Dr. N.G.P. ARTS AND SCIENCE COLLEGE (Autonomous)

REGULATIONS 2022-23 for Post Graduate Programme (Outcome Based Education model with Choice Based Credit System)

M.Sc. Degree

(For the students admitted during the academic year 2022-23 and onwards)

Programme: M.Sc. Physics

Eligibility:

A pass in the course of B.Sc. Degree Examination with Physics as Major and Mathematics and Chemistry as Ancillary subjects, or an examination accepted as equivalent there to accept by the academic council.

Programme Educational Objectives:

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

- 1. To produce graduates with advanced knowledge in Physics and requisite skills, in order to use their knowledge in Physics in a wide range of practical applications.
- 2. To develop creative thinking and the power of imagination to enable graduates work in research in academia and industry for broader applications.
- 3. To relate the training of Physics graduates to the employment opportunities within the country.
- 4. To promote societal values through Physics related activities.



PROGRAMME OUTCOMES:

On the successful completion of the program, the following are the expected outcomes.

PO Number	PO Statement
PO1	Apply theoretical knowledge of principles and concepts of Physicsto practical problems.
PO2	Develop skills in planning and carrying out advanced physics experiments.
PO3	Solve scientific problems by applying a combination of theory, numerical simulation, and experiments.
PO4	Relate critically to scientific models.
PO5	Examining specific phenomena theoretically and experimentally, to contribute to the generation of new scientific insights or to the innovation of new applications of physics research.



PG REGULATION (R4) (Students Admitted in the AY 2022-23)

(OUTCOME BASED EDUCATION WITH CBCS)

Effective from the academic year 2022-23 and applicable to the students admitted to the Degree of Master of Arts/Commerce/Management/Science.

1.NOMENCLATURE

1.1 Faculty: Refers to a group of programmes concerned with a major division of knowledge. Eg. Faculty of Computer Science consists of Programmes like Computer Science, Information Technology, Computer Technology, Computer Applications etc.

1.2 Programme: Refers to the Master of Arts/Management/Commerce/Science Stream that a student has chosen for study.

1.3 Batch: Refers to the starting and completion year of a programme of study. Eg. Batch of 2022–2024 refers to students belonging to a 2-year Degree programme admitted in 2022 and completing in 2024.

1.4 Course: Refers to component of a programme. A course may be designed to involve lectures / tutorials / laboratory work / seminar / project work/ practical training / report writing / Viva voce, etc or a combination of these, to effectively meet the teaching and learning needs and the credits may be assigned suitably.

a) Core Courses A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

b) Extra Departmental Course (EDC): A course chosen generally from a related discipline/subject, with an intention to seek exposure in the discipline relating to the core domain of the student.

c) Discipline Specific Elective Course (DSE): Elective courses are offered under main discipline/ subject of study.

d) Project Work: It is considered as a special course involving application of knowledge in problem solving/analyzing/exploring a real-life situation. The Project work will be given in lieu of a Core paper.



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e) Extra credits Extra credits will be awarded to a student for achievements in co-curricular activities carried out outside the regular class hours. The guidelines for the award of extra credits are given in section two, these credits are not mandatory for completing the programme.

f) Advanced Learner Course (ALC): ALC is doing work of a higher standard than usual for students at that stage in their education. Research work / internships carried out in Universities/ Research Institutions/ Industries of repute in India or abroad for a period of 15 to 30 days.

2. STRUCTURE OF PROGRAMME

- Core Course
- Extra Departmental Course (EDC)
- Discipline Specific Elective (DSE)
- Industrial Training (IT)
- Project

3. DURATION OF THE PROGRAMME

M.Sc. /M.Com. / M.A. Programme must be completed within 2 Years (4 semesters) and maximum of 4 Years (8 semesters) from the date of acceptance to the programme. If not, the candidate must enroll in the course determined to be an equivalent by BoS in the most recent curriculum recommended for the Programme.

4. REQUIREMENTS FOR COMPLETION OF A SEMESTER

Every student shall ordinarily be allowed to keep terms for the given semester in a program of his/ her enrolment, only if he/ she fulfills at least seventy five percent (75%) of the attendance taken as an average of the total number of lectures, practicals, tutorials, etc. wherein short and/or long excursions/field visits/study tours organised by the college and supervised by the faculty as envisaged in the syllabus shall be credited to his attendance. Every student shall have a minimum of 75% as an overall attendance.



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5. EXAMINATIONS

The end semester examinations shall normally be conducted after completing 90 working days for each semester. The maximum marks for each theory and practical course as follows,

a) Mark distribution for Theory Courses

Continuous Internal Assessment (CIA)):	50 Marks
End Semester Exams (ESE)	:	50 Marks
Total	:	100 Marks

i) Distribution of Internal Marks

S.No.	Particulars	Distribution of Marks
1	CIA I (2.5 Units) (On	15
	completion of 45 th working day)	
2	Model (All 5 Units) (On	15
	completion of 85 th working day)	
3	Assignment	05
4	Attendance	05
5	Library Usage	05
6	Skill Enhancement *	05
	Total	50

Assignment Rubric

(Maximum -20 marks converted to 5 marks)

Criteria	4 marks	3 Marks	2 Marks	1 MArk
Language	Excellent	Good spelling	Reasonable	Bad spelling
	spelling and	and Grammar	spelling and	and
	Grammar		Grammar	Grammar
Style	Outstanding	Attains	Approaches	Elementary
	style beyond	College level	College level	form with
	usual college	style	style	little or no
	level			variety in
				sentence
				structure



Referencing	Good use of wide range of reference sources	Moderate use of suitable reference materials	Shows signs of plagiarism & using sources without referencing	No reference material used
Development	Main points well developed with high quality and quantity support	Main points developed with quality and quantity supporting details	Main points are present with limited details and development	Main points lack detailed development
Critical	Advanced	Proficient	Adequate	Limited
thinking/Problem	attempt to	attempt to	attempt to	attempt to
solving	interpret the	interpret the	interpret the	interpret the
	process,	process,	process,	process,
	content/	content/	content/	content/
	analyse and	analyse and	analyse and	analyse and
	solve the	solve the	solve the	solve the
	problem	problem	problem	problem

Breakup for Attendance Marks:

S.No	Attendance Range	Marks Awarded
1	95% and Above	5
2	90% - 94%	4
3	85% - 89%	3
4	80% - 84%	2
5	75% - 79%	1

Note:

Special Cases such as NCC, NSS, Sports, Advanced Learner Course, Summer Fellowship and Medical Conditions etc. the attendance exemption may be given by principal and Mark may be awarded.



Break up for Library Marks:

S.No	Attendance Range	Marks Awarded
1	10h and above	5
2	9h– less than 10h	4
3	8h – less than 9h	3
4	7h - less than 8h	2
5	6h – less than 7h	1

Note:

In exception, the utilization of e-resources of library will be considered.

*Components for "Skill Enhancement" may include the following:

Class Participation, Case Studies Presentation/Term paper, Field Study, Field Survey, Group Discussion, Term Paper, Presentation of Papers in Conferences, Industry Visit, Book Review, Journal Review, e-content Creation, Model Preparation & Seminar.

Components for Skill Enhancement

Any one of the following should be selected by the course coordinator

S.No.	Skill Enhancement	Description		
		 Engagement in class 		
1	Class Participation	Listening Skills		
		• Behaviour		
		 Identification of the problem 		
2	Case Study Presentation/	Case Analysis		
2	Term Paper	Effective Solution using		
		creativity/imagination		
	Field Study	Selection of Topic		
3	There Study	 Demonstration of Topic 		
		Analysis & Conclusion		
	Field Curryon	Chosen Problem		
4	Field Sul vey	 Design and quality of survey 		
		Analysis of survey		



5	Group Discussion	 Communication skills Subject knowledge Attitude and way of presentation Confidence Listening Skill
6	Presentation of Papers in Conferences	 Sponsored International/National Presentation Report Submission
7	Industry Visit	 Chosen Domain Quality of the work Analysis of the Report Presentation
8	Book Review	 Content Interpretation and Inferences of the text Supporting Details Presentation
9	Journal Review	 Analytical Thinking Interpretation and Inferences Exploring the perception if chosen genre Presentation
10	e-content Creation	 Logo/ Tagline Purpose Content (Writing, designing and posting in Social Media) Presentation
11	Model Preparation	 Theme/ Topic Depth of background Knowledge Creativity Presentation
12	Seminar	 Knowledge and Content Organization Understanding Presentation



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ii) Distribution of External Marks

Total	:	50
Written Exam	:	50

Marks Distribution for Practical course

Total	:	100
Internal	:	50
External	:	50

i) Distribution of Internals Marks

S. No.	Particulars	Distribution of Marks
1	Experiments/Exercises	15
2	Test 1	15
3	Test 2	15
4	Observation Notebook	05

Total

50

ii) Distribution of Externals Marks

S.No.	Particulars	External Marks
1	Materials and methods/ Procedures/Aim	10
2	Experiment/ Performance/ Observations/ Algorithm	10
3	Results/ Calculations/ Spotters/ Output	10
4	Inference/Discussion/ Presentation	10
5	Record	6
6	Viva- voce	4
	Total	50



A) Mark Distribution for Project

Total	:	200
Internal	:	100
External	:	100

i) Distribution of Internal Marks

S.No.	Particulars	Internal Marks
1	Review I	40
2	Review II	40
3	Attendance	20
	Total	100

ii) Distribution of External Marks

S.No	Particulars	External Marks
1	Project Work & Presentation	80
2	Viva -voce	20
	Tot	al 100

Evaluation of Project Work shall be done jointly by Internal and External Examiners.

6. Credit Transfer

a. Upon successful completion of 1 NPTEL Course (4 Credit Course) recommended by the department, during Semester I to II, a student shall be eligible to get exemption of one **4 credit course** during the 3rd or 4th semester. The proposed NPTEL course should cover content/syllabus of exempted core paper in 3rd or 4th semester.



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S. No.	Course Code	Course Name	Proposed NPTEL Course	Credit
1			Option – 1 Paper title	4
			Option – 2 Paper title	
			Option – 3 Paper title	

b. Upon successful completion of **2 NPTEL Courses** (2 Credit each) recommended by the department, during Semester I to II, a student shall be eligible to get exemption of **one 4 credit course** during the 3rd or 4th semester. Out of 2 NPTEL proposed courses, **at least 1 course** should cover content/syllabus of exempted core paper in 3rd or 4th semester.

Mandatory

The exempted core paper in the 3rd or 4th semester should be submitted by the students for approval before the end of 2nd semester

S. No.	Course Code	Course Name	Proposed NPTEL Course	Credit
1			Option – 1 Paper title	2
			Option – 2 Paper title	2
			Option – 3 Paper title	
2			Option – 1 Paper title	2
			Option – 2 Paper title	
			Option – 3 Paper title	

Credit transfer will be decided by equivalence committee

	NPTEL Courses to be carried out during semester I – II.					
S. No.	Student Name	Class	Proposed NPTEL Course		Proposed Course for Exemption	
			Course I	Option 1- Paper Title Option 2- Paper Title Option 3- Paper Title	Any one Core Paper in 3 ^{rd or} 4 th	
			Course II	Option 1- Paper Title Option 2- Paper Title Option 3- Paper Title	Semesters	
Cla	iss Advisor			HoD	Dean	



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7. Internship/Industrial Training

Students must undertake industrial / institutional training for a minimum of 15 days and not exceeding 30 days during the II semester summer vacation. The students will submit the report for evaluation during III semester.

Mark Distribution for industrial / institutional training

Total	:	100
Internal	:	50
External	:	50

i) Distribution of Internal Marks

S.No.	Particulars	Internal Marks
1	Review I	20
2	Review II	20
3	Attendance	10
	Total	50

ii) Distribution of External Marks

S.No	Particulars	External Marks
1	Internship / Industrial training Presentation	40
2	Viva –voce	10
	Total	50

Evaluation of Internship /Industrial training Presentation shall be done jointly by Internal and External Examiners.

8. Extra Credits: 10

Earning extra credit is not essential for programme completion. Student is entitled to earn extra credit for achievement in Curricular/Co-Curricular/ Extracurricular activities carried out other than the regular class hours.

A student is permitted to earn a maximum of 10 extra Credits during the programme period.



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Credit Category Self study Course 1 CA/ICSI/CMA (Foundations) 1 CA/ICSI/CMA (Inter) 1 Sports and Games 1 Publications / Conference Presentations 1 (Oral/Poster)/Awards Innovation / Incubation / Patent / Sponsored 1 Projects / Consultancy Representation in State / National level 1 celebrations Awards/Recognitions/Fellowships 1 Advanced Learner Course (ALC)* 2

A maximum of 1 credit under each category is permissible.

Credit shall be awarded for achievements of the student during the period of study only.

GUIDELINES

Self study Course

A pass in the self study courses offered by the department.

The candidate should register the self study course offered by the department only in the III semester.

CA/ ICSI/ CMA (Foundations)

Qualifying foundation in CA/ICSI/CMA / etc.

CA/ICSI/ CMA (Inter)

Qualifying Inter in CA/ICSI/CMA / etc.

Sports and Games

The Student can earn extra credit based on their Achievement in sports in University/ State / National/ International.

Publications / Conference Presentations (Oral/Poster)

Research Publications in Journals

Oral/Poster presentation in Conference



Innovation / Incubation / Patent / Sponsored Projects / Consultancy

Development of model/ Products /Prototype /Process/App/Registration of Patents/ Copyrights/Trademarks/Sponsored Projects /Consultancy

Representation in State/ National level celebrations

State / National level celebrations such as Independence day, Republic day Parade, National Integration camp etc.

Awards/Recognitions/Fellowships

Regional/ State / National level awards/ Recognitions/Fellowships

*Advanced Learner Course (ALC):

ALC is doing work of a higher standard than usual for students at that stage in their education.

Research work/internships carried out in Universities/ Research Institutions/ Industries of repute in India or abroad for a period of 15 to 30 days will be considered as Advanced Learners Course.

QUESTION PAPER PATTERN

SECTION	MARKS	DESCRIPTION	TOTAL	Remarks
Section -	8 x 0.5= 04 Marks	MCQ		Marks
А				secured will
Section - B	3 x 2 = 06 Marks	Answer ALL Questions		be
		Either or Type ALL		converted
		Questions Carry Equal	25 Marka	To 15 mark
		Marks	25 Walks	
Section - C	3 x 05 = 15 Marks	Answer ALL Questions		
		Either or Type ALL		
		Questions Carry Equal		
		Marks		

CIA Test I: [1^{1/2} Hours-2.5 Units] - 25 Marks



SECTION	MARKS	DESCRIPTION	TOTAL	Remarks
Section – A	10 x 1 = 10 Marks	MCQ		
Section - B	5 x 6 = 30 Marks	Answer ALL Questions (Either or Type Questions) Each Questions Carry Equal Marks	50 Marks	Marks secured will be converted
Section - C	1 x 10 = 10 Marks	Compulsory Question		10 15 mark

CIA Test	II/ Model	[3	Hours-5	Units]	- 50 Marks
		L -			



SECTION	MARKS	DESCRIPTION	TOTAL
Section – A	10 x 1 = 10 Marks	MCQ	
Section - B	5 x 6 = 30 Marks	Answer ALL Questions (Either or Type Questions) Each Questions Carry Equal Marks	50 Marks
Section - C	1 x 10 = 10 Marks	Compulsory Question	

End Semester Examination [3 Hours-5 Units] - 50 Marks



PG Credit Distribution:

Part	Subject	No. of Papers	Credit	Semester No.			
	Core	14	Theory: 11 x04 =44 02x03 = 06	I-IV			
III		06	Practical: 06x02=12				
	Elective	04	04 x04 =16	I-IV			
	EDC	01	01 x04 =04	II			
	Industrial Training		02	III			
	Project Work	01	01 x08 =08	IV			
	TOTAL CREDITS 92 -						



CURRICULUM

M.Sc. Physics

Course Code	Course	Course Name	т	т	р	Exam (h)	Max Marks			Cradite
Course Coue	Category	Course Maine	L	I	ľ	(11)	CIA	ESE	Total	Cleans
First Semester										
222PY2A1CA	Core- I	Mathematical Physics	4	1	_	3	50	50	100	4
222PY2A1CB	Core- II	Thermodynamics and Statistical Mechanics	4	1	-	3	50	50	100	4
222PY2A1CC	Core- III	Classical Mechanics	4	-	-	3	50	50	100	4
222PY2A1CD	Core- IV	Electronics	4	_	-	3	50	50	100	4
222PY2A1CP	Core Practical - I	Thermodynamics and Optics	-	-	4	4	50	50	100	2
222PY2A1CQ	Core Practical -II	Electronics -I	_	-	4	4	50	50	100	2
222PY2A1DA		Energy Physics								
222PY2A1DB 222PY2A1DC	DSE -I	Materials Physics and Processing Techniques Laser Physics and	4	-	-	3	50	50	100	4
	Total	Nonlinear Optics	•							
	- 0141		20	2	8	-	-	-	700	24



