Annexure - I

Faculty of Science Ordinance, Curriculum & Syllabus Master of Science (Physics) (2019-20)



Shree Guru Gobind Singh Tricentenary University, Gurugram (Haryana)-122505, India



MASTER OF SCIENCE [M.Sc.]

COURSE ORDINANCE

1. PREAMBLE

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system.

Faculty of Science. Shree Guru Gobind Singh Tercentenary University, Gurugram with the aim to enhance academic standards in quality of higher education has adopted the UGC guide lines as such in all PG courses.

The grading system is considered to be better than the conventional marks system and in order to facilitate student mobility across institutions with in India and across countries the community grade point average (CGPA) has been introduced in all the PG courses. The guidelines as follows,

CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

- a. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
- b. Elective Course: Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
 - i. Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The

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University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

- ii. **Dissertation/Project:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
- c. Skill Enhancement Course: The course based upon the content that leads to Knowledge enhancement.

2. GOALS:

- i. Employment prospects for post graduates are very good. The scientific knowledge and mathematical and analytic skills acquired help to place across a wide range of industries including aerospace, pharmaceutical, dyes, fabrics, electronics, semiconductors, petroleum, communications, computing, education, commerce, civil services and many more.
- ii. The course will build a rich knowledge base to provide a foundation for the continued study of science.
- iii. The theoretical and experimental skills necessary to analyze and solve a range of advances problems, providing an excellent foundation for leadership.
- iv. Post-graduation leads to abundance of research opportunities.

3. OBJECTIVES

The postgraduate training should enable the student to:

- i. Practice efficiently various investigative procedures backed by scientific knowledge including basic sciences and skills.
- ii. Get expertise in his/her field of interest
- iii. Play the assigned role in the implementation of required practical skills.
- iv. Be a motivated 'teacher' defined as one keen to share knowledge and skills with a colleague or a junior or any learner continue to evince keen interest in continuing education irrespective of whether he/she is in a teaching institution or is practicing and use appropriate learning resources.
- v. Exercise empathy and a caring attitude and maintain professional integrity, honesty and high ethical standards.
- vi. The student is expected to know his subject in depth; however, emphasis should be on the analytical techniques. Knowledge of recent advances and basic sciences as applicable to his/her specialty should get high priority.
- vii. Competence in skills commensurate with the specialty (actual hands-on training) must be ensured.

4. Duration and Nomenclature of the Course:

The duration of M.Sc (Physics /Chemistry /Mathematics /Forensic Science/Environmental Science course shall be of two academic years consisting of four (4) semesters (15-17 weeks) under Choice Based Credit System(CBCS). On successful completion of all the four semesters, the student will be awarded M.Sc.Degree in the concerned course. The student

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shall complete the course within a maximum period of 4 years from the date of admission to the first semester, failing which he/she will be disqualified from the course.

5. Admission to the Course:

i. Eligibility for Admission:

For admission to the 1st Semester of M.Sc. (Physics) course, the candidate must have passed B.Sc. (Pass) with Physics as one of the subjects/B.Sc. (Hons.) Physicswith 50% marks (45% marks in case of SC/ST candidates of Haryana only) in aggregate or equivalent grade from any university recognized by UGC

For admission to the 1st Semester of M.Sc. (Chemistry) course, the candidate must have passed B.Sc. (Pass) with Chemistry as one of the subjects/B.Sc. (Hons.) Chemistry with 50% marks (45% marks in case of SC/ST candidates of Haryana only) in aggregate or equivalent grade from any university recognized by UGC.

For admission to the 1st Semester of M.Sc. (Mathematics) course, the candidate must have passed B.Sc. (Pass) with Mathematics as one of the subjects/B.Sc. (Hons.) Mathematics /B.A (Pass) with Mathematics/ as one of the subjects/ B.A (Hons.) Mathematicswith 50% marks (45% marks in case of SC/ST candidates of Haryana only) in aggregate or equivalent grade from any university recognized by UGC.

For admission to the 1st Semester of M.Sc. (Forensic Science) course, the candidate must be graduate with Physics, Chemistry & Mathematics, Physics, Chemistry & Biology OR Agricultural sciences OR BCA OR B.Pharm. OR B.Sc.(Nursing) OR Engineering sciences OR B.Sc.(Forensic Sciences) OR Medical sciences with 50% marks (45% marks in case of SC/ST candidates of Haryana only) in aggregate or equivalent grade from any university recognized by UGC.

For admission to the 1st Semester of M.Sc. (Environmental Science) course, the candidate must have passed B.Sc(Non Medical/ Environmental Sciences/Life Sciences/Bio Sciences/ Agriculture) with 50% marks (45% marks in case of SC/ST candidates of Haryana only) in aggregate or equivalent grade from any university recognized by UGC.

ii. Schedule of admission and payment of fees:

The admission schedule, along with last date for the submission of admission forms and payment of fees, shall be fixed by the Vice-Chancellor from time to time.

6. Mode of Selection of Candidates for Admission:

The admissions will be made as per the following criteria:

Sr.No.	Criteria	Condition	
1	On the Basis of the Merit of the qualifying	g If the no. of applicants is up to 3	
	Examination.	times of the intake	
2	On the Basis of the Merit of the Entrance Examination.	If the no. of applicants is more than 3 times of the intake	

7. Syllabus:

The syllabus is based on Choice Based Credit System (CBCS) and is recommended by Board of Studies and approved by Academic Council from time to time.

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8. Scheme of Examination, distribution of marks, credit system and Syllabus:

The Scheme of examination, distribution of marks in various papers along with the credit system and the syllabus of the course shall be as approved by Board of Studies/Academic Council from time to time.

9. Medium of Instruction and Examination:

The medium of the instruction and the examination shall be English only.

10. Attendance Requirements/Eligibility to Appear in Examination:

The student should fulfill the following criteria to be eligible for appearing in the End Term Semester Examinations:

- i. He/she should bear a good moral character.
- ii. He/she should be on the rolls of the Dept./Faculty of the University during the semester.
- iii. He/she should have 75% of the attendance during the respective semester. Twenty five per cent (25%) of attendance relaxation shall account for illness and contingencies of serious and unavoidable nature.
- iv. The Dean of the Faculty of his own or on the recommendation of the HOD shall have the power to give relaxation upto 5% on genuine grounds over the minimum 75% attendance.
- v. Further, the Vice Chancellor of his own or on the recommendation of the Dean shall have the power to give further relaxation upto 5% on genuine grounds over the above mentioned minimum attendance.
- vi. He/she should not be a defaulter in payment of any dues of the SGT University and no disciplinary action is pending against the student.

11. Exemption from Attendance / Shortage of attendance to be condoned:

The shortage of lecture to the maximum limit as under can be condoned by the competent authority:

Sr. No	Exemptable No. of Lecture	Ground of Exemption	Competent Authority
1	All periods of the days of blood donation	Voluntarily blood donation to the Blood Bank.	Dean of the Faculty
2	All periods of the day of Examination	For appearing in the supplementary examinations(Theory /Practical/Viva-voce)	-do-
3	10 days attendance during a semester	For participation in University or Inter- Collegiate Sports Tournaments/ Youth Festivals, NCC/NSS Camps/University Educational Excursions/ Mountaineering Courses	-do-

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4	15days attendance during a semester	For participation in Inter- University Sports Tournaments/ Youth Festivals	-do-
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Provided:

- i. that he/she has obtained prior approval of the Dean, Faculty of Science;
- ii. that credit may be given only for the days on which lectures were delivered or tutorials or practical work done during the period of participation in the aforesaid events.

12. Attendance Shortage Warning:

Attendance shortage warning will be displayed on the Faculty's Notice Board and University Website by 10th day of every month.

13. Detained students

A student, who does not fulfill the criteria prescribed in Clauses10-11, will not be eligible for appearing in the End Term Semester Examination in that particular paper and will be deemed as Detained in that paper. Such student will repeat the course/paper alongwith the regular students of the subsequent batchto fulfill the prescribed conditions to appear in the "End Term" examination of the course/paper.

14. Submission of Examination Forms and Payment of Examination Fee:

The Dean, Faculty of Science shall submit the examination admission forms of thosestudents who satisfy the eligibility criteria to appear in the examinations to the Controller of Examinations as per schedule of examination circulated by him from time to time.

15. University Examinations:

i. End Term Semester Examinations:

The examination for the 1^{st} and 3^{rd} semesters (Odd Semesters) shall ordinarily be held in the month of December and of the 2^{nd} and 4^{th} semesters (Even Semesters) in the month of May/June. The examination dates are fixed by the controller of examination with the approval of Vice Chancellor.

ii. Fail/ Reappear candidates:

Fail / re-appear candidate of the odd semesters $(1^{st}\& 3^{rd})$ will take re-appear exams as an ex-student in the subsequent exams of the odd semesters $(1^{st}\&3^{rd})$. Similarly, for the even semesters $(2^{nd}\&4^{th})$, he/she will take re-appear exams. in the subsequent exams of the even semesters $(2^{nd}\&4^{th})$. However, a candidate appearing in the 4th semester examination (Regular) may appear simultaneously in his/her re-appear paper(s) of lower semesters.

16. Improvement Examination:

The student may be permitted to improve his/her result subject to the following conditions:

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- i. The student will be permitted to appear in improvement examination as an ex-student with regular batches.
- ii. The student will be permitted to improve his/her CGPA in one or all papers in which he/she has obtained CGPA less than 'First Division' in aggregate.
- iii. Only one chance per paper will be given. The chance must be availed within a year of initially passing of every semester examination.
- iv. The candidate will be required to apply and allowed to appear only for theory examinations.
- v. If the status/nature of the student's result does not improve by five (05) or more per cent, his/her improvement result will be declared "PRS" (Previous Result Stands).
- vi. The candidate shall be allowed to appear in the improvement examination(s) along with regular candidates as and when the course is offered. No separate examination will be held for improvement of result. In case of change of syllabi, the student shall have to appear for improvement in accordance with the changed syllabi of the concerned course applicable to the regular students of that exam.

17. Setting of Question Papers:

- i. The Head of the Department/Dean of the Faculty shall supply the panel of internal and external examiners duly approved by the Board of Studies to the Controller of Examinations. The paper(s) will be set by the examiner(s) nominated by the Vice-Chancellor from the panel of examiners.
- ii. An examiner shall be allowed to set not more than two papers in a semester examination.
- iii. The examiner(s) will set the question papers as per criteria laid down in the Scheme of Examinations as approved by the Board of Studies/Academic Council of the University.

18. Evaluation Process – Theory and Practical: Evaluation of Answer Books:

The answer books may be evaluated either by the paper setter or any other internal or external examiner to be nominated by the Controller of Examiners with the approval of the Vice-Chancellor from the panel of examiners approved by the Board of Studies.

Re-evaluation of Answer Books:

Re-evaluation/ rechecking of any paper is allowed. The students can apply for Re-evaluation/ Re-checking of any paper to the Controller of Examinations through the HoD/Dean of the Faculty within 10 days of the declaration of result by paying prescribed fee.

Practical Examinations - Appointment of Examiner:

a. The practical examinations shall be conducted by a Board of two Examiners consisting of one internal and one external examiner to be nominated by the Vice-Chancellor from the panel of examiners.

Marks Distribution:

The distribution of marks in examination of the practical paper will be as per the criteria given below:

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a. Experimental performance = 60% marks
b. Viva-Voce = 30% marks
c. Laboratory work report = 10% marks

19. External Assessment (Summative Assessment):

Sixty per cent marks shall be assigned to each theory and practical paper as Summative Assessment. The distribution of marks in theory as well as practical papers will be in accordance to IQAC guidelines.

20. Internal Assessment(Formative Assessment):

i. (Theory Papers)

a. Based on 40 Marks:

1	Assignment	5 marks
2	Mid Term Test (10 Marks each)	20 marks
3	Synergy / Project	10 marks
4	Attendance	5 marks
	Marks distribution for Attenda	nce in % age
	95<=Attendance=100	5 marks
	90<=Attendance<95	4 marks
	85<=Attendance<90	3 marks
	80<=Attendance<85	2 marks
	75<=Attendance<80	1 marks
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b. Based on 20 Marks:

1	Assignment	5 marks
2	Mid Term Test	10 marks
3	Attendance	5 marks
	Marks distribution for At	tendance in % age
	95<=Attendance=100	5 marks
	90<=Attendance<95	4 marks
	85<=Attendance<90	3 marks
	80<=Attendance<85	2 marks
	75<=Attendance<80	1 marks
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ii. (Practical/Project/Dissertation)

i. Based on 40 Marks:

S.no.	40 Marks	s Internal	60 Marks External
1	Attendance	10 marks	
2	Practical/Project	10 marks	

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	File/Dissertation		30 marks for Practical	
3	Internal Viva-Voce	20 marks	examination (Conduction/	
	Marks distribution for At	tendance in % age	- Demonstration J/Project File/Dissertation + 30 marks for	
	97.5<=Attendance=100	10 marks	Viva-Voce in End-term	
	95<=Attendance<97.5	9 marks	Examination by External Experts.	
	92.5<=Attendance<95	8 marks		
	90<=Attendance<92.5	7 marks		
	87.5<=Attendance<90	6 marks		
	85<=Attendance<87.5	5 marks		
	82.5<=Attendance<85	4 marks		
	80<=Attendance<82.5	3 marks		
	77.5<=Attendance<80	2 marks		
	75<=Attendance<77.5	1 Marks		

ii. Based on 20 Marks:

s.no.	20 Marks In	30 Marks External	
1	Attendance	5 marks	
2	Practical/Project File/Dissertation	5 marks	15 marks for Practical
3	Internal Viva-Voce	10 marks	examination (Conduction/
	Marks distribution for At	tendance in % age	file/Dissertation + 15 marks for
	95<=Attendance=100	5 marks	Viva-Voce in End-term
	90<=Attendance<95	4 marks	Examination by External Experts.
	85<=Attendance<90	3 marks	
	80<=Attendance<85	2 marks	
	75<=Attendance<80	1 Marks	

- iii. In case of ex-students, those appearing for re-appear / improvement examination in any semester, their previous Internal Assessment marks will be counted. If there is any change in Scheme of Examination, then Internal Assessment marks will be modified accordingly.
- iv. The concerned teacher shall preserve records on the basis of which the Internal Assessment has been awarded and shall make the same available to the Controller of Examinations whenever required.
- v. The Head of the Department/ Dean of the Faculty shall ensure:
 - a. That the internal assessment marks are displayed for information of the students at least seven (07) days before the commencement of the examinations of each semester
 - b. That the internal assessment marks are submitted to the Controller of Examinations at least seven (07) days before the commencement of the examinations of each semester.

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21. Criteria for Promotion to Higher Semester:

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The student shall be promoted to 2^{nd} and 4^{th} semester automatically without any condition of passing minimum number of papers. For promotion from 2^{nd} to 3^{rd} Semester, the student shall have to clear at least 50% papers of 1^{st} and 2^{nd} semesters taken together.

22. Credit Based Grading System:

i. Key Definitions:

Programme	An educational programme leading to award of a Degree, Diploma or Certificate.
Course	Usually referred to as 'paper' is a component of a programme. All courses need not carry the same weight.
Credit	A unit by which the course work is measured. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours for practical work/field work per week. A Research Based Paper /Project is equal to 6 credits.
Credit Point	It is the product of grade point and number of credits for a course i.e. Credit Point = No. of credits in a course X "grade value" of the grade obtained in the course.
Grade Point	There are two types of GPAs as given hereunder:
Average (GPA)	Semester Grade Point Average (SGPA) Cumulative Grade Point Average (CGPA) Every student earns a distinct SGPA and a distinct CGPA at the end of each specified semester.
SGPA	SGPA is a measure for performance of student in a Semester. It is the Point Average ratio of sum of the product of number of credits with the grade points scored by the student in all the courses taken by him/her and the sum of the number of credits of all the Courses undergone by the student i.e. SGPA (Si) = \sum (CixGi) / \sum Ci
CGPA	CGPA is a measure of performance up to any Grade Gradespecified semester Point Average beginning from the first Semester. It is also calculated in the same (CGPA) manner as SPGA taking into account all the courses undergone by a student over all the semesters of programme i.e. $CGPA = \sum (Cix Si) / \sum Ci$
Grade Point	It is a numerical weight allotted to each letter grade on a 10-point scale.
Letter Grades	It is an index of the performance of a student in a said course. The Grades are denoted by letters O, A+, A, B+, B, C, P, F and Ab.

ii. Credits, Semesters, Courses and total Credit Points:

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S.No	Course	Semesters	Core Courses	Discipline Specific elective Courses	Skill Enhancement Courses	Total Credi ts
1	M.Sc.(Physics)	4	72	16	12	100
2	M.Sc.(Chemistry)	4	74	12	14	100
3	M.Sc.(Mathematics)	4	78	12	10	100
5	M.Sc.(Forensic Sciences)	4	86	8	6	100
6	M.Sc.(Environmental Science)	4	60	24	16	100

Grading Table

Range of Percentage of Marks	Letter Grade	Grade Points	Range of Grade Points	Classification
90 and above	O (Outstanding)	10	9-10	Outstanding
80 & above but less than 90	A+ (Excellent)	9	8< 9	Excellent
70 & above but less than 80	A (Very Good)	8	7< 8	1 st Div with Distinction
60 & above but less than 70	B+ (Good)	7	6< 7	1 st Division
50 & above but less than 60	B (Above Average)	6	5<6	2 nd Division
Above 40 but less than 50	C (Pass Average)	5	Above 4 <5	3 rd Division
40	P(Pass)	4	4	Pass
Less than 40	F (Fail)	0	-	Fail

Formula for Calculating percentage of marks:

 $CGPA \times 10 \text{ e.g. } 6.53 \times 10 = 65.3$

Formula for Grade Point calculation:

G = (Marks Obtained in Paper/Total marks of paper) x100.

Formula for Computation SGPA & CGPA

- i. The SGPA is the ratio of sum of the product of the number of credits with the grad points scored by a student in all the courses taken by a students and the sum of the number of credits of all the courses taken by the students;
 - i.e SGPA (Si) = $\sum (Ci \times Gi) / \sum Ci$,

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where Ci is the no of credits of the ith course and Gi is the grad point Scored by the student in the ith course

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by the students over all the students over all the semesters of a programme, i.e

$$CGPA = \sum (Ci \times Si) / \sum Ci$$

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded up to 2 decimal points and reported in the transcripts. Result–Cum-Detailed Marks Card/ Transcript: Based on the above recommendations on letter grades, grade points and SGPA and CGPA, the DMC/ Transcript for each semester and a consolidated transcript in dictating the performance in all semester may be issued

Course	Credit	Grade Letter	Grade Point	Credit Points (Credit × Grad)
Course 1	3	Α	8	$3 \times 8 = 24$
Course 2	4	B +	7	$4 \times 7 = 28$
Course 3	3	В	6	$3 \times 6 = 18$
Course 4	3	0	10	$3 \times 10 = 30$
Course 5	3	С	5	$3 \times 5 = 15$
Course 6	4	В	6	$4 \times 6 = 24$
Course o	20			139

iv. 1. Illustration of Computation of SGPA and CGPA and Format for Transcripts

Thus, SGPA = 139/20 = 6.95

Similarly, Suppose the SGPA for 2nd, 3rd and 4th semester are 7.85, 5.6, and 6.0 with credits 22, 24 and 22, respectively, then for a two-year PG Programme, the CGPA will be computed as followed,

 $CGPA = (20 \times 6.95 + 22 \times 7.85 + 24 \times 5.6 + 22 \times 6.0)/88 = 6.57$

Course	Credits	Grade Letter	Grad Point Block	Range of Grad Points(Actual Grade Value as per marks obtained	Earned Credit Point(Credit × Actual Grade Value)
Course 1	3	0	10	9.2	3×9.2=27.6
Course ?	3	A+	9	8.2	3×8.2=24.6
Course 3	4	A	8	7	4×7=28
Course 4	3		7	6.7	3×6.7=27.6
Course 5	3	B	6	5.6	3×5.6=16.8
Course 5	3	C C	5	4.7	4×4.7=18.8
Course 6	20		5	,	135.9

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Thus, SGPA= 135.9/20 = 6.79

Similarly suppose SGPA for 2^{nd} , 3^{rd} , and 4^{th} semester are 7.85, 5.6 and 6.0 with credits 22, 24, and 22 respectively

 $CGPA = (20 \times 6.79 + 22 \times 7.85 + 24 \times 5.6 + 22 \times 6.0)/88 = 6.53$

Calculating percentage of marks

 $CGPA \times 10 E.G.6.53 \times 10 = 65.3$

23. Pass criteria:

The minimum percentage of marks to pass the examination in each subject/paper will be 40% each in theory paper, practical /field work/Research Project etc. examination & internal assessment. The student has to pass in summative and formative (Internal) assessment separately.

24. Declaration of Results:

- i. The Controller of Examinations shall declare the results as early as possible after the conclusion of each examination, but before the start of teaching for the next academic session.
- ii. Each successful student/ the student placed in reappear shall receive a copy of the Detailed Marks Certificate/ Grade Card Sheet of each semester examination.
- iii. The student whose result is declared late without any fault on his/her part may attend classes for the next higher semester provisionally at his /her own risk and responsibility, subject to his /her passing the concerned semester examination. In case, the student fails to pass the concerned semester examination, his/her attendance/internal assessment in the next higher semester in which he / she was allowed to attend classes provisionally will stand cancelled.

25. Other Provisions:

- i. Nothing in the Ordinance shall debar the University from amending the Ordinance and the same shall be applicable to all the students whether old or new.
- ii. Any other provision not contained in the Ordinance shall be governed by the rules and regulations framed by the University from time to time.
- iii. In case of any dispute, the Vice-Chancellor will be competent authority to interpret the rules and his interpretation shall be final.

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UNIVERSITYS' COMMON COURSE ORDINANCE POSTGRADUATE & UNDERGRADUATE PROGRAMS

1. Preamble:

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of the country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning (online & offline) process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system.

Department of Physics, Faculty of Science, Shree Guru Gobind Singh Tricentenary University, Gurugram with the aim to enhance academic standards in quality of higher education has adopted the UGC guidelines in its Postgraduate (PG) program (M. Sc. Physics). The grading system is considered to be better than the conventional marks system and in order to facilitate student mobility across institutions within India and across countries the community grade point average (CGPA) has been introduced in this PG program. The guidelines are as follows:

CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed pool of courses comprising core, elective, skill and ability enhancement courses. The courses can be evaluated by a uniform grading system in the higher education system. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in the evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

a. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

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- b. Elective Course: Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
 - i. **Discipline Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
 - ii. **Dissertation/Project:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
- c. Skill Enhancement Course: The course based upon the content that leads to Knowledge enhancement.
- d. Ability Enhancement Compulsory Course: The course based upon the content that leads to the development of a professional of ability.
- e. **Open Elective Course:** The course based upon the content that enhances interdisciplinary knowledge

2. Justification/Score of the Course:

The Master of Science (Physics) degree offers students a foundation in fundamental/applied physics, together with experience in forefront research. The student will take a suite of core Physics courses and also perform research in project work.

The aim of the programme is to train students with advanced knowledge and understanding physics with higher order critical, analytical, problem solving and research skills; ability to think rigorously and independently to meet higher level expectations of academia and research with sufficient transferrable skills, and to achieve holistic development and to prepare themselves to face the world outside in a dignified manner.

A Master in Physics opens up avenues that are vibrant and an interesting mix of money and intellect. There are endless possibilities for those who love the world of physics. One can definitely find out ways

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and means by which you can find new avenues of work. It should be a combination of technical knowledge and what the job offers in terms of both monetary benefits and intellectual growth.

