure and application?
2. Explain the materials and fabrication processes used in the production of optical fibers. How do these factors influence the mechanical properties and attenuation characteristics of the fibers?
3. Analyze the role of Erbium-doped fiber amplifiers (EDFAs) in fiber optic communication systems. How do solitons in optical fibers contribute to long-distance communication?
4. Explore the applications of optical fibers in communication and medicine. How does the block diagram of a fiber optic communication system illustrate the key components and functions?

Short Questions:

1. What is the difference between single-mode and graded-index optical fibers?
2. Briefly describe the process of total internal reflection in optical fibers.
3. What is the role of Erbium-doped fiber amplifiers in optical communication?
4. How are optical fibers used in medical imaging?

Programme: B.Sc. Honours in Physics(Major)
Semester wise Revised Syllabus under CBCS 2020-21

SEMESTER- VIII
COURSE CODE: 24PHYM73A
MODERN OPTICS

Model Question Paper

Duration: 3Hrs **Max Marks: 60**

Section A

Answer any five questions from the following (4M$\times$ $5 = 20M$)

1. What is the significance of time-dependent perturbation theory in quantum mechanics?
2. Briefly describe the role of creation and annihilation operators in quantum electrodynamics.
3. What is the significance of the threshold condition for laser oscillation?
4. Name two key applications of CO2 lasers in industry.
5. Briefly describe the concept of optical mixing in nonlinear optics.
6. What is parametric generation of light, and how is it achieved?
7. What is the basic principle of holography?
8. How does Fourier transform holography differ from Fresnel holography?
9. Briefly describe the process of total internal reflection in optical fibers.
10. What is the role of Erbium-doped fiber amplifiers in optical communication?

Section B

Answer all the questions (8M$\times$ $5 = 50M$)

11. (a)Discuss the principles of time-dependent perturbation theory and its application to understanding the interaction of radiation with matter.

(OR)

(b)Explain the concept of electric dipole interaction in quantum electrodynamics. How do creation and annihilation operators contribute to the quantization of the electromagnetic field?

12. (a)Explain the importance of the Einstein coefficients in laser physics. How do these coefficients relate to population inversion and the threshold condition for laser oscillation?

(OR)

(b)Compare the construction and operation of different types of lasers, such as Ruby, He-Ne, Argon ion, and CO_2 lasers. What are their specific applications?

13. (a)Discuss the origin of optical nonlinearity and its impact on the propagation of light in nonlinear optical media.

(OR)

(b)Explain the process of harmonic generation, including second and third harmonic generation. How does phase matching condition play a crucial role in these processes?

14. (a)Analyze the applications of holography in various fields, such as data storage, security, and medical imaging. What are the advantages of using holography in these applications?

(OR)

(b)Explore the role of Fourier optics in the analysis of optical systems. How does the Fourier transform of a Dirac-delta function relate to Fraunhofer diffraction?

15. (a)Analyze the role of Erbium-doped fiber amplifiers (EDFAs) in fiber optic communication systems. How do solitons in optical fibers contribute to long-distance communication?

(OR)

(b)Explore the applications of optical fibers in communication and medicine. How does the block diagram of a fiber optic communication system illustrate the key components and functions?

Dr. VS KRISHNA GOVT. DEGREE COLLEGE (A), VISHAKAPATNAM

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Semester wise Revised Syllabus under CBCS 2020

Four Year – B.Sc. (Hons), STREAM B (VIII-SEMESTER)

Domain Subject: PHYSICS

Programme: 14B: FIBRE OPTICS

MAX MARKS – 60 TIME – 3 HOURS (CREDITS- 4)

S.NO	UNIT	TOPIC	ESSAY TYPE QUESTIONS (SECTION-B) Each one 8 marks	SHORT ANSWER QUESTIONS (SECTION-A) Each one 4 marks
1	I	**Overview of Optical Fiber Communication**	1	2
2	II	**Transmission Characteristics of Optical Fibers**:	1	2
3	III	**Optical Sources and Detectors**	1	2
4	IV	**Fiber Couplers and Connectors**	1	2
5	V	**Optical Amplifiers and Networks**	1	2
			5 (internal choice)	10 (five to be answered out of TEN questions)
		marks	5×8=40 (With choice)	5×4=20 (With choice)
			10×8=80 Total	5×8=40 Total

$$\boldsymbol{Percentage\ of\ choice} = \frac{\mathbf{120-60}}{\mathbf{120}} \times \mathbf{100} = \mathbf{50\%}$$

Semester wise Revised Syllabus under CBCS 2020
Four Year – B.Sc. (Hons), STREAM B (VIII-SEMESTER)
Domain Subject: PHYSICS

14B: FIBRE OPTICS

Hours/Week: 6
Credits: 5

Course Objectives: To familiarize students with the basics of Fiber Optics technology, its working principle, fiber materials, transmission Characteristics optical sources, detectors, couplers, connectors, amplifiers and optical networks.