·····	Course	Course Name		T	гр	P (h)	Max Marks			Credits
Course Code	Course Name L				(11)	CIA	ESE	Total	cicuits	
Second Semester										
222PY2A2CA	Core - V	Spectroscopy	4	-	-	3	50	50	100	4
222PY2A2CB	Core- VI	Solid State Physics	4	1	-	3	50	50	100	4
222PY2A2CC	Core- VII	Quantum Mechanics-I	4	1	-	3	50	50	100	4
222PY2A2CP	Core Practical - III	Solid State and Spectroscopy	-	-	4	4	50	50	100	2
222PY2A2CQ	Core Practical - IV	Electronics-II		-	4	4	50	50	100	2
222MT2A2EA	EDC	Numerical Methods	4	-	-	3	50	50	100	4
222PY2A2DA		Physics of Nanomaterials								
222PY2A2DB	DSE -II	Experimental Design	4	-	-	3	50	50	100	4
222PY2A2DC		Medical Physics								
		Tota	1 20	2	8	-	-	-	700	24

Schairman/HoD

BoS Chairman/HoD Department of Physics Dr. N. G. P. Arts and Science College Coimbatore – 641 048

	Dr.N.G.P. Arts and Science College						
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M.Sc. Physics (Students admitted during the AY 2022-23)

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Course Code	Course	Course Norse	T	—	D	Exam	Max Marks		Credita	
Course Code	Course Code Category Course Name		L		P	(h)	CIA	ESE	Total	Credits
Third Semester	r					Hand Specific Street			Shere they do	
222PY2A3CA	Core -VIII	Quantum Mechanics- II	4	1	-	3	50	50	100	4
222PY2A3CB	Core - IX	Electromagnetic Theory	4	1	-	3	50	50	100	4
222PY2A3CC	Core - X	Condensed Matter Physics	3	1	-	3	50	50	100	3
222PY2A3CD	Core - XI	Microprocessors and Microcontroller	3	1	-	3	50	50	100	3
222PY2A3CP	Core Practical - V	Electronics -III	-	-	4	4	50	50	100	2
222PY2A3CT	IT	Industrial Training	-	-	-	-	50	50	100	2
222PY2A3DA		Crystal growth and thin film techniques								
222PY2A3DB	DSE -III	Instrumental methods of analysis	4	-	-	3	50	50	100	4
222PY2A3DC		Radiological safety aspects								
222PY2A4CV	Core-XIV	Project	-	-	4	-	-	-	50	
	Total			4	8	-	-	-	700	22

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M.Sc. Physics (Students admitted during the AY 2022-23)

	Course					Exam	Max Marks			Credite
Course Code	Course Code Category Course Name		L	T	P	(h)	CIA	ESE	Total	Credits
Fourth Semeste	er									
222PY2A4CA	Core- XII	Molecular Physics	4	1	-	3	50	50	100	4
222PY2A4CB	Core-XIII	Nuclear and Elementary Particle Physics		1	-	3	50	50	100	4
222PY2A4CP	Core Practical-VI	Microprocessor		-	4	4	50	50	100	2
222PY2A4CV	Core-XIV	Project	-	-	12	-	100	100	200	8
222PY2A4DA		Solar Cells								
222PY2A4DB	DSE -IV	Band gap Engineering in Semiconductors	4	-	-	3	50	50	100	4
222PY2A4DC		Plasma Physics]							
	Total			2	16	-	-	-	600	22
	*Grand Total								3400	92

Theory / Practical/ IT : CIA 50: ESE 50 Project : CIA 100: ESE 100

*Total Credits does not exceed 92 credits

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M.Sc.Physics (Students admitted during the AY 2022-23)

DISCIPLINE SPECIFIC ELECTIVE

Students shall select the desired course of their choice in the listed elective course during Semesters I & IV

Semester I (Elective I) List of Elective Courses

S. No	Course Code	Course Name
1	222PY2A1DA	Energy Physics
2	222PY2A1DB	Materials Physics and Processing Techniques
3	222PY2A1DC	Laser Physics and Nonlinear Optics

Semester II (Elective II) List of Elective Courses

S. No	Course Code	Course Name
1	222PY2A2DA	Physics of Nanomaterials
2	222PY2A2DB	Experimental Design
3	222PY2A2DC	Medical Physics

Semester III (Elective III) List of Elective Courses

S. No	Course Code	Course Name
1	222PY2A3DA	Crystal growth and thin film physics
2	222PY2A3DB	Instrumental methods of analysis
3	222PY2A3DC	Radiological safety aspects

Semester IV (Elective IV) List of Elective Courses

S. No	Course Code	Course Name
1	222PY2A4DA	Solar Cells
2	222PY2A4DB	Band gap Engineering in Semiconductors
3	222PY2A4DC	Plasma Physics



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EXTRA CREDIT COURSES

The following are the courses offered under self study to earn extra credits:

S. No	Course Code	Course Name
1	222PY2ASSA	IPR, Innovation and Entrepreneurship
2	222PY2ASSB	Nanoscience

CERTIFICATE PROGRAMMES

The following are the programme offered to earn extra credits:

S. No	Programme Code	Course Code	Course Name
	and Name		
1	2PY5A: Certificate	222PY5A1CA	Nanomaterials Preparation Techniques
	Course in		
	Nanomaterials		
	Preparation Techniques		
2	2PY5B: Certificate	222PY5B1CA	Nanomaterials Characterization
	Course in		
	Nanomaterials		
	Characterization		



Course Code	Course Name	Category	L	Т	Р	Credit
222PY2A1CA	MATHEMATICAL PHYSICS	CORE	4	1	ŀ	4

PREAMBLE

This course has been designed for students to learn and understand

- The concept of matrices, types of linear equations and complex variables
- Develop expertise in special functions and partial differential equations
- Develop expertise in special functions and partial differential equations

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Outline the concept of matrices and vector	K2
CO2	Identify the definite integrals using complex variables	К3
CO3	Make use of the special function in terms of various polynomials	К3
CO4	Identify the differential equations for first and second order equations	К3
CO5	Analyze the concept of tensors and group theory	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1				\checkmark	
CO2	~	~	~		✓
CO3	~	~	\checkmark		~
CO4	~	~	\checkmark		\checkmark
CO5	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark

✓	Skill Development	Entrepreneurial Development
 ✓ 	Employability	Innovations
	Intellectual Property Rights	Gender Sensitization
	Social Awareness/ Environment	Constitutional Rights/ Human Values/ Ethics



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Total Credits: 4

SEMESTER I

Total Instruction Hours: 60 h

Syllabus

Unit I Matrices and Vectors

Rank of a matrix and some of its theorems (Normal Form, Triangular Form) - Types of linear equations - Solution to linear homogeneous and non-homogeneous equations - Vectors: Linear dependence and independence of vectors - Linearly dependence and independence of vectors by rank method - Inner product space - Orthogonal vectors - Orthonormal vectors - Gram-Schmidt orthogonalization process.

Unit II Complex Variable

Analytical functions - Cauchy-Riemann equations - Line integrals - Cauchy's theorem - Cauchy integral formula - Taylor's and Laurent's expansions - Cauchy's residue theorem – Poles – Evaluation of residues.

Unit III Special Functions

Legendre's differential equations: Legendre polynomials - Generating functions – Recurrence relation - Bessel's differential equation: Bessel polynomials – Generating functions – Recurrence relation - Hermite differential equation: Hermite polynomials - Generating functions – Recurrence relation.

Unit IV Differential Equations and Partial Differential Equations 12 h

Differential Equations: Linear ordinary differential equations - First order and second order equations and their various solutions - Partial differential equations: Solution of Laplace equation – Solution of wave and heat equations in two dimensions - Poisson and Helmholtz equations - Diffusion and wave equations.

Unit V Tensor and Group theory

Tensors: Contravariant - Covariant - Mixed tensors - Addition and subtraction of tensors - Symmetry and Antisymmetry tensor - Quotient rule - Pseudo tensors. Group theory: Subgroups - Classes - Cyclic groups - Abelian groups - Cosets - Homomorphism and isomorphism - Reducible and irreducible representations - Character table for simple molecular types (C2v and C3v point group).



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12 h

12 h

12 h

12 h

Text Books

- 1Dass H K and Rama Verma S, 2010, "Mathematical Physics", S. Chand and
Company Ltd , New Delhi.
- Gupta B D, 2009, "Mathematical Physics", 4th Edition, Vikas Publishing 2
- House Pvt Ltd, New Delhi.

References

- 1 George B. Arfken, Hans J. Weber, Frank E. Harris, 2012, "Mathematical Methods For Physicists: A Comprehensive Guide", Academic Press.
- 2 Sathya Prakash M, 2016, "Mathematical Physics with Classical Mechanics, 6th Edition, Sultan Chand & Sons, New Delhi.
- ³ Rajput, B.S, 2008, "Mathematical Physics", 20th Edition, PragatiPrakashan.
- 4 E Book: Greenberg, M D. 2013," Advanced Engineering Mathematics", 2nd Edition, Person new.
- ⁵ https://www.myprivatetutor.ae/prime/documents/ppts/details/199/ppto n-state-transition-matrix&title=www.myprivatetutor.ae.
- ⁶ https://www.tutorialsduniya.com/notes/complex-analysis-notes./
- 7 https://www.tutorialsduniya.com/notes/linear-algebra-tensor-analysisnotes/.



Course Code	Course Name	Category	L	Т	Р	Credit
222PY2A1CB	THERMODYNAMICS AND STATISTICAL MECHANICS	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The concepts of microstates, macrostates and ensembles
- The various statistical distributions and transport phenomenon
- The concepts of phase transitions and thermodynamic functions

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Relate the thermodynamics, microstates through thermodynamics postulates, quantities and relations	K2
CO2	Identify the micro and macroscopic properties of the mater	K3
CO3	Explain the classical and quantum distribution laws and their relations	K2
CO4	Apply the transport properties and understand equilibrium and non-equilibrium process	K3
CO5	Classify and evaluate the heat capacities, Ising model through phase transitions	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1				\checkmark	
CO2	\checkmark	\checkmark	\checkmark		\checkmark
CO3				~	
CO4	\checkmark	\checkmark	\checkmark		\checkmark
CO5	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark

 ✓ 	Skill Development	Entrepreneurial Development
	Employability	Innovations
	Intellectual Property Rights	Gender Sensitization
	Social Awareness/ Environment	Constitutional Rights/ Human Values/ Ethics



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M.Sc. Physics (Students admitted during the AY 2022-23)

Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit IThermodynamics, Microstates and Macrostates12 h

Basic postulates of thermodynamics – Fundamental relations and definition of intensive variables – Intensive variables in the entropic formulation – Equations of state – Euler relation - Densities - Gibbs-Duhem relation for entropy - Microstates and macrostates – Ideal gas – Liouville's Theorem.

Unit II Microcanonical, Canonical and Grand Canonical Ensembles 12 h

Microcanonical distribution function – Two level system in microcanonical ensemble – Gibbs paradox – The canonical distribution function – Partition function and free energy of an ideal gas – Relation between grand canonical and canonical partition functions.

Unit III Distributions Functions and Fermi Energy 12 h

Maxwell-Boltzmann -Bose-Einstein and Fermi-Dirac distributions – Non interacting Bose gas and thermodynamic relations – Chemical potential of bosons – Non interacting Fermi gas and thermodynamic relations – Fermi gas at zero and low temperature – Fermi energy - Fermi momentum.

Unit IVTransport Processes12 h

Derivation of Boltzmann transport equation - Representation of states - Free streaming - Collision term - Equilibrium distribution – Transport phenomena - One speed and one dimension – Thermal conductivity - Brownian motion - Langevin's theory - Molecular diameter.

Unit VHeat Capacities, Ising Model and Phase Transitions12 h

Heat capacities of heteronuclear diatomic gas – Heat capacities of homonuclear diatomic gas – One-dimensional Ising model and its solution by variational method - Phase transitions and criterion for phase transitions – Classification of phase transitions by order and by symmetry – Phase diagrams for pure systems – Clausius-Clapeyron equation.



Text Books

- 1Palash B Pal, 2017, "An Introductory Course of Statistical Mechanics", Narosa
Publishing House, New Delhi.
- 2 Reif, 2010, "Fundamentals of Statistical and Thermal Physics", Sarat Book Distributors.

References

- 1 Kittel C, 2004, "Elementary Statistical Physics", John Wiley & Sons.
- 2 Agarwal J P, SatyaPrakash, 2008, "Thermodynamics And Statistical Physics", Pragati Prakashan, Meerut.
- ³ Gupta and Kumar, 2003, "Statistical Mechanics", Pragati Prakashan, Meerut.
- 4 E Book: SatyaPrakash, "Statistical Mechanics", Kedar Nath Ram Nath, Meerut.
- ⁵ https://youtu.be/SBe7n7WpU8M
- ⁶ https://www.slideshare.net/NarendraKumar277/3d-ising-model



Course Code	Course Name	Category	L	Т	Р	Credit
222PY2A1CC	CLASSICAL MECHANICS	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The concepts of Lagrangian and Hamiltonian mechanics
- Apply the concepts of classical mechanics to the particle systems and rigid bodies
- Emphasize the mathematical formulation in relativity problems

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Apply the Lagrangian formulation for the motion of the particles	K3
CO2	Construct the Hamilton's dynamics and experiment with variational principle	К3
CO3	Summarize the canonical transformations	K2
CO4	Analyze the dynamics of a rigid body in various aspects	K4
CO5	Make use of the central force problem and theory of relativity	К3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	\checkmark	~	\checkmark	\checkmark	\checkmark
CO2	\checkmark	~	\checkmark	\checkmark	\checkmark
CO3				\checkmark	
CO4	\checkmark	~	\checkmark	\checkmark	\checkmark
CO5	\checkmark	√	✓	\checkmark	\checkmark

✓	Skill Development	Entrepreneurial Development
 ✓ 	Employability	Innovations
	Intellectual Property Rights	Gender Sensitization
	Social Awareness/ Environment	Constitutional Rights/ Human Values/ Ethics



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10 h

Total Credits: 4

SEMESTER I

Total Instruction Hours: 48 h

Syllabus

Unit I Lagrangian Dynamics

Mechanics of system of particles - Coordinate systems - Configuration space -Constraints – Principle of virtual work - D'Alembert's principle – Hamilton's principle - Lagrange's equation – Conservation laws and Symmetry properties – Applications of the Lagrangian formulation: Single particle in space - Atwood's machine.

Unit II Hamilton's Dynamics and Variational Principle 10 h

Cyclic coordinates - Conservation theorem - Jacobi integral equation for Hamilton's principle function - Hamilton's equations - Hamilton's equations in different coordinate systems - Examples in Hamiltonian dynamics - Calculus of variation - Principle of least action.

Unit IIIClassical Transformation and Poisson Brackets9 h

Canonical transformations - Legendre transformation - Generating functions -Procedure for application of canonical transformations - Condition for canonical transformation - Poisson brackets - Lagrange Brackets - Relation between Lagrange and Poisson brackets.

Unit IVDynamics of a Rigid Body10 h

Generalized coordinates of rigid body - Euler angle - Infinitesimal rotation as vectors - Components of angular velocity - Angular momentum - Inertia tensor -Moments of Inertia for different body systems - Euler's equations of motion -Torque free motion of a rigid body.

Unit V Central Force Problem and Theory of Relativity 9 h

Reduction to the equivalent one body problem - Equation of motion and first integrals - Classification of orbits - Kepler problem: Motion under inverse square law - Artificial satellites - Virial theorem – Lorentz transformation - Consequences of Lorentz transformations.



Text Books

- Upadhaya J C, 2018, "Classical Mechanics", 2nd Edition, Himalaya Publishing
- 1 House Pvt. Ltd, Mumbai.
- Aruldhas G, 2015, "Classical Mechanics", PHI Learning Private Limited, New Delhi.

References

- 1 Gutpa S L, Kumar V, and Sharma HV, 2016, "Classical Mechanics", Pragati Prakashan, Meerut.
- 2 Gupta K C, 2018, "Classical Mechanics of Particles and Rigid Bodies", 3rd Edition, New Age International Publishers, New Delhi.
- Rana N C and Joag P J, 2015, "Classical Mechanics", Tata McGraw Hill, New Delhi.
- 4 E-Book: Goldstein H, Poole C, and Safko J, 2002, "Classical Mechanics", 3rd Edition, Pearson Education Asia, New Delhi.
- ⁵ https://archive.nptel.ac.in/courses/115/105/115105098/
- ⁶ https://archive.nptel.ac.in/courses/115/106/115106123/



Course Code	Course Name	Category	L	Т	Р	Credit
222PY2A1CD	ELECTRONICS	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The various types of diodes, transistors and their applications
- Acquire knowledge on transistors and thyristors
- The types of operational amplifiers and integrated circuits

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Outline about various semiconductor diodes	К2
CO2	Identify and construct various transistors and optoelectronic devices	K3
CO3	Examine the working of thyristors and its applications	K4
CO4	Categorize the analog electronics	K4
CO5	Experiment with the operational amplifiers and integrated chips	К3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1				\checkmark	
CO2	\checkmark	\checkmark	\checkmark	\checkmark	
CO3	\checkmark	\checkmark	\checkmark	\checkmark	✓
CO4	\checkmark	\checkmark	\checkmark	\checkmark	✓
CO5	\checkmark	\checkmark	\checkmark	\checkmark	

 ✓ 	Skill Development	Entrepreneurial Development
 ✓ 	Employability	Innovations
	Intellectual Property Rights	Gender Sensitization
	Social Awareness/ Environment	Constitutional Rights/ Human Values/ Ethics



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SEMESTER I

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Special Diodes

V-I Characteristic of a PN junction diode - The ideal diode - Static and dynamic resistance of a diode - Parallel configuration of a diode circuits with a DC voltage source - Diode circuit with DC and AC voltage sources - Zener diode - Tunnel diode - Varactor diode - Schottky diode.