3. Duration of the Course:

Name of the Programme	Duration	
Master of Science (Physics)	02 Years (4 Semesters)	

4. Admission to the Course:

(a) Name of the Degree:

Master of Science (Physics)

(b) Eligibility for Admission:

Name of the Programme	Eligibility
1. Master of Science (Physics)	For admission to the 1 st Semester of M.Sc.
	(Physics) program, the candidate must have
	passed B.Sc. (Pass) with Physics as one of
	the subjects/B.Sc. (Hons.) Physics with
	50% marks (45% marks in case of SC/ST
	candidates of Haryana only) in aggregate
	or equivalent grade from any university
	recognized by UGC.

Migration/Lateral entry admission in second year/third semester of an academic programme, wherever permitted, shall be considered on the basis of merit in the qualifying examination and subject to the availability of seats in the academic programme where admission is desired. Student who ever granted lateral entry admission is required to pay the requisite fee as admissible to the fresh batch.

(c) Migration Admission :

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A student of any other University/Institute/College, recognized by the concerned regulatory/statutory body like UGC etc., shall be eligible for migration (admission) to the University. Migration will be allowed, if the seat is available in that programme andcannot be claimed as a right by the candidate. Migration can only be allowed, if the student studied the programme in regular mode and is not having any backlog.

In addition to the Application Form for admission, student has to provide the following documents "

- (i) Marksheets/result of all the examinations passed.
- (ii) Detailed syllabi for all the courses studies till date.
- (iii) The migration Certificate and Character Certificate stating that no disciplinary/academic action has been taken or pending.
- (iv) All other relevant documents which are required for admission in the programme in which migration is sought.

Studies and Examinations passed by the candidate are recognized as equivalent to the corresponding examination of the University and he fulfills the minimum qualification and other eligibility laid down for admission to the programme to which he/she seeks migration in the University.

The migration case will be submitted to the University Equivalency Committee to verify all the relevant records and candidate will be admitted on the recommendations of the Committee only.

(d) Student Exchange and Credit Transfer

For a student exchange from or to a University, credit transfer from or to a University is possible only when there is an academic tie-up with the University and mutually agreed student exchange and credit transfer policy is approved by the Academic council. Student under the exchange programme shall not be considered as migrated.

The University may enter into collaboration with other Universities worldwide whereby students of those Universities can spent a semester or more at SGT University and study courses, accordingly to mutually agreed guidelines. Such students will be known as Associate Students of SGT University for the duration they spend at SGT University and will be governed for all academic matters of the University. Reciprocally, SGT University students may be permitted to spend a semester or more and study courses in collaborating Universities with or without transfer of credits.

(e) Schedule of admission and payment of fees:

The admission schedule, along with last date for the submission of admission forms and payment of fees, shall be fixed and notified by the Registrar with the approval of the Vice-Chancellor from time to time duly approved by the Academic Council/Board of Management of the University.

Students detained due to shortage of attendance and re-admitted will attend regular classes with alternative batch and will be required to pay the Tuition Fee and Examination Fee and make over the attendance criteria as prescribed in the Ordinance.

No 1

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However, ex-students will be exempted from making up the deficiencies of the attendance criteria.

5. Mode of Selection of Candidates for Admission:

On the basis of the merit of the qualifying examination or as per the guidelines of the Statutory Bodies/Haryana Private Universities Act, 2006 as amended from time to time.

6. Medium of Instructions :

The medium of the instruction and the examination shall be English only.

7. University Examinations :

(a) End Term Semester Examinations :

The examination for all the Odd Semesters shall ordinarily be held in the month of November/December and of the Even Semesters in the month of May/June.

Fail/re-appear candidates of the Odd Semesters will re-appear in exams as an exstudent in the subsequent exams of the Odd Semesters. Similarly, for the Even Semesters he/she will re-appear in exams in the subsequent exams of the Even Semesters. However, candidates appearing in the Final Semester examination (Regular) may appear simultaneously in his/her re-appear paper(s) of lower semesters i.e. previous semesters as arranged by the Controller of Examinations.

(b) Scheme of the Examinations/Distribution of Marks:

The Scheme of examination, distribution of marks in various papers along with the credit system and the syllabus of the course shall be as prepared by the respective Board of Studies of the Faculty and duly approved by the Academic Council of the University from time to time.

(d) Attendance Requirements/Eligibility to Appear in Examination:

The student should fulfill the following criteria to be eligible for appearing in the End Term Semester Examination:

(i) He/she should have 75% attendance during the respective semester in each subject which is mandatory. Only 5% relaxation in the required attendance on account of illness and other contingencies by the Dean/Principal may be condoned. Further, the Vice Chancellor may also condone additional 5% of the required attendance in an extreme emergency case on merit basis. The relaxation of the attendance by the Dean/Principal/Vice Chancellor cannot be claimed as a matter of right by the students; it shall depend on facts and circumstances of individual case.

If a student does not meet the attendance criteria as mentioned above, he/she will not be permitted to appear in the End Term Examination. He/she can appear in the subsequent Odd/Even Semester examination after making up the deficiencies in the attendance.

(ii)

He/she is not a defaulter in payment of any dues of the SGT University

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- (iii) No disciplinary action is pending against the student.
- (iv) He/she should be on the rolls of the Faculty/College during the semester.
- (v) The shortage of attendancecan be condoned by the competent authority as mentioned below in the table to the maximum limit and the same will be within the limit of the attendance criteria as mentioned in Point No. (i) above :

Sr. No	Exemptible attendance	Ground of Exemption	r t
1.	5%	For illness and contingencies of serious nature by the Dean & the Vice Chancellor	peter age c
2.	All periods of the day of donation	Voluntary blood donation to the Blood Bank.	com short
3.	All periods of the day of Examination.	For appearing in the supplementary examinations (Theory /Practical/Viva-voce	Ity is lone : tenda
4.	Maximum of 10 days attendance during a semester	For participation in University or Inter- Collegiate Sports Tournaments/ Youth Festivals, NCC/NSS Camps/University Educational Excursions, Mountaineering Courses	n of the Facu ority to cond lecture/ att
5.	Maximum of 15 days attendance during a semester	For participation in Inter-University Sports Tournaments/Youth Festivals/Exhibition/ Symposium	Dean autho

Provided that :

- (i) He/she has obtained prior approval of the Dean of the Faculty.
- (ii) Credit may be given only for the days on which lectures were delivered or tutorials or practical work done during the period of participation in the aforesaid events.

(e) Attendance Shortage Warning :

Attendance shortage warning will be regularly displayed on the Faculty's Notice Board every month and shall also be informed to the parents/guardians by the respective Course Coordinator.

In case, a student falls short of attendance during any semester, his result will be marked as "DETAINED" which can be removed subsequently after completing attendance requirement.

(e) Submission of Examination Forms :

All the students are required to submit their Examination Form through University ERP only before the last date as notified by the Controller of Examinations. The Examination Forms of the eligible students shall be validated by the Dean and will be forwarded to the Controller of Examinations within the prescribed date. In case, examination form is not submitted by scheduled last date, a late fee will be charged as prescribed by the University from time to time.

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8. Setting of Question Papers:

The Dean of the Faculty shall supply the panel of internal and external examiners duly approved by the Board of Studies to the Controller of Examinations. The paper(s) will be set by the examiner(s) nominated by the Vice-Chancellor from the panel of examiners.

The question papers will be moderated by the Moderation Committee in the Chairmanship of Dean/Principal of the Faculty/College who is proficient in the subject in the office of the Controller of Examinations. The moderation will be done to see the difficulty level and that no question is out of syllabus and there is no mistake in the questions and the committee will amend/correct the paper accordingly.

The examiner(s) will set the question papers as per the criteria laid down in the Scheme of Examinations as approved by the Board of Studies/Academic Council.

9. Appointment of Examiners:

The examiners will be appointed as per the following guidelines with the approval of the Vice Chancellor by taking due care that his/her own relative is not appearing in the examination :

- (a) An internal/external examiner should be of the level of an Assistant Professor/consultant/equivalent or above respective in the subject in а University/Institution/College/Hospital.
- (b) One external and one internal examiner will jointly conduct the practical examination.
- (c) External examiners shall not be from the same University and should preferably be from outside the University.
- (d) External examiners shall be rotated at an interval of 3 years.

10. Evaluation Process – Theory, Practical & Internal Assessment:

(a) Evaluation of Answer Books:

The answer books may be evaluated either by the paper setter or any other internal or external examiner to be nominated by the Controller of Examinations with the approval of the Vice-Chancellor from the panel of examiners approved by the Board of Studies.

(b) Re-evaluation of Answer Books:

The students can apply for Re-evaluation/Re-checking of any paper through the HOD/Dean of the Faculty by paying fee as per re-evaluation rules of the university.

(c) Internal/Formative Assessment:

Formative assessment in each theory paper shall have the following distribution:

(i)	Attendance		=	5 Marks
	75 to 80	01		
	Above 80 to 85	02		
	Above 85 to 90	03		
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Above 90 to 95		04
Above 95 to 100	x	05

(ii)	Midterm Class Tests (subjective & objective)	=	20 marks
(iii)	Assignment	=	05 marks
(iv)	Problems/Projects/Seminar/Case Study etc	=	10 marks

The concerned teacher shall make continual assessment weekly over the content covered during the week and also shall have record of the same. It shall preferably be displayed monthly and finally cumulatively before the start of the semester examination. In case, any student fails to clear the Internal Examination, the Vice Chancellor may relax and permit for Re-examination considering the request of the student on merit with the recommendations of the respective Deans.

- (i) In case of ex-students, those appearing for re-appear/improvement examination in any semester, their previous Internal Assessment marks will be counted.
- (ii) The concerned teacher shall submit records to the HoD/Dean on the basis of which the Internal Assessment has been awarded and HoD/Dean shall make the same available to the Controller of Examinations whenever required.
- (iii) That the internal assessment marks are submitted to the Controller of Examinations at least 7 (seven) days before the commencement of the end-term examinations of each semester.

(d) Practical Examinations:

(i) Appointment of Examiners:

The practical examinations shall be conducted by a Board of two Examiners consisting of one internal and one external examiner to be nominated by the Vice-Chancellor from the panel of examiners recommended by the Board of Studies.

- (ii) **Distribution of Marks**: Practical examination for summative examination in all semesters will have the following distribution:
 - (aa) Summative assessment distribution (30 Marks):

Demonstration/conduction/presentation	=	20 marks
Viva Voce examination	=	10 marks

(ab) Formative assessment distribution (20 Marks):

Attendance

5 marks

=

75 to 80	01
Above 80 to 85	02
Above 85 to 90	03
Above 90 to 95	04
Above 95 to 100	05

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Laboratory work report = 5 marks Midterm oral examination/assessment = 10 marks

(e) Project:

(i) Topic Selection and Appointment of Guide/Supervisor

Each student will be assigned a Teacher as Guide/ Supervisor from the Department. Topic of the Project will be approved by the Dean of the respective Faculty on the recommendations of the Teacher Guide/supervisor.

(ii) Evaluation:

The examination for Project shall be conducted by a Board of Two Examiners consisting of one internal and one external examiner to be nominated by the Vice-Chancellor from the panel of examiners recommended by the Board of Studies. Evaluation of the Project Report will be done by the External examiner or by Internal Examiner. The student will submit the project report in the form as specified by the department atleast before 15 days before the commencement of the examination, failing which it will be acceptable only with late fee of Rs. 2000/-

(f) Field Training

Evaluation of the field training will be for the marks as prescribed in the Scheme of Examinations of the respective course/program. The formative assessment of field training shall be based on the presentation, case reports and log sheets as well as on the basis of viva voce and reports adjudged by the joint board of external and/or internal examiners.

(g) Re-appearance for Improvement :

A student may re-appear in any theory paper prescribed for a semester after making the prescribed Examination Fee as notified by the University from time to time, on foregoing in writing his/her previous performance in the paper/s concerned. This can be done in the immediate subsequent semester examination only (for example, a student re-appearing in paper prescribed for 1stSemester examination may do so along with subsequent 3rdSemester examination and shall not be allowed to appear along with papers for 5thSemester.

A candidate who had cleared examination of Third Academic Year (Vth and Vlth Semesters) may re-appear in any paper of Vth and Vlth Semester only once at the immediate subsequent examinations on foregoing in writing her/her previous performance in the paper/s concerned, within the prescribed span period. Likewise will be applicable for the Fourth Academic Year also.

In the case of re-appearance in paper, the result will be prepared on the basis of candidate's current performance in the examination.

In the case of a candidate, who opts to re-appear in any paper/s under the aforesaid provisions,, on surrendering her/his earlier performance but fails to re-appear in the paper/s concerned, the marks previously secured by the candidate in the paper/s in

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which he/she has failed to re-appear shall be taken into account while determining his/her result of the examination held currently.

11. Criteria for Promotion to Higher Semester(s):

(a) For programs of the duration of 4 Academic Years (8 Semesters).

The student will be promoted to the next semesters irrespective of the number of papers cleared/passed in the lower semesters. But he/she will not be allowed to appear in the examination of the 4th Semester unless he/she has cleared atleast 50% papers of 1st and 2nd semesters taken together and further the students will not be allowed to appear in the examination of the 6th semester unless he/she has cleared 1st and 2nd semesters and 50% papers of 3rd and 4th semesters taken together. Furthermore, the students will not be allowed to appear in the examination of the 8th semesters taken together. Furthermore, the students will not be allowed to appear in the examination of the 8th semester unless he/she cleared 1st, 2nd, 3rd and 4th semesters and 50% papers of 5th and 6th semesters taken together.

(b) For programs of the duration of 3 Academic Years (6 Semesters).

The student will be promoted to the next semesters irrespective of the number of papers cleared/passed in the lower semesters. But he/she will not be allowed to appear in the examination of the 4th Semester unless he/she has cleared atleast 50% papers of 1st and 2nd semesters taken together and further the students will not be allowed to appear in the examination of the 6th semester unless he/she has cleared 1st and 2nd semesters and 50% papers of 3rd and 4th semesters taken together.

(c) For program of the duration of 2 Academic Years (4 Semesters).

The student will be promoted to the next semesters irrespective of the number of papers cleared/passed in the lower semesters. But he/she will not be allowed to appear in the examination of the 4th Semester unless he/she has cleared 50% subjects of 1st and 2nd semesters taken together.

12. Pass % criteria and grading system:

- (a) The minimum percentage of marks to pass a course/paper will be as given below. Each Faculty is required to adopt any one scheme out of the below mentioned and incorporate the same in their respective Scheme of Examinations.
 - (i) The pass percentage for each component i.e. End Term Examination (Theory/Practical) and Internal Assessment is 40% separately (for the courses adopting Table No. 3).
 - (ii) The pass percentage for Internal Assessment will be 40% to be eligible to appear in End Term Examination, whereas overall pass percentage will be 50% in the End Term Examination (Theory/Practical) including Internal Assessment (For all other courses) (for the courses adopting Table No. 1).
 - (iii) The pass percentage for each component i.e. End Term Examination (Theory/Practical) and Internal Assessment is 40% separately (for the courses adopting Table No. 2).
 - (iv) To qualify for award of degree, a Grade Point of4.0, 5.0 and 6.0 respectively and minimum numbers of credits required for that degree as defined in the Scheme of Examinations of the concerned course.

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(The Department of Physics, Faculty of science opt option – ii as Pass % criteria for M.Sc. Physics Programme)

(b) Credit Based Grading System:-

Key Definitions:

Programme: An educational programme leading to award of a Degree, diploma or certificate.

Course: Usually referred to, as 'papers' is a component of a programme. All courses need not carry the same weight

Credit: A unit by which the course work is measured. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours for Practical Work/Field Work/ Research Based Paper /Project per week.

Credit Point: It is the product of grade point and number of credits for a course i,e, Credit Point = No. of credit in a course \mathbf{x} "grade value" of the grade obtained in the course.

Semester Grade Point Average (SGPA): The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the Courses undergone by a student, i.e. SGPA(Si) = \sum (Ci x Gi) / \sum Ci

Cumulative Grade Point Average (CGPA):CGPA The is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of programme, i.e, CGPA = \sum (Ci x Si) / \sum Ci

Grade Point : It is a numerical weight allotted to each letter grade on a I0-point scale with 7/6/5LETTER GRADES: It is an index of the performance of students in a said course.

Grades are denoted by letters 0, A+, A, B+, B, C, P and F etc.

Grade and its corresponding values. (For the courses where the pass marks are 50%)

[Faculty of Engineering & Technology, Law, Behavioural Sciences (Except B. Sc. (Clinical Psychology) & BA (Hons.) (Psychology), Fashion & Design, Mass Communication & Media Technology, Agricultural Sciences (Except M. Sc. programs), Education, Hotel & Tourism Management, Commerce & Management, Science, Allied Health Sciences, Physiotherapy]

Range of Percentage of Marks	Letter Grade	Grade Points	Range of Grade Points	Classification
90% and above	O (Outstanding)	10	9-10	Outstanding
80% and above but less than 90%	A+ (Excellent)	9	8<9	Excellent
70% and above but less than	A (Very Good)	8	7<8	1 st Division with

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80%				Distinction
60% and above but less than 70%	B+ (Good)	7	6<7	1 st Division
Above 50% but less than 60%	B (Above Average)	6	>5<6	2 nd Division
Minimum Pass Marks 50%	P (Pass Average)	5	5	Pass
Below minimum pass marks	F (Fail)	0	-	Fail

Grade and its corresponding values. (For the courses where the pass marks are 60%)

Faculty of Agricultural Sciences (M. Sc. programs)

Range of Percentage of Marks	Letter Grade	Grade Points	Range of Grade Points	Classification
90% and above	O (Outstanding)	10	9-10	Excellent
80% and above but less than 90%	A+ (Excellent)	9	8<9	1 st Division with Distinction
70% and above but less than 80%	A (Very Good)	8	7<8	1 st Division
Above 60% but less than 70%	B (Good)	7	>6<7	2 nd Division
Minimum Pass Marks 60%	P (Pass)	6	6	Pass with 1 st Division
Below minimum pass marks	F (Fail)	0		Fail

Grade and its corresponding values. (For the courses where the pass marks are 40%)

Faculty of Behavioural Sciences [B. Sc. (Clinical Psychology) & BA (Hons.) (Psychology)]

Range of Percentage of Marks	Letter Grade	Grade Points	Range of Grade Points	Classification
90% and above	O (Outstanding)	10	9-10	Outstanding
80% and above but less than 90%	A+ (Excellent)	9	8<9	Excellent
70% and above but less than 80%	A (Very Good)	8	7<8	1 st Division with Distinction
60% and above but less than 70%	B+ (Good)	7	6<7	1 st Division
50% and above but less than 60%	B (Above Average)	6	5<6	2 nd Division
Above 40% but less than 50%	P (Pass Average)	5	>4<5	3 rd Division
Minimum Pass Marks 40%	P (Pass Average)	4	4	Pass
Below minimum pass marks	F (Fail)	0		Fail

Semester Grade Point Average (SGPA):

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SGPA (Si)=Σ(Ci ×Gi)/ΣCi

Where Ci is the number of credits of the ith course and Gi is the grade point scored as per marks obtained by the student in the ith course. Further, G is calculated as given below:

G=[Marks obtained in paper/Total marks of paper]×10 (The multiplication factor)

Cumulative Grade Point Average (CGPA):

CGPA= Σ(Ci ×Si)/ΣCi

Where Si is the SGPA of the ith Semester and Ci is the total number of credits in that Semester.

Formula for calculating percentage of marks;

CGPA×10 (The multiplication factor)

(c) Grace Marks :

Maximum 1% of total marks (Maximum to 5 marks) excluding internal assessment marks can be awarded to a student in one academic year.

13. Declaration of Results:

- (a) After the semester/year examinations are over, the Controller of Examinations shall publish the results of those students who had appeared in the examinationspreferably within 45 days of last paper of course examination.
- (b) Each successful student/ the student placed in reappear shall receive a copy of the Detailed Marks Certificate/ Grade Card Sheet of each semester examination.
- (c) The successful students after the 4th, 6thor 8thsemester examination shall be equated in seven ascending letter grade (P to O) and grade points from 4 to 10 on the basis of final CGPA obtained by him/her in the 1st to 4th, 1st to 6th or 1st to 8th semester examinations.

14. Discharge of the students from the program

The student who does not clear all the papers with in the stipulated time frame span period i.e. duration of the program + 02 years will be discharged from the programme.

15. Re-admission

As per the chapter 2, Clause 2.4.5. of the First Ordinance of the University, if a student remains absent, without leave of absence, from his/her classes for a continuous period of seven working days without any valid reason, medical or otherwise, his/her name shall be struck off from the rolls of the University. However, the student may be re-admitted on payment of the prescribed fee by the University from time to time, if Dean/Principal is satisfied that re-admission of the student will not fall short of requisite percentage of the attendance.

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If a student is re-admitted, all his previous records are revived under the current structure, regulations and scheduled of fees.

A student, who has been rusticated or expelled from University, cannot be re-admitted.

16. Simultaneously pursuing other degree

As per the guidelines of the University Grants Commission, students will not be permitted to pursue two degrees simultaneously. If at any time, it comes to the notice of the University, his/her degree will be cancelled without any prior notice.

17. Appearing for additional papers after award of degree

The student will be allowed to appear for additional papers available in that degree course after the completion of course within the span period subject to attendance requirement and internal assessment. A separate marksheet will be issued for such paper(s).

18. Other Provisions:

- (a) Nothing in this Ordinance shall debar the University from amending the Ordinance and the same shall be applicable to all the students from the date of its implementation.
- (b) Any other provision not contained in the Ordinance shall be governed by the rules and regulations framed by the University from time to time.
- (c) In case of any interpretation, The Vice-Chancellor is empowered in this regard and his interpretation shall be the final.
- (d) This ordinance will be effective from the AdmissionsSession 2019-20.