Course Outcomes
Upon the successful completion of the course, students will be able to:

CO1: Outline the overview of optical fiber communication.

CO2: Describe the transmission characteristics of optical fibers.

CO3: Discuss the principles of optical sources and detectors and differentiate LEDs from laser diodes.

CO4: Summarize the principles of fiber couplers and connectors. **CO5:**
Analyze the principles of optical amplifiers and Networks.

SYLLABUS

UNIT - I Overview of Optical Fiber Communication: **14 Hrs**
Introduction, ***History and evolution, Comparison with other communication media,*** Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber (no derivations in article 2.4.4), single mode fiber, cut-off wavelength and mode field diameter. Optical Fibers: ***Fiber Optic Components,*** fiber materials, photonic crystal, fiber optic cables specialty fibers.

UNIT - II Transmission Characteristics of Optical Fibers: **12 Hrs** Introduction, ***Total internal reflection, Attenuation and dispersion.*** Attenuation, absorption, scattering losses, bending loss, dispersion, Intra modal dispersion, Inter modal dispersion.

Unit - III Optical Sources and Detectors: **12 Hrs** Introduction, LED's, LASER diodes, Photo detectors, Photo detector noise, Response time, double hetero junction structure, Photo diodes, comparison of photo detectors. ***PIN Photodiodes, Avalanche Photodiodes (APDs)***

UNIT - IV Fiber Couplers and Connectors: **12 Hrs**
Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers. ***Types of connectors, Splicing methods (fusion and mechanical)***

UNIT - V Optical Amplifiers and Networks: **14 Hrs**

Optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA. Optical Networks: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, High – speed light – waveguides.

Telecommunications, Role in global networks,Future trends and innovations

List of Activities:

1. Assignments
2. Student Seminars

Recommended Books

1. Optical Fiber Communication – Gerd Keiser, 4th Ed., MGH, 2008.
2. Optical Fiber Communications– – John M. Senior, Pearson Education. 3 rd. Impression, 2007.

Reference Books

1. Fiber optic communication – Joseph C Palais: 4th Edition, Pearson Education.
2. Introduction to Fiber Optics by Ajoy Ghatak & K. Thyagarajan, Cambridge University Press.

Semester wise Revised Syllabus under CBCS 2020
Four Year – B.Sc. (Hons), STREAM B (VIII-SEMESTER)
Domain Subject: PHYSICS

14B: FIBRE OPTICS

Theory Credits: 5 6 hrs/week

Model Paper

Max Marks: 60

Section A

Answer any five questions from the following (4M$\times 5 = 20M$)

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Section B

Answer all the questions (8M$\times 5 = 40M$)

11. (A)

(OR)

(B)

12. (A)

(OR)

(B)

13. (A)

(OR)

(B)

14. (A)

(OR)

(B)

15. (A)

(OR)

(B)

Dr. VS KRISHNA GOVT. DEGREE COLLEGE (A), VISHAKAPATNAM

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Semester wise Revised Syllabus under CBCS 2020
Four Year – B.Sc. (Hons), STREAM B (VIII-SEMESTER)
Domain Subject: PHYSICS
PROGRAMME: 15B: NANOMATERIALS AND DEVICES

MAX MARKS – 60 TIME – 3 HOURS (CREDITS- 3)

S.NO	UNIT	TOPIC	ESSAY TYPE QUESTIONS (SECTION -B) Each one 8 marks	SHORT ANSWER QUESTIONS (SECTION-A) Each one 4 marks
1	I	**Basic Concepts in Nanomaterials**	1	2
2	II	**Synthesis of Nanomaterials**	1	2
3	III	**Nano –Carbon**	1	2
4	IV	**Carbon Nano tubes-Graphene**	1	2
5	V	**Nano Devices**	1	2
			5 (internal choice)	5 (five to be answered out of ten questions)

$$\boldsymbol{Percentage\ of\ choice} = \frac{\mathbf{120-60}}{\mathbf{120}} \times \mathbf{100} = \mathbf{50\%}$$

Semester wise Revised Syllabus under CBCS 2020
Four Year – B.Sc. (Hons), STREAM B (VIII-SEMESTER)
Domain Subject: PHYSICS

15B: NANOMATERIALS AND DEVICES

(COURSE CODE :)

Hours/Week: 6 **Credits: 5**

Course Objectives: To familiarize students with the fundamental concepts, properties, synthesis methods, bottom –up and top-down approaches, nano carbon clusters, C_{60} structures, nanotubes, design of nanoscale devices and their applications.

