SYLLABUS

B. Sc. Non-Medical

Program Code: BSNM

SESSION: 2023-24

MATA GUJRI COLLEGE
AN AUTONOMOUS COLLEGE
SRI FATEHGARH SAHIB

MATA GUJRI COLLEGE
FATEHGARH SAHIB
(AN AUTONOMOUS COLLEGE)
AFFILIATED TO PUNJABI UNIVERSITY, PATIALA

CONTENTS

ABOUT THE PROGRAMME

Department of Physics was established in the year 1959 and since then B.Sc. Non-Medical course is going on. . B.Sc. Non-Medical is a three-year Undergraduate degree program offered by the P.G. Department of Physics and degrees are affiliated to Punjabi university, Patiala. The course has semester system that is distributed annually and the course is divided into 6 semesters. Candidates enrolled in B.Sc. course learn about various topics associated with the concepts of Physics. These courses provide knowledge of fundamental science related to the properties of matter and energy and relationship between them. These courses include mechanics, optics, electricity and magnetism, acoustics and heat. Modern physics, based on quantum theory, includes atomic, nuclear, particle and solid state studies. Physics is a science of observation of physical phenomena that involves the study of matter and its motion through space, along with related concepts; the main goal of physics is to understand how the universe evolved and behaves. Physics often explain the fundamental mechanisms of other sciences and is governed by the laws of nature. Physics also makes significant contributions through advances in new technologies that arise from theoretical break throughs.This program provides insights to experimental work and for this purpose the department has two State-of-Arts laboratories including Nuclear Physics laboratory, dark room and a store. Laboratories are fully equipped with the latest apparatus, which are essential for the students of B.Sc. for better understandings of theoretical concepts.

Program Name: Bachelor of Science Non-medical (B. Sc. N.M.) (Physics subjects)

Program Objectives:

After completing undergraduate program in sciences, a student will be able to

PO 1. Develop an in-depth knowledge and understanding through the core courses which form the basis of Physics.

PO 2. To apply conceptual knowledge and skills learnt into practical world and in real life situations.

PO 3. Gain theoretical insight into scientific concepts theories and models

PO 4. Enhance their Creative thinking and problem-solving capabilities

PO 5. Develop a foundation for pursuing higher education in the field of Science.

PO 6. Use experimental apparatus as a tool for scientific investigations/understanding

Program Specific Outcomes (PSOs):

PSO 1. Understanding the basic concepts of physics particularly concepts in mechanics, quantum mechanics, statistical mechanics and electricity and magnetism to appreciate how diverse phenomena observed in nature follow from a small set of fundamental laws through logical and mathematical reasoning.

PSO 2. To equip the students with theoretical knowledge along with the necessary practicalskills for scientific world.

PSO 3. To develop conceptual and analytical abilities required for effective decision making inever changing technical environment.

PSO 4. Gain hands-on experience to work in applied fields.

PSO 5. Understand the basic concepts of certain sub fields such as nuclear, wave optics, solid state physics, and Special theory of relativity etc.

PSO 6. Facility of logical reasoning that can be applied to diverse fields.

ORDINANCES & OUTLINES
FOR
TEST SYLLABI AND COURSE OF READING

B. Sc. NON MEDICAL

2023-24

COURSE CODE: BSNM

MATA GUJRI COLLEGE FATEHGARH SAHIB

An Autonomous College

Re-Accredited with Grade 'A' by NAAC

Covered under Star College Scheme, DBT, GOI

Approved by
Academics Council

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ORDINANCES

For B.Sc. Non Medical (Semester System)
(UNDER THE +3 SCHEME)

Applicability of Ordinances for the time being in force

1. Notwithstanding the integrated nature of a course spread over more than one academic year, the ordinances in force at the time a student joins a course shall hold good only for the examination held during or at the end of the academic year. Nothing in these Ordinances shall be deemed to debar the College from amending the ordinances subsequently and the amended ordinances, if any, shall apply to all the students whether old or new.

2. B.Sc. Non Medical is an integrated course comprising three parts spread over three years. Each part will consist of two semesters. The course of study of B.Sc. shall be divided in six semesters and College examination will be held at the end of every semester in the months of November/December (for semester I, III & V) and May/June (for semester II, IV & VI) or as fixed by the Academic Council.

3. This course is under Choice Based Credit System (CBCS). The CBCS provides an opportunity for the students to choose courses from the prescribed list comprising core, elective or skill based courses

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

ii. **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.

   a. **Discipline Specific Elective (DSE) Course:** Elective courses offered under the main discipline/subject of study are referred to as Discipline Specific Elective.

b. 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.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper

c. Generic Elective (GE) Course: An elective course chosen from an unrelated discipline/subject, with an intention to seek exposure beyond discipline/s of choice is called a Generic Elective. The purpose of this category of papers is to offer the students

Navjeet Kaur

the option to explore disciplines of interest beyond the choices they make in Core and Discipline Specific Elective papers.

A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

iii. **Ability Enhancement Courses (AEC):** The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; i. Environmental Science and, ii. English/Hindi/Modern Indian Language (MIL) Communication. These are mandatory for all disciplines.