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Sr. No.	Semester/ Year	Course Code	Nomenclature	Theory/ Practical	Core/ AECC/ SEC/ DSE/ GE	Lecture	Tutorial	Practical	Credits	Max	Pass	Experimental Performance	Viva-voce	Lab Work Report/ Dissertation Report	Мах	Pass	Attendance	Midterm/ Internal Viva - Voce	Assignment	Practical File/Project File/Seminar	Мах	Pass	Мах	Pass	Overall Pass Marks	Whether to be offered under CBCS (Yes/No)	Scheme of Examinations (Theory +Internal+ Practical+Oral/ Theory+Internal +Practical/ Theory+Practical
1		17080101	Mathematical Physics	Theory	Core	4			4	60	24						5	20	5	10	40	16			40	NO	Theory+Internal
2		17080102	Classical Mechanics	Theory	Core	4			4	60	24						5	20	5	10	40	16			40	NO	Theory+Internal
3		17080103	Quantum Mechanics - I	Theory	Core	4			4	60	24						5	20	5	10	40	16	1000	1	40	NO	Theory+Internal
4	1/1	17080104	Statistical Mechanics	Theory	Core	4	-		4	60	24						5	20	5	10	40	16		-	40	NO	Theory+Internal
5		17080105	Laboratory Course - I	Practical	Core			8	4			36	18	6	60	24	10	20		10	40	16	1.		40	NO	Practical+Internal
6		1/080106	Laboratory Course - II	Practical	Core			8	4		1	36	18	6	60	24	10	20		10	40	16			40	NO	Practical+Internal
		17080107	Protessional Ethics and Human Values	Theory	SEC	2	-	-	2	30	12	-			-		5	10	5	1	20	8			20	NO	Theory+Internal
0		17090201	Solid State Dhusing			-	-	-	-	-	-	-	-		-	-		-		1		-					
0		17080201	Quantum Machanica II	Theory	Core	4	-	-	4	60	24	-	-	-	-	-	5	20	5	10	40	16	-	-	40	NO	Theory+Internal
10		17080202	Electrodynamics and Plasma Physics	Theory	Core	4	-	-	4	60	24	-	-	-	-	-	5	20	5	10	40	16	-	-	40	NO	Theory+Internal
11	11/1	17080204	Electronic Devices	Theory	Core	4	-		4	60	24	-	-	-	-	-	5	20	5	10	40	16	-	-	40	NO ·	Theory+Internal
12	•	17080204	Lectionic Devices	Drectical	Core	4	-	-	4	60	24		-	-	-	101	5	20	5	10	40	16		-	40	NO	Theory+Internal
13		17080206	Laboratory Course - IV	Practical	Core	-	-	0	4	-	-	36	18	6	60	24	110	20	-	10	40	16	-	-	40	NO	Practical+Internal
14	5	17080207	Lasers and its Applications	Theory	SEC	2	-	0	2	20	12	30	18	6	60	24	110	20	-	110	40	16	-	-	40	NO	Practical+Internal
				Theory	SEC	-		-		30	12	-	-		-	-	P	110	1.0	-	20	8	-	-	20	NO	Theory+Internal
15		17080301	Computational Methods & Programming	Theory	Core	4	-	-	4	60	24		-	-	-	-	1 5	1 20	E	1 10	10	16	-		10	NO	The secul internal
16		17080302	Atomic and Molecular Physics	Theory	Core	4	-		4	60	24	-	-	-	-	-	5	20	5	10	40	10	-	-	40	NO	Theory+Internal
17		17080303	Laboratory Course - V	Practical	Core	-		8	4	100		36	19	6	60	24	10	20	1 3	10	40	16	-		40	NO	Drecticel Internal
18		17080304	Laboratory Course - VI	Practical	Core		-	8	4	-	-	36	19	6	60	24	10	20	1	10	40	16		-	40	NO	Practical+Internal
19	111 / 11	17080305	The Physics of Energy	Theory	SEC	2	-	-	2	30	12	100	10	10	100	24	5	5	5	5	20	8	-	-	20	NO	Theonytinternal
20		17080306	Condensed Matter Physics - I	Theory	DSF	4		-	4	60	24	-	-	-	-	-	5	20	5	10	140	16	-		10	NO	Theory+Internal
21		17080307	Electronics - I	Theory	DSF	4			4	60	24	-	-	-	-	-	5	20	5	10	40	16	-	-	40	NO	Theory+Internal
22		17080308	Nuclear Physics - I	Theory	DSE	4	-	-	4	60	24		-		-	-	5	20	5	10	40	16	-	-	40	NO	Theory+Internal
23		17080309	Spectroscopic Techniques - I	Theory	DSE	4		-	4	60	24	-	-	-	+	-	5	20	5	10	40	16	-	-	40	NO	Theory+Internal
				Theory	DOL	-	-	-	-	100		-	-	-	-	1.	10	20	10	10	40	10	-	-	40	NU	Theory+Internal
24		17080401	Physics of Nano Materials	Theory	Core	4	-	-	4	60	24	1	1	-	-	-	5	20	5	10	40	16	-	-	40	NO	Theonytinternel
25		17080402	Laboratory Course - VII	Practical	Core	-		8	4			36	18	6	60	24	10	20	1	10	40	16	-	-	40	NO	Practical+Internal
26		17080403	Project	Practical	SEC			12	6		1	1-	45	45	90	36	15	30	-	15	60	24	-	-	60	NO	Practical+Internal
27	IV/II	17080404	Condensed Matter Physics - II	Theory	DSE	4			4	60	24		1	1.0	1-0	1	5	20	5	10	40	16			40	NO	Theory+Internal
28		17080405	Electronics - II	Theory	DSE	4			4	60	24		1	1	1	-	5	20	5	10	40	16	-	-	40	NO	Theory+Internal
29		17080406	Nuclear Physics - II	Theory	DSE	4			4	60	24	1		1	1	1	5	20	5	1 10	40	16	1	-	40	NO	Theory+Internal
30		17080407	Spectroscopic Techniques - II	Theory	DSE	4			4	60	24		1	-	-	-	5	20	5	1 10	40	16	-		40	NO	Theonytinternal

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										The	ory	1	Theo	ory (Ir	ntern	al)		Pr	actic	al	P	racti	cal (I	ntern	al)	0	ral			
Sr. No.	Semester/ Year	Course Code	Nomenclature	Theory/ Practical	Core/ AECC/ SEC/ DSE/ GE	Lecture	Tutorial	Practical	Credits	Max	Pass	Attendance	Midterm	Assignment	H.Moject/Seminar	Max	Pass	Viva-voce	Max	Pass	Attendance	Lab Work	Midterm	Max	Pass	Max	Pass	Overall Pass Marks	Whether to be offered under CBCS (Yes/No)	Scheme of Examinations (Theory +Internal+ Practical+Oral/ Theory+Internal +Practical/ Theory+Practical
1		17080101	Mathematical Physics	Theory	Core	4		-	4	60		5 2	20	5	10	40	16											50	NO	Theory+Internal
2		17080102	Classical Mechanics	Theory	Core	4			4	60		5 2	20	5	10	40	16											50	NO	Theory+Internal
3	dia a te	17080103	Quantum Mechanics - I	Theory	Core	4			4	60		5 2	20	5	10	40	16											50	NO	Theory+Internal
4	171	17080104	Statistical Mechanics	Theory	Core	4			4	60		5 2	20	5	10	40	16				2						14	50	NO	Theory+Internal
5		17080105	Laboratory Course - I	Practical	Core			8	4								3	6 2	4 60	D	10	10	20	40	16			50	NO	Practical+Internal
6		17080106	Laboratory Course - II	Practical	Core			8	4								3	6 2	4 60		10	10	20	40	16			50	NO	Practical+Internal
7		17080107	Professional Ethics and Human Values	Theory	SEC	2			2	30		5	5	5	5	20	8		1									20	NO	Theory+Internal
8		17080201	Solid State Physics	Theory	Core	4			4	60		5 2	20	5	10	40	16	+	+	-					1			50	NO	Theory+Internal
9	11	17080202	Quantum Mechanics - II	Theory	Core	4			4	60		5 2	20	5	10	40	16											50	NO	Theory+Internal
10	- 2-5	17080203	Electrodynamics and Plasma Physics	Theory	Core	4			4	60		5 2	20	5 1	10	10	16											50	NO	Theory+Internal
11	1171	17080204	Electronic Devices	Theory	Core	4			4	60		5 2	20	5 1	10	10	16											50	NO	Theory+Internal
12		17080205	Laboratory Course - III	Practical	Core			8	4								3	6 24	4 60)	10	10	20	40	16			50	NO	Practical+Internal
13		17080206	Laboratory Course - IV	Practical	Core			8	4								3	6 24	4 60)	10	10	20	40	16			50	NO	Practical+Internal
14		17080207	Lasers and its Applications	Theory	SEC	2			2	30		5	5	5	5 3	20	8											20	NO	Theory+Internal
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10 1000001 Computational Mathrods & Programing Theory Core 1 <t< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></t<>																	
1 17080001 Computational Methods & Programming Theory Core 4 1 6 10 16 1 <	Theory+Internal	Theory+Internal	Practical+Internal	Practical+Internal	Theory+Internal	Theory+Internal	Theory+Internal	Theory+Internal	Theory+Internal		Theory+Internal	Practical+Internal	Practical+Internal	Theory+Internal	Theory+Internal	Theory+Internal	Theory+Internal
15 17060301 Computational Methods & Programming Theory Core 4 1 4 60 5 20 5 10 40 16 1	Q	ON	NO	NO	NO	NO	NO	NO	ON		ON	ON	NO	N	ON	NO	NO
15 17060301 Communical Methods & Programming Theory Core 4 1 6 5 2 5 10 10 1 1 1 17 17060302 Atomic and Methods & Programming Theory Core 4 2 5 5 10 40 16 1 10	50	50	50	50	20	50	50	50	50		50	50	75	50	50	50	50
15 17080201 Computational Methods <i>F</i> Programming Theory Core 4 6 5 0 1 <th1< th=""> <th1< th=""> 1 <</th1<></th1<>	_																-
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15 17080301 Computational Methods & Pogramming Theory Core 4 1 6 5 0 6 10 0 16 1 17 17080302 Jamicand Molecular Physics Theory Core 4 1			0	0								0	0			-	_
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15 17080301 Computational Methods & Programming Theory Core 4 60 17 17080302 Atomic and Molecular Physics Theory Core 4 6 6 18 17080303 Laboratory Course - V Practical Core 4 6 6 19 17080305 Laboratory Course - V Practical Core 4 6 6 20 17080305 The Physics of Energy Theory SEC 2 3 6 21 17080305 The Physics of Energy Theory SEC 2 4 6 6 22 17080305 The Physics of Energy Theory SEC 2 4 6 6 23 17080305 Nuclear Physics -1 Theory DSE 4 6 6 23 17080305 Nuclear Physics -1 Theory DSE 4 6 6 23 17080305 Nuclear Physics -1 Theory DSE <	S	5			2	S	2	5	5		5		-	5	5	5	2
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15 17080301 Computational Methods & Programming Theory 17 17080302 Atomic and Molecular Physics Theory 18 17080303 Laboratory Course - V Practical 19 11/11 17080305 Laboratory Course - V Practical 19 11/11 17080305 Laboratory Course - VI Practical 11 17080305 The Physics of Energy Theory Theory 20 17080305 Condensed Matter Physics - I Theory Theory 21 17080305 Electronics - I Theory Theory 22 17080305 Spectroscopic Techniques - I Theory 23 17080305 Spectroscopic Techniques - I Theory 24 17080305 Spectroscopic Techniques - I Theory 25 17080305 Proster Physics - I Theory 26 17080405 Proster Physics - II Theory 27 N / II 17080405 Electronics - II Theory 28 17080405 <t< td=""><td>Core</td><td>Core</td><td>Core</td><td>Core</td><td>SEC</td><td>DSE</td><td>DSE</td><td>DSE</td><td>DSE</td><td>2</td><td>Core</td><td>Core</td><td>SEC</td><td>DSE</td><td>DSE</td><td>DSE</td><td>DSE</td></t<>	Core	Core	Core	Core	SEC	DSE	DSE	DSE	DSE	2	Core	Core	SEC	DSE	DSE	DSE	DSE
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	15	16	17	18	19	20	21	22	23		24	25	26	27	28	29	08



M.Sc. (Physics)

Course Structure under Choice Based Credit System (CBCS): 2019-20

SEMESTE R	COURSE CODE	COURSENAME	L	T	P	Contact hours/ week	Credits	Max. Marks	Formative Assessment	Summativ Assessmen
		Core Courses		1						
	17080101	Mathematical Physics	4	0	0	4	4	100	40	60
	17080102	Classical Mechanics	4	0	0	4	4	100	10	60
1	17080103	Quantum Mechanics-I	4	0	0	4	4	100	40	00
A Side Star	17080104	Statistical Mechanics	4	0	0	4	4	100	40	60
	17080105	Laboratory Course-I	0	0	8	9	4	100	40	60
	17080106	Laboratory Course-II	0	0	0	0	4	100	40	60
		Skill Enhancement Course			0	8	4	100	40	60
	17080107	Professional Ethics & Human Values	2	0	0	2	2	50	20	30
Total Credits	5		18	0	16	34	26	650	260	300
	1	Core Courses							200	390
)	17080201	Solid State Physics	4	0	0	4	1	100	10	(0
	17080202	Quantum Mechanics-II	4	0	0	4	4	100	40	60
	17080203	Electrodynamics and Plasma Physics	4	0	0	4	4	100	10	60
	17080204	Electronic Devices	4	0	0	4	4	100	40	<u>60</u>
II	17080205	Laboratory Course-III	0	0	8	8	4	100	40	60
	17080206	Laboratory Course-IV	0	0	8	8	4	100	40	60
	17080207	Skill Enhancement Course	-							
Total Credits	17000207	Laser and its applications	18	0	0	2	2	50	20	30
		Core Courses	10		10	34	20	050	260	390
	17080301	Computational Methods & Programming								
	17080301	Atomic and Molecular Disciss	4	0	0	4	4	100	40	60
	17080302	Atomic and Molecular Physics	4	0	0	4	4	100	40	60
	17080303	Laboratory Course-V	0	0	8	8	4	100	40	60
III	17080304	Laboratory Course-VI	0	0	8	8	4	100	40	60
		Skill Enhancement Course		1						
	17080305	The Physics of Energy	2	0	0	2	2	50	20	30
•	-	Discipline Specific Elective Courses (Che	oose any	two o	f the fo	llowing speci	alization)			
	17080306	Condensed Matter Physics-I	4	0	0	4	4	100	40	60
	17080307	Electronics - I	4	0	0	4	4	100	40	60
	17080308	Nuclear Physics-I	4	0	0	4	4	100	40	00
1	17080309	Spectroscopic Techniques-I	4	0	0	4	4	100	40	60
Fotal Credits			18	0	16	34	7	650	40	60
	(Core Courses		-			20	050	260	390
1.0	17080401 F	Physics of Nano Materials	1	0	0			100		
	17080402	aboratory Course-VII		0	0	4	4	100	40	60
	9	kill Enhancement Course			0	8	4	100	40	60
28	17080403 P	Project	0	-						
IV		 Dissipling Specific Floret	0	0	12	12	6	150	60	90
	(Student onting specialized course in this	ve Cour	rses (C	hoose a	any two of the	e following s	pecializatio	n)	
	17080404	Condensed Matter Physics-II	4 semes	0	0	opt the advar	ace paper of	the same	specialized course)
	17080405 I	Electronics-II	1	0	0	4	4	100	40	60
	17080406	Nuclear Physics-II	4	0	0	4	4	100	40	60
	17080407	Spectroscopic Techniques-II	4	0	0	4	4	100	40	60
otal Credite		, see the second	4	0	0	4	4	100	40	60
	and the second se		12	0	20	32	22	550	220	330
	Gra	and Total	66	0	68	134	100	2500	1000	1500

19

dr. 7/6/19



Category	Credits		
Core Course	72	72	
Discipline Specific Elective Course	16	16	
Skill Enhancement Course (SEC)	12	12	
Total	100	100	

19

Scheme of Studies M.Sc. (Physics): 2019-20

dr. 7/4/19

Non 2/1/18



CORE COURSES

Semester-I

1000 7/6/19

2. Course Name	Mathematical Physics	L	T	P	
3. Course Code	17080101	4			
4. Type of Course (n	se fick mark)	4 C(b	0	0	189.53
5. Pre-requisite	ise tiek mark)		DSE ()	SEC ()	
(if any) Total Number of I		6. Frequency (use tick marks)	Even () Odd $()$	Either Sem ()	Every
Lectures = 52	Lectures, Tutorials,	Practical		1	John (
8. Course Descriptio	n.	Tutorials $= 0$	Practical = 0	1	
The course will teach a	hout				
These methods include	solution of differentia	nematical methods which a al equations, tensors and n	are used in solving pro	blems in p	hysics.
. Course Objectives	:		and complex	variables.	S. C.
Го impart knowledge al	bout various mathema	atical tools employed to stu	udy physics problems		
0. Course Outcomes	(COs):		y payone problems.		
tudents will have under	rstanding of	and the second			
various techniques to	solve differential equ	ations			
. how to use special fur	ctions in various phy	sics problems			
1 Unit wine data 1	1.7	problems			
	ontant		and the second		
nit-1 Number of ector spaces: Introduct: oduct, orthonormal to ontravariant tensors, S thogonal Unitary and	f lectures = 12 fon, definition of linea pasis, Gram-Schmidt ymmetric and skew-	Title of the unit: Vector ar vector space, Linear ind orthogonalization proce symmetric tensor, produc	r spaces, tensors and dependence, basis and ess, Linear operators ct of tensors Metric t	matrices dimension , Covaria	n, scalar
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It office wise detailed control It office wise detailed control <td>f lectures = 12 ion, definition of linea pasis, Gram-Schmidt ymmetric and skew- Hermition Matrices, e Flectures = 12</td> <td>Title of the unit: Vector ar vector space, Linear ind orthogonalization processymmetric tensor, produce igen values & Eigen vector Title of the unit: Different</td> <td>r spaces, tensors and dependence, basis and ess, Linear operators ct of tensors Metric t ors, Matrix diagonaliza ential equations and s</td> <td>matrices dimensior , Covaria ensors, M tion. special fur</td> <td>n, scalar ant and atrices</td>	f lectures = 12 ion, definition of linea pasis, Gram-Schmidt ymmetric and skew- Hermition Matrices, e Flectures = 12	Title of the unit: Vector ar vector space, Linear ind orthogonalization processymmetric tensor, produce igen values & Eigen vector Title of the unit: Different	r spaces, tensors and dependence, basis and ess, Linear operators ct of tensors Metric t ors, Matrix diagonaliza ential equations and s	matrices dimensior , Covaria ensors, M tion. special fur	n, scalar ant and atrices
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http://nptel.ac.in/courses/115103036/

http://web.mit.edu/al24406/www/mathmeth/DiffForms_SchulzSchulz_10Sep.pdf https://www.youtube.com/watch?v=LYNOGk3ZjFM

13. Books Recommended

1. G. Arfken and H.J. Weber. Mathematical Methods for Physicists. San Diego: Academic Press.

2. A.W. Joshi. Matrices and Tensors in Physics. New Delhi: Wiley Eastern.

3. P.K. Chatopadhyay. Mathematical Physics. New Delhi: Wiley Eastern.

4. C. Harper. Introduction to Mathematical Physics. New Delhi: Prentice Hall of India.

5. M.L. Boas. Mathematical Methods in the Physical Sciences. New York: John Wiley.

6. L .Pipes and L.R. Horwell. Applied Mathematics for Engineers and Physicists.

7. Mary L. Boas. Mathematics for Physicists.

8. B.S. Rajput. Mathematical Physics.

9. A. K. Ghatak and I. C. Goyal. Mathematical Methods for Physicists.

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12. Brief Description of self- learning / E-learning component.

To understand basic concepts in detail, students may get study materials on these links.

- 1. https://onlinecourses.nptel.ac.in/noc18_ph02
- 2. https://www.mooc-list.com/tags/nuclear-physics
- 3. www.nuclearonline.org/Courses.htm
- 4. https://study.com/directory/category/Physical_Sciences/Physics/Nuclear_Physics.html
- 5. https://www.class-central.com/tag/nuclear%20physics

13.Books Recommended

- 1. R. R. Roy and B. P. Nigam, "Nuclear Physics: Theory and Experiment", Wiley Eastern Limited, 1993.
- 2. M. K. Pal, "Theory of Nuclear Structure", Affiliated East-West Press, New Delhi.
- 3. Greiner and Maruhn, "Nuclear Models", Springer, 1996.
- 4. W. E. Burcham, "Nuclear Physics : An Introduction", Longman Group Limited, London, 1973.
- 5. R. G. Sachs, "Nuclear Theory", Addison-Wesley Publishing Company, Cambridge, 1955.
- 6. K. S. Krane, "Introductory Nuclear Physics", Wiley India Pvt. Ltd., 2008

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2. Course Name	Quantum	L	Т		P	
3 Course Cal	Mechanics-I				ľ	
4. Type of Course	1/080103	4	0	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	0	
5. Pre-requisite	(use tick mark)	Core (\vee)	DSE ()		SEC ()	
(if any) 7 Total Number		6. Frequency (use tick marks)	Even ()	Odd(v)	Either Sem ()	Ever Sem
Lectures = 52	Lectures, Tutorials,	Practical				
8. Course Descript	ion•	Tutorials = 0	Practic	al = 0		
momentum, time evo familiar with time ind 9. Course Objectiv	es:	quantum mechanics, be monic oscillator, bra-ket r theory applied to various p	ginning wi notation. Th problems.	th wave n ne students	nechanics, will also	angu be ma
To give exposure about	it the various tools em	ploved to analyze the quan			1	
10. Course Outcome	s (COs):		tum mecha	nical proble	ems.	
Students will have up	lerstanding of					
1 Importance of	orstanding of:					
· importance of quant	um mechanics compar	red to classical mechanics a	at microsco	pic level.		
2. Various tools to cald	culate Eigen values and	d total angular momentum	of particles.			
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The Schrödinger equativalues, Ehrenfest's the ncertainty principle, epresentations, Degen imensional Box, tunnet nit – 2 Number	ons, time dependent ar corem, Gaussian wav- eigen values and E eracy and orthogonal eling problem and linea of lectures = 12	Schroedinger equation and time independent forms, e packet and its spreadin bigen functions, wave fun- lity. Application of Schro ar harmonic oscillator Title of the unit: Quant	s with app probability g., Exact action in dinger equ	sm of quan lications / current de. statement a coordinate ation for a	nsity, exp and proof and mor a particle	ectatio of th nentur in on
The Schrödinger equativalues, Ehrenfest's the ncertainty principle, epresentations, Degen imensional Box, tunnet $\frac{1}{1}$ Number perator in quantum n genvectors of operate evelopment of states a perators, Matrix represented by the state of the state operator in quantum represented by the state operator of states a perator	ions, time dependent are corem, Gaussian wav- eigen values and E eracy and orthogonal eling problem and linear of lectures = 12 nechanics, Hermitian of ors, Dirac s Bra and nd operators, Heisenber sentation of an operator	Schroedinger equation Ind time independent forms, e packet and its spreadin Eigen functions, wave func- lity. Application of Schro ar harmonic oscillator Title of the unit: Quant operator and Unitary operator Ket algebra, Linear harmor erg, Schroedinger and inter- or, Unitary transformations	s with app probability g., Exact nction in dinger equ um operat ator change nonic oscill active pictu	sm of quan lications / current de statement a coordinate ation for a ors ors of basis, I ator, coher irres, Annihi	nsity, exp and proof and mor a particle Eigen valu ent states lation & c	ectatic of th nentur in on ues an- , Timo reation
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The Schrödinger equativalues, Ehrenfest's the incertainty principle, epresentations, Degen limensional Box, tunned $Init - 2$ Number Deparator in quantum n igenvectors of operator of states a perators, Matrix representation for spherically trious commutation relues and eigenvectors ddition of angular momentum function of angular momentum for states and eigenvectors ddition of angular momentum storder Stark effect in pund state of Harmonia . Brief Description of p://nptel.ac.in/courses/	ions, time dependent as corem, Gaussian wav- eigen values and E eracy and orthogonal eling problem and linea of lectures = 12 nechanics, Hermitian of ors, Dirac s Bra and nd operators, Heisenber sentation of an operator of lectures = 14 operators and their rep symmetric (central) po- lations. Eigen values of J2 and Jz. Represen- mentum, C.G. coefficient f lectures = 14 bation theory, non dega hydrogen, The Variation c oscillator, Hydrogen f self-learning / E-lear 115106066/	Schroedinger equation Ind time independent forms, the packet and its spreading ligen functions, wave fur lity. Application of Schro ar harmonic oscillator Title of the unit: Quant operator and Unitary operator Ket algebra, Linear harmonic or, Unitary transformations. Title of the unit: Angular presentation in spherical pol otentials, spherical harmonic and eigenvectors of L2 and that ion of general angular ments, Stern-Gerlach experiment Title of the unit: Time in enerate case, first and second atom and Helium atom, Var rning component	with app probability ag., Exact nction in dinger equ um operat ator change nonic oscill active pictu ar coordina cs, Hydrog d Lz. Spin nomentum of nent. dorder per value of th ander-Waal	sm of quan lications / current de. statement a coordinate ation for a ors e of basis, H ator, coher ires, Annihi um tes, Solutio en atom. C angular mo operator, t perturbat turbation, I e energy, ap s interaction	nsity, exp and proof and mor a particle Eigen valu rent states lation & c ommutato omentum,	ectatio of the nentur in on ies and , Timo reation odingen ors and Eigen



https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/ https://www.ks.uiuc.edu/Services/Class/PHYS480/qm_PDF/QM_Book.pdf