Course Outcomes

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

CO1: Outline the classification of nanomaterials, quantum confinement and size dependent properties.

CO2: Describe bottom-up and top-down approaches and different methods of synthesizing nanomaterials.

CO3: Discuss the bonding nature, unique properties of new carbon structures, carbon clusters, structure of C_{60}, its properties and applications.

CO4: Summarize the various methods of fabricating carbon nanotubes, graphene, their electrical & Mechanical Properties, and applications.

CO5: Explain the basics of nanoscale devices, their design and fabrication, concept of photolithography, MEMS, single electron transistor, and applications.

SYLLABUS

UNIT-1: Basic Concepts in Nanomaterials **12 Hrs**

Nanomaterials: Size-Dependent Properties**: **Increased Surface Area**: **Quantum Effects.

Scientific Revolution - Feynman's Vision – Nanoscience – Nanotechnology – Nanomaterials - Classification of Nanomaterials - dimensions, confinement - Surface to volume ratio - Energy at bulk and nanoscale - Nature Nanophenomena- Size dependent variation in Physical- Chemical- Catalytic properties

UNIT–II: Synthesis of Nanomaterials **13 Hrs**

Introduction to Bottom –up and Top-down approaches, Ball milling –Inert Gas condensation – Physical vapour deposition -, Molecular Beam Epitaxy – Sputtering – Pulsed laser Deposition –Chemical vapour deposition - Sol Gel – Hydrothermal Synthesis. ***Green Synthesis***, ***Lithography***

UNIT-III: Nano –Carbon **14 Hrs**

Carbon molecules: Nature of the carbon bond –New Carbon structure –carbon clusters – Small carbon clusters –Discovery of C60–Structure of C60and its properties –Synthesis of bucky balls and Applications. ***Carbon Nanotubes (CNTs).***

UNIT-IV: Carbon Nano tubes-Graphene **14 Hrs**

Carbon Nanotubes: ***Single-Walled Carbon Nanotubes (SWCNTs)***, ***Multi-Walled Carbon Nanotubes (MWCNTs),*** Fabrication –Structure –***Properties,*** Electrical Properties – Mechanical properties – Applications of carbon Nanotubes. Graphene: Fabrication– Structure–Electrical Properties – Mechanical properties –Applications.

UNIT–V: Nano Devices **13 Hrs**

Introduction – Nanofabrication – Photo-Lithography – Pattern transfer – Introduction to MEMSSingle Electron Transistor – Solar Cells – Light Emitting diodes – Gas Sensors – Micro batteries - Field emission display devices – Fuel Cells.

List of Activities:

1. Assignments
2. Student Seminars

Recommended Books

1. Nanomaterials: Synthesis, properties and Applications – Edited by A.S. Edelstein and R.C. Cammarata, Institute of Physics Publishing, 2002.
2. Nano practices from Theory to Applications edited by Gunter Schmid, Wiley VCH, 2004.

Reference Books

1. Introduction to Nanotechnology – Charles P. Poole Jr and Frant J. Owens, Wiley Inter science, 2003.
2. Nano electronics and Nano systems by K. Glosekotter and J. Dienstuthi (Springer), 2004.

Semester wise Revised Syllabus under CBCS 2020
Four Year – B.Sc. (Hons), STREAM B (VIII-SEMESTER)
Domain Subject: PHYSICS

15B: NANOMATERIALS AND DEVICES

Hours/Week: 6 **Credits: 5**

Model Paper **Max Marks: 60**

Section A

Answer any five questions from the following **(4M$\times 5 = 20M$)**

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

Section B

Answer all the questions (8M$\times 5 = 40M$)

11. (A)

(OR)

(B)

12. (A)

(OR)

(B)

13. (A)

(OR)

(B)

14. (A)

(OR)

(B)

15. (A)

(OR)

(B)

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Semester wise Revised Syllabus under CBCS 2020
Four Year – B.Sc. (Hons), STREAM B (VIII-SEMESTER)
Domain Subject: PHYSICS