Unit IIPower Electronics and Optoelectronics Device9 h

Bipolar junction transistor construction, Current gain, Input and output of BJT in CB, CE, CC configurations - Phototransistor - Operation, characteristic, drain and transfer characteristics of JFET. Circuit symbol - drain characteristics and transfer characteristics of depletion type MOSFET.

Unit III Thyristors

Types of thyristors - Silicon controlled rectifier (SCR) - SCR biasing and operation -SCR equivalent circuit – V-I characteristics of SCR – Uni-junction Transistor (UJT) constructions and equivalent circuit of UJT - UJT operation – V-I characteristics of UJT - Silicon controlled switch (SCS) - SCS operation - applications - SUS, SBS, SAS.

Unit IV Analog Electronics

Op-Amp Pparameters - Block diagram of an Op-Amp - The Op-Amps as a Voltage amplifier - Ideal operational amplifier - Virtual ground and summing point - Inverting amplifier - Non inverting amplifier - Linear amplifier - Differential amplifier - Active filters - low pass filters - high pass filters - band pass filters.

Unit VOp Amp Applications and Special ICs10 h

Comparators - The integrator - The differentiator - Log Amplifier - Antilog Amplifier - Linear integrated circuits - Digital integrated circuits - Integrated devices and circuits formation - Applications - 555 timer circuit - Functional block diagram - Characteristics and applications - Astable and monostable multivibrator.



9 h

10 h

10 h

Text Books

- Sedha R S, 2013, "Applied Electronics", S.Chand and Company, New Delhi.
 Mehta V K, Rohit Mehta, 2014, "Principles of Electronics", S.Chand and
- 2 Company, New Delhi.

References

- Theraja B L, 2014, "Basic Electronics", S. Chand and Company, New Delhi.
 Jacob Millman, Christos C Halkias, Chetan Parikh, 2016, "Integrated
- Electronics Analog and Digital Circuits and Systems", 2nd Edition, McGraw
 Hill Education (India) P Ltd, New Delhi.
- ³ David A, 2007," Electronic Devices and Circuits", 4th Edition, Prentice Hall.
- 4 E Book: Walter Banzhaf, 2010, "Understanding Basic Electronics", American Radio Relay League
- ⁵ https://nptel.ac.in/courses/108101091
- 6 https://nptel.ac.in/courses/108102095



CORE PRACTICAL - I : THERMODYNAMICS AND OPTICS

SEMESTER I

Total Credits:2Total Instructions Hours:48 h

S.No	Contents
1	Determination of Stefan's constant.
2	Determination of specific heat capacity of metal-Forbes Method.
3	Determination of specific heat capacity of Liquid -Ferguson Method.
4	Young's Modulus- Elastic constants of the material -Elliptical fringes.
5	Determination of the wavelength of laser source - transmission grating.
6	Determine unknown resistance using a Kelvin double bridge experiment.
7	Determination of refractive index of liquid-Air wedge.
8	Determination of Audio Frequency-Bridge method.
9	Characteristics of LDR.
10	Determination of Planck's constant.
11	Thermal conductivity of liquid and air by Lee`s disc method.
12	Determination of wavelength of laser - single slit/Double slit.
13	Young's Modulus- Elastic constants of the material-hyperbolic fringes.
14	Determination of the thickness of wire by air wedge.
15	Determination of the thermistor - temperature coefficient and bandgap energy distribution

Note: Any 10 Experiments


References

- 1 Dunlap R A, 1988, "Experimental Physics: Modern methods", Oxford University Press, New Delhi.
- 2 Smith E V, 1970, "Manual for experiments in Applied Physics", Butterworths.
- 3 CMalacara D,1988, "Methods of Experiments Physics", Series of Volume, Academic Press, Inc.
- 4 Raghvan V, 2004, "Experiments in material science", 5th edition, PHI Learning Pvt. Ltd.



SEMESTER I

Total Credits:2Total Instructions Hours:48 h

S.No	Contents
1	Build the Waveform generation of Sine Wave using OP-AMP.
2	Construction of Hartley oscillator using OP-AMP.
3	Construction of an Astable Multivibrator.
4	Construction of Differentiator, Integrator circuit using OP-AMP.
5	Construction of Adder, Subtraction, Sign Changer circuit using OP-AMP.
6	Assemble the Serial and parallel sequential circuits using Shift Register.
7	Determine the shift of output voltage using Clipping and Clamping Circuits.
8	Construct the Modulus counter using IC 7490.
9	Determine the Analog to digital Converter using Op-Amp.
10	Build the Triangular waveform generation using Op-Amp.
11	Construct the Phase Shift Oscillator.
12	Make the Square Wave form using OP-AMP.
13	Construction of an active filters using Op-Amp.
14	Construction of an frequency response of an Op-Amp.
15	Assemble the parameters of Op - Amp.

Note: Any 10 Experiments



- 1 Jones B K, 1986, "Electronics for Experimentation and research", Prentice-Hall.
- 2 Zbar P B., Malvino A P and Miller M A., 1994, "Basic Electronics: A text lab manual", Tata McGraw Hill, New Delhi.
- 3 Malvino A.P., 1992, "Basic Electronics A text lab manual", Tata McGraw Hill.
- 4 Singh S P., 2003, "Advanced Practical Physics Vol I & II", Pragati Prakasan Meerut.



Course Code	Course Name	Category	L	Т	Р	Credit
222PY2A1DA	ENERGY PHYSICS	DSE	4	I	-	4

This course has been designed for students to learn and understand

- The concept of energy resources
- The types of renewable energy and production of biomass
- The energy storage systems

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Relate the energy source and their importance.	K1
CO2	Make use of the concept of hydro-power and wind power	К3
CO3	Categorize the energy from biomass, biofuels and geothermal.	K4
CO4	Analyze the solar energy and photo synthesis.	K4
CO5	Identify the energy systems, storage and transmission.	К3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1				\checkmark	
CO2	~	~	\checkmark	\checkmark	
CO3	~	~	\checkmark	\checkmark	~
CO4	~	~	\checkmark	\checkmark	✓
CO5	√	\checkmark	\checkmark	\checkmark	

 ✓ 	Skill Development		Entrepreneurial Development
✓	Employability	✓	Innovations
	Intellectual Property Rights		Gender Sensitization
 ✓ 	Social Awareness/ Environment		Constitutional Rights/ Human Values/ Ethics



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Total Credits: 4

SEMESTER I

Total Instruction Hours: 48 h

Syllabus

Unit I Energy Source

Energy and sustainable development - Scientific principles of renewable energy -Properties of transparent materials - Heat transfer by mass transport - Multimode transfer and circuit analysis - Extraterrestrial solar radiation - Components of radiation - Effect of earth's atmosphere - Measurement of solar radiation.

Unit IIHydro-power and Wind power9 h

Assessing the resource for small installations - Reaction turbines - Hydroelectric systems - Turbine types and terms - Linear momentum and basic theory - Dynamic matching - Blade element theory- Characteristics of the wind - Power extraction by a turbine - Electricity generation - Mechanical power.

Unit III Biomass, Biofuels and Geothermal energy 10 h

Biofuel classification - Biomass production for energy farming - Direct combustion for heat - Pyrolysis (destructive distillation) - Alcoholic fermentation - Anaerobic digestion for biogas - Wastes and residues - Vegetable oils and biodiesel -Geophysics - Dry rock and hot aquifer analysis - Harnessing Geothermal Resources.

Unit IVSolar Energy and Photo synthesis10 h

Air heaters - Water desalination - Solar ponds - Solar concentrators - Solar thermal electric power systems - Photon absorption at the junction - Solar radiation absorption - Maximizing cell efficiency -Solar cell construction - Types and adaptations of photovoltaics - Photovoltaic circuit properties - Thermodynamic considerations - Photophysics.

Unit VEnergy systems, Storage and Transmission9 h

Biological storage - Chemical storage - Heat storage - Electrical storage: batteries and accumulators - Fuel cells - Mechanical storage - Distribution of energy -Electrical power - Socio-political factors - Some policy tools.



10 h

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- 1 E Book: John Twidell and Tony Weir, 2006, "Renewable Energy Resources", 2nd Edition, Taylor & Francis Group.
- 2 Rai G D, "Solar Energy Utilisation", 2014, Khanna Publishers, New Delhi.

References

- 1 Kothari D P, Singal K C, RakeshRanjan, 2014, "Renewable Energy Sources and Emerging Technologies", 2nd Edition, PHI Learning (P) Ltd, New Delhi.
- 2 Kreith and Kreider, 1978, "Principles of Solar Engineering", McGraw Hill Pub, New Delhi.
- ³ Sukhatme S P, 1996, "Solar Energy", TMH Publishers, New Delhi.
- 4 Meinel A B and Meinal A P, 1976, "Applied Solar Energy", S. Chand & Co. New Delhi.
- ⁵ https://www.slideshare.net/sanjanaangel16/ biomass-energy-ppt
- 6 https://www.google.com/url sa=t&source=web&rct=j&url=https://th.fhiberlin.mpg.de/th/lectures/materialscience



Course Code	Course Name	Category	L	Т	Р	Credit
222PY2A1DB	MATERIALS PHYSICS AND PROCESSING TECHNIQUES	DSE	4	I	I	4

This course has been designed for students to learn and understand

- The nucleation and growth techniques of crystals, thin films and nanomaterials
- The various plasma and vacuum processing techniques
- The structural, morphology, and surface characterization techniques

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Experiment with the growth process of crystals	К3
CO2	Explain the methods of plasma processing	К2
CO3	Make use of the important concepts of vacuum techniques	K3
CO4	Categorize the physical and chemical growth methods	K4
CO5	Examine the various spectroscopic and microscopic characterization methods for materials	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	1	1	√		1
CO2				~	
CO3	~	~	~		~
CO4	~	√	~	~	~
CO5	~	√	~	~	~

✓	Skill Development	Entrepreneurial Development
 ✓ 	Employability	Innovations
	Intellectual Property Rights	Gender Sensitization
	Social Awareness/ Environment	Constitutional Rights/ Human Values/ Ethics



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10 h

Total Credits: 4

SEMESTER I

Total Instruction Hours: 48 h

Syllabus

Unit I Crystal Growth and Nucleation

Nucleation phenomena: Critical supersaturation Homogeneous and heterogeneous nucleation - Nucleation on a substrate - Nucleation of a crystalline material - Surface nucleation - Vapor-Liquid-Solid mechanism of crystal growth -Gibbs's free energy- Chemical potential - Solubility curves - Bridgman-Stockbarger and related techniques - Czochralski and related techniques.

Unit II Thermal Plasma Processing

Advantages of plasma processing - Thermal plasmas - Principles of plasma generation - DC plasma torches - AC plasma torches - RF plasma torches - Plasmaparticle interaction - Plasma processing systems - Plasma-spraying - Plasma reactors and furnaces - Plasma decomposition - Processing of ceramics - Treatment of hazardous wastes.

Unit III Vacuum Techniques

Artificial vacuum - Natural vacuum - Applications of vacuum techniques -Calculation of vacuum systems - Vacuum pumps - Principles of pumping -Parameters and classifications - Mechanical pumps - Vapour pumps - Ion-pumps -Classification and selection of vacuum gauges - Thermal conductivity gauges -Pirani gauge.

Unit IV Growth Technique of Thin films and Nanomaterials 9 h

Thermal Evaporation: RF heating - Electron bombardment heating - Cathodic sputtering: Glow discharge sputtering - Reactive sputtering - Physical Vapor Deposition - Chemical Vapor Deposition - Sol-Gel Technique - Hydrothermal growth - Combustion synthesis - Microwave synthesis.

Characterization Tools Unit V

Working principles and instrumentation: X-Ray Diffraction - Raman spectroscopy -UV-vis spectroscopy - Photoluminescence spectroscopy - Fourier transform infrared spectroscopy - Scanning electron microscopy - Transmission electron microscopy - Scanning probe microscopy.



9 h

10 h

10 h

- 1 Bhat H L, 2015, "Introduction to crystal growth principles and practice", CRC Press, Boca Raton, USA. (Unit 1)
- 2 Ananthapadmanabhan P V and Venkataramani N, 1999, "Thermal plasma processing", Pergamon Materials series Vol.2. (Unit 2)

References

- 1 Roth A, 1990, "Vacuum Technology", 3rd Edition, North Holland. (Unit 3)
- Rajendra Kumar Goyal, 2018, "Nanomaterials and nanocomposites, synthesis,
- ² Properties, characterization techniques and applications", CRC Press, Boca Raton, USA. (Unit 4)
- 3 Hartmut Frey, Hamid R Khan, 2015, "Handbook of thin film technology", Springer-Verlag, Berlin. (Unit 4, 5)
- 4 Chopra K L, 1969, "Thin films phenomena", 1st Edition, McGraw Hill, New York.
- ⁵ Rajendran V, 2014, "Materials Science", Tata McGraw-Hill, New Delhi
- ⁶ https://doi.org/10.1142/9789812770387_0002
- ⁷ https://nanocomposix.com/pages/nanoparticle-characterization-techniques



Course Code	Course Name	Category	L	Т	Р	Credit
222PY2A1DC	LASER PHYSICS AND NONLINEAR OPTICS	DSE	4	-	-	4

This course has been designed for students to learn and understand

- The type of lasers, and their characteristics
- The applications of lasers in industry and medicine
- The theory and applications of non-linear optics

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Explain the principle and construction of various lasers	K2
CO2	Identify the features of lasers	K3
CO3	Apply the characteristics of LASER in various industrial and medical applications	K3
CO4	Make use of the concepts of nonlinear optics in higher order harmonic generations	К3
CO5	Examine the nonlinear optical interactions and make use in various applications	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1				\checkmark	
CO2	~	~	\checkmark	\checkmark	
CO3	~	~	~	~	
CO4	~	~	~	~	
CO5	~	~	\checkmark	~	✓

✓ Skill Development	Entrepreneurial Development
✓ Employability	Innovations
Intellectual Property Rights	Gender Sensitization
Social Awareness/ Environment	Constitutional Rights/ Human Values/ Ethics



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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I 10 h Lasers Fundamentals and Types

Principle of laser - Absorption process - Emission process - Characteristics of laser -Einstein relation - Laser operation - Population inversion and derivation of threshold gain - Gain medium - Optical feedback - Active medium - Laser types -He-Ne laser - CO₂ laser - Nd:YAG laser- Semiconductor laser - Liquid dye laser.

Unit II Laser Characteristics

Threshold conditions - Line shape function with Doppler broadening - Population inversion and pumping threshold - High intensity laser - Laser modes and mode locking - Mode locking method - Q switching and techniques - Frequency stabilization.

Unit III Laser Applications

Industry - Medical application of laser - Safety aspects in laser usage - Laser Doppler velocity meter - Laser strain gauges - Holography: Operating principle -Construction and reconstruction of hologram - Simplified theory of holography -Holographic memory - Laser machining processes - Laser spectroscopy.

Unit IV 10 h Introduction to Nonlinear Optics

Introduction to nonlinear optics - Descriptions of nonlinear optical processes -Second harmonic generation - Optical parametric oscillation - Third-order nonlinear optical processes - Third-harmonic generation - Nonlinear susceptibility -Properties of the nonlinear susceptibility.

Unit V Non Linear Optical Interactions 10 h

The wave equation for nonlinear optical media - Phase matching - Quasi-phase matching - The Manley Rowe relations - Sum frequency generation - Difference frequency generation and parametric amplification - Nonlinear optical interactions with focused Gaussian beams.



9 h

9 h

- 1 Nagabhushana S, Sathyanarayana N, 2013, "Laser and Optical Instrumentation", IK International Publishing House Pvt Ltd, New Delhi
- 2 E Book: Robert W. Boyd, 2008, "Nonliner Optics", 3rd Edition, Academic Press.