13. Books Recommended

1. Schiff. Quantum Mechanics. New Delhi: Tata McGraw-Hill.

2. B. Craseman and J.L. Powell. Quantum Mechanics. New Delhi: Narosa.

3. S. Gasiorowicz. Quantum Mechanics. New York: John Wiley.

4. J.J. Sakurai. Modern Quantum Mechanics. Addison Wesley.

5. P.M. Mathews and K. Venkatesan. Quantum Mechanics. New Delhi: Tata McGraw-Hill.

6. Ghatak and Loknathan. Quantum Mechanics.

7. M.P. Khanna. Quantum Mechanics. New Delhi: HarAnand.

8. V.K. Thankappan. Quantum Mechanics. New Delhi: New Age International.

9. N. Zettili. Quantum Mechanics: Concepts and Applications.

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2. Course Name	G1 11 11 1						
	Statistical	L	Т	P			
3. Course Code	17080104	1					
4. Type of Course (us	e tick mark)	Core (1)	0	0			
5. Pre-requisite	c tick mark)	Core (V) DSE ()		Core (V) DSE ()		SEC ()	
(if any)		(use tick marks)	Even () Odd (\vee) Either	Every		
7. Total Number of L	ectures, Tutorials.	Practical		Sem ()	Sem		
Lectures = 52	,	Tutorials = 0	$\mathbf{Practical} = 0$		-		
3. Brief Syllabus:	had a strength of the				the second		
Bose-Einstein condensat: which cannot be explaine Bose-Einstein condensat:	provide an undersi ion, Ising model, ra ed using classical n	tanding of the phase space a ndom walk, Brownian moti nechanics principles.	and quantum space, on and many more	, canonical sys physical phen	stems, omeno		
The course aims to provid ypes of system like car writing partition function	de students with an nonical, micro-can s for these systems	understanding of the basics onical and grand-canonica	of phase space, en l system. To deve	sembles, and d lop understan	lifferer ding (
0. Course Outcomes (C	COs):						
After the successful com	pletion of the cours	e students would be alle			-		
. Understand phase sn	ace and canonical	c, students would be able to)				
Write partition funct	ione for the	system.					
Describe the 1	ions for the canoni	cal, micro-canonical and gr	and-canonical system	ems.			
motion	involved in Bose-	Einstein condensation, Isin	ng model, random	walk and Br	ownia		
1 Unit wise detailed							
1. Unit wise detailed c	ontent						
nit-1 Number of	lectures - 12						
Init-1 Number of	lectures = 12	Title of the unit: Basic	s of statistical mee	chanics			
Unit-1 Number of	lectures = 12	Title of the unit: Basics and Ensemble average, T	s of statistical mec	hanics	states		
Unit-1 Number of hase space, Liouville's t concept of equal a priori	lectures = 12 theorem, Ensemble probability, statisti	Title of the unit: Basics and Ensemble average, The cal equilibrium, micro can	s of statistical mec ne microscopic and onical ensemble, Q	chanics 1 macroscopic Quantization of	states f phase		
Number of hase space, Liouville's to concept of equal a priori coace, Classic limit, Symmetric	theorem, Ensemble probability, statisti netry of wave func	Title of the unit: Basics and Ensemble average, T ical equilibrium, micro can tions.	s of statistical mec ne microscopic and onical ensemble, Q	hanics macroscopic Quantization of	states f phase		
Unit-1Number ofPhase space, Liouville's tPhase space, Classic limit, SymmetryInit - 2Number of	lectures = 12 theorem, Ensemble probability, statisti netry of wave func lectures = 12	Title of the unit: Basics and Ensemble average, Ti ical equilibrium, micro can tions. Title of the unit: Canor	s of statistical mec ne microscopic and onical ensemble, Q nical systems	hanics 1 macroscopic Quantization of	states, f phase		
Unit-1Number ofPhase space, Liouville's tPhase space, Liouville's tPhase space, Classic limit, SymmetryUnit - 2Number ofThe micro-canonical ensemble and itsanonical ensemble and itsnergy fluctuations; Equipnsemble, Statistics of parassical ideal gas in grand	Flectures = 12 theorem, Ensemble probability, statistinetry of wave funct lectures = 12 emble theory a sthermodynamics, partition and Virial amagnetism, The g l canonical ensemb	Title of the unit: Basic:and Ensemble average, Tlical equilibrium, micro cantions.Title of the unit: Canorand its application to ipartition function; classicaltheorems, a system of quatheory; density and energy	s of statistical mec the microscopic and onical ensemble, Q nical systems deal gas of me ideal gas in canoni ntum harmonic ose ad significance of gy fluctuations.	chanics macroscopic Quantization of pho atomic particular cal ensemble to cillators as can statistical quart	states, f phase rticles; theory, tonical ntities,		
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Unit-1Number ofPhase space, Liouville's tPhase space, Liouville's tConcept of equal a prioripace, Classic limit, SymmInit - 2Number ofThe micro-canonical ensemble and itsanonical ensemble and itsnergy fluctuations; Equipnsemble, Statistics of parlassical ideal gas in grandInit - 3Number ofuantum states and phaseoncepts and thermodynardiation fields) and gas ofeal Fermi gas, discussicoltzmann H-Theorem	Flectures = 12 theorem, Ensemble probability, statistinetry of wave funct lectures = 12 emble theory a sthermodynamics, partition and Virial amagnetism, The g l canonical ensemb lectures = 14 e space; an ideal g nic behavior of an f photons (the Deby on of heat capacity	Title of the unit: Basic:and Ensemble average, Tlical equilibrium, micro canctions.Title of the unit: Canonmd its application to ipartition function; classicaltheorems, a system of quagrand canonical ensemble arle theory; density and energyTitle of the unit: Quantgas in quantum mechanicalIdeal Bose gas; Bose-Einsye filed); Ideal Fermi systemy of a free electron gas an	s of statistical mechanical ensemble, Que microscopic and onical ensemble, Que mical systems deal gas of mechanical gas in canoni ideal gas in canoni intum harmonic oscient disignificance of gy fluctuations. um mechanical enternation condensation; mechanical ensembles; Ideal tein condensation; mis; the thermodyn to the temperatures	chanics macroscopic Quantization of Dono atomic particular cal ensemble to cillators as can statistical quart statistical quart membles Bose system, gas of photom amic behavior s; Pauli param	states f phase rticles; theory, tonical ntities, basic is (the of an neters,		
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To understand basic concepts in detail, students may get study materials on following links. <u>https://onlinecourses.nptel.ac.in/noc18_ph02</u> https://www.cmi.ac.in/.

https://www.cmi.ac.in/~kpnmurthy/StatisticalMechanics2017/book.pdf

12.Books Recommended

1. R.K. Patharia. Statistical Mechanics. 2nd ed. Oxford: Butterworth-Heinemann.

2. K. Huang. Statistical Mechanics. New Delhi: Wiley Eastern.

- 3. B.K. Agarwal and M. Eisner. Statistical Mechanics. New Delhi: Wiley Eastern.
- 4. C. Kittel. Elementary Statistical Physics. New York: John Wiley.
- 5. S.K. Sinha. Statistical Mechanics. New Delhi: Tata McGraw Hill.
- 6. Suresh Chandra. Textbook of Statistical Mechanics. New Delhi: CBS Publishers.

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1.	Name of the Depar	tment: Physics					
2.	Course Name	Laboratory Course-I	L	T		P	
3.	Course Code	17080105	0	0		8	
4.	Type of Course (us	e tick mark)	Core $()$	DSE ()		SEC ()	
5.	Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd $()$	Either Sem ()	Every Sem ()
7.	Total Number of L	ectures, Tutorials,	Practical		1		
Lee	ctures = 0		Tutorials = 0	Practic	cal = 104		

8. Course Description:

In this course student will gain the practical knowledge about the working of different semiconductor devices like photovoltaic cell, photo diode and determination of various parameters using various instruments.

9. Course Objectives:

1. To study the working principles of photovoltaic cell and photodiode

2. Determining e/m ratio, excitation potential and phase velocity

10. Course Outcomes (COs):

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

Correlate the theoretical concepts and identify its practical applications through experiments.

11. List of Experiments

1. To determine Planck's constant using photovoltaic cell.

2.To measure the excitation potential of Argon using the Franck - Hertz method 3. To verify that atomic systems have discrete energy levels by bombarding electrons and observing the difference in energy levels.

4. To determine the value of e/m using Thomson method.

5. To Study the Photo-Diode Characteristics.

6. To determine the variation of refractive index of the material of prism and to verify Cauchy's dispersion formula.

7. To measure the numerical aperture and acceptance angle of an optical fibre.

8. To study the quantum tunneling effect with solid state device, e.g. tunneling current in backward diode or tunnel diode.

9. Creating Standing harmonic waves and study wavelength as a function of frequency and to find out the phase velocity

10. Creating standing harmonic waves and measure the linear mass density of the string

12. Book Recommended

1. R. A. Dunlup. Experimental Physics: Modern Methods. New Delhi: Oxford University Press.

2. B. K. Jones. Electronics for Experimentation and Research. Prentice-Hall.

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1. Name of the Depa	artment: Physics	A file of the second second			And States	
2. Course Name	Laboratory Course H	L	T		P	
3. Course Code	17080106	0	0			
4. Type of Course (u	ise tick mark)	Core $()$	DSE ()		8 SEC 0	
(if any)		6. Frequency	Even ()	$Odd(\sqrt{)}$	Either	Every
7. Total Number of I	Lectures, Tutorials,	Practical			Sem ()	Sem ()
Lectures = 0 8. Course Description		Tutorials = 0	Practic	cal = 104		

8. Course Description:

In this course student will gain the practical knowledge about the different functions of CRO, thermocouple, its calibration, pn junction diode etc

9. Course Objectives:

To determine various parameters like Boltzman constant, thermo emf, Curie temperature, velocity of sound in liquid etc.

10. Course Outcomes (COs):

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

Correlate the theoretical concepts and identify its practical applications through experiments.

11. List of Experiments

1. To study the characteristic of voltage doubler and voltage tripler.

2. To measure (i) the frequency of an a.c. signal and (ii) the phase difference between the two voltages using

3. To measure the Curie Temperature of a given ferroelectric material.

4. To measure the Curie Temperature of a given magnetic material.

5. To determine value of Boltzmann constant using V-I characteristic of PN diode.

6. Velocity of sound in liquids – ultrasonic interferometer meter

7. To study the thermocouple and plot the graph between thermo emf vs temperature. 8. Calibration of a thermocouple by potential meter

9. To find the dielectric constant of liquids

10. To calculate the time constant of a capacitor using RC circuit.

12. Book Recommended

- 3. R. A. Dunlup. Experimental Physics: Modern Methods. New Delhi: Oxford University Press.
- B. K. Jones. Electronics for Experimentation and Research. Prentice-Hall. 4.

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Skill Enhancement Compulsory Courses

Semester - I

3 Course C. 1	Professional ethics and human value	L		T		Р
4 Type of Come	1/080107	2		0		0
5 Pro requisite	se tick mark)	Core ()	DSE ()	AEC ()	SEC (✓)	OEO
7 Total Number of I		6. Frequenc y (use tick marks)	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
Lectures = 26	ectures, Tutorials, P	ractical				
8. Course Description	.	Tutorials = 0)	Practical	= 0	
9. Course Objectives	: d human velves i se				,	
2. To develop the respon	nsibility in students at	professional an	d societal 1	evels		
0. Course Outcomes (COs):	<u> </u>				
. The students will und	derstand the values of	professional eth	nics and mo	oral values d	eeply.	
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https://youtu.be/2VYF_t51FyE

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13. Books Recommended

- 1. Professional Ethics and Morals by Prof.A.R.Aryasri, DharanikotaSuyodhana Maruthi Publications.
- 2. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman and M. Jayakumaran University Science Press.
- 3. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill 2013

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Semester-II

2. Course Name	Solid State	I	-	
Course Mame	Physics	L	T	Р
3. Course Code	17080201	4	0	0
4. Type of Course (ise tick mark)	Core $()$	DSEO	SECO
5. Pre-requisite	Physics at	6. Frequency	Even (v) Odd ()	SEC ()
(if any)	graduation level	(use tick marks)		Sem () Sem
7. Total Number of	Lectures, Tutorials, I	Practical		
Lectures = 52		Tutorials = 0	Practical = 0	1
This course will deeper analyze the electrical, r 9. Course Objective 1. To study the basics	n your understanding on mechanical, optical, an s: of crystallography	of the different types of cr d magnetic properties of t	ystal structures and t he solids.	hat will help you to
To study the basic o	f origin of band gap in	different types of solids.		
To analyze the elect	rical and thermal prop	erties of metals.		
To understand the d	liamagnetic, paramagn	etic and ferromagnetic pro-	operties of the mater	ials
. To get familiar with	superconducting phen	omenon and its applicatio	ons.	
0. Course Outcomes	(COs):			1
After successful comple	tion of the course stu	dents will		
. have a basic knowled	dge of crystal systems	and spatial arms the		
understand the conce Brillouin zones	ept of reciprocal space	and be able to use it as a t	cool to know the sign	nificance of
. be able to calculate the	hermal and electrical p	properties in the free-elect	ron model	
. know the fundamenta charge carrier mobili	al principles of semico ty and density	nductors, including pn-ju	nctions, and be able	to estimate the
. know basic models o	f magnetism			
be able to outline the	importance of solid st	ate physics in the modern	society	
1. Unit wise detailed o	content	r-jeres in the modelli	society	
nit-1 Number o	of lectures = 12	Title of the unit: Cryste	Structure	
ecapitulation of basic of nit cells, Crystal structu odium chloride, Cesiun iffraction, Reciprocal 1 ormulations of X-ray of rillouin interpretation, xperimental methods of ethods.	concepts: Bravais latti tres and lattices with b in chloride, Diamond, a attice and Brillouin z liffraction by a crysta Crystal and atomic s of structure analysis:	ce, Primitive vectors, Prin asis, Lattice planes and M and Zinc-blende structures cones (examples of sc, b al and their equivalence, structure factors, Structure Types of probe beam, th	mitive, conventional filler indices, Simple s, Determination of c cc and fcc lattices) Laue equations, Ev- re factor of the bcc ne Laue, rotating cr	and Wigner-Seitz crystal structures- crystal structure by , Bragg and Laue wald construction, c and fcc lattices, rystal and powder
nit - 2 Number o	f lectures = 12	Title of the weite T		
assignt these of the	1	The of the unit: Lattice	dynamics and ther	mal properties
spersion relation, First odes; Quantization of onons; Thermal proper	Brillouin zone, Group lattice vibration: Pho ties: Lattice (phonon)	approximation), Vibratic velocity, Two atoms per nons, Phonon momentum heat capacity, Normal mo	ons of crystals with primitive basis- aco n, Inelastic scatterin des, Density of state	monatomic basis- ustical and optical ng of neutrons by as in one and three



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01111 - 3	Number of lectures $= 14$	Title 6 the second seco
Free electro	realized of feetures = 14	Title of the unit: Electronic properties of solids
capacity of conductivity	the electron gas, Experiment and Ohm's law, Hall effect; Fai	ons: Density of states, Fermi energy, Effect of temperature, Hea al heat capacity of metals, Thermal effective mass, Electrica lure of the free electron gas model and Band theory of solids:
Solution of zone scheme semiconduct	ential and Block's theorem, Krom the central equation, Approximates es of energy band representation tors and insulators; Tight binding	ig-Penney model, Wave equation of electron in a periodic potential ate solution near a zone boundary, Periodic, extended and reduced , Number of orbitals in an energy band, Classification into metals g method and its application to SC
and BCC st	ructures.	
Unit - 4	Number of lectures = 14	Title of the unit: Superconductivity
		- no or the unit. Superconductivity
Meissner eff and infrared London equa Flux quantiz- interference,	ect, Type I and type II superconductority and properties, Isotope effect; Theor tion, Coherence length, Salient f ation in a superconducting ring; High T _c superconductors (introd	Action of superconductivity by magnetic field, actors, Entropy, Free energy, Heat capacity, Energy gap Microwave retical survey: Thermodynamics of the superconducting transition, reatures of the BCS theory of superconductivity, BCS ground state; DC and AC Josephson effects; macroscopic long-range quantum uction only).
12 Brief Dec		
12.Dilei Des	cription of self-learning / E-lea	rning component
For understar	cription of self-learning / E-lea	rning component
For understar	cription of self-learning / E-lea ading the basic concepts in detail it.edu/courses/physics/	rning component , students may get the study materials from these E-learning links
For understar https://ocw.m	cription of self-learning / E-lea ading the basic concepts in detail it.edu/courses/physics/ c.in/courses/115105099/	rning component , students may get the study materials from these E-learning links
For understar https://ocw.m https://nptel.a	cription of self-learning / E-lea ading the basic concepts in detail it.edu/courses/physics/ c.in/courses/115105099/ c.in/courses/115104109/	rning component , students may get the study materials from these E-learning links
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For understar https://ocw.m https://nptel.a https://nptel.a l. Introduction 2. Solid State	cription of self-learning / E-lea ading the basic concepts in detail it.edu/courses/physics/ c.in/courses/115105099/ c.in/courses/115104109/ commended n to Solid State Physics (7th edit Physics by Neil W. Ashcroft and	rning component , students may get the study materials from these E-learning links ion) by Charles Kittel
For understar https://ocw.m https://nptel.a https://nptel.a 3.Books Red . Introduction . Solid State . Applied Sol	cription of self-learning / E-lea ading the basic concepts in detail it.edu/courses/physics/ c.in/courses/115105099/ c.in/courses/115104109/ commended a to Solid State Physics (7th edit Physics by Neil W. Ashcroft and id State Physics by Rainikant	rning component , students may get the study materials from these E-learning links ion) by Charles Kittel I N. David Mermin
For understar https://ocw.m https://nptel.a https://nptel.a 13.Books Rec . Introduction 2. Solid State . Applied Sol . Solid State	cription of self-learning / E-lea ading the basic concepts in detail it.edu/courses/physics/ c.in/courses/115105099/ c.in/courses/115104109/ commended a to Solid State Physics (7th edit Physics by Neil W. Ashcroft and id State Physics by Rajnikant Physics: An Introduction to Theo	rning component , students may get the study materials from these E-learning links ion) by Charles Kittel I N. David Mermin
For understar https://ocw.m https://nptel.a https://nptel.a 13.Books Red . Introduction 2. Solid State . Applied Sol . Solid State . Principles o	cription of self-learning / E-lea ading the basic concepts in detail it.edu/courses/physics/ c.in/courses/115105099/ c.in/courses/115104109/ commended In to Solid State Physics (7th edit Physics by Neil W. Ashcroft and lid State Physics by Rajnikant Physics: An Introduction to Theo f the Theory of Solids (2nd edition	rning component , students may get the study materials from these E-learning links ion) by Charles Kittel i N. David Mermin bry and Experiment by H. Ibach and H. Luth on) by J. M. Ziman