Programme: 16B: ENERGY STORAGE DEVICES

Hours/Week: 6 **Credits: 5**

S.NO	UNIT	TOPIC	ESSAY TYPE QUESTIONS (SECTION-B) Each one 8 marks	SHORT ANSWER QUESTIONS (SECTION-A) Each one 4 marks
1	I	**Energy storage systems**	1	2
2	II	**Thermal storage system**	1	2
3	III	**Chemical storage system**	1	2
4	IV	**Electromagnetic storage systems**	1	2
5	V	**Electrochemical storage system**	1	2
			5 (internal choice)	5 (five to be answered out of ten questions)

$$\textit{Percentage of choice} = \frac{120-60}{120} \times 100 = 50\%$$

Semester wise Revised Syllabus under CBCS 2020
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16B: ENERGY STORAGE DEVICES

(COURSE CODE :)

Hours/Week: 6 **Credits: 5**

Course Objectives: To familiarize students with the fundamental of different types of energy storage systems, their operating principles, challenges and their applications.

Course Outcomes

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

CO1: Identify the current and future needs, opportunities, challenges, benefits of energy storage systems and analyze the current electric vehicle market.

CO2: Describe the types of thermal storage systems and their economic evaluation, types of organic and inorganic materials used for heat storage.

CO3: Discuss chemical method of storing hydrogen, methane, solar energy, and the opportunities and challenges associated with chemical storage systems.

CO4: Analyze the performance of double layer capacitors with electrostatically charged storage and superconducting magnetic energy storage systems.

CO5: Explain the working principles of batteries, super capacitors, fuel cells, and their applications.

SYLLABUS

UNIT I: **Energy storage systems** –

12 Hrs

Scope of energy storage, needs and opportunities in energy storage, Technology overview and key disciplines, comparison of time scale of storages and applications, Energy storage in the power and transportation sectors. Importance of energy storage systems in electric vehicles, Current electric vehicle market. ***Flywheel.***

UNIT II: **Thermal storage system**-

13 Hrs

Heat pumps, hot water storage tank, solar thermal collector, application of phase change materials for heat storage-organic and inorganic materials, efficiencies, and economic evaluation of thermal energy storage systems. ***Molten Salt Storage. Phase Change Materials (PCMs).***

UNIT III: **Chemical storage system**

12 Hrs

Hydrogen, ***Hydrogen Storage***, methane etc., concept of chemical storage of solar energy, application of chemical energy storage system, advantages and limitations of chemical energy storage, challenges, and future prospects of chemical storage systems **.** Solid-State Batteries

UNIT IV: **Electromagnetic storage systems**

13 Hrs

Capacitor-Based System, Double layer capacitors with electrostatically charge storage, superconducting magnetic energy storage (SMES), concepts, advantages and limitations of electromagnetic energy storage systems, and future prospects of electrochemical storage systems.

UNIT V: **Electrochemical storage system**
14 Hrs

(a) Batteries-Working principle of battery, primary and secondary (flow) batteries, battery performance evaluation methods, major battery chemistries and their voltages- Li-ion battery& Metal hydride battery vs lead-acid battery. ***Nickel-Metal Hydride (NiMH)***,
(b) Supercapacitors ***or Ultra capacitors*** - Working principle of supercapacitor, types of supercapacitors, cycling and performance characteristics, difference between battery and supercapacitors, Introduction to Hybrid electrochemical supercapacitors
(c) Fuel cell: Operational principle of a fuel cell, types of fuel cells, hybrid fuel cell-battery systems, hybrid fuel cell-supercapacitor systems.
(d) Applications of Energy Storage Systems

List of Activities:

1. Assignments
2. Student Seminars **Recommended Books**

1. Frank S. Barnes and Jonah G. Levine, Large Energy Storage Systems Handbook (Mechanical and Aerospace Engineering Series), CRC press (2011)
2. Pistoia, Gianfranco, and Boryann Liaw. Behaviour of Lithium-Ion Batteries in Electric Vehicles: Battery Health, Performance, Safety, and Cost. Springer International Publishing AG, 2018.