References

- 1 AvadhanuluM. N., Hemne P.S., 2013, " An Introduction to Lasers theory and applications", S. Chand and Co., New Delhi
- 2 Richard L Sutherland, 2003, "Handbook of Nonlinear Optics", Marcel Dekker AG
- 3 Laud L L, 1991, "Lasers and Nonlinear Optics", 2nd Edition, New Age International (P) Ltd, New Delhi.
- 4 Skoog D A, Holler F J and Crouch S R, 2007, "Principles of Instrumental Analysis", Thomson Brooks/Cole, Belmont, CA
- 5 https://www.youtube.com/watch?v=PK4yFaGHSFc&list=PLU0oJASIjGxdZ MtypwhvGrnmuzNnNdcKt
- 6 https://www.youtube.com/watch?v=Ab1nxxkgjH8&list=PLp6ek2hDcoNCj _QQA2CmW1JIHAm5aD7o



Course Code	Course Name	Category	L	т	Р	Credit
222PY2A2CA	SPECTROSCOPY	CORE	4		1	4

This course has been designed for students to learn and understand

- The different techniques of spectroscopy and their applications 0
- The microwave, IR, and Raman spectroscopy and their instrumentation 0
- The nuclear magnetic resonance, electron spin resonance, nuclear quadrupole resonance and 0 Mossbauer spectroscopy

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Interpret the concepts of microwave spectroscopy to identify various chemical compounds.	K2
CO2	Discuss the modes of vibration in molecules using IR spectroscopy.	K2
CO3	Apply the theory of Raman spectroscopy for structure determination of organic and inorganic compounds.	К3
CO4	Illustrate the spectra of Nuclear magnetic resonance and Electron spin resonance.	K3
CO5	Analyze the principle of nuclear quadrupole resonance and Mossbauer spectroscopy.	K4

MAPPING WITH PROGRAMME OUTCOMES

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COs/POs	PO1	PO2	PO3	PO4	PO5
CO1				~	
CO2				~	
CO3	1	1	√	1	
CO4	1	1	1	1	
CO5	1	1	1	1	1

COURSE FOCUSES ON

~	Skill Development	\checkmark	Entrepreneurial Development
✓	Employability	1	Innovations
\checkmark	Intellectual Property Rights		Gender Sensitization
	Social Awareness/ Environment		Constitutional Rights/ Human Values/ Ethics



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COIMBATORE | INDIA

M.Sc. Physics (Students admitted during the AY 2022-23)

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STER II

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I **Microwave Spectroscopy**

Rotation of molecules - Rigid rotator (diatomic molecules) - Expression for the rotational constant - Intensity of spectral lines - Theory of microwave spectra of linear and symmetric top molecules - Techniques and instrumentation - Chemical analysis by microwave spectroscopy.

Unit II Infrared Spectroscopy

Vibrational energy of a diatomic molecule - Infrared selection rules - Vibrating diatomic molecule - Normal modes of vibration in crystal - Interpretation of vibrational spectra - Group frequencies - IR spectrophotometer instrumentation -Sample handling techniques - Fourier transform infrared spectroscopy (Principle and Working) - Applications.

Unit III Raman Spectroscopy

Theory of Raman scattering - Rotational Raman spectra - Vibrational Raman spectra - Mutual exclusion principle - Raman spectrometer - Sample handling techniques - Polarization of Raman scattered light - Structure determination using IR and Raman spectroscopy - Raman investigations of phase transitions -Resonance Raman scattering - Surface selection rules - SERS microprobe -Applications of SERS.

Nuclear Magnetic Resonance and Electron Spin Resonance Unit IV 10 h Spectroscopy

Theory of NMR method - Resonance condition - NMR instrumentation -Relaxation processes - Bloch equations - Chemical shift - Spin-spin coupling -Interpretation of certain NMR spectra.

Principle of ESR - ESR spectrometer - Total Hamiltonian - Hyperfine structure -ESR spectra of free radicals in solution.



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M.Sc. Physics (Students admitted during the AY 2022-23)

9 h

50

9h

Unit V Nuclear Quadrupole Resonance and Mossbauer 10 h Spectroscopy

Principle of nuclear quadrupole resonance – Transitions for axially and non-axially symmetric systems – NQR instrumentation – Crystallographic inequivalence – Chemical bonding – Hydrogen bonding.

The Mossbauer effect - Recoilless emission and absorption - Experimental techniques - Isomer shift – Quadrupole Interaction - Magnetic hyperfine interaction – Applications.

Text Books

1

Aruldhas G, 2017, "Molecular Structure and Spectroscopy", 2nd edition,

Prentice Hall of India Pvt. Ltd & New Delhi.

Colin N Banwell and Elaine M McCash, 2016, "Fundamentals of Molecular

2 Spectroscopy", 4th edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi.

References

- 1 William Kemp, 2002, "Organic Spectroscopy", 3rd edition, Palgrave Publishers Ltd, New York.
- 2 Jag Mohan, 2004, "Organic Spectroscopy Principles and Applications", 2nd edition, Narosa Publishing House Pvt. Ltd, New Delhi.
- 3 Sharma YR, 2013, "Elementary Organic Spectroscopy Principles and Chemical Applications", 3rd edition, S. Chand & Company Pvt. Ltd, New Delhi.
- 4 Straughen R P and Walker S, 1976, "Spectroscopy", Vols. I, II and III, 2nd edition Chapman & Hall, London.
- 5 http://www.rnlkwc.ac.in/pdf/study-material/chemistry/Spectroscopy.pdf.
- 6 https://microbenotes.com/infrared-ir-spectroscopy.
- 7 NPTEL Video: www.youtube.com/watch?v=g2sqX3FkcRo&list=PLOzRYV m0a65eCqECeSQJwmKX6D4zibX84.



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Course Code	Course Name	Category	L	т	P	Credit
222PY2A2CB	SOLID STATE PHYSICS	CORE	4	1	-	4

This course has been designed for students to learn and understand

- The crystalline structure, lattice vibration of atoms
- The free electron and band theory of crystalline materials
- The concept of dielectrics and superconductors

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Identify the crystallography and bonding in solids.	K2
CO2	Discuss the crystal structure and binding.	K2
CO3	Relate the crystal imperfections and atomic diffusion.	КЗ
CO4	Interpret lattice vibration and thermal properties.	K3
CO5	Explain the free electron and band theory.	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1				1	
CO2	en l'Arrivelle			1	
CO3	~	1	1	1	
CO4	~	~	1	1	
CO5	1	1	1	1	1

COURSE FOCUSES ON

 ✓ 	Skill Development	\checkmark	Entrepreneurial Development
~	Employability	✓	Innovations
1	Intellectual Property Rights		Gender Sensitization
	Social Awareness/ Environment		Constitutional Rights/ Human Values/ Ethics



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Total Credits: 4

SEMESTER II

Total Instruction Hours: 60 h

Syllabus

Unit I Fundamentals of Crystallography and Bonding in Solids 12 h

Crystalline state – Bravais lattices and crystal systems – Elements of symmetry – Crystal directions – Miller indices – Simple crystal structures (NaCl, CsCl, Hexagonal close packed structure, Diamond structure, Cubic ZnS structure). Forces between atoms – Ionic bonding – The Born-Haber Cycle – Covalent bonding – Metallic bonding – Hydrogen bonding – Van Der Waals bonding.

Unit II Crystal Structure and Binding

Diffraction of X-Rays by simple lattice array of atom - Bragg's law - Correction for Bragg's equation - Laue method - Rotating crystal method -Powder photograph method - Diffraction of electrons - Diffraction of neutrons - Laue derivation of amplitude of scattered wave - Reciprocal lattice - Properties of reciprocal lattice -Reciprocal lattice to BCC & FCC lattice.

Unit III Crystal Imperfections and Atomic Diffusion

Point imperfections – Concentrations of Vacancy, Frenkel and Schottky imperfections – Line Imperfections – Burgers Vector – Presence of dislocation – Surface imperfections – Polorans – Excitons. Ficks first and second law – Diffusion mechanism – Applications of diffusion – Kirkendall effect.

Unit IV Lattice Vibration and Thermal Properties 12

Elastic vibrations of continuous media - Theory of wave motion of one dimensional atomic lattice - Group and phase velocity - Phonons – Phonon momentum – Inelastic scattering of neutron by phonons. Thermal properties: Einstein's theory of specific heat – Anharmonic crystal interactions - Lattice thermal conductivity of solids.

Unit V Free Electron and Band Theory

Failure of classical free electron theory - Fermi-Dirac distribution - Matthiessen's rule - Magnetoresistance. Bloch theorem - Kronig - Penney model - Extended,

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12 h

12 h

Reduced and periodic zone schemes – Tight binding approximation – Brillouin Zone - Construction of Fermi surfaces - De Haas-van Alphen effect.

Text Books

- 1 Wahab M.A, 2019, "Solid State Physics", 3rd edition, Narosa Publication, New Delhi.
- 2 Gupta S L, Kumar V, 2018, "Solid State Physics", 9th edition, K. Nath& Co., Meerut.

References

- 1 Pillai S O, 2018, "Solid State Physics", 8th edition, New age international Publisher.
- 2 Charles Kittel, 2017, "Introduction to Solid State Physics", 8th edition, Wiley India Pvt. Ltd, New Delhi.
- 3 Phillips P, 2012,"Advanced Solid State Physics", 2nd Edition, Cambridge University Press.
- 4 Patterson J D, Bailey B C, 2007, "Solid-State Physics: Introduction to the Theory", Springer Publications.
- 5 Puri R K, Babbar V K, 2010, "Solid State Physics", S.Chand, New Delhi.
- 6 https://www.fzu.cz/~knizek/literatura/Ashcroft_Mermin.pdf
- 7 http://www.issp.ac.ru/ebooks/books/open/Introduction%20to%20Modern %20Solid%20State%20Phys.pdf

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Course Code	Course Course Name Code QUANTUM MECHANICS - I	Category	L	Т	P	Credit
222PY2A2CC	QUANTUM MECHANICS - I	CORE	4	1	-	4

This course has been designed for students to learn and understand

- The wave functions, quantum mechanical operators and its applications
- The quantum mechanical concepts to solve wave equations
- The angular momentum and system of identical particles

COURSE OUTCOMES

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

CO Number	CO NumberCO StatementCO1Understand the principles of quantum mechanics applicable to various observables on wave functions.	
CO1		
CO2	Interpret time independent Schrodinger equation for square well potential problems.	K2
CO3	Relate the concept of three dimensional potentials and angular momentum.	К3
CO4	Apply matrix method for quantum mechanical problems and explain system of identical particles.	К3
CO5	Analyze scattering and partial wave concepts.	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1				1	-s. enertin da
CO2				1	
CO3	✓	1	1	1	
CO4	\checkmark	1	1	1	
CO5	\checkmark	1	1	1	~

COURSE FOCUSES ON

~	Skill Development	\checkmark	Entrepreneurial Development
 Image: A state of the state of	Employability	1	Innovations
\checkmark	Intellectual Property Rights		Gender Sensitization
	Social Awareness/ Environment		Constitutional Rights/ Human Values/ Ethics



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QUANTUM MECHANICS - I

SEMESTER II

12 h

12 h

Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I Foundations of Quantum Mechanics

Postulates of quantum mechanics - Interpretation of the wave function - Schrödinger wave equations - Probability of interpretation - Current density -Expectation value -Ehrenfest's theorem - Stationery states - Admissibility conditions of the wave function - Linear operator - Eigen values and functions - Hermitian operator - Dirac's notation.

Unit II One Dimensional Energy Eigen value Problems 12 h

Equation of motion – Schrödinger, Heisenberg and interaction representation - Square well potential with rigid walls - Square well potential with finite walls - Square well potential barrier - Alpha emission - Free particle - Linear harmonic oscillator: Schrödinger method.

Unit III Three-Dimensional Problems and Angular Momentum 12 h

Particle in a spherical symmetric potential - Rigid rotator - Hydrogen atom – Angular momentum operator and commutation relations – Eigen value and Eigen function of L_2 and L_z – Eigen value of J_2 and J_z – Spin angular momentum - Addition of angular momenta – Clebsh Gordan coefficients.

Unit IV Heisenberg Method and Many Electron Atoms 12 h

Matrix representation of wave function and operator - Properties of matrix elements -Schrodinger equation in matrix form - Eigen value problems - Unitary transformation -Linear harmonic oscillator in matrix method - Pauli's principle - Inclusion of spin – Spin functions for two electrons and three electrons.

Unit V Scattering Theory

Scattering cross section – Scattering by a central potential: Partial wave analysis – Scattering by an attractive square well potential - Breit-Wigner Formula - Scattering length - Expression for phase shifts - Green's function - Born approximation and its validity.



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- 1 Aruldhas G, 2008, "Quantum Mechanics", 2nd edition, Prentice Hall of India Pvt. Ltd & New Delhi.
 - Matthews P M, Venkatesan K, 2010, "A Textbook of Quantum Mechanics",
- 2 2nd edition, McGraw Hill Education (India) Private Limited& New Delhi.

References

- 1 Leonard I. Schiff, 2016, "Quantum Mechanics", 3rd edition, Mc Graw Hill International& New Delhi.
- 2 Rajasekar Shanmuganathan, Velusamy R, 2014, "Quantum Mechanics I", 2nd edition & CRC Press.
- 3 SatyaPrakash, Kedar Nath, 2018, "Quantum Mechanics", 5th edition, Ram Nath and Co. Publications.
- 4 Thankappan V K, 2018, "Quantum Mechanics", 2nd edition, New Age International (P) Ltd.
- 5 Merzbacher E, 2011, "Quantum Mechanics", 3rd edition, John Wiley Inter science Publications
- 6 https://scholar.harvard.edu/files/david-morin/files/waves_quantum.pdf.
- 7 https://farside.ph.utexas.edu/teaching/qmech/qmech.pdf.

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222PY2A2CP CORE PRACTICAL: SOLID STATE AND SPECTROSCOPY

SEMESTER II

Total Credits:2Total Instructions Hours:48 h

S.No	Content
1	Determination of optical activity of specific rotation using Polarimeter.
2	Determination of refractive index of liquid using He-Ne laser.
3	Determination of e /m by Thomson method.
4	Determination of Rydberg's constant using Solar spectrum.
5	Determination of e/m by Magnetron method.
6	Study the band gap energy using Thermistor.
7	Determination of Hall coefficient, mobility, Hall angle and number of charge carriers by using Hall setup.
8	Determination of refractive index of liquid by Newton's ring.
9	Determination of resistivity and band gap using four probe method for given materials.
10	Estimate the band gap and particle size of a material from a given UV-Visible spectrograph.
11	Determination of viscosity using liquid -Mayer's disc method.
12	XRD spectrum analysis of the given sample.
Note: Ar	y 10 experiments
Referenc	es
1 Ra Lea	ghavan V, 2004, "Experiments in Material Science". 5th edition, PHI arning Pvt. Ltd., New Delhi.
2 Sai Pu	mir Kumarghosh, "Textbook of Advanced Practical Physics", NCBA blishers.

- 3 Arora C.L, "Practical Physics", S. Chand & Co., New Delhi.
- 4 Smith E. V, 1970, "Manual for experiments in Applied Physics", Butterworths.



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222P ¥ 2	A2CQ CORE PRACTICAL - IV: ELECTRONICS - II SEMESTER II
	Total Credits: 2 Total Instructions Hours: 48 h
S.No	Contents
1	Construction of Colpitt's oscillator using Op-Amp.
2	Study the Schmitt's trigger using OP-Amp.
3	Study the static and drain characteristics of a JFET.
4	Construction of Analog to Digital convertor using IC 74148.
5	Construction of inverting, non-inverting and voltage follower using Op Amp.
6	Study the half adder, full adder, half subtractor and full subtractor usin ICs.
7	Construction of bistable multivibrator using Op-Amp 741/ NE 555.
8	Study the characteristics of BJT.
9	Construction of logarithmic amplifier using Op-Amp 741.
10	Construction of an astable multivibrator using IC 741.
11	Construction of second order low and high pass filters using IC 741.
	Current the characteristics of MOSEET

Ouseph. C.C , 2014, "Practical Physics and Electronics", Viswanathan 1 Publishers Ltd.

- Bhattacharya. A.B, 2011, "Advanced Electronic Practicals", New Central 2 Book Agency (NCBA)
- Chattopadhyay. D , 2015, "Advanced Course in Practical Physics", 3 New Central Book Agency (NCBA)
- Samir Kumar Ghosh, 2013, "Text Book of Advanced Practical Physics", 4
- New Central Book Agency (NCBA) Dr.NGPASC

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SEMESTER II

Course Code	Course Name	Category	L	Т	P	Credit
222MT2A2EA	NUMERICAL METHODS	EDC	4	-	-	4

This course has been designed for students to learn and understand

- The method of solving algebraic and transcendental equations.
- The effectiveness of numerical solution over analytical solution.
- Error analysis of a method to examine its accuracy.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Discuss numerical solution of algebraic and transcedental Equation.	K1
CO2	Estimate errors in polynomial interpolation & detection of errors by difference table.	K2
CO3	Apply the methods of numerical differentiation and integration.	K4
CO4	Compute the solution of system of equations by Gauss elimination and Seidal method.	K3
CO5	Estimate the solution of ordinary differential equations.	K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1				1	
CO2	\checkmark	1	1	1	
CO3	1	1	1	EST CLEARE	
CO4	\checkmark	1	1		×
CO5	1	1	1		1

COURSE FOCUSES ON

~	Skill Development	Entrepreneurial Development
\checkmark	Employability	Innovations
	Intellectual Property Rights	Gender Sensitization
	Social Awareness/ Environment	Constitutional Rights/ Human Values/ Ethics



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SEMESTER II

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Solution of Algebraic and Transcendental Equations 9 h

Introduction - bisection method - iteration method - method of False Position - Newton-Raphson method - Ramanujan's method - Graeffe's Root-Squaring method.