New HEIIS

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	e Name	Quantum Machanias II	L	Т		P	
3. Course	Code	17080202	1	0			
4. Type of	f Course (use	tick mark)	Game (c)	0		0	
5. Pre-rec	misite	tick mark)		DSE ()	1	SEC ()	
(if any)		6. Frequency (use tick marks)	Even (\mathbf{v})	Odd ()	Either Sem ()	Every Sem (
. Iotal N	umber of Le	ctures, Tutorials,	Practical				
Course	<u>J2</u>		Tutorials = 0	Practic	al = 0		
The student particle syst	s will be made tems, etc.	e familiar with adva	nced topics such as approx	imation me	thods, sca	ttering theo	ory, mar
. Course	Objectives:		·	<u> </u>	11.37		
`o impart ki	nowledge of a	dvanced quantum 1	mechanics for solving relevant	vant physica	al problem	IS.	
0. Course	Outcomes (C	COs):			1		
tudents wil	l have underst	tanding of:					1.4.4.67
approxima	ation methods	, scattering theory,	etc.				
Importanc	e of relativisti	ic quantum mechan	ics compared to non-relati	vistic quant	tum mecha	anics	
				-			
1. Unit wis	e detailed con	ntent					4.25
1. Unit wis nit-1 /KB Appro ethod for	e detailed con Number of I eximation: WI	ntent lectures = 12 KB method for one	Title of the unit: Appr e-dimensional problems, A	oximation Application	methods to barrier	penetratio	n, WKI
1. Unit wiss nit-1 /KB Appro- ethod for robability o liabatic and	e detailed con Number of l eximation: WF three dimens f transition fr sudden appro	ntent lectures = 12 KB method for one ional problems, T om one state to an oximations.	Title of the unit: Appr e-dimensional problems, A 'ime-dependent perturbati tother, harmonic perturbat	oximation Application on theory: ion, Fermi	methods to barrier General s golden n	penetratio expression rule, select	n, WKI for th ion rule
1. Unit wiss nit-1 /KB Appro- nethod for robability o diabatic and nit - 2	e detailed con Number of I eximation: WF three dimens f transition fr sudden appro Number of I	ntent lectures = 12 KB method for one ional problems, T om one state to an oximations. ectures = 14	Title of the unit: Appr e-dimensional problems, A ime-dependent perturbati other, harmonic perturbat Title of the unit: Scatte	oximation Application on theory: ion, Fermi ering theory	methods to barrier General s golden n	penetratio expression rule, select	n, WKI for th ion rule
1. Unit wiss nit-1 /KB Appro- rebability of diabatic and nit - 2 eneral cons- action, Gree attering and otential effer r one level juare-well,	e detailed con Number of I eximation: WF three dimens f transition fr sudden appro Number of I iderations; kin n's function fo aplitude in ter ctive range th and two leve Hard sphere, o	ntentlectures = 12KB method for one ional problems, T rom one state to an oximations.ectures = 14nematics, wave me or scattering, partial rms of phase shifts eory, application t els, non-resonant so coulomb potential,	Title of the unit: Appr e-dimensional problems, A ime-dependent perturbati other, harmonic perturbat Title of the unit: Scatte chanical picture, scattering wave analysis: asymptotic c, cross-sections, optical t o low energy scattering; re- cattering-wave and p-wave Born approximation; its va	oximation Application on theory: ion, Fermi ering theory g amplitude behaviour heorem, ph esonant scat e resonance alidity, Born	methods to barrier General s golden n y e, different of partial v ase shifts tering, Bre s, exactly n series.	penetratio expression rule, select ial and tota vaves, phas and its rele eit-Wigner soluble pr	n, WKI for th ion rule al cross se shifts lation to formula
1. Unit wis Unit-1 VKB Appro- nethod for robability o diabatic and nit - 2 eneral cons- section, Gree cattering am- otential effer r one level juare-well, nit - 3	e detailed con Number of I eximation: WF three dimens f transition fr sudden approved Number of I iderations; kin n's function for aplitude in ter ctive range th and two leve Hard sphere, on Number of I	ntentlectures = 12KB method for oneional problems, Trom one state to anoximations.ectures = 14mematics, wave meor scattering, partialrms of phase shiftseory, application tels, non-resonant socoulomb potential,ectures = 14	Title of the unit: Appr e-dimensional problems, A ime-dependent perturbati tother, harmonic perturbat Title of the unit: Scatte chanical picture, scattering wave analysis: asymptotic s, cross-sections, optical the o low energy scattering; re- cattering-wave and p-wave Born approximation; its var	oximation Application on theory: ion, Fermi ering theory g amplitude behaviour heorem, ph esonant scat e resonance alidity, Born	methods to barrier General s golden n y e, different of partial y ase shifts tering, Bre s, exactly n series.	penetratio expression rule, select ial and tota vaves, phas and its rele eit-Wigner soluble pr	n, WKI for th ion rule al cross se shifts lation to formula
1. Unit wis Init-1 VKB Appro- nethod for robability o diabatic and nit - 2 eneral consection, Gree attering and tential effer r one level juare-well, nit - 3 any-particled distinguishan nnection be two spin par lium atom (e detailed con Number of I eximation: WF three dimens f transition fr sudden appro Number of I iderations; kin n's function fo aplitude in ter ctive range th and two leve Hard sphere, o Number of I e Schrodinger ability and its tween spin, sy prices, Pauli o para- and orth	ntentlectures = 12KB method for one ional problems, T rom one state to an oximations.ectures = 14mematics, wave me or scattering, partial rms of phase shifts eory, application t els, non-resonant so coulomb potential,ectures = 14r wave equation, consequences, exc ymmetry and statistic exclusion principle nohelium).	Title of the unit: Appr e-dimensional problems, A ime-dependent perturbati iother, harmonic perturbati chanical picture, scattering wave analysis: asymptotic c, cross-sections, optical ti o low energy scattering; recentering-wave and p-wave Born approximation; its validentical particles: Physic identical particles: Physic change operator, Symmetrics, Fermions and bosons; S and Slater determinant, App	oximation Application on theory: ion, Fermi ering theory g amplitude behaviour heorem, ph esonant scat e resonance alidity, Born -particle sy cal meaning ic and anti Spin and tota oplication to	methods to barrier General of s golden n s golden n y c, different of partial v ase shifts tering, Bre s, exactly n series. stem ng of iden -symmetrial wave fun o the electr	penetratio expression rule, select ial and tota vaves, phas and its rele eit-Wigner soluble pr ntity, print c wave function for a ronic system	n, WKI for th ion rule al cross se shifts lation to formula roblems ciple of nctions, system n of the
1. Unit wiss Init-1 VKB Appro- tethod for robability o diabatic and nit - 2 eneral consection, Gree attering am- tential effer r one level [uare-well, nit - 3 any-particled distinguishan nection be two spin pa lium atom (it - 4	e detailed con Number of I eximation: WF three dimens f transition fr sudden appro Number of I iderations; kin n's function fo aplitude in ter ctive range th and two leve Hard sphere, o Number of I e Schrodinger ability and its tween spin, sy tricles, Pauli o para- and orth	ntentlectures = 12KB method for one ional problems, T rom one state to an oximations.ectures = 14mematics, wave me or scattering, partial rms of phase shifts eory, application t els, non-resonant so coulomb potential,ectures = 14r wave equation, consequences, exc ymmetry and statistic exclusion principle nohelium).ectures = 12	Title of the unit: Appr e-dimensional problems, A ime-dependent perturbati iother, harmonic perturbati chanical picture, scattering wave analysis: asymptotic c, cross-sections, optical ti o low energy scattering; recentering-wave and p-wave Born approximation; its valiation theory identical particles: Physic identical particles: Physic change operator, Symmetric cs, Fermions and bosons; S and Slater determinant, Apprint Title of the unit: Relative radiation theory	oximation Application on theory: ion, Fermi ering theory g amplitude behaviour heorem, ph esonant scat e resonance alidity, Born -particle sy cal meaning ic and anti Spin and tota oplication to	methods to barrier General as golden n y e, different of partial v ase shifts tering, Bre- s, exactly n series. stem ng of iden -symmetrial wave fun o the electr	penetratio expression rule, select ial and tota vaves, phas and its rele eit-Wigner soluble pr ntity, prince c wave function for a conic system	n, WK1 for th ion rule al cross se shifts lation to formula roblems ciple of nctions, system n of the
I. Unit wiss nit-1 /KB Appro- ethod for robability of liabatic and nit - 2 eneral consection, Gree attering and tential effer r one level uare-well, nit - 3 any-particle listinguishan nection be two spin particles listinguishan ium atom (it - 4 pin-Gordan insition pro-	e detailed con Number of I eximation: WF three dimenss f transition fr sudden appro Number of I iderations; kin n's function fo aplitude in ter ctive range th and two leve Hard sphere, o Number of Ie e Schrodinger ability and its tween spin, sy articles, Pauli of para- and orth Number of Ie Equation, D bability for in	ntent lectures = 12 KB method for one ional problems, T ional problems, T com one state to an oximations. ectures = 14 mematics, wave me or scattering, partial rms of phase shifts eory, application t els, non-resonant so coulomb potential, ectures = 14 r wave equation, consequences, excommetry and statistic exclusion principle nohelium). ectures = 12 irac Equation and duced emission, elements	Title of the unit: Appr e-dimensional problems, A ime-dependent perturbati iother, harmonic perturbati chanical picture, scattering wave analysis: asymptotic c, cross-sections, optical ti o low energy scattering; regardering-wave and p-wave Born approximation; its validentical particles: Physic identical particles: Physic identical particles: Physic change operator, Symmetrics, Fermions and bosons; S and Slater determinant, Appendic and slater determinant, Ap	oximation Application on theory: ion, Fermi ering theory g amplitude behaviour heorem, ph sonant scat e resonance alidity, Born -particle sy cal meaning ic and anti Spin and tota oplication to vistic quant transition nsitions, se	methods to barrier General a s golden n s golden n y e, different of partial v ase shifts tering, Bre s, exactly n series. stem ng of iden -symmetri al wave fun o the electr tum mech probabiliti lection rul	penetratio expression rule, select ial and tot vaves, phas and its rele eit-Wigner soluble pr ntity, print c wave function for a ronic system anics and cy for absores.	n, WK for th ion rule al cross se shifts lation to formule roblems ciple of nctions s system n of the

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Manne 101

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1.	Name of the Depart	tment: Physics					
2.	Course Name	Electrodynamics & Plasma Physics	L	T		P	
3.	Course Code	17080203	4	0		0	
4.	Type of Course (use	e tick mark)	Core $()$	DSFO		U CECO	CALC:
5.	Pre-requisite (if any)	,	6. Frequency (use tick marks)	Even $()$	Odd ()	Either	Every
7.	Total Number of Le	ctures, Tutorials, Pr	actical			Sem ()	Sem ()
Lec	tures = 52		Tutorials = 0	Practic	al = 0		
8.	Course Description:			uette	u U		

This course aims to provide students with an introduction to the principles and behaviour of dynamical electric and magnetic systems, and a theoretical foundation in classical field theory. Plasma physics is an important subject for a large number of research areas. The primary learning outcome for this course is for the students to learn the basic principles and main equations of plasma physics, at an introductory level, with emphasis on topics of broad applicability.

9. Course Objectives:

To apprise the students regarding the concepts of electrodynamics and its use in various situations. To have a working understanding of the elements of Plasma Physics on topics including: Basic plasma properties; Motion of charged particles in magnetic field; Plasma waves and kinetic representation of plasmas.

10. Course Outcomes (COs):

1. Demonstrate and understanding of the use of scalar and vector potentials and of gauge invariance

- 2. Know and use methods of solution of Poisson/Laplace equation
- 3. Know and use principles of Lorentz covariant formalism
- 4. Know about radiation fields of moving charge
- 5. Gather basic understanding of Plasma state essential for higher studies.

11. Unit wise detailed content Unit-1 Number of lecture

Number of lectures = 14 Title of the unit: Electrostatics

Electric Field, Gauss Law, Differential form of Gauss Law, Electromagnetic scalar and vector potentials, Maxwell's equations in terms of scalar and vector potentials, Non uniqueness of Electromagnetic potentials and concept of Gauge. Lorentz gauge and coulomb gauge. Boundary value problem, Poisson and Laplace equations, Solution of Laplace equation in Rectangular coordinates, Green's Theorem, Dirichlet and Neumann boundary conditions, Formal solution of boundary value problem with Green's function, Electrostatic potential energy and energy density.

Unit - 2 Number of lectures = 12

ectures = 12 Title of the unit: Method of Images

The method of electrical images. Point charge near an infinite grounded conducting plane, Spherical conductor near point charge: When the sphere is at zero potential or earthed, insulated conducting sphere near a point charge, when the sphere is kept insulated and carries a total charge e, Point charge near a conducting sphere at fixed potential, Conducting sphere in a uniform electric field.

Unit - 3	Number of lectures $= 14$	Title of the unit. Flash
		The of the unit: Electromagnetic Waves and Radiation by
		Moving Charges

Wave equation, Reflection and Refraction of electromagnetic waves at a plane interface between dielectrics, Wave propagation in a non-conducting and conducting media, Fresnel relations, Brewster's angle, Wave guides:

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TE and TM modes in rectangular wave guides; Moving point charges, Retarded potentials, Lienard-Wiechart potentials for a point charge, The fields of moving charge particles, Total power radiated by a point charge: Larmor's formula and its relativistic generalization.

Unit - 4 Number of lectures = 12 Title of the unit: Plasma Physics

Elementary concepts, Derivation of moment Equations from Boltzmann Equation, Plasma Oscillation, Theory of simple oscillation, Electron oscillation in a plasma, Electronic oscillations when the motion of ions is also considered. Derivation of plasma oscillation using Maxwell's equation, Propagation of Electromagnetic waves in plasma containing a magnetic field Quasi neutrality of plasma, Debye shielding distance, Plasma production and heating of the plasma, Confinement of plasma, plasma instabilities.

12. Brief Description of self learning / E-learning component

http://nptel.ac.in/syllabus/95102023/

https://nptel.ac.in/courses/115102020/

https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-522-space-propulsion-spring-2015/lecturenotes/MIT16_522S15_Lecture8.pdf

13. Books Recommended

- 1. Classical Electrodynamics by J.D. Jackson.
- 2. Introduction to Electrodynamics by A. Z. Capri and P. V. Panat.
- 3. Electrodynamics by S. P. Puri.
- 4. Introduction to Electrodynamics by D. J. Griffiths.
- 5. Introduction to Plasma Physics by F. F. Chen.
- 6. Introduction to Plasma Theory by D. R Nicholson.

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2. Co	urse Name	Electronic	L	Т		P	
2 0		Devices	all all and a second			1	
J. Co 4 Tw	Irse Code	17080204	4	0		0	
5. Pre	-requisite	Be tick mark)	$Core(\vee)$	DSE ()		SEC ()	
(if 7 Tot	any)	graduation level	6. Frequency (use tick marks)	Even $()$	Odd ()	Either Sem ()	Every Sem
Lecture	a = 52	ectures, Tutorials,	Practical				
8. Cor	rse Description	1:	1 utorials = 0	Practic	al = 0		
industry Physics. semicon the basic cells, an	. It caters to und The course pro- ductors, and the es of devices with d their properties	lergraduate and grad ovides the students reason for the domi th emphasis on their s will also be explain	tanding of the electronic de luate students with a diver- with the basic physics be inance of silicon in the elec- electronic characteristics. ned.	evices used se backgrou chind semic ctronics ind Optical de	in the cur and in Mat conductor ustry. The vices like	rent semic terials Scie materials, course als LEDs, lase	onduct ence, ar types o cove ers, sola
9. Cou	rse Objectives:				1	1	
I. To st	udy the basics of	electronic compone	ents			1	
2. To st	ady the basic con	ncept and characteri	stics of electronic devices	and circuits			
3. To ob	serve the charac	teristics of optical d	evices like LED, lasers and	d Solar celle			
4. To ge	t familiar with th	ne different number	systems and logic gates		,		
10. Cou	rse Outcomes (COs):	· · · · · · · · · · · · · · · · · · ·				
After suc	cessful completi	on of the course at				1.2	1
1. Appl	v the concept of	semiconductor phys	dents will be able to				
2. Appl	v the concepts of	f basic electronic d					
3. Unde	rstand operation	of diodes transista	evices to design various ele	ectronic circ	cuits		
4. Anal	vze electronic ci	renits	is in order to design basic of	circuits			
5. Desig	in small and larg	e signal amplifier of	ironita for anti-				
1. Unit	wise detailed co	e signal amplifier ci	ircuits for various practical	application	IS	1. 19 A. 7	
Jnit-1	Number of	lectures $= 14$	Title of the unit, Deale	<u>a</u>			
-n junct	on diada Cana		The of the unit: Basic	Semicondu	ctor Devi	ces	
hotodioc tructure Character Depletion	le, light emitting & Operation, pir istics, JFET as MOSFET, com	g diodes and liquid ach off voltage, Sing Switch and Amp parison of p & n Ch	tions, switching diodes, C crystal display, Junction J gle ended geometry of JFET lifier. MOSFET: Enhance annel FET, SCR, 4 layer pr	lippers & (Field Effec Γ , Volt Am ement MO npn devices	Clampers, t Transisto pere chara SFET, Th s, Tunnel d	Photoconc or (JFET) cteristic, T reshold V iode	luctors, : Basic ransfer oltage,
mt - 2	Number of	lectures $= 12$	Title of the unit: Optoel	lectronic D	evices		
ependent mitting d	and non - radiat resistance (LD iodes (LEDs), se	ive transitions, Sola PR), photodiodes, P emiconductor diode	r Cell: basic characteristics IN diodes, metal semicor lasers, Photo transistor.	s, radiation nductor, av	effects and valanche p	l fill factor hotodiode,	, Light Light
nit - 3	Number of	lectures = 14	Title of the unit: Operat	tional Amp	lifier		
ifferentia verting i non-invo op volta np paran	Il Amplifier: Cir nputs, CMRR, C erting amplifier, ge gain, Input re neters. Op-amp	cuit configuration, c Operational Amplific Op-amp with negati sistance, output resi Application: D.C. a	lual input balanced output of ers: Block diagram, open a ve feedback Voltage series stance, band width, output nd A.C. amplifier, summi	different an und close lo feedback, E t offset volt ing, scaling	aplifier, In op configu Effect of fe age, Meas	verting and tration, invedback on urements of aging amo	l Non- verting closed of Op-

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Integrator, Differentiator, Electronic analog computation comparator.

Unit - 4 Number of lectures = 12 Title of the unit: Digital Circuits

Various Number system and their arithmetic: binary number system, 2's compliment, Octal number system, hexadecimal number system, BCD codes, Excess-3 codes, Gray codes, Octal codes, Hexadecimal codes and ASCII codes: Digital (binary) operation of a system, Logic system, the OR gate, the AND gate, the NOT gate, the exclusive OR gate, De Morgan's laws, the NAND and NOR diode- transistor gates, Modified DTL gates, high threshold logic (HTL) gates, transistor-transistor logic (TTL) gates output stages, resistance transistor logic (RTL) logic, direct coupled transistor logic (DCTL) gates, emitter coupled logic (ECL) gates, Digital MOSFET circuits, complementary MOS (CMOS) logic gates, comparison of logic families, Karnaugh-map (K-map) up to four variables and its applications.

12. Brief Description of self-learning / E-learning component

For understanding the basic concepts in detail, students may get the study materials from these E-learning links

https://ocw.mit.edu/courses/physics/

https://nptel.ac.in/courses/117107094/

https://www.youtube.com/watch?v=CeD2L6KbtVM

13. Books Recommended

- 1. J. Millman and C. C. Halkies, Integrated Electronics. Tata McGraw-Hill.
- 2. R. P. Jain. Modern Digital Electronics, Tata McGraw Hills.
- 3. Malvino and Leach, Digital Electronics.
- 4. S. M. Sze, Semiconductor Devices: Physics and Technology.
- 5. Ramakanth A. Gayakwad, Op-Amps & Linear Integrated Circuits. 2nd ed. 1991.
- 6. A.P. Malvino and Donald, Principal and Application in Electronics. Tata McGraw-Hill
- 7. Thomas L. Floyd. Digital Electronics. New Delhi: Person.
- 8. A.D. Helfrick and W.D. Cooper, Modern electronics Instrumentation and Measurements Techniques, New Delhi: PHI
- 9. J. D. Rayder, Fundamental of electronics.

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2 Course Nome	rtment: Physics					
2. Course Name	Course-III	L	T		P	
3. Course Code	17080205	0	0		8	
4. Type of Course (us	se tick mark)	Core $()$	DSE ()		SECO	
5. Pre-requisite (if any)		6. Frequency	Even $()$	Odd ()	Either	Every
7. Total Number of L	ectures, Tutorials,	Practical			Sem ()	Sem (
Lectures = 0		Tutorials = 0	Practic	al = 104		
8. Course Description	1:					
In this course students devices like JFET, MO	s will gain practica SFET, LED etc and	al knowledge about varie d use of op amp for differ	ous semico ent arithm	onductor a letic opera	and optoe ations.	lectroni
To study the characterist	in furt Morr					
To use on amp for differ	ics of JFET, MOSF	ET, Solar cell				
To use op amp for unter	ent arithmetic opera	tions, square, ramp generation	tor and Wei	in bridge o	scillator	
10. Course Outcomes (COs):					
After successful comple	tion of the					
Correlate the theoretical	clion of the course,	students will be able to				
results.	concepts and iden	tify its practical application	ons through	h experim	ent procee	lure and
11. List of Experiments			<u></u>	<u></u>		
1. To study the characteri	istics of Junction Fie	ld Effect Transistor				
2. To study the characteri	stics of Metal Oxide	Semiconductor Field Eff	ot Transist			
3. To study the characteri	stics of SCR and its	application as a switching	dowing	or		
4. To use Op-Amp for dif	fferent Arithmetic O	perations	device.			
5. To use Op-Amp as Squ	are, Ramp Generato	or and Wien Bridge Oscille	ton			
6. To study the characteri	stics of a solar cell a	nd calculate its fill for t	1101			
7. To design an (i) inverti- operational amplifier.	ng amplifier and (ii)	non-inverting amplifier, o	f a given ga	ain using		
3. To use Op-Amp as Full	Wave Rectifier.					
. To study the characteris	stics of optoelectron	ics Devices (I FD photo d	atactor)			
0. To design combination	nal Logic Circuits	LED, photo-d	elector).			
2. Book Recommended	:					
. R. A. Dunlup. Experim	ental Physics. Mode	ern Methods New Dallis) wford II.		1	
DKI DI	, s.co. 1.1000	the moust new Deini: (Jatora Univ	ersity Pre	SS.	

2. B. K. Jones. Electronics for Experimentation and Research. Prentice-Hall.

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1.	1. Name of the Department: Physics										
2.	Course Name	Laboratory	L	Т		P					
		Course-IV		1.1.1.1.1.1		-					
3.	Course Code	17080206	0	0		8					
4.	4. Type of Course (use tick mark)		Core $()$	DSE ()		SEC 0					
5.	Pre-requisite (if any)		6. Frequency (use tick marks)	Even $()$	Odd ()	Either Sem ()	Every Sem ()				
7. Total Number of Lectures, Tutorials, Practical											
Lectures =		Tutorials =	Practical = 104								
8. Course Description:											

Through this course student will gain practical knowledge about solid state practicals like two probe method, four probe, Hall effect, electrical analogues of crystal lattice. They will also get a basic idea about LASERs.

9. Course Objectives:

To calculate the energy gap of semiconductor, charge carrier concentration and type of semiconductor.

To determine the wavelength and thickness of wire using Lasers

To study the mono atomic and di-atomic lattice practically and compare it with theory.

10. Course Outcomes (COs):

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

Correlate the theoretical concepts and identify its practical applications through experiment procedure and results.

11. List of Experiments

1. Two probe method for resistivity measurement.

2. To study Hall effect in semiconductor to determine Hall voltage, concentration of charge carriers and the type of semiconductor etc.

3. To measure the band gap of Germanium using four probe method.

- 4. Wavelength measurement of LASER using diffraction grating.
- 5. To study conductivity of thin film by four probe method.

6. Study of dispersion relation for the mono-atomic lattice - comparison with theory.

7. Determination of cut-off frequency of the mono atomic lattice

8. Study of the dispersion relation for the di-atomic lattice – acoustical mode and optical mode energy gap. Comparison with theory.

9. To measure the thickness of thin wire and width of slit using He-Ne/Diode Lasers.

10. Determination of ionization potential of mercury

12. Book Recommended:

3. R. A. Dunlup. Experimental Physics: Modern Methods. New Delhi: Oxford University Press.

4. B. K. Jones. Electronics for Experimentation and Research. Prentice-Hall.

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Semester - II

1.	1. Name of the Department: Physics											
2.	Course Name	Lasers and its applications	L	Τ		P						
3.	Course Code	17080207	2	0		0						
4.	. Type of Course (use tick mark)		Core ()	DSE ()		SEC $()$						
5.	Pre-requisite	Physics at	6. Frequency	Even $()$	Odd ()	Either	Every					
	(if any)	graduation level	(use tick marks)	-		Sem ()	Sem ()					
7. Total Number of Lectures, Tutorials, Practical												
Lectures = 26			Tutorials = 0	Practical = 0								
8. Course Description:												

This course provides an introduction to the fundamental principles governing the operation and design of coherent light sources and applications of lasers.

9. Course Objectives:

To provide students a thorough understanding of the fundamentals of lasers: their unique properties, their operations and their applications.

10. Course Outcomes (COs):

It will equip the students with the knowledge of how a coherent light is generated and amplified, the techniques behind different lasers design, and applications of lasers in spectroscopy, chemistry, medicine, biology, military and other areas.

10. Unit wise detailed content

Unit-1Number of lectures = 12Title of the unit: Lasing principle and properties of LasersIntroduction to LASERs, Interaction of Light with matter, Einstein's concept of stimulated emission, Calculation
of Einstein's coefficients, Population inversion, 3-level system and 4-level system, components of LASERs,
Modes of LASER cavity and standing waves, Transverse modes of Laser Cavity. Continuous and pulsed Lasers.
Properties of Laser: Directionality, Intensity, Coherence and Monochromaticity.

Unit - 2 Number of lectures = 14 Title of the unit: Types of LASERs and applications

Pulsing Techniques: Cavity dumping, Q - switching, Mode locking.

Types of Lasers: Solid State LASERs (Ruby LASER & Nd:YAG LASER), Atomic and Ionic Gas LASERs (He-Ne LASER & Argon LASER), Molecular Gas LASERs (CO_2 LASER & N_2 LASER), Chemical LASERs (Iodine LASER & Excimer LASER).

Some contemporary Laser applications: Medical, Defense and Transport usages, LIDAR technique, Internet of Thing sensors, rocket navigation, communication, LASER spectroscopy, barcode processing, printing.

11. Brief Description of self -learning / E-learning component

https://nptel.ac.in/courses/104104085/12

https://ocw.mit.edu/resources/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/laser-fundamentals-

12. Books Recommended

- 1. A.K. Katiyar, C.K. Pandey, Manisha Bajpai, Fundamentals of Laser Systems and Applications, Wiley.
- 2. Dr M N Avadhanulu, Dr P S Hemne, An Introduction to Lasers: Theory and Applications, S Chand.
- 3. K Thyagrajan, A Ghatak, Lasers: Fundamentals and Applications, Springer.