Reference Books

1. Ralph Zito, Energy storage: A new approach, Wiley (2010) 4.
2. Robert A. Huggins, Energy storage, Springer Science & Business Media (2010)

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Domain Subject: PHYSICS 16B: ENERGY STORAGE DEVICES
(COURSE CODE :)

Hours/Week: 6 **Credits: 5**

Model Paper

Max Marks: 60

Section A

Answer any five questions from the following (4M$\times 5 = 20M$)

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Section B

Answer all the questions (8M$\times 5 = 40M$)

11. (A)

(OR)

(B)

12. (A)

(OR)

(B)

13. (A)

(OR)

(B)

14. (A)

(OR)

(B)

15. (A)

(OR)

(B)

Semester wise Revised Syllabus under CBCS 2020
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Domain Subject: PHYSICS

17B: EMBEDDED SYSTEMS (Skill Oriented)

Hours/Week: 3
Credits: 3

Course Objectives: To familiarize students with the basic principles of embedded systems, their architecture of 16F84A, its hardware details, assembler and assembler programs, and PIC Microcontroller and its applications.

Learning outcomes:

On Completion of the course, the students will be able to		Knowledge level (Bloom's Taxonomy)
CO 1	**Compare** different embedded systems and their suitability for different applications	Level 4 (Analyse)
CO 2	**Explain** the architecture, memory organization, timing generation, the power-up and reset functions of the 16F84A microcontroller	Level 2 (Understand)
CO 3	**Demonstrate** the knowledge of parallel ports, function of clock oscillators, interrupts, power supply requirements, interrupts, timer and counter of the PIC16F84A	Level 4 (Analyse)
CO 4	**Compile** simple assembler programs and adopting a development environment.	Level 6 (Create)
CO 5	**Describe** the CPU architecture of PIC 16F873A microcontroller, its interface as LED displays, liquid crystal displays, sensors and actuators.	Level 4 (Analyse)

SYLLABUS

UNIT-I: Introduction to Embedded Systems **7 Hrs**
Embedded systems in today's world – examples of embedded systems – Microprocessors and Microcontrollers – Microchip and PIC microcontroller – Introduction to PIC microcontrollers using the 12 series.

UNIT –II: Architecture of 16F84A **8 Hrs** Architecture of 16F84A – Memory organization – in 16F84A – Timing generation – Power-up and Reset functions in 16F84A.

UNIT-III: Hardware Details of 16F84A **8 Hrs**
Parallel ports: Basic idea – Technical challenge – connecting to the parallel port – Parallel ports of PIC16F84A – Clock oscillator – Power supply – Interrupts – Timers and counters – watch dog timer– Sleep mode.

UNIT-IV: Assembler and Assembler Programs **8 Hrs**
Basic idea – PIC 16 series instruction set and ALU – Assemblers and Assembler format – creating simple programs – Adopting a development environment –

UNIT-V: PIC Microcontroller PIC 16F873A **8 Hrs**
Block diagram and CPU – Memory and memory maps – Interrupts – Oscillator, Reset and Power supply – Parallel ports. Comparator and PR2 register–capture/ Compare/ PWM(CCP) Module – Interface: LED displays– Liquid crystal displays – Sensors – Actuators. **List of Activities:**

1. Assignments
2. Student Seminars

Recommended Books

1. Microcontrollers: Theory and Applications by Ajay V. Deshmukh, Tata McGraw- Hill, New Delhi, 2005.
2. The 8051 Microcontroller and Embedded systems, by Mahammad Ali Mazidi and Janice Gillispie Mazidi, Pearson Education Asia, Pvt. Ltd., 2000.

Reference Books

1. Designing Embedded Systems with PIC Microcontrollers: Principles and Applications by Tim Wilmshurst, First Edition, 2007, Newnes– Elsevier– Publishers.
2. Designing with PIC Microcontrollers by John B. Peatman, Pearson Education, Inc.,1998.

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	3	1	1	1	1	2	3	3	3	3
CO 2	3	1	1	1	1	1	3	3	3	3
CO 3	3	1	1	1	1	2	3	3	3	3
CO 4	3	1	1	1	1	2	3	3	3	3
CO 5	3	1	1	1	1	1	3	3	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	2	1	3
CO 2	3	3	3	1	3
CO 3	3	3	3	1	3
CO 4	3	3	2	1	3
CO 5	3	3	3	1	3

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Domain Subject: PHYSICS

17B: EMBEDDED SYSTEMS (Skill Oriented)

Blue Print for Semester End Theory Examinations

S.No	Type of question	No of questions given			No of questions to be answered		
		No of questions	Marks allotted to each question	Total marks	No of questions	Marks allotted to each question	Total marks
1	Section A Short answer questions	10 (Two questions from each unit)	4	40	5 (Any five out of 10 questions)	4	20
2	Section B Long answer questions	10 (Two questions from each unit with only internal choice)	8	80	5 (Answer one question from each unit)	8	40
Total				120			60