Unit II Solution of Linear Systems

Direct Methods: Gaussian Elimination method- modification of the Gauss Method to compute the inverse - method of factorization - solution of tridiagonal systems - solution of linear systems: iterative methods - Householder's method.

Unit III Interpolation

Introduction - errors in polynomial interpolation - finite differences - detection of errors by difference tables - differences of a polynomial - Newton's formulae - Gauss's central difference formulae - Stirling'sformula - interpolation with unevenly spaced points: Lagrange's interpolation formula - error in Lagrange's interpolation formula - Hermite'sinterpolation formula.

Unit IV Numerical Differentiation and Integration 10 h

Introduction - numerical differentiation - maximum and minimum values of a tabulated function - numerical integration - Trapezoidal rule - simpson's 1/3 Rule - simpson's 3/8 Rule - Boole's and Weddle's Rules

Unit V Numerical Solution of Ordinary Differential Equations 10 h

Introduction - solution by Taylor's series - Picard's Method - Euler's Method

- Runge-Kutta Methods - Predictor Corrector Methods.



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10 h

9 h

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- Sastry S.S., 2012, "Introductory methods of Numerical Analysis", 5th
- Edition, Prentice-Hall of India, NewDelhi.

References

- Venkataraman M.K, 1999, "Numerical Methods in Science and Engineering", 1 5th edition, National Publishing Company, Chennai.
- GrewalB.S,2010,"Numerical Methods in Engineering &Science: with 2 Programs in C and C++", 10th edition, Khanna Publishers, New Delhi.
- Jain M.K., IyengarS.R.K. and Jain, R.K., 2012, "Numerical methods for 3 Scientific and Engineering Computation", 6th edition, New Age International, New Delhi.
- Curtis F.Gerald, 2007, "Applied Numerical Analysis", 7th edition, Pearson 4 Education India Ltd., New Delhi.

Note: Distribution of marks 80% Problems and 20% Theory.

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Course Code	Course Name	Category	L	т	Р	Credit
222PY2A2DA	PHYSICS OF NANOMATERIALS	DSE	4		-	4

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This course has been designed for students to learn and understand

- The classification of nanomaterials and their synthesis.
- The properties of nanomaterials.
- The characterization techniques of nanomaterials.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Interpret the classification of nanomaterials.	K2
CO2	Sketch about special nanomaterials.	K2
CO3	Demonstrate the physical properties of nanomaterials.	К3
CO4	Experiment with synthesis methods of nanoparticles.	К3
CO5	Analyze the characterization techniques of nano technology.	K4

MAPPING WITH PROGRAMME OUTCOMES

	and the second second		201	PO4	POS
COs/POs	PO1	PO2	PO3	P04	105
CO1				1	~
CO2				1	2
CO3	1	1	✓		1
CO4	1	1	√		1
CO5	1	1	~	1	1

COURSE FOCUSES ON

~	Skill Development	\checkmark	Entrepreneurial Development
\checkmark	Employability	1	Innovations
~	Intellectual Property Rights		Gender Sensitization
	Social Awareness/ Environment		Constitutional Rights/ Human Values/ Ethics



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SEMESTER II

10 h

10 h

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Classification of Nanomaterials

Definition of zero, one, two and three dimension nanomaterials – Surface energy – Chemical potential as a function of surface curvature – Electrostatic stabilization: Surface charge density - DLVO theory - Steric stabilization: solvent and polymer.

Unit II Special Nanomaterials

Carbon fullerenes and Nanotubes: Carbon fullerenes, Fullerene derived crystals, Carbon nanotubes - Micro and Mesoporous materials: Ordered mesoporous structures - Random mesoporous structures - Crystalline microporous materials: zeolites - Organic-inorganic hybrids: Class 1 hybrids - Class 2 hybrids.

Unit III Properties

Physical properties of nanomaterials: Melting points and lattice constants – Mechanical properties – Optical properties: Surface plasmon resonance – Quantum size effects – Electrical property: Surface scattering - Change of electronic structure -Quantum transport - Effect of microstructure.

Unit IV Synthesis

Physical vapour deposition: Evaporation - Molecular beam epitaxy - Sputtering -Chemical vapour deposition: Typical chemical reaction - Reaction kinetics - CVD methods - Atomic layer deposition - Superlattices - Sol-Gel Films.

Unit V Characterization

Structural Characterization: X-Ray diffraction – Scanning electron Microscopy – Transmission Electron Microscopy - Scanning probe microscopy – Chemical Characterization: Optical spectroscopy - Electron spectroscopy - Ion spectroscopy.



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9 h

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- Guozhong Cao, 2017, "Nanostructures; nanomaterials: Synthesis, Properties and applications", 2nd edition, World Scientific Publishing Co.Pvt. Ltd.
- Rajendran V, 2010, "Processes and Characterization of Advanced
 Nanostructured materials" 1st edition, Macmillan, India.

References

- 1 Chattopadhyay K K, Banerjee AA, 2009, "Introduction to Nanoscience and Nanotechnology", 2nd edition, PHI Learning private Limited.
- 2 Pradeep T, 2007, "Nano-The Essentials" Tata McGraw-Hill publishing company limited, New Delhi.
- Chris Binns, 2010, "Introduction to Nanoscience and Nanotechnology" JohnWiley and Sons, New Jersey.
- 4 Charles P. Poole Jr, Frank, Ownes, 2003 "Introduction to Nanotechnology", Sathyam Enterprise, New Delhi.
- 5 Alain Nouailhat, 2008, "An Introduction to Nanoscience and Nanotechnology", 2nd edition, Wiley.
- 6 https://web.pdx.edu/~pmoeck/phy381/intro-nanotech.pdf.
- https://etp-nanomedicine.eu/wp-content/uploads/2018/10/nano-handson-activities_en.pdf.

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Course Code	Course Name	Category	L	т	P	Credit
222PY2A2DB	EXPERIMENTAL DESIGN	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The concepts of measurements and estimation of errors.
- The fundamental concepts of monitoring systems and its applications.
- The concepts of optoelectronic devices.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Illustrate the basic concept of measurements and errors.	K2
CO2	Identify the tools used in electronic and digital instruments.	K2
CO3	Demonstrate the mechanism of transducer systems.	К3
CO4	Relate the concepts and applications of optical fibers.	К3
CO5	Analyze the concept of optoelectronic devices.	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1				1	
CO2				1	
CO3	\checkmark	1	✓		1
CO4	✓	1	✓		1
CO5	\checkmark	1	~	1	1

COURSE FOCUSES ON

Imployability Imployability	
✓ Intellectual Property Rights Gender Sensitization	
Social Awareness/ Environment Constitutional Rights/ Humar Ethics	Values/



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222PY2A2DB	EXPERIMENTAL DESIGN	SEMESTER II

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Concepts of Measurements and Error

Measurement - Instrumentation - Classification of instruments - Factors relating to selection of instruments - Functions of instruments - Accuracy, errors and correction - Application of measurement system - Limiting errors - Types of errors -Sources of errors.

Unit II Electronic and Digital Instruments

Essentials of an electronic instrument - Advantages - Electronic voltmeter - Types of electronic voltmeters - Vacuum tube voltmeters - Differential voltmeter (D.C.) -Analog and Digital system - Basic concepts of digital instruments - Digital voltmeter - Advantages - Characteristics - Application.

Unit III Transducers

Classification of transducers - Resistive, inductive and capacitive pressure transducer - Linear variable differential transformer (LVDT) - Piezoelectric transducer - Photoelectric transducers - Carbon microphone - Ribbon microphone -Moving coil microphone - Crystal microphone.

Unit IV Fibre Optics

Structure of optical fibres - Classification of optical fibres - Propagation of light -Total internal reflection - Fibre characteristics - Splicing and connector - Fusion splices - Fibre optic communications - Advantage and disadvantage - Application of fibre optic communication.

Unit V Optoelectronic Devices

Spectral response of human eye - Light emitting diode - Photoemissive devices -Photomultiplier tube - Photovoltaic devices - Types of photoconductive cells -Photodiodes - PN junction - PIN - Avalanche photodiode.



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10 h

10 h

9h

10 h

9 h

- Theraja B L, 2014, "Basic Electronics", 3rd edition, S. Chand Publisher, New Delhi.
- 2 Rajput R K, 2008, "Electronic measurements and Instrumentation", 2nd edition, S. Chand Publisher, New Delhi.

References

- 1 SawhneyA K, 2013, "A Course In Electronic Measurements and Instrumentation", 2nd edition, International publishing house, New Delhi.
- 2 Alan S Morris, 2013, "Measurement and instrumentation", 3rd edition, AP publisher, New Delhi.
- 3 Deb A C, 2011, "Fundamentals of Biochemistry", 3rd edition, New central book agency.
- John G. Webster, 2010, "Medical Instrumentation Application and Design",
 2nd edition, John Wiley and Sons publication, New Delhi.
- 5 Fulekar M H, 2013, "Bioinstrumentation", 3rd edition, International publishing house, New Delhi.
- 6 https://circuitglobe.com/measurement-error.html.
- 7 https://www.youtube.com/watch?v=8vKo_TBBX8E.

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Course Code	Course Name	Category	L	Т	Р	Credit
222PY2A2DC	MEDICAL PHYSICS	DSE	4	-	-	4

This course has been designed for students to learn and understand

- The basic characteristics and production of X-rays.
- The fundamental concepts of radiation physics and its applications.
- The concept of radiation therapy techniques and radiation protection devices.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Identify the characteristics and production of X-rays.	К3
CO2	Analyze the theory of radiation, experiment with various radiation chambers.	K4
CO3	Infer the principle and the function of various imaging system.	K2
CO4	Illustrate basic radiation therapy techniques.	К3
CO5	Explain the radiation measurements and protection devices.	К3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	1	1	1		✓
CO2	√	1	1	1	~
CO3	N N N N N N N N N N N N N N N N N N N			1	
CO4	\checkmark	1	1		1
CO5	1	1	1		1

COURSE FOCUSES ON

~	Skill Development	1	Entrepreneurial Development
~] Employability	1	Innovations
1	Intellectual Property Rights		Gender Sensitization
	Social Awareness/ Environment		Constitutional Rights/ Human Values/ Ethics



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MEDICAL PHYSICS

SEMESTER II

Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I X-Rays

Electromagnetic spectrum - Production of X-rays - X-ray spectra - Brehmsstrahlung - Characteristic X-ray - X-ray tubes - Coolidge tube - X-ray tube design - Tube cooling - Stationary Mode - Rotating anode X-ray tubes - Quality and intensity of Xray - X-ray generator circuits - Half wave and full wave rectification - Filament circuit - Kilo voltage circuit.

Unit II **Radiation Physics**

Radiation units - Exposure - Absorbed dose - Rad gray - Kera relative biological effectiveness - Effective dose - Inverse square law - Interaction of radiation with matter - Radiation detectors - Thimble chamber - Condenser chamber - Geiger counter - Ionization chamber - Dosimeters - Survey methods - TLD and semiconductor detectors.

Unit III **Medical Imaging Physics**

Radiological imaging - Radiography - Filters - Grids - Cassette - X-ray film - Film processing - Fluoroscopy - Computed tomography scanner - Generations -Mammography - Ultrasound imaging - Magnetic resonance imaging - Thyroid uptake system - Gamma camera (Only Principle, function, and display).

Unit IV **Radiation Therapy Physics**

Radiotherapy - Kilovoltage machines - Deep therapy machines - Tele-cobalt machines - Basics of teletherapy units - Medical linear accelerator - Radiation protection - External beam characteristics - Phantom - Dose maximum and build up Bolus - Percentage depth dose - Tissue - Air ratio - Back scatter factor.

Unit V **Radiation Protection**

Principles of radiation protection - Protective materials - Radiation effects - Somatic, genetic stochastic and deterministic effect - Personal monitoring devices - TLD film badge - Pocket dosimeter.



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10 h

10 h

9 h

10 h

9 h

- Thayalan K, 2003, "Basic Radiological Physics", 2nd edition, Jayapee Brothers 1 Medical Publishing Pvt. Ltd., New Delhi.
- Khan F M, 2003, "Physics of Radiation Therapy", 3rd edition, Williams and 2 Wilkins.

References

- Bushberg, Seibert, Leidholdt, 2002, "The Essential Physics of Medical 1 Imaging" 2nd edition, Williams and Wilkins.
- Scott, K N, Mathur A K, 2007 "Textbook of Biomedical Instrumentation" CBS 2 publisher, New Delhi.
- Fulekar M H, 2013, "Bioinstrumentation", 2nd edition, International 3 publishing house, New Delhi.
- Mandeep Singh, 2014, "Introduction to Biomedical Instrumentation", PHI 4 Publisher, New Delhi.
- John G, Webster, 2010, "Medical Instrumentation Application and Design", 5 John Wiley and Sons publication.
- https://indico.cern.ch/event/34840/attachments/687622/944392/Silari_Su 6 mmer Students lecture_01.08.08.pdf.
- 7 http://ijlalhaider.pbworks.com/w/file/fetch/70354430/IP447_BIB.pdf.

BoS Chairman/HoD Department of Physics Dr. N. G. P. Arts and Science College Coimbatore - 641 048

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Course Code	Course Name	Category	L	Т	P	Credit
222PY2A3CA	QUANTUM MECHANICS – II	CORE	4	1	-	4

This course has been designed for students to learn and understand

- The concepts of fundamental laws of quantum mechanics
- The basic Klein-Gordon equation and Dirac equation.
- The concepts of micro and macroscopic properties of the mater.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Outline on the approximation methods and its applications.	K2
CO2	Explain the scattering theory and partial wave analysis	K2
CO3	Analyze the Time independent perturbation theory and its simple applications.	K4
CO4	Apply the Klein-Gordon equation, Dirac equation and interpretation of negative energy states.	K3
CO5	Interpret Euler Lagrange's and Hamiltonian formulation.	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	\checkmark	\checkmark	\checkmark	\checkmark	1.62 Sec.
CO2	\checkmark	~	1	✓	Carlos and a second
CO3	\checkmark	~	~		\checkmark
CO4	1	~	v	- ser Empach s.	\checkmark
CO5	۵ مربع المربع	~	1		\checkmark

COURSE FOCUSES ON

~	Skill Development	\checkmark	Entrepreneurial Development
 ✓ 	Employability	 ✓ 	Innovations
-	Intellectual Property Rights	-	Gender Sensitization
\checkmark	Social Awareness/ Environment	-	Constitutional Rights/ Human Values/ Ethics


Total Credits: 4

SEMESTER III

Total Instruction Hours: 60 h

Syllabus

Unit I **Approximation Methods**

Time independent perturbation theory - Non-degenerate energy levels - First and second order - Degenerate energy levels - Variation method: upper bound on ground state energy - Applications to excited state - Hydrogen molecule -Exchange interaction - WKB approximation: One dimensional Schrodinger equation - Bohr Somerfield quantum condition - Barrier penetration.

Unit II **Scattering Theory**

Partial waves - significant number of partial waves - Partial wave analysis -Asymptotic behavior of partial waves - Phase shifts - Scattering amplitudes in terms of phase shifts - Differential and total cross section: optical theorem - Phase shifts: relation to the potential - Transformation from center of mass to lab frame.

Unit III **Time Dependent Perturbation Theory** 12 h

Introduction - Transition probabilities - Constant and harmonic perturbations -Transition probabilities - Fermi's Golden rule - Selection rules for dipole radiation - Adiabatic approximation - Sudden approximation - Magnetic resonance - Semiclassical treatment of an atom with electromagnetic radiation.

Unit IV **Relativistic Quantum mechanics** 12 h

Klein-Gordon equation and its interpretation - Equation of continuity - Dirac equation for a free particle - Dirac matrices - Covariant form of Dirac equation -Probability density - Plane wave solutions - Interpretation of negative energy states - Antiparticle - Spin of Dirac particle..

Unit V **Classical Fields and Second Quantization** 12 h

Classical fields - Euler Lagrange equations - Hamiltonian formulation - Noether's theorem - Quantization of real and complex scalar fields: creation, destruction and number operators - Fock states - Second quantization of K.G. field.



12 h

- 1 Aruldhas. G, 2008,"Quantum mechanics", 2nd Edition, Prentice Hall of India, Pvt. Ltd, New Delhi.
- 2 P.M. Matthews and K. Venkatesan, 2010, "A textbook of Quantum Mechanics", 2nd Edition, McGraw Hill Education (India) Private Limited, New Delhi.