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Semester-III

2.	Course Name	Computational Methods & Programming	L	Т		P	
3.	Course Code	17080301	4	0		0	
4.	Type of Course (1	use tick mark)	Core $()$	DSE ()		SEC O	
5.	Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	$Odd(\sqrt{)}$	Either Sem ()	Every Sem (
7.	Total Number of	Lectures, Tutorials, H	Practical		·	0	
Lec	tures = 52		Tutorials = 0	Practic	cal = 0		
).	Course Descriptio	on:				Sec. 1	
low To i	v to obtain solutions Course Objective impart the basic known prigues to solve physical	s to system of linear eques:	and C programming. To g	tions, etc u	sing compu	tational m	putationa
.0.	Course Outcomes	(COs):	nputer programming lang	guages.			
tred	lanta will have t			and states		A sector	
. C . va olv	language arious computationa re research problem	al methods like bisections.	on method, Euler, Newton	1-Raphson	and Ranga-	Kutta use	ful to
. C . va olv 1. l Init Leyv cate	2 language arious computational ve research problem Unit wise detailed t-1 Number of words – constants, ments – while, do-to v of structures – unit	al methods like bisections. content of lectures = 14 variables and data tyge while and for statement ons – file operations, E	Title of the unit: Progr pes – data input and out the go to statement – fur Examples of writing C- pr	ramming in ramming in put – cont inctions – a ogramming	and Ranga- n C rol structur arrays – poi g of comput	Kutta use es – if ar inter – str ational m	ful to
C va lolv 1. 1 Jnit Leyv ate Tay	2 language arious computational re research problem. Unit wise detailed i-1 Number of words – constants, ments – while, do v of structures – union -2 Number of	al methods like bisections. content of lectures = 14 variables and data type while and for statement ons – file operations, E f lectures = 12	Title of the unit: Progr pes – data input and out the s – go to statement – fu Examples of writing C- pr	ramming in put – cont inctions – a ogramming	and Ranga- n C rol structur arrays – poi g of comput	Kutta use es – if ar inter – str ational m	ful to nd switch uctures – ethods.
. C . va olv 1. 1 nit eyv ate tray nit	2 language arious computational ve research problem. Unit wise detailed t-1 Number of words – constants, ments – while, do-to v of structures – unito -2 Number of s of quadratic equation od and Newton Rap	al methods like bisections. content of lectures = 14 variables and data type while and for statement ons – file operations, File f lectures = 12 tion - Limits for real rephysical readings.	Title of the unit: Progr pes – data input and out thts – go to statement – fu Examples of writing C- pr Title of the unit: Roots oots of a polynomial equing roots of the equations.	ramming in put – cont inctions – a ogramming of Equati ation – Bis	and Ranga- n C rol structur arrays – poi g of comput ons eection meth	Kutta use es – if ar inter – str ational m	ful to nd switch uctures - ethods.
. C . va olv 1. 1 nit eyv ate tray nit oot eth	2 language arious computational ve research problem Unit wise detailed -1 Number of words – constants, ments – while, do- v of structures – unition - 2 Number of s of quadratic equation od and Newton Rap - 3 Number of	al methods like bisections. content of lectures = 14 variables and data type while and for statement ons – file operations, F f lectures = 12 tion - Limits for real real reals phson method for finditing f lectures = 14	Title of the unit: Progr pes – data input and out tts – go to statement – fu Examples of writing C- pr Title of the unit: Roots oots of a polynomial equ ng roots of the equations.	ramming in put – cont inctions – a ogramming of Equati ation – Bis	and Ranga- n C rol structur arrays – poi g of comput ons section meth	Kutta use es – if ar inter – str ational m nod, False	ful to nd switch uctures - ethods.
. C . va olv 1. l nit nit eth nit ger aus	2 language arious computational ve research problemanic Unit wise detailed -1 Number on words – constants, ments – while, do- v of structures – unition - 2 Number on s of quadratic equation od and Newton Rap - 3 Number on n values and Eigen values s elimination and providention	al methods like bisections. content of lectures = 14 variables and data type while and for statement ons – file operations, F f lectures = 12 tion - Limits for real real phson method for finditing f lectures = 14 vector of matrix-inversed ivotal condensation method	Title of the unit: Progr pes – data input and out the second statement – fur examples of writing C- pr Title of the unit: Roots oots of a polynomial equing roots of the equations. Title of the unit: Linear e of a matrix- determinant ethods.	ramming in put – cont inctions – a ogramming of Equati ation – Bis r Algebra – solution of	and Ranga- n C rol structur arrays – poi g of comput ons section meth of linear sys	Kutta use es – if ar inter – str ational m nod, False	ful to nd switch uctures - ethods. position quations-
· C · va olv I. l Init ieyv ate ray nit oot eth nit ger aus nit	2 language arious computational re research problem. Unit wise detailed Unit wise detailed t-1 Number of words - constants, ments - while, do- / of structures - unitional -2 Number of s of quadratic equation od and Newton Rap -3 Number of n values and Eigen vision and pite -4 Number of	al methods like bisections. content of lectures = 14 variables and data typy while and for statement ons – file operations, F f lectures = 12 tion - Limits for real r phson method for finditing f lectures = 14 vector of matrix-inversed ivotal condensation methods f lectures = 12	Title of the unit: Progr pes – data input and out its – go to statement – fur examples of writing C- pr Title of the unit: Roots oots of a polynomial equing roots of the equations. Title of the unit: Linear e of a matrix- determinant ethods.	ramming in put – cont ogramming of Equati ation – Bis r Algebra – solution of	and Ranga- n C rol structur arrays – poi g of comput ons section meth of linear sys	Kutta use es – if ar inter – str ational m nod, False tems of ec	ful to nd switch uctures - ethods.
. C. va olv 1. l nit ceyv ate tray nit oot eth nit ger aus nit rape	2 language arious computational re research problem. Unit wise detailed i-1 Number of words - constants, ments - while, do- v of structures - unit i-2 Number of s of quadratic equa od and Newton Rap -3 Number of n values and Eigen values and Eigen values s elimination and protection -4 Number of e-Kutta methods, N	al methods like bisections. content of lectures = 14 variables and data type while and for statement ons – file operations, F f lectures = 12 tion - Limits for real real reals on son method for finding f lectures = 14 vector of matrix-inversed ivotal condensation method f lectures = 12 on's rule (one -third) Monte-Carlo Simulation	Title of the unit: Progr pes – data input and out the s – go to statement – fur xamples of writing C- pr Title of the unit: Roots oots of a polynomial equing roots of the equations. Title of the unit: Linear e of a matrix- determinant ethods. Title of the unit: Integr solution of ordinary diffin and its applications	ramming in put – cont unctions – a ogramming of Equati ation – Bis r Algebra – solution of ration and ferential eq	and Ranga- n C rol structur arrays – poi g of comput ons section meth of linear sys differentiar juation by 1	Kutta use es – if ar inter – str ational m nod, False ttems of ec tion Euler met	ful to nd switch uctures - ethods. position quations- hod and
. C . va olv 1. 1 1. 1 1. 1. 1. 1. 1. 1. 1. 1.	2 language arious computational re research problem. Unit wise detailed Lunit wise detailed Linit wise detailed Words - constants, ments - while, do- Y of structures - unit - 2 Number of s of quadratic equa od and Newton Rap - 3 Number of n values and Eigen values and Eigen values s elimination and pice - 4 Number of ezoidal rule-Simpsce e-Kutta methods, N Brief Description of	al methods like bisections. content of lectures = 14 variables and data type while and for statement ons – file operations, F f lectures = 12 tion - Limits for real r phson method for finditing f lectures = 14 vector of matrix-inversed ivotal condensation method f lectures = 12 physical condensation f self learning / E-lear	Title of the unit: Progr pes – data input and out its – go to statement – fu examples of writing C- pr Title of the unit: Roots oots of a polynomial equ ng roots of the equations. Title of the unit: Linear e of a matrix- determinant ethods. Title of the unit: Integr solution of ordinary diff and its applications	ramming i put – cont inctions – a ogramming of Equati ation – Bis r Algebra – solution of ration and ferential eq	and Ranga- n C rol structur arrays – poi g of comput ons section meth of linear sys differentian quation by 1	Kutta use es – if ar inter – str ational m nod, False ttems of ec tion Euler met	ful to nd switch uctures - ethods. position quations- hod and
. C . va olv 1. 1 nit nit eyv ate tray nit ape ung . B ps:	2 language arious computationa re research problem. Unit wise detailed -1 Number of words – constants, ments – while, do- of structures – uni - 2 Number of s of quadratic equa od and Newton Rap - 3 Number of s elimination and pi - 4 Number of ezoidal rule-Simpso e-Kutta methods, N Brief Description of //www.edx.org/cou	al methods like bisections. content of lectures = 14 variables and data type while and for statemere ons – file operations, H f lectures = 12 tion - Limits for real re- ohson method for finding f lectures = 14 vector of matrix-inverse ivotal condensation method f lectures = 12 on's rule (one -third) Monte-Carlo Simulation f self learning / E-lear USE/programming-basis	Title of the unit: Progr pes – data input and out its – go to statement – fu examples of writing C- pr Title of the unit: Roots oots of a polynomial equing roots of the equations. Title of the unit: Linear e of a matrix- determinant ethods. Title of the unit: Integr solution of ordinary diff a and its applications ming component	ramming in put – cont unctions – a ogramming of Equati ation – Bis r Algebra – solution of ration and ferential eq	and Ranga- n C rol structur arrays – poi g of comput ons section meth of linear sys differentia quation by I	Kutta use es – if ar inter – str ational me nod, False tems of ec tion Euler met	ful to nd switch uctures - ethods. position quations- hod and
. C. va olv 1. 1 init ate ray nit oot eth nit ger aus nit ape init ape ps: ps:	2 language arious computational re research problem. Unit wise detailed i-1 Number of words - constants, ments - while, do- v of structures - unition i-2 Number of s of quadratic equation od and Newton Raperiation and provident settimination set	al methods like bisections. content of lectures = 14 variables and data typy while and for statement ons – file operations, F f lectures = 12 tion - Limits for real r phson method for finding f lectures = 14 vector of matrix-inversed ivotal condensation method f lectures = 12 on's rule (one -third) fonte-Carlo Simulation f self learning / E-lear rse/programming-basic TSE/computational-method	Title of the unit: Progr pes – data input and out its – go to statement – fu Examples of writing C- pr Title of the unit: Roots oots of a polynomial equing roots of the equations. Title of the unit: Linear e of a matrix- determinant ethods. Title of the unit: Integr solution of ordinary diffinand its applications ming component cs	ramming in put – cont unctions – a ogramming of Equati ation – Bis r Algebra – solution of ration and ferential eq	and Ranga- n C rol structur arrays – poi g of comput ons section meth of linear sys differentia juation by 1	Kutta use	ful to nd switcl uctures - ethods. position quations- hod and

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M P 3. Course Code 1 4. Type of Course (use times in the second secon	Iolecular hysics 7080302 ck mark) ures, Tutorials fundamental ur matters are go ctronic, magnet	4 Core (√) 6. Frequency (use tick marks) c, Practical Tutorials = 0	0 DSE () Even ()	Odd (√)	0 SEC () Either	Every
3. Course Code 1 4. Type of Course (use ti 5. Pre-requisite (if any) 7. Total Number of Lectures Lectures = 52 8. Course Description: Atom and molecule are the satoms. The properties of all individual properties like eleptoperties of matter made of molecules and build up the properties and build up the properti	7080302 ck mark) ares, Tutorials fundamental ur matters are go ctronic, magnet	4 Core (√) 6. Frequency (use tick marks) 5. Practical Tutorials = 0	0 DSE () Even ()	Odd (√)	0 SEC () Either	Ever
 4. Type of Course (use ti 5. Pre-requisite (if any) 7. Total Number of Lectures Lectures = 52 8. Course Description: Atom and molecule are the statoms. The properties of all individual properties like eleptroperties of matter made of molecules and build up the properties and build u	ck mark) Ires, Tutorials fundamental ur matters are go ctronic, magnet	Core (√) 6. Frequency (use tick marks) c, Practical Tutorials = 0	DSE () Even ()	Odd $()$	SEC () Either	Ever
 5. Pre-requisite (if any) 7. Total Number of Lectures 7. Total Number of Lectures 7. Total Number of Lectures 8. Course Description: Atom and molecule are the statement of the properties of all individual properties like eleptoperties of matter made of molecules and build up the properties and build up the prop	fundamental ur matters are go ctronic, magnet	6. Frequency (use tick marks) practical Tutorials = 0	Even ()	Odd $()$	Either	Ever
 7. Total Number of Lectures 4. Course Description: Atom and molecule are the statoms. The properties of all individual properties like eleptroperties of matter made of molecules and build up the properties and build up the prop	fundamental ur matters are go ctronic, magnet	, Practical Tutorials = 0	Practic		Sem ()	Sem
8. Course Description: Atom and molecule are the statoms. The properties of all individual properties like ele properties of matter made of molecules and build up the production of the statement of the statemen	fundamental ur matters are go ctronic, magnet	Tutorials = 0	Practic			
Atom and molecule are the a atoms. The properties of all individual properties like ele properties of matter made o molecules and build up the p	fundamental ur matters are go ctronic, magnet		ITactit	al = 0	Prese (Pres	
9. Course Objectives:	or atoms and nore-requisite kn	verned by the electronic st tic and optical properties, w nolecules. This course wil owledge for all science and	se. Matter, w ructure of a which are qui ll enlighten d engineerin	whatever the tom and mo te different the knowle g field.	e states, is plecule. The from the c edge of at	made of hey hav ollectiv oms ar
Comparing hatres						4
 comparing between a spectroscopy, Atomic sj Molecular spectroscopy 	itomic emissio pectrum	on spectroscopy and at	omic absor	ption spec	troscopy;	Optica
. Theory of magnetic ener	gy, Anomalous	Zeeman's effect and Land	lue splitting	factor		
. Molecular Spectra of dia	tomic molecule	es Vibrational and Rotation	al energy le	vels		
. To learn basics of NMR	& ESR.		in onorgy to	ve15.		
0. Course Outcomes (COs	;):					
state and justify the select vibrations.	ion rules for va	rious optical spectroscopie	ally applied s in terms of	electric and the symme	d magnetio stries of mo	c fields olecula
nit-1 Number of lec	$\frac{\Pi t}{turos - 14}$	THE COL				
uantum states of one elect	ron system at	Title of the unit: Aton	nic Physics			
auli's exclusion principle, s quivalent and non-equivalen ack effect and Stark effect, plitting, Intensity Ratio and c	pectrum of He t electron atom Hyperfine Stru letermination o	e atom and Heisenbeg res , Breit's Scheme, Normal a locture of Spectral lines: Isc f Nuclear spin.	ntisation and onance, L-S and Anomale tope effects	l Stern-Ger and J-J co ous Zeemar , Nuclear p	clach experimentation experimentation of the second	erms of aschen perfine
nit - 2 Number of lect	tures $= 14$	Title of the unit: Micr	owave, Infr	a-Red and	Raman	
ypes of molecules, Diatomic fect of isotopic substitution, atomic molecule, Simple sperimental arrangement for fect, Raman Spectra and Mc	Molecule as ri Diatomic mole Harmonic Os Raman Spect	Spectroscopy gid rotator: its energy level cule as non-rigid rotator. V scillator, Anharmonic os ra, Classical theory of Ra	, spectra and /ibrating dia cillator, Di man effect,	l intensities tomic mole atomic Vi Quantum t	of spectra ccule: ener brating R heory of	al lines gy of a lotator Ramar
nit - 3 Number of lect	ures = 12	Title of the unit: Float	tomia Count	CD: /		
e Born-Oppenheimer Appr ectronic Spectra: The Franck ucture of Electronic-Vibrat	oximation, Vib -Condon Princ tion Transition	prational Coarse Structure: iple, Dissociation Energy a s, The Fortrat parabola, J	Progression n Dissociation predissociation	a of Diaton is, Intensity on Products	v of Vibra , Rotation	cules tional- al Fine

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- 1. Byron S. Gottfried. Schaum's outline of Theory and Problems of Programming with C. New Delhi: Tata McGraw-Hill,1991.
- 2. Suresh Chandra. Application of Numerical Techniques with C. New Delhi: Narosa Publishing House, 2006.
- 3. Brain W. Kernighan and Dennis. M. Ritchie. The C Programming Language. 2nd ed. New Delhi: Prentice-Hall of India, 1988.
- 4. E. Balagurusamy. Numerical Methods. New Delhi: Tata McGraw-Hill, 1999.
- 5. A.K. Ghattak, T.C. Goyal and S.J. Chua. Mathematical Physics. New Delhi: Macmillan, 1995.

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2. Course Name	Laboratory	T				1. 1. 1.
Course raille	Course-V	L	T	:	P	
3. Course Code	17080303	0	0		0	
4. Type of Course (use tick mark)	Core $()$	DSE ()		SECO	
5. Pre-requisite		6. Frequency	Even ()	$Odd(\sqrt{)}$	Either	Even
7. Total Number of	Lootunes Test 11	(use tick marks)			Sem ()	Sem
Lectures $= 0$	Lectures, Iutorials,	Practical Tutoriala – 0	1.2.1			
8. Course Description	on:	1 utoriais – U	Practic	cal = 104		1
Many problems in phy practical knowledge of computational methods	vsics need to be solve thow to obtain solutions.	ed using computational ons to system of linear e	techniques. ' quations, dif	This course ferential eq	will give quations, e	you thete. usin
9. Course Objective	s:					
to impart the basic kno echniques to solve phy	wledge of computers a visit signal advance co	and C programming. To programming lar	give exposur nguages.	e about vari	ious comp	utation
U. Course Outcomes	(COs):					
C langest will have under	erstanding of:					
L. Clanguage and MAT	LAB					
olve research model	al methods like bisecti	on method, Euler, Newto	on-Raphson	and Ranga-	Kutta usei	ful to
1 List of E-	S.					
T. List of Experiment	ts					
. To perform Matrix	summation, subtraction	on and multiplication.				
. To find the root of a	lgebraic equation usin	ng bisection method.				
. To find the root of a	lgebraic equation Nev	vton Raphson method.				
. To find the root of a	lgebraic equation usir	ng Muller method.				
. To fit a straight line	through given data u	sing Least square method	4			
. To fit the given data	using polynomial fitt	ing	u.			
. Interpolation and ex	trapolation using Lag	range method				
. To perform Numeric	al differentiation usin	a Nourten?				
. MATLAB: Digital	Signal Processing	g newton's method.				
0. MATLAB: Solving	Ordinary Differential	Equations				
1. MATLAR - Matrix	operations	Equations.				
2 Beele D	operations.					
2. BOOK Recommende	d:					11.1
Ross L. Spencer and	Michael Ware. Introd	luction to MATLAB. Br	igham Youn	o Universit	v	
Suresh Chandra. App	lications of Numerica	I Techniques with $C \cdot N$	ew Delhi- N	arosa 2004	y,	
Vinay K. Lngle and	John G. Proakis Digi	tal Signal Processing L	ing MATT	a Usa, 2006.		
Publishing, 1997. Lez, Richard E. Wood	ds, and Steven L. Edd	ins. Digital Image Dross		B. PWS		
Prentice-Hall, 2003.		ino, Digital illage Proces	ssing Using I	MATLAB.		
Learning MATIAD	The MethWint T	1000			1	

5 Learning MATLAB – The MathWorks, Inc., 1999.

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2. Course Name	Laboratory	I				
	Course-VI	L	T		P	a part
3. Course Code	17080304	0	0		8	
4. Type of Course (u	se tick mark)	Core $()$	DSE O		SECO	
5. Pre-requisite		6. Frequency	Even ()	$Odd(\sqrt{)}$	Either	Every
(if any)		(use tick marks)			Sem ()	Sem
/. Total Number of]	Lectures, Tutorials,	Practical				John
8 Course Description		Tutorials =	Practic	al = 104	25 1 1	
9. Course Objectives	s:			,		
To study the principle a	nd working of GM c	ounter				
l'o determine Lande's g	factor and to study 2	Zeeman effect				
To determine the hyster	esis loss magnetic sa	mples				
10. Course Outcomes	(CO_{s})				And the second second	
After successful compl Correlate the theoretica results.	etion of the course, l concepts and iden	students will be able to tify its practical application	tions throug	h experime	nt proced	lure and
After successful compl Correlate the theoretica results.	etion of the course, I concepts and iden	students will be able to tify its practical applicat	tions throug	h experime	nt proced	lure and
After successful compl Correlate the theoretica results.	etion of the course, al concepts and iden s	students will be able to tify its practical applicat	tions throug	h experime	nt proced	lure and
After successful compl Correlate the theoretica results. II. List of Experiment To study Quincke's m	etion of the course, al concepts and iden s nethod. rature of magnetic m	students will be able to tify its practical applicat	tions throug	h experime	nt proced	lure and
After successful compl Correlate the theoretica results. 1. List of Experiment . To study Quincke's m . To study Curie temper . Dielectric constant and	etion of the course, l concepts and iden s nethod. rature of magnetic m d Curie temperature of	students will be able to tify its practical application aterials.	tions throug	h experime	nt proced	lure and
After successful compl Correlate the theoretica results. 1. List of Experiment 1. To study Quincke's m 2. To study Curie temper 5. Dielectric constant and 5. To determine the wave	etion of the course, etion of the course, al concepts and iden s method. rature of magnetic m d Curie temperature of elength of LASER us	students will be able to tify its practical applicat aterials. of ferroelectric ceramics.	tions throug	h experime	nt proced	lure and
After successful compl Correlate the theoretica results. 11. List of Experiment 1. To study Quincke's m 2. To study Curie temper 3. Dielectric constant and 4. To determine the wave 5. To study the magne nagnetization of a mater	etion of the course, etion of the course, al concepts and iden s method. rature of magnetic m d Curie temperature of elength of LASER us tic hysteresis (B-H ial using hysteresis 1	students will be able to tify its practical applicat aterials. of ferroelectric ceramics. sing Michelson interferon curve) and calculate th oop.	tions throug neter. ne retentivity	h experime	nt proced	lure and
After successful compl Correlate the theoretica results. 11. List of Experiment To study Quincke's m Dielectric constant and To determine the wave To study the magne nagnetization of a mater To study the character. To study the character. To find the end point e To find the absorption To Study Zeeman effect	etion of the course, etion of the course, al concepts and iden s tethod. rature of magnetic m d Curie temperature of elength of LASER us tic hysteresis (B-H ial using hysteresis la istics of G.M. Count energy of given source coefficient of given	students will be able to tify its practical applicat aterials. of ferroelectric ceramics. sing Michelson interferon curve) and calculate th oop. er. er. the using G.M. Counter. material using G.M. counter.	tions throug neter. ne retentivity ter.	h experime	nt proced	lure and
After successful compl Correlate the theoretica results. 1. List of Experiment To study Quincke's m To study Curie temper Dielectric constant and To determine the wave To study the magne hagnetization of a mater To study the character To find the end point e To find the absorption To Study Zeeman effec D. To find the value of I	etion of the course, etion of the course, al concepts and iden s method. rature of magnetic m d Curie temperature of elength of LASER us tic hysteresis (B-H ial using hysteresis la istics of G.M. Counto energy of given source coefficient of given et.	students will be able to tify its practical applicat aterials. of ferroelectric ceramics. sing Michelson interferon curve) and calculate th oop. er. se using G.M. Counter. material using G.M. coun	tions through neter. ne retentivity ter.	h experime	nt proced	lure and
After successful compl Correlate the theoretica results. 1. List of Experiment To study Quincke's m To study Curie temper Dielectric constant and To determine the wave To determine the wave To study the magne lagnetization of a mater To study the character To find the end point e To find the absorption To Study Zeeman effect To find the value of L 2. Book Recommended	etion of the course, etion of the course, al concepts and iden s tethod. rature of magnetic m d Curie temperature of elength of LASER us tic hysteresis (B-H ial using hysteresis lu- istics of G.M. Counter energy of given source coefficient of given et. .ande's g factor for a d:	students will be able to tify its practical applicat aterials. of ferroelectric ceramics. sing Michelson interferon curve) and calculate th oop. er. er. the using G.M. Counter. material using G.M. count n electron using Electron	tions throug neter. le retentivity ter. Spin Resona	h experime	nt proced	turation
After successful compl Correlate the theoretica results. 1. List of Experiment To study Quincke's m To study Curie temper Dielectric constant and To determine the wave To determine the wave To study the magne tagnetization of a mater To study the character To find the end point e To find the absorption To Study Zeeman effect To find the value of L 2. Book Recommended R. A. Dunlup, Experiment	etion of the course, etion of the course, al concepts and iden sethod. rature of magnetic m d Curie temperature of elength of LASER us tic hysteresis (B-H ial using hysteresis la istics of G.M. Counter energy of given source coefficient of given ct. ande's g factor for a t: nental Physics: Mod	students will be able to tify its practical applicat aterials. of ferroelectric ceramics. sing Michelson interferon curve) and calculate th oop. er. er using G.M. Counter. material using G.M. coun n electron using Electron	tions throug neter. ne retentivity ter. Spin Resona	h experime	nt proced	turation
After successful compl Correlate the theoretical esults. 1. List of Experiment . To study Quincke's m . To study Curie temper . Dielectric constant and . To determine the wave . To study the magne lagnetization of a mater . To study the character. To find the end point e To find the absorption To Study Zeeman effect). To find the value of L 2. Book Recommended R. A. Dunlup. Experim B. K. Jones Electron	etion of the course, etion of the course, al concepts and iden s nethod. rature of magnetic m d Curie temperature of elength of LASER us tic hysteresis (B-H ial using hysteresis le istics of G.M. Counter energy of given source coefficient of given ct. ande's g factor for a 1 : mental Physics: Mode ion for Energy	students will be able to tify its practical applicat aterials. of ferroelectric ceramics. sing Michelson interferon curve) and calculate th oop. er. er. the using G.M. Counter. material using G.M. counter. material using G.M. counter. material using C.M. counter.	tions throug neter. ne retentivity ter. Spin Resona Oxford Univ	h experime /, coercivit	nt proced y and sa	turation

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http://nptel.ac.in/syllabus/95102023/

https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/

https://www.ks.uiuc.edu/Services/Class/PHYS480/qm_PDF/QM_Book.pdf

13. Books Recommended

1. Quantum Mechanics (3rd edition) by L. I. Schiff

2. Quantum Mechanics (2nd edition) by B. H. Bransden and Joachain

3. Introduction to Quantum Mechanics (2nd edition) by David J. Griffiths

4. Quantum Mechanics by A. K. Ghatak and S. Loknathan

5. A Textbook of Quantum Mechanics by P. M. Mathews and K. Venkatesan

6. Quantum Mechanics (3rd edition) by S. Gasiorowicz

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<u>Semester – III</u>

1. Name of t	he Depar	tment: Physics	States and the second second			1	
2. Course Na	ame	The Physics of Energy	L		T		Р
3. Course Co	ode	17080305	2		0	-	0
4. Type of Co	ourse (us	e tick mark)	Core ()	DSE ()		SEC)
5. Pre-requis (if any)	site		6. Frequency (use tick marks)	Even ()	Odd (√)	Either Sem ()	Every
7. Total Num	ber of L	ectures, Tutorials,	Practical			Joenn ()	Sem ()
Lectures $= 26$			Tutorials $= 0$	Practic	al = 0		
8. Course De	scription	:					
The course wil	l focus or	n the physical princ	inles underlying energy				

reduction for transport, industry and buildings. The application of these principles for harvesting energy from various sources will also be discussed.