Percentage of choice given $= \frac{(120-60)}{120} \times 100 = 50\%$

Semester wise Revised Syllabus under CBCS 2020
Four Year – B.Sc. (Hons), STREAM B (VIII-SEMESTER)
Domain Subject: PHYSICS

17B: EMBEDDED SYSTEMS (Skill Oriented)

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	Marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2(two out of four)	I (one out of two)
Understanding/ Comprehension	27%	16	2(two out of four)	
Application	20%	12	I (one out of two)	I (one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		I (one out of two)
Total	IOO	60	5(each question has internal choice)	5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	**I**		2(one out of two)	2
2	**II**		2(one out of two)	2
3	**III**		2(one out of two)	2
4	**IV**		2(one out of two)	2
5	**V**		2(one out of two)	2
			5(each question has internal choice)	5 out of given 10

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Semester wise Revised Syllabus under CBCS 2020
Four Year – B.Sc. (Hons), STREAM B (VIII-SEMESTER)
Domain Subject: PHYSICS

17B: EMBEDDED SYSTEMS (Skill Oriented)

Max Marks: 60

Model Paper

Section A

Answer any five questions from the following (4M$\times 5 = 20M$)

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Section B

Answer all the questions (8M$\times 5 = 40M$)

11. (a)

(OR)

(b)

12.(a)

(OR)

(b)

13.(a)

(OR)

(b)

14.(a)

(OR)

(b)

15.a)

(OR)

(b)

B.Sc. PHYSICS SEMESTER END EXAMINATION
[2023-24 Batch onwards]
IV Year B.Sc (Hons.)- PHYSICS
Course Code: 24(PHY)M826B

SEMESTER-VIII COURSE 18B: PHOTONICS (SKILL ORIENTED)

Theory Credits: 3 3 hrs/week

Course Objectives: To familiarize students with the principles of Laser systems, properties and applications, fiber optic components and sensors, basics of integrated optics, light modulation, Photonic crystals and optical communications and their applications.

S.No.	Course outcome	Course outcome with action verb	Level in Blooms Taxonomy
1.	CO-1	Describe the excitation mechanisms and working principles of different types of lasers, and its application as laser isotope separation.	Level-3
2.	CO-2	Explain the principles of fiber optic splices, connectors, optical couplers, switches, fiberoptic isolators, and their applications in fiber optic networks and sensors.	Level-4
3.	CO-3	Outline the principles and functioning of waveguides, integrated photo diodes, edge and surface emitting lasers and their applications.	Level-4
4.	CO-4	Demonstrate the knowledge of optic, acousto-optic, magneto-optic modulation, and advantages of optical modulation	Level-5
5.	CO-5	Describe the basics, features, theoretical modeling, fabrication methods of photonic crystals, their applications in optical communications and as sensors.	Level-5

SYLLABUS

UNIT–I: Laser systems, Properties and Applications 8 Hrs

General description, structure, excitation mechanism and working of CO2, Argon ion, laser Nd:YAG, Optical parametric oscillator, semiconductor and erbium doped fiber lasers. QSwitching- Laser applications in isotopic separation.

UNIT- II: Fiber Optic Components and Sensors 8 Hrs

Connector principles, Splices, Connectors, Source coupling, Directional couplers, Star couplers, Switches, Fiber optical isolator, Wavelength division multiplexing, Time division multiplexing, Fiber Bragg gratings- Fiber optic sensors, Intensity modulated sensors, Current sensors, Chemical sensors –Fiber optic rotation sensors.

UNIT- III: Integrated Optics 7 Hrs

Introduction – Planar wave guide – Channel wave guide – Y-junction beam splitters and couplers – Prism and grating couplers – Lens waveguide– Integrated photodiodes – Edge and surface emitting laser – Distributed Bragg reflection and Distributed feedback lasers

UNIT – IV: Modulation of Light 8 Hrs

Introduction, Birefringence, Electro-optic effect, Pockels and Kerr effects, Electro-optic phase modulation, Electro-optic amplitude modulation, Electro-optic modulators: scanning and switching, Acousto-optic effect, Acousto-optic modulation, Magneto-optic effect, Advantages of optical modulation.