References

- 1 J.L. Powell and B. Crasemann, 1961, "Quantum Mechanics", 2nd Edition Addison-Wesley Pub.
- P.A.M. Dirac, 2013, "The principles of Quantum mechanics", 2nd Edition, Igal Meirovich Publication.
- 3 L.D. Landau and E.M.Lifshitz, 2013, "Quantum Mechanics", 3rd Edition, Pergamon.
- 4 Thankappan, V.K. 2012, "Quantum Mechanics", 3rd edition, New Age International Publishers, Delhi.
- 5 Schiff , L.I, 1968, "Quantum Mechanics", 3rd Edition, McGraw Hill Education (India) Private Limited, New Delhi.

https://www.qms.physik.uni-rostock.de/storages/uni-

- 6 rostock/Alle_MNF/Physik_Qms/Lehre_Scheel/quantenoptik/Quantenopti k- Vorlesung3.pdf
- 7 http://www.physics.usu.edu/Wheeler/ClassicalMechanics/CMNoetherThe orem.pdf



Course Code	Course Name	Category	L	Т	Р	Credit
222PY2A3CB	ELECTROMAGNETIC THEORY	CORE	4	1	-	4

75

PREAMBLE

This course has been designed for students to learn and understand

- The fundamental theories that explain electrostatics and magnetostatics.
- The electrodynamics principle for explaining the electromagnetic wave propagation.
- The analytical problems of relativistic systems in electrodynamics.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Summarize the fundamentals of electrostatics	K2
CO2	Outline the concepts of magnetostatics	K2
CO3	Develop the skills to solve problems of motion of charged particles in various fields	K3
CO4	Analyze the concept of electromagnetic theory in electromagnetic waves	K4
CO5	Examine the electrodynamics of radiating and relativistic systems	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	\checkmark	\checkmark	\checkmark	~	
CO2	\checkmark	\checkmark	\checkmark	\checkmark	
CO3	1	~	1		~
CO4	~	~	~		~
CO5	~	~	~	dan Strewest	~

COURSE FOCUSES ON

Skill Development	_ Entrepreneurial Development
✓ Employability	- Innovations
- Intellectual Property Rights	- Gender Sensitization
- Social Awareness/ Environment	_ Constitutional Rights/ Human Values/ Ethics



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Total Credits: 4

SEMESTER III

Total Instruction Hours: 60 h

Syllabus

Unit I Electrostatics

Coulomb's law - The electric field – Line, Flux and gauss's law - Divergence of e - application of gauss's law – Curl of E - Poisson's equation – Laplace's equation – Work and energy in electrostatics: energy of a point charge distribution – Energy of continuous charge distribution – Induced charges – Capacitors - Laplace equation in one dimension and two dimensions – Electric fields in matter: dielectrics – induced dipoles – Gauss's law in the presence of dielectrics

Unit II Magnetostatics

Lorentz force – Magnetic fields – Magnetic forces – Currents – Biot-Savart law – Divergence and Curl of B – Ampere's law - Comparison of magneto statics and electrostatics – Magnetic vector potential - Effect of magnetic field on atomic orbit – Ampere's law in magnetized materials – Ferromagnetism.

Unit III Electromotive Force

Ohm's law – Electromotive force – Motional EMF – Electromagnetic induction – Faraday's law – Induced electric field – Inductance – Energy in magnetic field – Maxwell's equation in free space and linear isotropic media – Continuity equation – Poynting theorem.

Waves In One Dimension: Wave Equation – Sinusoidal Waves – Reflection and transmission – Polarization.

Unit IV Electromagnetic Waves

The wave equation for E and B – Monochromatic plane waves – Energy and momentum in electromagnetic waves – Electromagnetic waves in matters - TE Waves in rectangular wave guides – The Co-axial transmission Line - Scalar and vector potentials – Gauge transformation – Coulomb gauge and Lorentz gauge – Lorentz force law in potential form

Unit V Relativistic Electrodynamics

Four vectors and tensors – Transformation equations for charge and current densities - Transformation equations for the electromagnetic potentials – The electromagnetic field tensor – Transformation equations for electric and magnetic



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12 h

12 h

12 h

12 h

field vectors – Covariance of Maxwell equations in four vector forms and in four tensor forms – Covariance and transformation law of Lorentz force.

Text Books

- 1 David J. Griffiths, 2013, Introduction to Electrodynamics, 4th Edition, Pearson Publisher.
- 2 Chopra K. K and Agarwal G. C, 2017, Electromagnetic Theory, 6th Edition, K.Nath & Co.

References

- 1 John David Jackson, 1999, Classical Electrodynamics, 3rd Edition, John Wiley& Sons.
- 2 Gupta S.L and Kumar V, 2017, Electrodynamics, 24th Edition, Pragati Prakashan.
- 3 Laud B.B, 2011, Electromagnetics, 3rd Edition, New Age International Publisher.
- 4 Sathya Prakash, 2019, Electromagnetic Theory and Electrodynamics, Kedarnath Ramnath and Co., Meerut.
- ⁵ https://ocw.mit.edu/courses/8-311-electromagnetic-theory-spring-2004
- 6 NPTELVideo:https://www.youtube.com/watch?v=G5P6dInMTFg&list=PL uv3GM6-gsE3-hVNaw-YEb7EeY5XVPZdz
- 7 NPTELVideo:https://www.youtube.com/watch?v=pGdr9WLto4A&list=PLl 6m4jcR_DbOx6s2toprJQx1MORqPa9rG



Course Code	Course Name	Category	L	Т	Р	Credit
222PY2A3CC	CONDENSED MATTER PHYSICS	CORE	3	1	-	3

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PREAMBLE

This course has been designed for students to learn and understand

- The concept of free electrons in crystals.
- The thermal, and optical properties of the materials.
- The magnetic properties and superconductors.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Summarize the concept of free electrons in crystals	K2
CO2	Explain the thermal and optical properties of materials	K2
CO3	Apply the dielectric properties of materials	K3
CO4	Compare the magnetic properties of materials.	K4
CO5	Extend the knowledge on superconductors	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	~	\checkmark	~	✓	
CO2	~	\checkmark	\checkmark	\checkmark	
CO3	\checkmark	\checkmark	\checkmark	~	
CO4	~	\checkmark	\checkmark		~
CO5	\checkmark	\checkmark	✓	✓	

COURSE FOCUSES ON

\checkmark	Skill Development	-	Entrepreneurial Development
 ✓ 	Employability	✓	Innovations
-	Intellectual Property Rights	-	Gender Sensitization
_	Social Awareness/ Environment	-	Constitutional Rights/ Human Values/ Ethics



Total Credits: 3

SEMESTER III

Total Instruction Hours: 48 h

Syllabus

Unit I Free Electrons in Crystal

Electrons moving in 1d potential well - Fermi Dirac statistics - Electrical conductivity of metals - Relaxation time and mean free path - Electrical conductivity and Ohms law - Wiedemann Franz Lorentz law - Electrical resistivity of metals - The Hall effect

Unit II Thermal and Optical Properties of Materials 9h

The Specific heat of solids -Debye model-Thermal conductivity of solids-Thermal conductivity due to electrons- Thermal conductivity due phonons-Thermal resistance of solids-Photoconductivity- Photoelectric and photovoltaic effect-Photoluminescence.

Unit III Semiconducting and Dielectric Properties of Materials 10 h

Free carrier concentration in semiconductors- Fermi level and carrier concentration in semiconductors-Mobility of charge carriers- Effect of temperature on mobility-Dipole moment -Local electric field at an atom-Dielectric constant and its measurement-Polarizability-Classical theory of electronic polarizability-Dipolar polarizability- Piezo-Pyro and Ferro electric properties of crystals- Ferroelectricity.

Unit IV **Magnetic Properties of Materials** 10 h

Classification of magnetic materials - Atomic theory of magnetism - The quantum numbers -Origin of permanent magnetic moments - Langevin's classical theory of diamagnetism and Langevin's classical theory of paramagnetism-Fundamental quantum theory of paramagnetism-Ferromagnetism -Weiss molecular field --Ferromagnetic domain - Domain theory-Anti-ferromagnetism - Ferrimagnetism and ferrites.

Unit V **Theory of Superconductors**

Sources of superconductivity- Response of magnetic field -Meissner effect- Origin of Energy Gap-Isotope Effect - London Equations- London Penetration Depth-Coherence Length-Elements of BCS Theory-Normal Tunneling and DC and AC Josephson effect-High temperature superconductivity.



- 1 Wahab. M.A, 2022, "Solid State Physics: Structure And Properties of Materials" 22 nd reprint, Narosa publications.
- Charles Kittel, 2006 "Introduction to Solid State Physics", 7th edition, John Wiley & sons.

References

- 1 S.O.Pillai, 2020 Solid State Physics, 9th Edition, New Age International Publishers.
- 2 Dekker A.J. 2000, Solid state physics , the Macmillan Press LTD.
- **3** P. Srivastava, Elements of Solid-state physics, 2nd Edition, Prentice Hall of India PVT LTD, New Delhi, 2008.
- 4 Gupta Kumar, 2011, Solid State Physics, K Nath and co Meerut.
- 5 K. Ilangovan ,2021, Solid State Physics, MJP publications, Chennai
- 6 Puri R.K., Babbar V.K., 2010 Solid State Physics And Electronics , S. Chand & Company Ltd, New Delhi
- 7 https://youtu.be/Ofzd2ZqFvjo



Course Code	Course Name	Category	L	T	P	Credit
222PY2A3CD	MICROPROCESSORS AND MICROCONTROLLER	CORE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- The architecture and assembly language of 8085 and 8086 microprocessor.
- The interfacing of 8085 microprocessor.
- The architecture and programming of 8051 microcontroller.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Outline the architecture of microprocessor 8085 and write assemble language program.	K2
CO2	Experiment with the architecture and programming of 8086 microprocessor.	K3
CO3	Make use of the interfacing in 8085 microprocessor.	К3
CO4	Contrast microprocessor and microcontroller and perform basic arithmetic programs.	K2
CO5	Examine the systems using microprocessor and microcontroller.	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	\checkmark	\checkmark	 ✓ 	\checkmark	
CO2	\checkmark	\checkmark	1		\checkmark
CO3	~	\checkmark	~		~
CO4	1	\checkmark	×	\checkmark	
CO5	~	\checkmark	1		\checkmark

COURSE FOCUSES ON

\checkmark	Skill Development	\checkmark	Entrepreneurial Development
\checkmark	Employability	\checkmark	Innovations
59	Intellectual Property Rights	-	Gender Sensitization
-	Social Awareness/ Environment	-	Constitutional Rights/ Human Values/ Ethics



SEMESTER III

Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Microprocessors 8085 Architecture and Programming 10 h

Microprocessor 8085 architecture and its operations - 8085 microprocessor bus organization - Internal data operations and the register- Data transfer operations arithmetic operations - Logical operations - Branching operations - Writing assembly language programs 8085 - Looping, counting and indexing - Counters and time delays - Stack - Subroutine.

Unit II 8086 Microprocessor

Features of 8086 - Architecture – Pins and signals – Minimum mode and maximum mode signals – External memory addressing - 8 bit data transfer – 16 bit data transfer – Interrupt processing – Response to interrupt – Classification of interrupt – Interrupt priority - 8086 assembly language programs: addition, subtraction and multiplication programs.

Unit III Interfacing of Microprocessor 8085

General purpose programmable peripheral device: 8255 a programmable peripheral interface (PPI) – Block diagram – mode 0 – BSR mode – A/D converter – 8237 DMA controller – Basic concept in serial I/O – Interfacing requirements – Transmission format - Synchronous vs asynchronous transmission.

Unit IV Microcontroller 8051Architecture and Programming 9 h

Features of microcontroller and 8051 - Difference between microprocessor and microcontroller – 8051 architecture - Pins and signals 8051- Memory organization – special function register (SFR) – 8051 interrupts - Execution – Sources – Enabling and disability – Priority- Timing- Level of interrupts - Instruction set - Addition, subtraction and multiplication programs in 8051.

Unit V System Designs using Microprocessor and Microcontroller 12 h

Traffic light control - Traffic light control system using 8086 microprocessor -Traffic light control system using 8051 microprocessor - Hardware for washing machine control using 8051 -Motor control using relay: electromagnetic relay -Operation - Driving a relay - Solid state relay -DC motor control using PWM - Stepper motor control.



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10 h

- 1 Gaonkar Ramesh S, 2013, "Microprocessor Architecture, Programming and Applications with 8085/8080", 6th Edition, New Age International.
- 2 Latha C, Murugeshwari B, 2015, "Microprocessors and Microcontrollers, 1st Edition, Scitech Publications.

References

- 1 Douglas V H, 1993, "Microprocessors and Interfacing-Programming and Hardware", Tata McGraw Hill& New Delhi.
- 2 Godse A P, Godse D A, 2011, "Microprocessors and Microcontrollers", Technical Publications& Pune.
- Badri R, 2001, "Advanced Microprocessors and Interfacing", Tata McGraw Hill& New Delhi.
- Kenneth J A, 1996, "The 8051 Microcontroller Architecture, Programming and
 Applications", 2nd Edition, Penram International publishing Pvt. Ltd& Mumbai.
- 5 https://myethiolectures.files.wordpress.com/2015/06/programming-8085.pdf
- 6 https://www.onlinenotesnepal.com/assembly-language-programmingwith-8085-microprocessor/



222PY2A3CP	CORE PRACTICAL: ELECTRONICS - III	SEMESTER III
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Total Credits:2Total Instructions Hours:48 h

Contents

1	Construct the Wien Bridge Oscillator using op-amp and verify the output performance by digital cathode ray oscilloscope
2	Construct binary ladder weighted resistor - using OP-AMP
3	Construct binary adder and subtractor using IC 7483 and IC 7486
4	Verify the characteristics of photo detector using digital multimeter
5	Study the characteristics of voltage doubler using digital voltmeter
6	Generate saw tooth wave using OPAMP
7	Study the characteristics of SCR
8	Construct monostable multivibrator using Op-AMP/NE 555
9	Characteristics of tunnel diode 1N3716
10	Construct half-adder and full-adder circuits using NAND gates and study their performance
11	Construct voltage regulated power supply using Zener diode
12	Study of the characteristics UJT - Relaxation Oscillator

Note: Any 10 Experiments



S.No

References

- 1 Ouseph. C C, 2014, Practical Physics and Electronics, Viswanathan Publishers Ltd.
- 2 Bhattacharya. AB, 2011, Advanced Electronic Practical's, New Central Book Agency (NCBA)
- 3 Chattopadhyay. D, 2015, Advanced Course In Practical Physics, New Central Book Agency (NCBA)
- 4 https://www.youtube.com/watch?v=2gF_nfaBV_0

Course Code	Course Name	Category	L	Т	р	Credit
22222243DA	CRYSTAL GROWTH AND THIN FILM	IDC	4	-	-	4
	TECHNIQUES					

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PREAMBLE

This course has been designed for students to learn and understand

- The various experimental techniques for crystal growth.
- The growth techniques for thin film deposition.
- The characterization techniques like XRD, SEM, TEM, AFM.

COURSE OUTCOMES

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

CO	CO Statement	Knowledge Level
Taumber	the transformer that the transformer through nucleation	K3
CO1	Develop the concepts of crystal growth technique through nucleation.	К2
CO2	Relate the various experimental techniques for crystal growth.	112
CO3	Identify various preparation methods like gel, melt and vapor growth	К3
003	techniques of crystal.	K3
CO4	Construct the thin films deposition in various techniques.	Ro
CO5	Analyze the various characterization techniques for both crystal and thin	K4
	film samples.	

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	~	\checkmark	~	
CO2	\checkmark	\checkmark	✓	\checkmark	
CO3	✓	\checkmark	~	✓ ✓	
CO4	\checkmark	\checkmark	~	~	
CO5	\checkmark	\checkmark	\checkmark		v

COURSE FOCUSES ON

Skill Development	✓ Entrepreneurial Development
Employability	✓ Innovations
- Intellectual Property Rights	- Gender Sensitization
- Social Awareness/ Environment	- Constitutional Rights/ Human Values/ Ethics



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M.Sc.Physics (Students admitted during the AY 2022-23)

CRYSTAL GROWTH AND THIN FILM TECHNIQUES

Total Credits: 4

SEMESTER III

Total Instruction Hours: 48 h

Syllabus

Unit I Basic Concepts and Nucleation Phenomenon 10 h

Crystals - Classes of crystal system – Crystal symmetry - Single crystal - Growth of crystal - Historical perspective - Nucleation phenomena: critical supersaturation - Homogeneous nucleation - Heterogeneous nucleation - Nucleation on a substrate - Nucleation of a crystalline material - Equilibrium shape of anisotropic nuclei.

Unit II Crystallization Principles and Growth Techniques 10 h

Solvents and solutions – Solubility diagram – Metastable zone and induction period – Miers TC diagram – Solution growth – Low and high temperatures solution growth – Slow cooling and solvent evaporation methods - Two-dimensional layer growth mechanism.

Unit III Gel, Melt and Vapor Growth Techniques 10 h

Principle of gel technique – Various types of gel - Structure and importance of gel - methods of gel growth and advantages - Melt technique – Czochralski growth-Bridgeman method – Horizontal gradient freeze – Hydrothermal growth – Vapor phase growth – Physical vapor deposition – Chemical vapor deposition.