9. Course Objectives:

To teach students the fundamental laws and physical processes that governs the sources, extraction, storage, and uses of energy.

10. Course Outcomes (COs):

Students will have enhanced their abilities to:

1. Understand how physical principles influence energy use.

2. Understand how to solve the problem of energy demand using various alternatives.

11. Unit wise detailed content Unit-1 Number of lecture

Number of lectures = 12 Title of the unit: Energy and its uses

Energy Literacy and the Challenge: Mechanical energy and transport, Electromagnetic energy, Heat and thermal energy, energy quantization in quantum, Entropy and temperature, Energy in chemical systems and processes Heat engines, Phase change energy conversion. Nuclear binding and Nuclear fission and fusion power. Energy storage, Energy conservation. Electricity generation and transmission: the grid, Climate change.

Unit – 2 Number of lectures = 14 Title of the unit: Sources of energy

Nuclear reactors and radiation, Bioenergy, Fossil fuels and Carbon footprint, Alternative Energy Harvesting: Solar energy global uptake, types of Solar absorption, Solar-thermal electricity, &Photovoltaics, Ocean energy flow & Ocean thermal energy conversion, Wind energy, Hydro, Geothermal energy.

12. Brief Description of self learning / E-learning component

https://www.edx.org/course/solar-energy-delftx-et3034x-0

https://www.edx.org/course/sustainable-energy-design-renewable-delftx-energyx-0

https://www.edx.org/course/understanding-nuclear-energy-delftx-nuclear01x-0

https://www.edx.org/course/energy-principles-and-renewable-energy-2

13. Books Recommended

1. R. L. Jaffe and W. Taylor . The Physics of Energy. Cambridge University Press

- 2. S P Sukhatme and J K Nayak. Solar Energy. McGraw-Hill Education
- 3. P. Rez. The Simple Physics of Energy Use. Oxford University Press
- 4. G.D. Rai. Non-conventional Energy Sources. Khanna Publisher

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Discipline Specific Elective Courses

Semester-III

2. Course Name	Condensed Matter Physics-I	L	T		P	
3. Course Code	17080306	4	0		0	
4. Type of Course (u	ise tick mark)	Core ()	DSE $(\sqrt{)}$	1	SECO	
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even ()	Odd()	Either	Every
7. Total Number of	Lectures, Tutorials, P	ractical			_ Sem ()	Sem ()
Lectures = 52 8. Course Descriptio	n:	Tutorials = 0	Practic	al = 0		
It includes Semiconduc	ctor crystals and Ferm	surfaces & metals, Opt	ical proper	ties of solid	ls Dielec	trics and

9. Course Objectives:

The aim of Condensed Matter Physics-I is to expose students to topics like electron dynamics in semiconductors and metals, Fermi surface and its determination, optical properties of solids, dielectrics and ferroelectrics, and quantum-mechanical origin of magnetism. Theoretical formulation of these properties has been brought in direct contact with relevant experiments.

10. Course Outcomes (COs):

The students should be able to learn how above mentioned properties can be deduced using the fundamental principles of mechanics (classical/quantum) and statistical mechanics.

11. Unit wise detailed content Unit-1 Number of lectur

Unit-1	Number of lectures = 14	Title of the unit: Semiconductor crystals and Fermi
		surfaces & metals
~ · ·		

Semiconductor crystals: Band gap, Direct and indirect absorption processes, Motion of electrons in an energy band, Holes, Effective mass, Physical interpretation of effective mass, Effective masses in semiconductors;

Fermi surfaces and metals: Fermi surface and its construction for square lattice (free electrons and nearly free electrons), Electron orbits, Hole orbits, Open orbits; Wigner-Seitz method for energy bands, Cohesive energy; Experimental determination of Fermi surface: Quantization of orbits in a magnetic field, De Hass-van Alphen effect.

Unit - 2 Number of lectures = 12 Title of the unit: Optical properties of solids

Dielectric function of the free electron gas, Plasma optics, Dispersion relation for em waves, Transverse optical modes in a plasma, Transparency of alkalis in the ultraviolet, Longitudinal plasma oscillations,

Plasmons and their measurement; Electrostatic screening, Screened coulomb potential, Mott metal-insulator transition, Screening and phonons in metals; Optical reflectance, Kramers-Kronig relations, Electronic interband transitions, Excitons: Frenkel and Mott-Wannierexcitons; Raman effect in crystals, Electron spectroscopy with X-rays.

Unit - 3 Number of lectures = 12 Title of the unit: Dielectrics and Ferroelectrics

Polarization, Macroscopic electric field, Dielectric susceptibility, Local electric field at an atom, Dielectric constant and polarizability, Clausius-Mossotti relation, Electronic polarizability, Classical theory of electronic polarizability. Structural phase transitions; Ferroelectric crystals and their classification; Landau theory of the phase transition; Anti-ferroelectricity, Ferroelectric domains; Piezoelectricity, Ferroelasticity.



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Unit - 4 Number of lectures = 14 Title of the unit: Magnetism

Diamagnetism and Paramagnetism: Langevin's classical theory of diamagnetism, Quantum theory of diamagnetism, Langevin's classical theory of paramagnetism, Weiss theory of paramagnetism, Quantum theory of paramagnetism, Ferromagnetism and antiferromagnetism: Weiss theory of ferromagnetism, Quantum theory of ferromagnetism, The Heisenberg model, Ferromagnetic domains, Bloch wall. Antiferromagnetism and the

12. Books Recommended

1. Introduction to Solid State Physics (7th edition) by Charles Kittel

2. Solid State Physics by Neil W. Ashcroft and N. David Mermin

3. Solid State Physics by S.O. Pillai, "New Age International Publishers".

4. Solid State Physics: An Introduction to Theory and Experiment by H. Ibach and H. Luth

5. Principles of the Theory of Solids (2nd edition) by J. M. Ziman

6. Fundamentals of Solid State Physics by Saxena, Gupta, Saxena and Mandal.

7. Elements of Solid State Physics (4th Edition) by J P Srivastava

13. Brief Description of self learning / E-learning component

For understanding the basic concepts in detail, students may get the study materials from these E-learning links

https://nptel.ac.in/courses/113104005/75 http://web.mit.edu/course/6/6.732/www/6.732-pt2.pdf https://unlcms.unl.edu/cas/physics/tsymbal/teaching/SSP-927/Section%2013_Optical_Properties_of_Solids.pdf

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2. Course Name	Electronics-I	L	Т	a second	P	1.1
3. Course Code	17080307	4	0	and the second	0	
4. Type of Course (us	se tick mark)	Core ()	DSE $()$	See Jack Co	SEC ()	
5. Pre-requisite (if any)	Physics at graduation level	6. Frequency (use tick marks)	Even ()	Odd()	Either Sem ()	Every
7. Total Number of L	ectures, Tutorials, I	Practical	1.0		Join ()	_ Seni (
Lectures = 52		Tutorials = 0	Practic	al = 0	1.6	the second
8. Course Description	1:					
This course will deepen modulation techniques	your understanding o	of the different types of op	perational a	mplifier, m	odulation	and de-
9. Course Objectives		processors.	1 1 1 1			
1. To study the working	principle and share			Sugar State		
2 To study the basic of	principle and charac	teristics of operational an	plifier.			
3 To understand the dif	amplitude and freque	ency modulation and its re	elated electr	onic circui	ts.	
4. To study the besies	ferent types of logic	circuits and its various ap	plication.			
5. To study the basics of	r A/D and D/A conve	rtors.				
J. To study the architect	ture, control logic uni	t and arithmetic logic uni	t of differer	nt types of r	nicroproc	essor.
10. Course Outcomes (COs):					
After successful complet	ion of the course, stu	dents will	2			
1. have a basic knowled	ge of operational amr	lifier and its uses				
2. understand the concer	ot of working of diffe	rent types of logic gates				
3. be able to design the e	electronic circuits usi	ng different types of logic gales.				
4. know the fundamenta	principles modulation	and do module the	gates.			
5. know basic microcom	puter and micronread	on and de-modulation tech	nniques.			
11 Unit wise detailed	puter and microproce	essors.				
Unit-1 Number of	entent	(T)	- A. A.			
Dia in Number 0	1 lectures = 14	Title of the unit: Operation	ational Am	plifier		
width,Voltage follower. Differentiator, Comparate shift Oscillator.	CMRR, DC, AC, S or, Oscillator principa	Summing Amplifiers, Ne Summing, Scaling & In al and Types, Frequency 1	gative and strumentation esponse an	Positive on Amplif d Frequenc	Feedback ier, Integr y stability	. Band ator & , Phase
Unit - 2 Number of	lectures = 12	Title of the unit: Modu	lation Con		-	1
PLL using IC Active Filt	ers Amplitude Med	lation D and the unit. Widdu	lation Con	imunicatio	n	
Fransmitter (Block Diage	ers., Ampirude Mod	ulation, De-modulation of	AM waves	s, Frequenc	y Modula	tion
and Delta modulation, Pul	lse Code Modulation,	stics feature, Super hetero Pulse width modulation,	odyne recei Block diagr	ver, Digita am od Rada	l commur ar & Rada	ication r range
Jnit - 3 Number of	lectures = 14	Title of the unit: Digita	l Electroni	cs		
Q.M. Method, Logic gates ype. Analog computation udder, A/D Convertors; (requency & voltage to tim unalog computation.	s, Decoder and De-mu , time & amplitude so Quantization and en- ne conversion, Sample	altiplexer, Multiplexer & saling, ROM and RAM, I coding, parallel compara and Hold circuit, solution	Encoder, Fl D/A Conver tor. A/D c n of ordinar	ip flops RS tor, weight onvertor us y differenti	, JK, MSJ ed resister sing, Volt al equation	K & D ; R-2R age to n using
Jnit - 4 Number of	lectures = 12	Title of the unit: Micro	DROGOGI	<u></u>	3	1
Aicrocomputer systems an iming diagram, Introducti 6 bit arithmetic instructio nd subroutines, programn	d Hardware., Microp on to 8085 basic instr ns., Arithmetic opera ning of 8085 using in	rocessor architecture and l uctions, Arithmetic opera ition related to memory, I structions, Introduction to	Microproce tion, logic of Rotate and of Microcont	ssor system operation, b compare instroller	n, Instructi ranch ope structions,	on and ration, Stack
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diatomic molecules.

Unit - 4 Number of lectures = 12

Title of the unit: Resonance Spectroscopy NMR: Basicprinciples, NMR instrumentation, Relaxation process: spin-spin and spin-lattice relaxation times, magnetic dipole coupling, chemical shift: measurement and factors affecting chemical shift.ESR: Basicprinciples, instrumentation, intensity of ESR lines, hyperfine interaction (Electron - Nucleus coupling), g - factor and factors affecting ESR lines, zero field splitting.

12. Brief Description of self learning / E-learning component

For understanding the basic concepts in detail, students may get the study materials from these E-learning links

https://ocw.mit.edu/courses/physics/

https://nptel.ac.in/courses/104104085/

https://nptel.ac.in/courses/115105100/56

13. Books Recommended

- Collin N Banwell and Elaine M McCash, Fundamentals of Molecular Spectroscopy, Tata McGraw-Hill. 1.
- 2. Raj Kumar, Atomic, Molecular Spectra: Laser, KedarNath Ram Nath
- 3. H Kaur, Spectroscopy, PragatiPrakashan
- 4. Atomic spectra & atomic structure, Gerhard Hertzberg: Dover publication, New York.
- 5. Molecular structure & spectroscopy, G. Aruldhas; Prentice Hall of India, New Delhi.

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1. Name of the Department: Physics

2. Course Name	Nuclear Dhysics I	T					
3 Course Code	Tructear T hysics - 1	L	T			P	
5. Course Coue	17080308	4	0			0	
4. Type of Course (1	use tick mark)	Core ()	DSEC	1		ASEO	
5. Pre-requisite		6. Frequency	Even () 0	ld	Either	Every
(if any)	State Section 19	(use tick marks)			$(\sqrt{)}$	Sem ()	Sem ()
7. Total Number of	Lectures, Tutorials, Pr	actical			()		
Lectures = 52		Tutorials $= 0$	D	mastical	0		
0 C D			r	racucar	= 0		12 C 19 C 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 C

8. Course Description:

The syllabus is divided into four units i.e. Introduction to nuclear physics, Two nucleons problems, Nuclear model –I and Nuclear Model –II.

9. Course Objectives:

The course aims to provide students with an understanding of the basics of nuclear physics two nucleons problem and nuclear models to explain the structure of nucleus.

10. Course Outcomes (COs):

After the successful completion of the course, students would be able to

1. Understand the basics of nuclear physics

- 2. Describe the two nucleons problem.
- 3. Explain the Nuclear models and their relative success and failures.

11. Unit wise detailed content Unit-1 Number of leg

Number of lectures = 12 Title of the unit: Introduction to nuclear physics

The atomic nucleus, nuclear radius, nuclear size, semi-empirical formula, nuclear binding energy, nuclear angular momentum and parity, nuclear electromagnetic moments, nuclear exited states, the deuteron, the nuclear many body problem, fundamental forces, elementary particles (leptons, quarks, elementary vector bosons), conservation laws and symmetric, accelerators and detectors, projectiles and targets, energies, nuclear interactions. Particle detectors, scattering of nucleons, low energy of n-p scattering.

Unit – 2 Number of lectures = 14 Title of the unit: The Two Nucleon Problem

Qualitative features and phenomenological potentials, Exchange forces, generalized Pauli principle. The ground state of deuteron, Range-depth relationship for square well potential., Neutron-Proton scattering at low energies (below 10 Mev), Concept of scattering length and its interpretation, Spin dependence of neutron-proton scattering, Effective range theory of n-p scattering, Coherent scattering of neutrons on ortho and para hydrogen, Magnetic moment and its importance in the determination of exact ground state of deuteron.

Unit – 3 Number of lectures = 13 Title of the unit: Nuclear Models – I

Liquid drop model, Outlines of Bohr and Wheeler theory of nuclear fission, Concept of magic numbers The properties of magic nucleus, Nuclear Shell Model, Predictions of shell closure on the basis of harmonic oscillator potential, Need of introducing spin-orbit coupling to reproduce magic numbers. Extreme single particle model and its predictions regarding ground state spin parity, Magnetic moment, Electric quadrupole moments.

Unit – 4 Number of lectures = 13 Title of the unit: Nuclear Models – II

Nuclear surface deformations, General parameterization, Types of multipole deformations, Quadrupole deformations, Symmetries in collective space, Surface vibrations, Vibrations of a classical liquid drop, The Harmonic quadrupole oscillator, The collective angular momentum operator, The collective quadrupole operator, Quadrupole vibrational spectrum, Rotating nuclei, The rigid rotor, The symmetric rotor, The asymmetric rotor.





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12. Brief Description of self-learning / E-learning component

For understanding the basic concepts in detail, students may get the study materials from these E-learning links <u>https://ocw.mit.edu/courses/physics/</u> <u>https://nptel.ac.in/courses/108108111/3</u>

https://nptel.ac.in/courses/117103066/7

13. Books Recommended

- 1. J. Millman and C. C. Halkies, Integrated Electronics. Tata McGraw-Hill.
- 2. R. P. Jain. Modern Digital Electronics, Tata McGraw Hills.
- 3. Malvino and Leach, Digital Electronics.
- 4. S. M. Sze, Semiconductor Devices: Physics and Technology.
- 5. Ramakanth A. Gayakwad, Op-Amps & Linear Integrated Circuits. 2nd ed. 1991.
- 6. A.P. Malvino and Donald, Principal and Application in Electronics. Tata McGraw-Hill
- 7. Thomas L. Floyd. Digital Electronics. New Delhi: Person.
- 8. A.D. Helfrick and W.D. Cooper, Modern electronics Instrumentation and Measurements Techniques, New Delhi: PHI
- 9. J. D. Rayder, Fundamental of electronics.

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I. Name of t	he Department: Physic	S				2019 St. 7 and 1885	
2. Course	Spectroscopic	L		Т		D	
Name	Techniques – I	1. Consi		-		P	
. Course	17080309	4		0 .	-	0	
Code						0	
. Type of Co	ourse (use tick mark)	Core ()	$DSE(\sqrt{)}$		SECO	
5. Prereq uisite (if any)		6. Fre (use tic	equency ck marks)	Even ()	Odd (√)	Either Sem ()	Every Sem ()
. Total Num	ber of Lectures, Tutor	ials, Prac	ctical				
ectures = 52			Tutorials	= 0		Practical =	0
. Course De	escription:	1					
This course include f Laser spectro	ludes basics of spectrosc oscopy. jectives:	copy, UV	/Visible spe	ctroscopy,	nonlinear	r phenomeno	on and application

and Bose-Einstein condensation in atomic vapors.

10. Course Outcomes (COs):

This course;

1. will give basic knowledge on spectroscopic techniques that use lasers

2. provide knowledge on the techniques and instrumentation for laser spectroscopy.

3. includes laboratory exercises that illustrate the concepts and phenomena that are characteristic of lasers

4. provide a degree of experimental skill in the spectroscopic applications.

11. Unit	wise detailed content	
Unit-1	Number of lectures = 14	Title of the unit: Basics of Spectroscopy and UV/Visible spectroscopy

Basics of Spectroscopy, Energy of electromagnetic radiation, Quantization of energy, Mechanisms of interaction of electromagnetic radiation with matter, Absorption peaks and line widths. UV/Visible Absorption Spectroscopy, Instrumentation, Beer Lambert law, Deviations from Beer Lambert's law. Applications: Quantification of compounds, Quality control, Chemical kinetics, Detectors in liquid chromatography instruments.

Unit – 2	Number of lectures = 12	Title of the unit: Non-Linear Phenomenon and related
		spectroscopy

Non-linear phenomena and generation of short pulses, laser system for spectroscopy, instrumentation for detection of optical signals and time-resolved measurements, absorption spectroscopy, fluorescence spectroscopy, Raman spectroscopy, non-linear spectroscopy, time-resolved spectroscopy, ultra-fast laser spectroscopy.

Unit _ 3	Number of lostrong - 14				
onn - 5	1 uniber of lectures = 14	Title of the unit: Applications of Leaser Section			
		Laser Spectroscony	1		

Cooling and Trapping of Atoms, Principles of Doppler Cooling, Polarization Gradient Cooling Qualitative Description of Ion Traps, Optical Traps and Magneto-Optical Traps, Bose Condensation, Applications of Laser.

Unit – 4	Number of lectures = 12	Title of the unit: Non Conventional Spectroscopic Techniques

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Two-photon spectroscopy, Saturation Spectroscopy, CARS, Experimental techniques of MPI spectroscopy, Optogalvanic spectroscopy and Supersonic Beam Spectroscopy with emphasis on measurement of molecular parameters.

12. Brief Description of self-learning / E-learning component:

For basic conceptual understanding and detail study, students may get the study material from the following links.

- 1. https://nptel.ac.in/courses/102103044/pdf/mod2.pdf
- 2. https://www.photonics.com/.../Lasers_Understanding_the_Basics
- 3. https://en.wikipedia.org/wiki/List_of_laser_applications
- 4. www.bgu.ac.il/~glevi/website/Guides/Lasers.pdf
- 5. ieeexplore.ieee.org/document/8048469/

13. Books Recommended

1. Laud: Laser and nonlinear optics

- 2. Ghosh: Laser Cooling and Trapping.
- 3. Demtroder: Laser Spectroscopy and Instrumentation
- 4. Svelto: Principles of Lasers
- 5. Sengupta: Frontiers in Atomic, Molecular and Optical Physics.
- 6. Laser Spectroscopy : W. Demtroder.
- 7. High Resolution Spectroscopy : J. M. Hollas.
- 8. Spectrophysics : A. Thorpe.