UNIT-V: Photonic Crystals 7 Hrs

Basics concepts, Theoretical modeling of photonic crystals, Features of photonic crystals, Methods of fabrication, Photonic crystal optical circuitry, Nonlinear photonic crystals, Photonic crystal fibers, Photonic crystals and optical communications, Photonic crystal sensors.

List of Activities: 1. Assignments 2. Student Seminars

Recommended Books

1. Laser fundamentals, W. T. Silfvast, Foundation books, New Delhi, 1999.
2. Introduction To Fibre Optics, A. Ghatak And K. Thyagarajan, Cambridge University Press, New Delhi, 1999
3. Optical Guided Wave Signal Devices, R.SymsAndJ.Cozens. Mcgraw Hill, 1993.
4. Optical Electronics, A Ghatak and K.Thyagarajan, Cambridge University Press, New Delhi,1991
5. Nanophotonics, P.N. Prasad, Wiley Interscience, 2003.

Reference Books

1. Lasers: Principles and applications by J. Wilson and J.F.B. Hawkes, Prentice, Hall of India, New Delhi, 1996
2. Fiber Optic Communication, Joseph C. Palais, Pearson Education Asia, India, 2001
3. Fundamentals of Photonics, B.E.A. Saleh and M.C. Teich, John Willy and Sons,1991

SEMESTER – VIII – Practical Lab Course-2 18-B- LAB-2: Photonics - Practical Hours/Week: 3 Credits: 2

Course Objectives: To equip, students with experimental skills, by applying the learnt concepts from Photonics.

Course Outcomes Upon the successful completion of this practical course, students will be able to

CO1: Determine the wavelengths of the given light source using Hartmann's Dispersion formula.
CO2: Evaluate the refractive index of a transparent solid bar using Diode Laser.
CO3: Study the bending Losses of light in Optical Fiber.
CO4: Determine the Pitch of Wire Mesh.
CO5: Study electro optic effect in the given crystal.
CO6: Determine the Numerical Aperture of the given Optical Fiber.
CO7: Determine (a) slit width & (b) diameter of wire using Laser.
CO8: Determine wavelength of the given He-Ne Laser by using diffraction grating.
CO9: Determine the wavelength of the given Laser source using a grating and a metal scale.

Any six of the following experiments:
List of Experiments:
1. Hartmann's Dispersion formula
2. Index of a Transparent Solid Bar using Diode Laser
3. Bending Losses in Optical Fiber
4. Determination of the Pitch of Wire Mesh
5. Electro Optic Effect
6. Numerical Aperture of the given Optical Fiber
7. Lasers-determination of wavelength with grating and metal scale
8. Laser-Determination of (a) slit width & (b) diameter of wire
9. Determination of wavelength of he-Ne Laser by using diffraction grating

B.Sc. PHYSICS SEMESTER END EXAMINATION
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SEMESTER-VIII COURSE 18B: PHOTONICS (SKILL ORIENTED)

CO-PO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	2	3	2	2	1	2	3	2	3	3
CO 2	3	3	2	2	1	2	3	3	3	2
CO 3	3	3	1	1	1	1	3	3	2	3
CO 4	3	3	2	1	2	2	2	3	2	3
CO 5	3	2	2	2	2	1	3	2	3	3

CO-PSO Mapping
1- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO -1	PSO- 2	PSO -3	PSO 4	PSO 5
CO 1	3	3	2	2	3
CO 2	3	3	2	2	3
CO 3	3	3	3	3	3
CO 4	2	3	2	2	2
CO 5	3	2	3	3	3

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Dr V.S.Krishna Govt. Degree College(A),
Visakhapatnam 2023-2024
Course Code: 24(PHY)M826B

BLUE PRINT (: PHOTONICS (SKILL ORIENTED)**)**
IV B.Sc. (Hons.) PHYSICS- SEM-VIII/Course : 18B
Max Marks-75 Time-3Hrs. Credits:3

		TOPIC	SECTION-A	SECTION-B	
S.No.	UNIT		ESSAY QUESTIONS 10 MARKS	SHORT QUESTIONS 5MARKS	TOTAL MARKS
1.	I	Laser systems, Properties and Applications	2	2	30
2.	II	Fiber Optic Components and Sensors	2	2	30
3.	III	Integrated Optics	2	2	30
4.	IV	Modulation of Light	2	2	30
5.	V	Photonic Crystals	2	2	30
6.		TOTAL QUESTIONS	10	10	150

[Note: Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 8 marks cither in Section-A or Section-B covering all the five units in the syllabus]