Unit IV Thin Film Deposition Techniques 9 h

Vacuum evaporation - Hertz-Knudsen equation - Evaporation from a source and film thickness uniformity - E-beam, pulsed laser, and ion beam evaporations - Mechanisms and yield of sputtering processes – DC, magnetically enhanced, reactive sputtering – Spray pyrolysis – Electro deposition – Sol-gel technique.

Unit V Characterization Techniques

X-Ray Diffraction – Powder and single crystal – Fourier transform infrared analysis – Elemental dispersive x-ray analysis – Transmission and scanning electron microscopy – Uv-Vis-NIR spectrometer – Basic principles and operations of AFMx-ray photoelectron spectroscopy for chemical analysis.



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Markov I V, 2004, "Crystal Growth for Beginners: Fundamentals of
 Nucleation, Crystal growth and Epitaxy", 2nd edition, World Scientific Publishing Company Private Limited & Singapore.

2 Bhat H L, 2015, "Introduction to Crystal Growth Principles and Practice", Taylor & Francis & London.

References

Aller.

- 1 Brice J C, 1986, "Crystal Growth Process", John Wiley & New York.
- 2 Ohring M, 2002, "Materials Science of Thin Films", 2nd Edition, Academic Press & Boston.
- 3 Kaufmann E N, 2012, "Characterization of Materials, Volume-I", John Wiley & New Jersey.
- 4 Goswami A, 2017, "Thin Film Fundamentals", New Age Publications & New Delhi.
- 5 https://books.google.com.jm/books?id=K0e8Nh9zSYC&printsec=frontcover &source=gbs_book_other_versions_r&cad=2#v=onepage&q&f=false.
- 6 http://www.pas.rochester.edu/~stte/phy415F20/units/unit_1-3.pdf
- 7 https://www.taylorfrancis.com/books/mono/10.1201/9781420042955/mate rials-characterization-techniques-sam-zhang-lin-li-ashok-kumar



Course Code	Course Name	Category	L	Т	P	Credit
222PY2A3DB	INSTRUMENTAL METHODS OF ANALYSIS	IDC	4	•	-	4

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PREAMBLE

This course has been designed for students to learn and understand

- The principle of analytical experimental methods.
- The concepts and applications of various instrumentation methods.
- The qualitative and quantitative instrumental analysis.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Summarize the types of instrumental methods, measurements, signals and data evaluation.	K2
CO2	Explain the instrumentation and analysis of TGA, DTA and DSC.	к2
CO3	Develop the skills to analyze XRD and XRF spectroscopic techniques.	К3
CO4	Analyze the concept of optical method and electron microscopes.	K4
CO5	Examine the electrochemical techniques.	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	\checkmark	\checkmark	\checkmark	1	
CO2	\checkmark	\checkmark	\checkmark	1	
CO3	1	✓	\checkmark		\checkmark
CO4	~	\checkmark	\checkmark		✓
CO5	~	\checkmark	~		✓

COURSE FOCUSES ON

\checkmark	Skill Development	Entrepreneurial Development
\checkmark	Employability	✓ Innovations
-	Intellectual Property Rights	- Gender Sensitization
	Social Awareness/ Environment	- Constitutional Rights/ Human Values/ Ethics



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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Instrumental Methods and Measurements Unit I

Classification of instrumental techniques - Basic functions of instrumentation -Sensitivity and detection limit - Hardware techniques for signal-to-noise enhancement - Software techniques for signal-to-noise enhancement - Evaluation of results -Accuracy and instrument calibration.

Unit II **Thermal Analysis**

Thermo gravimetric analysis: instrumentation – Applications – Differential thermal analysis: instrumentation - General principles - Applications - Differential scanning calorimetry: instrumentation - Applications - Microthermal analysis - Dynamic Mechanical analysis.

Unit III X-ray Analysis

Production of X-Rays and X-Ray spectra - Instrumentation - X-ray absorption methods - X-Ray fluorescence method - X-Ray diffraction: reciprocal lattice concept -Diffraction patterns - Automatic diffractometers - Choice of X-Radiation - X-ray powder data file - Quantitative analysis - Structural applications - Crystal topography.

9hUnit IV **Optical Methods and Electron Microscopy**

Ultraviolet-Visible molecular absorption spectrometry: measurement of transmittance and absorbance - Beer's law - Instrumentation: instrument components - Single beam instruments - Double beam instruments - Qualitative applications of UV absorption spectroscopy: solvents - Detection of functional groups - Electron spectroscopy: X-Ray photoelectron spectroscopy: principle - Instrumentation - Applications - Scanning tunneling microscope: principle - Instrumentation - Atomic force microscope: principle - Instrumentation

Electrical Methods Unit V

Electrochemical cells - Potentiometry: general principles - Reference electrodes - Ionselective field-effect-Transistors - Molecular selective electrode systems - Instruments for selecting cell potentials - Coulometry: CV relationships during an electrolysis -Coulometric methods of analysis - Voltammetry: voltametric instrumentation: cyclic voltammetry - Applications of voltammetry



10 h

10 h

9h

- 1 Skoog, Holler and Crouch, 2014, Principles of Instrumental Analysis, 6th Edition, Cengage Learning India Private Limited.
- 2 Willard M and Steve D, 1986. Instrumental Methods of Analysis, 7th Edition, CBS Publishers, New Delhi.

References

- 1 Skoog D.A and West M, 2004, Fundamentals of Analytical Chemistry, 8th Edition, Saunders-College Publishing.
- 2 Skoog, West & Holler, 1994, Analytical Chemistry-An Introduction, VI Edition, Saunders College Publishing
- 3 Stradling R.A, 1979, Electron Microscopy and Microanalysis of Crystalline Materials, Applied Science Publishers, London.
- 4 Philips V.A, 1971, Modern Metallographic Techniques and their Applications, Wiley Interscience.
- 5 https://nanohub.org/resources/28936/download/NACK_U6_Simchi_XPS. pdf
- 6 https://www2.chemistry.msu.edu/courses/cem419/cem372cyclicvoltamme try.pdf



Course Code	Course Name	Category	L	Т	Р	Credit
222PY2A3DC	RADIOLOGICAL SAFETY ASPECTS	DSE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The concepts of nuclear radiation towards biological effect and protection.
- The principles of optimization and detection of radiation.
- The safety aspects of nuclear radiation.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Interpret the structure of atomic nucleus.	K2
CO2	Explain use of the principles of radioactivity in handling radio-isotopes.	K2
CO3	Identify various radiations interacting with matter.	K3
CO4	Choose the various types of detectors for nuclear radiation.	K3
CO5	Take part in implementing the safety aspects principles.	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	\checkmark	\checkmark	\checkmark	~	
CO2	\checkmark	1	~	~	
CO3	\checkmark	1	~		1
CO4	✓	~	~		~
CO5	✓	~	~		\checkmark

COURSE FOCUSES ON

\checkmark	Skill Development	- Entrepreneurial Development
\checkmark	Employability	✓ Innovations
-	Intellectual Property Rights	- Gender Sensitization
\checkmark	Social Awareness/ Environment	- Constitutional Rights/ Human Values/ Ethics



Total Credits: 4

SEMESTER III

Total Instruction Hours: 48 h

Syllabus

Unit I General Properties of Atomic Nucleus 10

Scattering of alpha-particles - Nuclear size and determination : nuclear force methods, electromagnetic methods - Mass spectroscopy - Basic components of mass spectroscopes - Double focusing mass spectrograph - Double focusing mass spectrometer - Doublet method of mass spectroscopy - Mass synchrometer - Theories of nuclear compositions.

Unit II Radioactivity and Isotopes

Law of radioactive disintegration - Displacement laws of Soddy Russell and Fajans law of successive transformation - Radioactive equilibrium - Radioactive branching dosimetry - Induced radioactivity by nuclear bombardment - Mixture of activities radio-isotope therapy - Measurements of decay constants - Isotopes (separation and uses).

Unit III Interactions Nuclear Radiations with Matter 10 h

Interaction of charged particles with matter - Stopping power of heavy charged particles - Range and straggling - Stopping power and range of electrons - Cerenkov radiation - Synchrotron radiation - Absorption of gamma rays (Thomson, Rayleigh and Delbruck scattering) - Photoelectric effect - Compton effect - Pair production

Unit IV Detection and Measurement of Nuclear Radiations 10 h

Ionization chamber - Semiconductor detectors -Diffused junction detector - Surface barrier detector - Lithium drifted junction detector - Regions of multiplicative operation - Proportional counter - Geiger Muller counter (quenching of discharge) -Scintillation counters (photomultiplier tube, scintillators, pulse formation, resolving power)

Unit V Safety Concepts

Radiation units - Equivalent dose - Effective dose - Committed dose - Collective dose -Genetically significant dose - Detriment - Annual limit on intake - ALARA - Sources of radiation - Interaction of radiation with tissue - Radiation risk - Sources of exposure -Leakage limits - Personnel monitoring - Film badge – Thermo luminescent dosimeter -Pocket dosimeter.



10 h

9 h

- Tayal D. C, 2018, "Nuclear Physics", Himalaya Publishing House, Mumbai (Unit I to IV).
- Kuppuswamy Thayalan, 2017, "Basic Radiological Physics", Jaypee
 Brothers Medical Publishers Pvt. Ltd., New Delhi. (Unit -V).

References

- 1 AERB Radiation Production Rules 2004
- 2 Muraleedhara varier K, "Nuclear radiation detection, measurements and analysis"- Narosa Publications, New Delhi.
- 3 S. S. Kapoor and V.S. Ramamurthy- "Nuclear Radiation Detectors", Wiley Eastern Ltd.
- 4 Training course material on "Safety Aspects in Ionizing Radiation" by Indian Association for Radiation Protection
- ⁵ https://www.youtube.com/watch?v=ww5xpqv0yHs
- 6 https://www.youtube.com/watch?v=67PfCRGGY8c
- 7 https://www.uth.edu/dotAsset/7f418bea-3f2e-428a-92ee-0f529a7a2eba.ppt



222PY2ASSA

SELF STUDY: IPR, INNOVATION AND ENTREPRENEURSHIP

SEMESTER III

Total Credit: 1

Syllabus

Unit I Introduction to IPR

Introduction to intellectual property right (IPR), physical and intellectual property, tangible and intangible property, traditional knowledge, different types of intellectual property rights (IPR), patents, trade mark, trade secret, copyright, design and geographical indications

Unit II International Instruments of IPR

World trade and IPR-General agreement on trade and tariff (GATT), World intellectual property organization (WIPO), World trade organizations (WTO), Trade-related aspects of intellectual property rights (TRIPS), Establishment, functions and guidelines of GATT, WIPO, WTO, and TRIPS.

Unit III Indian Patent Act

Patent act 1970-Amendments of 1999, 2000, 2002 and 2005, Patentable subject matter, Patentability criteria, Non-Patentable inventions, Compulsory licenses.

Unit IV IPR Infringement

Infringement-direct, Contributory, and Induced, Infringer, Defences to Infringement, Remedies For Infringement (Civil And Criminal) and Penalties, appellate board.

Unit V Current Scenario

India's new national IP policy, 2016-Govt. of India, Step towards promoting IPR, Govt. schemes in IPR, Career opportunities in IP, IPR in current scenario with case studies, Advantages and disadvantages of IPR.



- 1 Nithyananda K.V, 2019, "Intellectual Property Rights: Protection and Management", Cengage Learning India Private Limited & Delhi.
- 2 Neeraj P,Khusdeep D, 2014,"Intellectual Property Rights", PHI Learning Private Limited & Delhi.

References

- 1 Ahuja, V K, 2017, "Law relating to Intellectual Property Rights", 3rd Edition, Lexis Nexis, Gurgaon, India.
- Subramanian N, Sundararaman M, 2018, "Intellectual Property Rights-An
 Overview" Retrieved from http://www.bdu.ac.in/cells/ipr/docs/iprengebook.pdf.
- 3 World Intellectual Property Organisation, 2004. WIPO Intellectual property Handbook.
- 4 https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489 .pdf



SEMESTER III

Total Credit: 1

Syllabus

Unit I Introduction

Definition of nanoscience – Importance of nanoscience – Physical and chemical properties - Electronic - Structural - Mechanical - Optical - Magnetic properties – Applications.

Unit II Conduction in Confined Geometries

Nanomaterials - 2D, 1D, 0D - Size and dimensionality effects - Partial confinement - Properties dependent on density of states - Quantum dots

Unit III Preparation of Nanomaterials

Top down and bottom-Up approach - Plasma arcing – Hydrothermal- Sol gel Process - Ball milling - Sputtering – Electro deposition.

Unit IV Characterization Techniques

X-Ray diffraction (XRD) - Scanning electron microscopy (SEM) - Transmission electron microscopy (TEM) - Absorption spectroscopy - FTIR spectroscopy - Photoluminescence (PL).

Unit V Significant Nanomaterials and Applications

Nano electronics - Nanobots - Biological applications of nanoparticles - Carbon Nanotubes (CNTs) - Nano mechanics.



- 1 Shanmugam S, 2011, "Nanotechnology", MJP Publishers, (2011).
- 2 SubbiahBalaji, 2010, "Nanobiotechnology", MJP Publishers (2010).

References

- 1 Guozhong Cao, 2011,"Nanostructures and Nanomaterials Synthesis, Properties and Applications" - World Scientific.
- 2 Pradeep T, 2012, "Nano: The Essentials", Tata McGraw-Hill Publishing Co.
- 3 Brecket A G, 2008, "Hand book on Nanotechnology", 1st Edition, Dominant publishers and distributors &New Delhi.

12/6/2023

BoS Chairman/HoD Department of Physics Dr. N. G. P. Arts and Science College Coimbatore – 641 048

	Dr.N.G.P. Arts and	Science College
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						99
Course Code	Course Name	Category	L	Т	P	Credit
222PY2A4CA	MOLECULAR PHYSICS	CORE	4	1	-	4

PREAMBLE

1

This course has been designed for students to learn and understand

- The fundamental knowledge on the structure and dynamics of the molecules through various theories
- The relation between molecular interactions and properties
- The phenomenal theories on reaction dynamics and transport properties

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Explain the molecular structure and bonding	K2
CO2	Interpret the molecular symmetry	K2
CO3	Experiment with the molecular interaction and mechanics	К3
CO4	Determine the molecular reaction dynamics	К3
CO5	Analyze the quantum theory in electron transfer and electronic structure	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1		✓			✓
CO2		\checkmark			✓
CO3		✓	✓	✓	✓
CO4		✓	✓	✓	✓
CO5	×		~	✓	

COURSE FOCUSES ON

✓	Skill Development		Entrepreneurial Development
✓	Employability	\checkmark	Innovations
	Intellectual Property Rights		Gender Sensitization
	Social Awareness/ Environment		Constitutional Rights/ Human Values/ Ethics



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SEMESTER IV

Total Instruction Hours: 60 h

Syllabus

Unit I Molecular Structure and Bonding

Chemical bonding - The Born-Oppenheimer approximation - Valence bond theory - The hydrogen molecule - Homonuclear diatomic molecules - Polyatomic molecules - Molecular orbital theory - Bond properties - Polyatomic molecules -Molecular shape in terms of molecular orbitals - Molecular structure and bond properties.

Unit II Molecular Symmetry

Symmetry elements and operations – The symmetry classification of molecules – Applications to molecular orbital theory – Character tables and symmetry labels – Vanishing integrals and orbital overlap - Vanishing integrals and selection rule.

Unit III Molecular Interactions and Mechanics

Electric properties of molecules - Electric dipole moments - Polarizabilities -Relative permittivity - Interactions between dipoles - Repulsive and total interactions - Molecular interactions in gases - Potential energy (force field) in molecular mechanics.

Unit IV Molecular Reaction Dynamics 12 h

Transition state theory – The Eyring equation – Thermodynamic aspects – Potential energy surface - Microscopic – Macroscopic connection - Zero-point vibrational energy - Molecular electronic, rotational, vibrational and translational partition functions.

Unit V Electron Transfer, Electronic Structure and Spectra 12 h

The rates of electron transfer processes – Theory of electron transfer processes – Crystal-field theory - Ligand-field theory - Electronic spectra of atoms - Electronic spectra of complexes - Charge-transfer bands.

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12 h

12 h

2

- 1 Atkins P and Depaula J, 2009, "Physical Chemistry", Oxford University Press.
- 2 Atkins P, OvertonT, Rourke J and Weller M, 2009, "Inorganic Chemistry", Oxford University Press.

References

- 1 Christopher, Cramer J, 2004, "Essential of Computational Chemistry Theories and Models", Oxford University Press.
- 2 Gerhard Herzberg, 2003, "Molecular Spectra and Molecular Structure", Krieger Pub. Co.
- 3 Robert Eisberg and Robert Resnick, 2006, "Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles", Wiley.
- 4 E-Book: W. Demtroder, "Molecular Physics", 2003, Springer, Berlin, Heidelberg. (doi.org/10.1007/978-3-662-55523-1).