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Semester-IV

2. Course Name	al unulle, I hysics					
	Physics of	L	T			Sand Ball
2.0.01	Nanomaterials	L	1		P	
3. Course Code	17080401	4	0		0	
4. Type of Course (use tick mark)	Core $()$	DSE ()		SECO	
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even $()$	Odd ()	Either Sem()	EverySem ()
7. Total Number of	Lectures, Tutorials	s, Practical				
Lectures $= 52$		Tutorials = 0	Practi	cal = 0		
8. Course Description	on:					
It includes Fundamenta Nanomaterials and Dev	al of Nanomaterials, vices	Nanofabrication Tech	niques, Char	acterizatior	n of Nanor	naterials and
9. Course Objective	es:					
fabrication of nanomat design electric devices, 10. Course Outcomes	erials, characterizati magnetic and gas so (COs):	on of different types o ensors etc. using nanon	e basics of n f nanomateri naterials.	anomateria als. It also	als, technic gives the	ques used in idea how to
After the successful con	unletion of the cour	so students 111				
1. understand the funda	mentals of monoment	se, students would be a	ble to			
2 understand die fullua	inentais of nanomat	erials.				
2. understand different	fabrication as well a	s characterization techn	niques of nar	omaterials		
3. describe the basic inv	volved in the design	of devices based on nat	notechnolog	у.		
11. Unit wise detailed	content			1		
Unit-1	Number of	Title of the	unit: Fundar	nental of N	-	
	lectures $= 12$			nemai oi iv	anomateri	als
Definition of nanotechno	lectures = 12 ology, Nanomaterial	s. Novel combination of	foroportion	fmatai 1	lanomateri	als
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Definition of nanotechnominiaturization, Function lependence on vapour nteractions, Size dependences nhomogeneous surfaces	lectures = 12 ology, Nanomaterial nal enhancement, N r pressure, Nuclea dence on Surface ter s, Quantum confiner	s, Novel combination o anoparticles as super at tion, Size dependenc asion of solid surfaces, nent & energy levels.	f properties o oms, Size de e on Chem Wetting-dev Band structu	of materials pendence of nical reactive wetting of r	s of nanoscon melting ivity, Inter- cough and	als ale, Device point, Size rmolecular chemically
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Electronic structure, Graphene, Metal matrix composites, Polymers- electroactive material blends,

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Semiconductor Nanoparticles, Nanowires, Nanoribbon and nanospring, Quantum computing, Ballistic transport, Coulomb blockade, Single electron devices, Molecular electronic devices, Coupled quantum dots, Spintronics, Ultra-sensitive magnetic sensors, Spin dependent transistors, Photonic devices, Mechanical and Fluidic devices, Chemical and bio-chemical sensors, Energy conversion devices

12. Brief Description of self-learning / E-learning component:

To understand basic concepts in detail, students may get study materials on following links. <u>https://onlinecourses.nptel.ac.in/noc18_ph02</u> <u>https://ocw.mit.edu/courses/physics/</u>

https://www.mooc-list.com/

13. Books Recommended

- 1. John H. Davies. The Physics of Low Dimensional Semiconductors. Cambridge University Press.
- 2. J.J. Ramsden. Nanotechnology- An Introduction. William Andrew Elsevier.
- 3. Ning Xi and King W. Chiu Lai. Nano-optoelectronics Sensors and Devices. William Andrew Elsevier.
- 4. V.V. Mitin, V.A. Kochetp and M.A. Stroscio. Quantum Heterostructures: Microelectronics and Optoelectronics. Cambridge University Press.
- 5. G. Cao. Nanostructures and Nanomaterials: Synthesis, Properties and Applications. Imperial College Press.
- 6. C.P. Poole and F.J. Owens. Introduction to Nanotechnology. New York: John Wiley. M. Wilson, K. Kannangara, M. Simmons and B. Raguse. Nanotechnology. Overseas Press.

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	Laboratory	L	Т		D	
	Course-VII		1		P	
3. Course Code	17080402	0	0		8	
4. Type of Course (u	se tick mark)	Core $()$	DSE ()	and the second	SEC ()	
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even $()$	Odd ()	Either Sem ()	Every Sem ()
/. 10tal Number of I	Lectures, Tutorials,	Practical				
8. Course Description		Tutorials = 0	Practic	al = 104		
UJT, coder – decoder, 9. Course Objectives	DAC, ADC etc.	ictical knowledge about o	circuit desig	gn and wo	orking of f	lip flops,
To study JK, SR flip flo	p, multiplexer, demu	ltiplexer, decoder, phase s	hifter and U	IJT.	al and	
To study the working of	DAC and ADC.					
To determine the range a	and energy of alpha p	particles				
To determine energy usi	ng Compton scatterin	ng				
10 -						
10. Course Outcomes (COs):	Sand Stranger				
After successful comple Correlate the theoretical results.	etion of the course, s l concepts and ident	students will be able to fify its practical application	ons through	n experime	ent proced	ure and
						uic and
11. List of Experiments	6				100 - 100	
11. List of Experiments 1. To study SR and JK fl	ip flop circuits using	logic gates				
11. List of Experiments 1. To study SR and JK fl 2. To study the UJT Chan	ip flop circuits using racteristics.	logic gates.				
 List of Experiments To study SR and JK fl To study the UJT Chan To study the use of Di 	ip flop circuits using racteristics. gital Comparator.	logic gates.				
 List of Experiments To study SR and JK fl To study the UJT Chan To study the use of Di To study use of multip 	ip flop circuits using racteristics. gital Comparator. lexer, de-multiplexer	logic gates.	т.			
 List of Experiments To study SR and JK fl To study the UJT Char To study the use of Di To study use of multip To measure input offset 	ip flop circuits using racteristics. gital Comparator. lexer, de-multiplexer et voltage, input bias	logic gates. , decoder and phase shifte current, input offset currer	r. ht and CMR	R of On-4	Amp	
 List of Experiments To study SR and JK fl To study the UJT Char To study the use of Di To study use of multip To measure input offset To study the working of A To study working of A To determine the range Energy determination u Cross section determine 	ip flop circuits using racteristics. gital Comparator. lexer, de-multiplexer et voltage, input bias of DAC and measure DC and measure rese and energy of alpha using Compton scatte nation using Compto	logic gates. , decoder and phase shifte current, input offset current resolution and setting time plution and conversion time particles using Spark Cou ering n scattering	r. ht and CMR e of DAC. he of ADC. inter	R of Op-A	Amp.	
 List of Experiments To study SR and JK fl To study the UJT Char To study the use of Di To study use of multip To measure input offset To study the working of A To study working of A To determine the range Energy determination u Cross section determinic 	ip flop circuits using racteristics. gital Comparator. lexer, de-multiplexer et voltage, input bias of DAC and measure DC and measure rese and energy of alpha using Compton scatte nation using Compton	logic gates. , decoder and phase shifte current, input offset current resolution and setting time plution and conversion time particles using Spark Cou- ering n scattering	r. ht and CMR e of DAC. he of ADC. inter	R of Op-A	Amp.	
 List of Experiments To study SR and JK fl To study the UJT Chan To study the use of Di To study use of multip To study use of multip To measure input offset To study the working of A To determine the range Energy determination u Cross section determinic 2. Book Recommended	ip flop circuits using racteristics. gital Comparator. lexer, de-multiplexer et voltage, input bias of DAC and measure DC and measure rese and energy of alpha using Compton scatte nation using Compto	logic gates. c, decoder and phase shifte current, input offset current resolution and setting time plution and conversion time particles using Spark Cou tring n scattering	r. ht and CMR e of DAC. he of ADC. inter	R of Op-A	Amp.	

8. B. K. Jones. Electronics for Experimentation and Research. Prentice-Hall.

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Discipline Specific Elective Courses

Semester-IV

1.	Name of the Depar	rtment: Physics			1000		
2.	Course Name	Condensed Matter II	L	Т		P	
3.	Course Code	17080404	4	0		0	
4.	Type of Course (us	se tick mark)	Core ()	DSE $()$	-1.2.3	SEC ()	<u></u>
5.	(if any)		6. Frequency (use tick marks)	Even	Odd ()	Either	EverySem
7.	Total Number of L	ectures, Tutorials,	Practical			Sem()	0
Lec	tures = 52	,	Tutorials = 0	Practic	al = 0		
8.	Course Description	I :	0	Tactic	ai – 0		

It includes Electron Transport Phenomenon, Nanostructures and Electron Transport, Beyond the independent electron approximation and Many-particle physics

9. Course Objectives:

The aim of second course on Condensed Matter Physics is to prepare students for undertaking somewhat advanced studies in Condensed Matter Physics.

10. Course Outcomes (COs):

It emphasizes on the consequences of going beyond the independent electron approximation and an exposure to the language of second quantization- the language in use in condensed matter theory research. Importantly, it also includes an introduction to the emerging field of Nano-structures and electron transport phenomenon in such systems.

11. Unit wise detailed content Unit-1 Number of lec

-1 Number of lectures = 12 Title of the unit: Electron Transport Phenomenon

Motion of electrons in bands and the effective mass tensor (semi-classical treatment), Currents in bands and holes, Scattering of electrons in bands (elastic, inelastic and electron-electron scatterings),

The Boltzmann equation, Relaxation time ansatzand linearized Boltzmann equation; Electrical conductivity of metals, Temperature dependence of resistivity and Matthiesen's rule; Thermoelectric effects, Thermopower, Seebeck effect, Peltier effect, The Wiedemann-Franz law.

Unit – 2 Number of lectures = 14 Title of the unit: Nanostructures and Electron Transport

Nanostructures; Imaging techniques (principle): Electron microscopy (TEM, SEM), Optical microscopy, Scanning tunneling microscopy, Atomic force microscopy; Electronic structure of 1D systems: 1D subbands, Van Hove singularities; 1D metals- Coulomb interactions and lattice couplings; Electrical transport in 1D:Conductance quantization and the Landauer formula, Two barriers in series- Resonant tunneling, Incoherent addition and Ohm's law, Coherence-Localization; Electronic structure of 0D systems (Quantum dots):Quantized energy levels, Semiconductor and metallic dots, Optical spectra, Discrete charge states andcharging energy; Electrical transport in 0D- Coulomb blockade phenomenon.

Unit - 3	Number of leature 12					and the second second			
child o	1 tumber of lectures = 12	Title	of	the	unit:	Beyond	the	independent	electron
		appro	xim	ation					ciccu on

The basic Hamiltonian in a solid: Electronic and ionic parts, One-electron model, The adiabatic approximation; The Hartree equations, Exchange: The Hartree-Fock approximation, Hartree-Fock theory of free electrons-Ground state energy, exchange energy, correlation energy (only concept); Screening in a free electron gas: The Dielectric function, Thomas-Fermi theory of screening, Calculation of Lindhard response function, Lindhard

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Unit – 4	Number of lectures = 14	Title of the unit: Many-particle physics: Second quantization formulation
Many-particl Normalized s equation to o creation and Application t state energy i	e Schrodinger wave equation symmetric and anti-symmetric w occupation number representation destruction operators; Field o degenerate electron gas: First a in first-order perturbation theory	in first quantization, The single-particle states as basis states, ave functions; Second quantization: Transformation of Schrodinger n (both for bosons and fermions), Many-particle Hilbert space and operators, Second-quantized from of number density operator; and second-quantized Hamiltonian operators, rs parameter, Ground- c, Contact with the Hartree-Fock result, Exchange energy.
12. Books R	ecommended	
1. Solid State	Physics: An Introduction to Pri	nciples of Materials Science (4th Ed.) by H. IbachandH Luth
2. Introductio	on to Solid State Physics (8th Ed	.) by Charles Kittel
3. Solid State	Physics by Neil W. Ashcroft an	d N. David Mermin
4. The Wave	Mechanics of Electrons in Meta	ls by Stanley Raimes
5. Quantum T	heory of Many-particle Systems	by A. L. Fetter and J. D. Walecka
6. Many-body	Quantum Theory in Condensed	Matter Physics by H. Bruus and K. Flensberg
7. Solid State	Physics by S.O. Pillai, "New Ag	ge International Publishers".
10. Brief Des	cription of self-learning / E-learning	arning component:
To understand	basic concepts in detail, studen	ts may get study materials on following links
https://www.	slideshare.net/prithusayak/cha	racterization-techniques-of-nanonarticles
https://nptel.	ac.in/courses/102104069/15	
https://nptel.	ac.in/courses/113107075/19	
	New clis	Jav. 0 10/19



2. Course	Name	Electronics-II	L	Т	Sec. 1997	P		
3. Course	Code	17080405	4	0	1.4.4.4.4.4.4	0		
4. Type of	Course (use	e tick mark)	Core ()	DSE $()$		SEC O	19.00	
5. Pre-requ	lisite	Physics at	6. Frequency	Even $()$	Odd ()	Either	Every	
7 Total N	mhanafIa	graduation level	(use tick marks)			Sem ()	Sem (
Lectures = 5	nuber of Le	ectures, Tutorials, P	ractical				Nalash.	
8. Course I	Description		Tutorials = 0	Practic	al = 0	pas gran		
 will help you help you to u 9. Course of 1. To study t 2. To study t 3. To undersi 	to fabricate nderstand th Objectives: he basics of he basics of rand the form	e the different types e techniques for mak different processes to ion-implantation and nation of different ele	of integrated circuits (IC ing contact between semi o grow the single crystal s d diffusion.	s) for the p iconductor	and metals	pplication	s. It also	
 To underst To get fam 	and the des iliar with di	ign of combinational fferent types of clean	logic circuits using IC. rooms.					
After marke	utcomes (C	.Us):						
Allel successi	ul completio	on of the course, stud	ents will be able to			1		
4. know the	working prin	ques for making cont nciple of adders, subt	act between semiconduct ractor, counters and shift	tor and met registers	als			
Unit-1	Number o	f lectures = 12	Title of the unit: IC Fa	brigation	I	1.14		
Silicon planar Concentration iffecting the concentration Unit - 2	process, (enhanced or etching proc gradient, Fic	Crystal growth, Wa xidation, chlorine ox cess, HF-HNO ₃ syste k's Laws, diffusivity f lectures = 12	fer production, Therma idation, Lithography & p em, dopant addition, Ior variation, Segregation, C	l oxidation attern trans implantat VD, epitax	h, high pr fer, Etchin ion, diffus ial and no	essure ox ag process, sion, Diffu n-epitaxial	idation, factors ision in films.	
Ionolithia IC	tool. 1		The of the unit: IC Fal	prication –	11			
ansistor fabri MOS devices	cation, Fabric, Monolithic	7, BJT Fabrication, ication of FET/NMO c diodes, Clean room	PNP transistor, Multi-e S enhancement, FET/NM s & their classifications.	mitter Sch IOS depleti	ottky tran on transist	sistor, Su or, Fabrica	perbeta ation of	
nit – 3	Number of	flectures = 14	Title of the unit: MOS s	ystems and	d SPICE	1		
fetal semicon harges, Origin electrical co nalysis.	ductor conta of oxide cha mputer simu	acts, Ideal MS contac arges, MOS structure, alation, SPICE and it	cts, Schottky barriers and Effect of bias voltage Ca ts evaluations, Electrical	d ohmic co pacitance o circuit spe	ntacts, Ox f MOS sys cifications	ide and in tem, Introc , The SPIC	terface fuction CE DC	
nit – 4	Number of	lectures = 14	Title of the unit: COM	IBINATIC USING IC	DNAL LO	GIC DES	IGN	
dders and the	ir use as Su s delay line,	bstractors, Ripple co , Serial to parallel co	ounters, Sequential logic nverter, parallel to serial	design, Shi converter,	ift register Ring cour	s, Applica nter, twiste	tion of	

synchronous sequential circuits, Applications of Asynchronous sequential circuits, Asynchronous sequential circuits, Applications of Asynchronous sequential circuits, Asynchronous sequential circuit design.



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12. Brief Description of self learning / E-learning component

For understanding the basic concepts in detail, students may get the study materials from these E-learning links https://ocw.mit.edu/courses/physics/

https://nptel.ac.in/courses/117107094/

https://www.youtube.com/watch?v=CeD2L6KbtVM 13. Books Recommended

- 1. Integrated electronics Millman&Halkias
- 2. Microprocessor and Interfacing D. V Hall
- 3. Micropressor Architecture Prog. & Appls. S. Goankar, Wiley-Estern
- 4. Micro Electronics Millman&Grabel
- 5. Digital Computer Electronics AP. Malvino.
- 6. Advanced Electronic Communication system by Kennedy
- 7. Modern digital electronics by R. P. Jain

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1. Name of the Depa	rtment: Physics			Carl and	48	
2. Course Name	Nuclear Physics – II	L	T		P	
3. Course Code	17080406	4	0	1. 1. 1. 1. 1.		
4. Type of Course (use tick mark)		Core ()	$DSE(\sqrt{)}$		ASEO	
5. Pre-requisite (if any)		6. Frequency (use tick marks)	Even $()$	Odd	Either Sem ()	Every Sem ()
7. Total Number of L	ectures, Tutorials, Pr	ractical				
Lectures = 52		Tutorials = 0	Practic	al = 0		
8. Course Description	1:			-		
The syllabus is divided ion accelerators &ion be	into four units i.e. par eam interactions in soli	ticles Identification, basic ds and Nuclear stability a	c electroni and nuclear	cs behind reactors.	nuclear teo	chniques,
9. Course Objectives				1	1	
The course aims to provi nuclear techniques, the v involved in nuclear stab	de students with an und working principles of id ility and Nuclear reacto	derstanding of the particle on accelerators & ion bea ors.	es identifica m interacti	ation, basi ons in sol	ic electronic ids & basic	cs behind features

10. Course Outcomes (COs):

After the successful completion of the course, students would be able to

1. Describe the particle Identification.

2. Explain the Nuclear Electronics, techniques, circuits and analyzers.

3. Explain the working principles of ion accelerators & ion beam interactions in solids.

4. Describe the basic features involved in nuclear stability and Nuclear reactors.

11. Unit wise detailed content

Unit-1	Number of lectures = 14	Title of the unit: Particles Identification	

Basic principle of ΔE -E detector telescopes, Short range charged particles ΔE -E telescope, Methods of particle identification using semiconductor and gaseous detectors, ΔE -E time of flight spectroscopy, Event by event particle identification system for heavy ion induced reaction analysis; neutron-gamma discrimination;

Modem Gas Detectors: Basic principle and operation of split anode ionization chamber, Position sensitive ionization chamber, Position sensitive proportional counter, Multi-wire proportional counter.

Unit – 2 Number of lectures = 14 Title of the unit: Nuclear Electronics

Types of preamplifiers: basic idea of voltage sensitive, Current sensitive pre-amplifiers, Details of charge sensitive preamplifier and its applications; Amplifier Pulse Shaping Circuits, RC, Gaussian, delay-line,Bipolar and zero cross-over timing circuits, Pole zero cancellation and base line restorer, Coincidence Techniques: basic idea of coincidence circuit its resolving time, Basic principle of slow coincidence, slow fast coincidence

Sum coincidence techniques; Single Channel Analyzer; Multi-Channel Analyzer; CAMAC Based Data Acquisition System.

Unit – 3 Number of lectures = 13	Title of the unit: Ion Accelerators and Ion Beam Interaction in Solids
----------------------------------	--

Ion Accelerators: Ion sources- basic features of RF ion source, Direct extraction negative ions source (Duo plasmatron), Source of negative ions by Cs sputtering (SNICS); Basic principle and working of Tandom accelerator and Pelletron accelerator and its applications; Ion Beam Interaction in Soilds: Basic ion bombardment processes in Solids- general phenomenon, ion penetration and stopping, Ion range parameters, channelling,

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components of an ion implanter, 8. Energy deposition during radiation damage, sputtering process and ion beam mixing.

Unit – 4 Number of lectures = 11 Title of the unit: Nuclear Reactors

Nuclear stability, fission, prompt and delayed neutrons, fissile and fertile materials- characteristics and production, Classification of neutrons on the basis of their energy, four factor formula, control of reactors using natural uranium, principle of breeder **Unit** reactors

12. Brief Description of self-learning / E-learning component:

To understand basic concepts in detail, students may get study materials on following links.

1. https://onlinecourses.nptel.ac.in/noc18 ph02

2. https://www.mooc-list.com/tags/nuclear-physics

3. www.nuclearonline.org/Courses.htm

4. https://study.com/directory/category/Physical_Sciences/Physics/Nuclear_Physics.html

5. https://www.class-central.com/tag/nuclear%20physics

13. Books Recommended

1. R. R. Roy and B. P. Nigam, "Nuclear Physics: Theory and Experiment", Wiley Eastern Limited, 1993.

2. M. K. Pal, "Theory of Nuclear Structure", Affiliated East-West Press, New Delhi.

3. Greiner and Maruhn, "Nuclear Models", Springer, 1996

4. W. E. Burcham, "Nuclear Physics : An Introduction", Longman Group Limited, London, 1973.

5. R. G. Sachs, "Nuclear Theory", Addison-Wesley Publishing Company, Cambridge, 1955.

6. K. S. Krane, "Introductory Nuclear Physics", Wiley India Pvt. Ltd., 2008

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17 Comment	N the Depar	tment: Physics			A. Sector	
2. Course	Name	Spectroscopic Techniques - II	L	Т	Р	
3. Course	Code	17080407	4	0	0	
4. Type of	Course (us	e tick mark)	Core ()	DSE $()$	SECO	
5. Pre-req (if any)	uisite		6. Frequency (use tick marks)	Even $()$ Odd ()	Either Sem ()	Every
7. Total N	umber of L	ectures, Tutorials, H	Practical			
8 Course	Decemination		Tutorials = 0	Practical = 0		
o. course	Description					
Whenever a This course molecules.	new molecu is all about	le is synthesized it is practical application	essential to determine its as of spectroscopic metho	structure using spectr ods for the determina	oscopic tec tion of stru	chnique acture o
9. Course	Objectives:				1	-
1. Compari	ng between	different spectroscor	ic techniques		1.00	8
2. To learn	basics of N	MD ESD M	ne teeninques			
10 Course (Duteomer (WIR, ESR, Mossbaue	er and laser spectroscopy	a she ta sa ba sa		
It. Course (Juccomes (C	_Us):	<u>*</u>			
1. Identify t	the basic con	nponents of spectroso	copic instrumentation.			
2. Demonst	rate an under	rstanding of the proc	esses responsible for NM	R chemical shifts and		
3. Elucidate	the structure	es of molecules from	spectral data	R chemical shifts and	splitting p	atterns.
11. Unit wise	e detailed co	ontent	-		-	and a second
Unit-1	Number of	of lectures $= 14$	Title of the unit: Laser	Spectroscopy		
Lasers as spe Laser tenabili	ctroscopic li ty, Fluoresce	ght sources, spectral ence and Raman Spe	characteristics of laser ectroscopy with Lasers. No	emission, single and i	multi-mode	e lasers
Unit - 2	Number o	of lectures $= 12$	Title of the unit: Time	manaluad and	y.	
Jltra short pu	lses and life	time manufacture	The of the unit: Time	resolved spectroscop	by	
Optical coupli	ing, trapping	of atoms and ions us	with lasers, pump and p sing lasers. Laser cooling.	probe technique, cohe	rent spectre	oscopy.
Unit - 3	Number o	f lectures = 12	Title of the unit: Nuclea Resonance Spectroscop	ar Magnetic and Ele	ctron Spin	1
Jeneral theory pin coupling, typerfine strue	y of high res chemical sh cture, anisotr	olution NMR spectro nift, Electron Spin R copic systems, the tri	oscopy, experimental tech esonance Spectroscopy: 1 plet state.	nnique, analyses of N Experimental method	MR spectra ls, ESR spe	a, spin- ectrum,
71	Number of	f lectures = 14	Title of the unit: Mossb Spectroscopy	auer and X-ray Pho	toelectron	
Jnit - 4	THE REAL PROPERTY OF THE					
Jnit - 4 Iossbauer Sp	pectroscopy	the Mossbauer effe	ct, experimental methods.	, hyperfine interaction	ns. molecu	lar and



electronic structures, X-ray Photoelectron spectroscopy: Experimental technique, XPS spectra and its interpretations, other derivative forms of XPS like ESCA, EDAX etc., chemical shift, stoichiometric analyses, electronic structure.

12. Brief Description of self learning / E-learning component

For understanding the basic concepts in detail, students may get the study materials from these E-learning links

https://ocw.mit.edu/courses/physics/

13. Books Recommended

1. Laser Spectroscopy by W. Demtroder (3rd Ed., Springer, 2003)

2. Modern Spectroscopy by J.M. Hollas (4th Ed., John Wiley, 2004)

3. Electron paramagnetic Resonance by J.A. Well and J.R. Bolton (2nd Ed., Wiley, 2007)

4. Electronic and Photoelectron Spectroscopy by A.M. Ellis, M. Feher and T.G. Wright (Cambridge Univ. Press, 2005)

5. Introduction to Spectroscopy by D.L.Pavia, G.M. Lampman and G.S. Kriz (Thomson learning, 2001)

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