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B.Sc. PHYSICS SEMESTER END EXAMINATION
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Course Code: 24(PHY)M826B

SEMESTER-VIII COURSE 18B: PHOTONICS (SKILL ORIENTED)

Time: 3 hrs. Maxmarks:60

SECTION – A

Answer all Questions of the following **[5 X 8 = 40]**

1. a)
[OR]
b)

2. a)
[OR]
b)

3. a)
[OR]
b)

4. a)
[OR]
b)

5. a)
[OR]
b)

SECTION – B

Answer any FIVE Questions of the following **[5 X 4 = 20]**

6. a)
7. a)
8. a)
9. a)
10. a)
11. a)
12. a)
13. a)
14. a)
15. a)

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B.Sc. PHYSICS SEMESTER END EXAMINATION
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SEMESTER-VIII COURSE 18B: PHOTONICS (SKILL ORIENTED)
QUESTION BANK

UNIT-I: Laser Systems, Properties, and Applications

Essay Questions:

1. Describe the working principle of CO2 lasers, including their structure and excitation mechanism. What are the typical applications of CO2 lasers, and how do their properties make them suitable for these applications?
2. Compare and contrast the Nd

   laser with the Argon ion laser in terms of their operation, applications, and advantages. Discuss how the specific characteristics of these lasers influence their use in various fields.

3. Explain the concept of Q-switching in lasers. How does Q-switching enhance the performance of lasers, and what are its applications in isotopic separation?

Short Questions:

1. What is the role of an optical parametric oscillator in laser systems, and how does it function?
2. Define the structure and excitation mechanism of semiconductor lasers. How do they differ from other types of lasers?
3. Briefly describe erbium-doped fiber lasers and their primary applications.

UNIT-II: Fiber Optic Components and Sensors

Essay Questions:

1. Discuss the principles and types of fiber optic connectors and splices. How do these components affect the performance of fiber optic systems?
2. Explain the working principles of fiber optic sensors, including intensity modulated sensors and chemical sensors. What are their advantages over traditional sensors?
3. Describe wavelength division multiplexing (WDM) and time division multiplexing (TDM) in fiber optic communications. How do these techniques improve the efficiency and capacity of optical networks?

Short Questions:

1. What are directional couplers and star couplers used for in fiber optic systems?
2. How do fiber optical isolators function, and why are they important in fiber optic communications?
3. Define fiber Bragg gratings and their role in fiber optic sensors.

UNIT-III: Integrated Optics

Essay Questions:

1. Explain the concept of planar waveguides and channel waveguides in integrated optics. How do these waveguides differ, and what are their applications in optical circuitry?
2. Describe the working principles and applications of Y-junction beam splitters and couplers in integrated optics. How do they facilitate the manipulation of light in optical devices?
3. Discuss the significance of distributed Bragg reflection (DBR) and distributed feedback (DFB) lasers in integrated optics. How do these lasers contribute to the performance of optical systems?

Short Questions:

1. What is the function of prism and grating couplers in integrated optics?
2. Define lens waveguides and their use in integrated optical circuits.
3. What are edge-emitting and surface-emitting lasers, and how do they differ in their application?

UNIT-IV: Modulation of Light

Essay Questions:

1. Discuss the birefringence effect and its impact on light modulation. How does this phenomenon influence the design of optical modulators?
2. Explain the electro-optic effect and its significance in phase and amplitude modulation of light. What are the differences between Pockels and Kerr effects?
3. Describe the acousto-optic effect and its application in optical modulation. How does acousto-optic modulation compare with electro-optic modulation in terms of performance and applications?

Short Questions:

1. What are the main advantages of optical modulation in communication systems?
2. Define electro-optic modulators and explain their use in scanning and switching applications.
3. How does the magneto-optic effect contribute to the modulation of light?

UNIT-V: Photonic Crystals

Essay Questions:

1. Explain the basic concepts and theoretical modeling of photonic crystals. How do these models help in understanding the behavior of light in photonic crystals?
2. Discuss the methods of fabricating photonic crystals and the challenges associated with these methods. What are the key features that influence the performance of photonic crystals?
3. Describe the role of photonic crystals in optical communications and sensors. How do photonic crystal fibers and nonlinear photonic crystals enhance these applications?

Short Questions:

1. What are the key features of photonic crystals that make them useful in optical circuitry?
2. Define photonic crystal fibers and discuss their advantages in fiber optics.
3. How does the theoretical modeling of photonic crystals help in designing photonic crystal sensors?