		1				102
Course Code	Course Name	Category	L	T	P	Credit
222PY2A4CB	NUCLEAR AND ELEMENTARY PARTICLE PHYSICS	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The principles and concepts governing nuclear and particle physics.
- The forces and reactions involved in nuclear particles.
- The concepts of radioactivity decay and elementary particles.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Interpret the various properties of nuclei.	K2
CO2	Apply the laws of radioactivity for various applications.	К3
CO3	Explain the properties of nuclear forces and nuclear reaction dynamics.	K2
CO4	Report the alpha, beta and gamma decay based on its theory.	К3
CO5	Analyze the concepts of elementary particles.	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1		✓			✓
CO2	\checkmark	✓	1		✓
CO3		1	✓		✓
CO4	✓	1		✓	
CO5	✓		\checkmark	✓	

COURSE FOCUSES ON

	✓	
ſ	✓	
ſ		
Γ		7

Skill Development	Entrepreneurial Development	
Employability	✓ Innovations	
Intellectual Property Rights	Gender Sensitization	
Social Awareness/ Environment	Constitutional Rights/ Human Ethics	Values/



M.Sc.Physics (Students admitted during the AY 2022-23)

Total Credits: 4

SEMESTER IV

Total Instruction Hours: 60 h

Syllabus

Unit I **Properties of Atomic Nucleus**

Nuclear size and its determination - Mass spectroscopy - Theories of nuclear composition - Binding energy - Semi empirical mass formula - Quantum numbers for individual nucleons - Independence of atomic and nuclear properties - Quantum properties of nuclear states - Nuclear magnetic dipole moment - Electric multipole moment

Unit II Radioactivity

Properties of radioactive rays - The laws of radioactive decay - Radioactive growth and decay - Ideal equilibrium - Transient equilibrium and secular equilibrium -Radioactive series - Radioactive isotopes of lighter elements - Artificial radioactivity - Determination of the age of earth - Carbon dating.

Unit III Nuclear Force and Nuclear Reactions

Nuclear force: The ground state of the deuteron - Ground state of deuteron - Central and non-central forces - Nuclear Reactions: Types of nuclear reactions - The balance of mass and energy in nuclear reactions - The Q equation - Reaction cross section -Breit - Wigner formula.

Unit IV **Radioactivity Decay**

Range of alpha particles - Disintegration energy of spontaneous alpha decay- Alpha decay paradox - Barrier penetration - Gamow's theory of alpha decay - Fermi's theory of beta decay - The detection of neutrino - Parity non conservation in beta decay - Gamma ray emission - Selection rules - Internal conversion - Nuclear

Unit V **Elementary Particles**

12 h Antiparticles and antimatters - Feynman diagrams - Estimation of a pion mass - The four fundamental forces of nature - W Bosons and gluons - Conservation laws - The nucleon isospin - The Gell-Mann-Nishijima relation: Isospin of particles - The Quark model - The QCD - Colour quantum number - Colors for quarks and Gluon.



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12 h

12 h

12 h

- 1 Tayal D.C, 2017, "Nuclear Physics", Himalaya Publishing House, Mumbai
- Patel. S. B, 2010, "Nuclear Physics-An Introduction", 2nd Edition, New Age International, Mumbai.

References

- 1 Roy R.R. and Nigam B. P, 2008, "Nuclear Physics", 1st Edition, New Age International, Chennai.
- 2 Cohen B.L, 2001, "Concepts of Nuclear Physics", 1st Edition, Tata McGraw Hill Education, India, Private Limited, Chennai.
- 3 David Griffiths, 2008, "Introduction to Elementary Particles", 2nd Edition, Wiley Publication, New Delhi.
- 4 Ghoshal S. N, 1994, "Nuclear Physics", S. Chand & Company Limited, New Delhi.
- ⁵ Swayam https://swayam.gov.in/nd1_noc20_ph19/preview
- 6 PGPathshala Paper No.: Nuclear and Particle Physics Module: Introduction to Nuclear Physics, Sanjay Kumar Chamoli
- 7 MIT Open Courseware https://ocw.mit.edu/courses/physics/8-701introduction-tonuclear-and-particle-physics-spring-2004/



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Total Credits:2Total Instructions Hours:48 h

S.No

Content

- 1 Write 8085 ALP for 8 bit addition and subtraction
- 2 Perform 8 Bit multiplication and division using 8085 instruction set
- 3 Find the biggest and smallest number element in the array using 8085
- 4 Write 8085 ALP for LED interfacing
- 5 Verification of sorting the element in ascending and descending order using 8085
- 6 Generate triangular and square wave by using 8085 ALP
- 7 Masking off most significant four bits and setting bits using two different instructions using 8085
- 8 Write 8085 ALP for Stepper motor controller
- 9 Write 8085 ALP for Elevator controller
- 10 Write Microprocessor 8085 ALP for interface IV (Waveform generation)
- 11 Write Microprocessor 8085 ALP for Traffic control system
- 12 Write Microprocessor 8085 ALP for subroutines (display results)

Note: Any 10 experiments

References

- Praod Borole, 2014, "8085 Microprocessor Architecture and Programming", ANE Books Pvt. Ltd.
- 2 Doughlas V. Hall, 1990, "Microprocessor Interfacing Programming and Hardware", 2nd Revised Edition, McGraw-Hill Inc, New Delhi.
- 3 Nagoor Kani, 2015, "Microprocessors and Micro Controllers", McGraw-Hill Inc, New Delhi.
- Aditya P. Mathur, 2016, "Introduction to Microprocessors", McGraw-Hill Inc., New Delhi.



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M.Sc.Physics (Students admitted during the AY 2022-23)

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Course Code	Course Name	Category	L	Т	Р	Credit
222PY2A4DA	SOLAR CELLS	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The technology behind different generations of solar cells
- The characteristics and properties of solar cells
- The construction and working of CdTe, DSSC and Perovskite solar cells

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level	
CO1	Explain the properties of semiconductors	К2	
CO2	Understand the properties and characteristics of solar cells	К2	
CO3	Analyze the amorphous silicon solar cell	K4	
CO4	Explain the construction of CdTe solar cells by thin film fabrication methods	К3	
CO5	Evaluate the construction of dye sensitized solar cells and perovskite solar cells	K4	

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1		✓			1
CO2		~			✓
CO3	✓		1		
CO4		✓			✓
CO5	✓		~		

COURSE FOCUSES ON

\checkmark	Skill Development	✓	Entrepreneurial Development
\checkmark	Employability	✓	Innovations
	Intellectual Property Rights		Gender Sensitization
	Social Awareness/ Environment		Constitutional Rights/ Human Values/ Ethics



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M.Sc.Physics (Students admitted during the AY 2022-23)

222PY2A4DA

SOLAR CELLS

Total Credits: 4

SEMESTER IV

Total Instruction Hours: 48 h

Syllabus

Unit I Fundamentals of Semiconductors

Semiconductor as solar cell material - Formation of energy bands - Charge carriers in semiconductors - Carrier concentration and distribution - Carrier motion in semiconductors - Drift-Motion due to Electric field - Generation of carriers - Recombination of carriers.

Unit II Solar Cells

Solar cell parameters - Open circuit voltage - Short circuit current - Fill Factor - Efficiency of solar cells - Effect of series and shunt resistance on efficiency - Effect of solar radiation on efficiency - Requirements for high short circuit current - Minimization of optical losses and recombination - Requirement for high open circuit voltage - Design for high FF - Solar simulator: I-V Measurement - Quantum efficiency measurement.

Unit III First Generation Solar Cells

Amorphous silicon: The first bipolar amorphous semiconductor - Designs for amorphous silicon solar cells - Staebler - Wronski effect - Atomic and electronic structure of hydrogenated amorphous silicon: Deposition techniques - RF glow discharge deposition -Glow discharge deposition at different frequencies - Hot wire chemical vapor deposition.

Second Generation Solar Cells

CdTe properties and thin films - Fabrication methods - Condensation/Reaction of Cd and Te2 vapors on a surface - Galvanic reduction of Cd and Te ions at a surface - Precursor reaction at a surface - Window Layers - CdTe absorber layer and cadmium chloride treatment - CdS/CdTe intermixing - Back contact - Solar cell characterization - CdTe

Unit V Third Generation Solar Cells

Operating mechanism of dye-sensitized solar cell - Materials - Performance of highly efficient DSSCs - Electron transfer processes and charge recombination in DSSC - Organic-Inorganic perovskites for photovoltaics - Deposition methods -Electronic properties -Device operation - Ongoing challenges - Lead-free alternatives.



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M.Sc.Physics (Students admitted during the AY 2022-23)

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- 1 Chetan Singh Solanki, 2013, "Solar Photovoltaics: Fundamental Technologies and Applications", 2nd Edition, PHI Learning Private Limited, New Delhi.
- Antonio Luque, Steven Hegedus, 2012, "Handbook of Photovoltaic Science and Engineering", 2nd Edition. Wiley, New York.

References

- 1 Angele Reinders, Pierre Verlinden, WilfriedVansark, 2017, "Photovoltaic Solar Energy", 3rd Edition, Wiley, New York.
- 2 Brabec C, Scherf U, Dyakonov V, 2008, "Organic Photovoltaics", 1st Edition, Wiley, New York.
- Kothari D P, Singhal K C, Rakesh Ranjan, 2014, "Renewable Energy Source and
 ³ Emerging Technologies", 2nd Edition, PHI Learning Private Limited, New Delhi.
- 4 John T, Tony W, 2005, "Renewable Energy Resources", 2nd Edition, Taylor &Francis, London.
- ⁵ https://www.energy.gov/eere/solar/solar-photovoltaic-cell-basics
- 6 https://onlinecourses.nptel.ac.in/noc21_ph25/preview/



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L	T	P	Credit
4	-	-	4
	4	4 -	4

PREAMBLE

This course has been designed for students to learn and understand

- The band structure of semiconductors.
- The study on semiconductor carrier properties.
- The applications of semiconductors in various fields

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Outline about band structure of semiconductors.	K2
CO2	Identify the physical characteristics of semiconductors	К2
CO3	Analyze the concept of band gap engineering	K4
CO4	Examine the excess carriers in semiconductors	K3
CO5	Explain the optical device in semiconductors	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1		✓			✓ ×
CO2		✓			1
CO3	~	✓	✓	✓	✓ √
CO4		✓			✓
CO5	✓	~	✓	✓	1

COURSE FOCUSES ON

\checkmark	Skill Development	✓ Entrepreneurial Development
✓	Employability	✓ Innovations
	Intellectual Property Rights	Gender Sensitization
	Social Awareness/ Environment	Constitutional Rights/ Human Values/ Ethics



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BAND GAP ENGINEERING IN **SEMICONDUCTORS**

Total Credits: 4

SEMESTER IV

Total Instruction Hours: 48 h

Syllabus

Unit I **Conduction in Metals**

Electron volt - Unit of energy - Current density - Motion in a magnetic field - Nature of the atom - Energy band theory of crystals - Insulators - Semiconductors -Conductors - Conduction in metals - Potential energy field in a metal - Bound and free electrons - Energy density - Fermi level - Density of states.

Unit II Theory of Semiconductors

Electrons and holes in an intrinsic semiconductor - Conductivity of a semiconductor - Carrier concentrations in an intrinsic semiconductor - Donor and acceptor impurities - Fermi level in a semiconductor having impurities - Diffusion - Carrier lifetime - The continuity equation.

Unit III Semiconductor Diode Characteristics **0**9 h

Qualitative theory of the p-n junction- The p-n junction as a diode - Band structure of an open - Circuited p-n junction - The current components in a p-n diode - Ohmic contacts - Open circuited p-n junction - Theory of p-n diode forward and reverse currents - The schottky barrier diode - The schottky effect

Unit IV **Excess Carriers in Semiconductors**

Optical absorption - Luminescence - Photoluminescence - Electroluminescence -Carrier lifetime and Photoconductivity - Direct recombination of electrons and holes - Indirect recombination of electrons and holes - Steady state carrier generation -Photoconductive devices - Diffusion of carriers - Diffusion processes - The Haynes-Shockley experiment.

Unit V **Optoelectronic Devices**

Photo diodes - Current and voltage in an illuminated junction - Solar cells -Photodetectors - Gain, Bandwidth, and Signal-to-Noise ratio of photodetectors -Light-Emitting diodes - Light-Emitting materials - Lasers - The basic semiconductor laser - Heterojunction lasers.



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09 h

11 h

09 h

10 h

Text Books

Late Jacob Millman, Christos C Halkias, Satyabrata Jit, 2007, "Electronic

- 1 Devices and Circuits", 3rd Ed, Tata McGraw Hill Education Private Limited, New Delhi.
- 2 Ben G. Streetman, Sanjay Kumar Banerjee., 2003, "Solid State Electronic Devices", 7th Ed., Pearson, Boston.

References

- 1 Ali Omar, M., 2000, "Elementary Solid-State Physics: Principles and Applications", 2nd Ed., Addison-Wesley.
- 2 Rita John, 2014, "Solid State Physics", 4th Ed, Tata McGraw Hill Publications, New Delhi.
- ³ Kittel, C., 2010, "Introduction to Solid State Physics", 7th Ed., Wiley.
- 4 Donald, A., 2003, "Semiconductor physics and devices", 3rd Ed., Mc Graw Hill, New Delhi.
- ⁵ https://www.electronicshub.org/types-of-semiconductor-devices.
- 6 https://nptel.ac.in/courses/108108122/



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M.Sc.Physics (Students admitted during the AY 2022-23)

		112					
Course Code	Course Name	Category	L	Т	P	Credit	
222PY2A4DC	PLASMA PHYSICS	DSE	4	-	-	4	

PREAMBLE

This course has been designed for students to learn and understand

- The concepts of plasma physics.
- The theoretical aspects in the production of plasma and its confinement.
- The working principle behind the applications of Plasma.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Summarize the basic concepts of plasma.	K2
CO2	Infer the characteristics of plasma.	K2
CO3	Analyze the confinements in plasma.	K4
CO4	Classify the different waves of plasma.	K2
CO5	Identify the different applications of plasma waves.	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1		1			✓
CO2		1			✓
CO3	~		✓	✓	
CO4		1			✓
CO5		1			✓

COURSE FOCUSES ON

×	Skill Development		Entrepreneurial Development
 ✓ 	Employability	✓	Innovations
	Intellectual Property Rights		Gender Sensitization
	Social Awareness/ Environment		Constitutional Rights/ Human Values/ Ethics



Total Instruction Hours: 48 h

Syllabus

Unit I Plasma Concepts

Plasma as state of matter - Debye shielding - Criteria for plasma - Magnetic pressure - Particle drifts – Plasma frequency - Landau damping - Collisions - Bohm diffusion - Plasma radiation.

Unit II Characteristics of Different Plasma

Production of plasma: Low pressure cold cathode discharge - Thermionic arc discharge - Plasma guns - Q machines - RF produced plasma - Current and voltage measurement in plasmas - Plasma probes: Electrostatic probe - Magnetic probe - Measurement types - Photography and atomic spectroscopy - Radiation measurements - Single particle measurements - Neutrons measurement - Light scattering measurement.

Unit III Plasma Confinement

Motion in a magnetic field - Motion in finite electric and magnetic field - Motion in inhomogeneous and curved magnetic fields - Magnetic mirrors - Motion in non-uniform electric field - Motion in time varying electric and magnetic field.

Unit IV Waves in Plasma

Wave representation - Group velocity - Phase velocity - Plasma oscillations -Electromagnetic waves in the absence of magnetic field - Electromagnetic waves perpendicular to magnetic field - Electromagnetic waves parallel to magnetic field -Electron plasma wave in cold and warm plasma - Ion acoustic wave.

Unit V Applications of Plasma

Gas discharges - Thermonuclear fusion - Laser driven fusion - Magnetic fusion - Magnetohydrodynamic generator (MHD) - Basic theory of MHD - Principle of working - Plasma diode.



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9 h

10 h

10 **h**

10 **h**

09 h

Text Books

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- 1 Chen F.F, 2016, "Introduction to Plasma Physics and Controlled Fusion, 3rd Edition", Springer International Publishing, Switzerland.
- 2 Ghosh B, 2014, "Basic Plasma Physics", 1st Edition, Narosa Publishing House, New Delhi.

References

- 1 Krall N.A and Trivelpiece A.W, 1973, "Principles of Plasma Physics", 1st Edition, McGraw Hill, US.
- 2 Stix T.H, 1962, "The Theory of Plasma Waves", 1st Edition, Mc Graw Hill, New York.
- 3 Bittencourt J.A, 2004, "Fundamentals of Plasma Physics", 3rd Edition, Springer, New York.
- 4 Choudhuri A.R, 2015, "The Physics of Fluids and Plasmas", 5th Edition, Cambridge, India.
- 5 E-Book: I. H. Hutchinson, 2022, Introduction to Plasma Physics, 2nd Edition, MIT press, Cambridge.
- 6 Website Link: https://www.youtube.com/watch?v=E8Fqdg4eI00
- 7 Website Link: https://www.mpg.de/plasma-physics



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