SEC courses are value-base and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

a. Ability Enhancement Compulsory Courses (AECC): Environmental Science, English Communication/Hindi Communication/MIL Communication.

b. Skill Enhancement Courses (SEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

iv. **Practical/tutorials:** The practicals/tutorials will be conducted keeping in view the spirit of UGC guidelines as per the needs and requirements of the concerned subject.

Value added courses are offered as per the guidelines of Punjabi University, Patiala Eligibility conditions for opting Value Added courses are same as those for B.Sc. Non medical course.Criteria to complete successfully is to score minimumt 35% marks in theory as well as Practical papers.

4. Terms defined under CBCS are as follows:

a. Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year.

b. Course: Usually referred to, as 'papers' is a component of a programme. All courses need not carry the same weight. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/tutorials/laboratory work/field work/outreach activities/ project work/vocational training/viva/seminars/term papers /assignments/ presentations/self study etc. or a combination of some of these.

c. Credit Based Semester System (CBSS): Under the CBSS, the requirement for awarding a degree or diploma or certificate is prescribed in terms of number of credits to be completed by the students.

d. Credit Point (CP): The numerical value obtained by multiplying the grade point (GP) by the no. of credit(C) of the respective course i.e. CP= GP X C.

e. Credit(C): A unit by which the course work is measured. It determines the number of hours of instructions required per week.

i)1 Credit = 1 Theory period of one hour duration

ii) 1 Credit = 1 Tutorial period of one hour duration
iii) 1 Credit = 1 Practical period of two hour duration

f. **Cumulative Grade Point Average (CGPA):** It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

g. **Grade Point (GP):** It is a numerical weight allotted to each letter grade on a 10 point scale.

h. **Letter Grade:** It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, P and F.

i. **Programme:** An educational programme leading to award of a degree, diploma or certificate.

j. **Semester Grade point Average (SGPA):** It is a measure of performance of work done in a semester. It is ratio of total credit points (CPs) secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed upto two decimal places.

k. **Semester:** Each semester will consist of 15-18 weeks of academic work. The odd semester may be scheduled from July to December and even semester from January to June.

l. **Transcript or Grade Card (GC) or Certificate:** Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, no. of credits, grades secured) along with SGPA of that semester and CGPA earned till date semester.

m. **Semester Examinations:** The comprehensive examinations conducted for summative evaluation of course.

n. **L-T-P:** The prescribed hours/week during a semester for Lecture-Tutorial-Practical to a particular course, in accordance with curriculum prescriptions based on respective nature

5. Eligibility Conditions for Admission:

5.1 A candidate will be eligible to join 1st semester of B.Sc. course, only if he/she has passed +2 examinations with Non-medical) with 45% marks in the 10+2 examination (Relaxation will be given to specific categories as per Govt. rules) from CBSE, Punjab School Education Board, or any other examination recognized as equivalent thereto.

5.2 To qualify for admission to **3rd semester of the Course**, the candidate must have passed 50% of total papers of the two semesters of the 1st year. In case, the result of 2nd semester is not declared at the time of admission to 3rd Semester, the student may be admitted provisionally and will be allowed to take examination of 3rd semester if he/she has passed in 50% of the total papers of first year (i.e. 1st and 2nd Semesters).

5.3 To **qualify for admission to 5th semester** of the course, the student may be admitted provisionally if the result of previous semester has not been declared and will be allowed to take examination of 5th semester, if he/she has passed 50% of the total papers of previous semesters.

5.4 The pass and reappear students of B.Sc. Part-I and II from other recognized universities shall be treated at par with the corresponding students of this College. He/she will be required to clear deficient papers of previous semesters, if any.

5.5 If any student gets admission after concealing any fact or his/her certificates are found fake after verification or he/she misleads the institution as any front or because of any other reason, his/her admission will stand cancelled/ his/her result cancelled though he/she may have been declared pass.

6. The outlines of tests and syllabi shall be such as prescribed by the Academic Council from time to time

7. The medium of instructions and examination will be English except for the non English subjects.

8. Punjabi is mandatory as per university rules. **Elementary Punjabi** in the lieu of Punjabi shall be allowed only to the following categories of candidates:

a. Candidates who have passed their Matriculation examination from a School located outside the State of Punjab.

b. Children of Defence personnel/Para military personnel (serving as well as retired) will be allowed to take up the subject of Punjabi, provided the father or the mother/guardian (in case father is deceased) of the candidate gives an affidavit that the candidate has not studied Punjabi at the School level.

9. A candidate must complete and pass the whole course of three years within a maximum of six years from the date of admission in B.Sc. first semester. If the candidate does not clear the lower examination within stipulated period, the higher result of the candidate will stand automatically cancelled.

10. Attendance Regulations & Condonation:

a. A student shall be eligible to appear for end semester examinations, if he/she acquires a minimum of 75% of attendance in each subject.

b. Request to the Principal for Condonation of shortage of attendance after the recommendation of the HOD will be forwarded to Lecture Shortage Condonation Committee. The committee can finally condone the shortage in aggregate up to 15% on medical grounds in each semester.

c. Any student representing the Institute/ University/ State/ Nation in any Academic/ Sports/ Cultural/Extra Co curricular/ NSS/NCC or any other event shall be considered on duty. His/ Her shortage of lectures shall be condoned, provided that the student is permitted in writing by the Principal/HOD concerned and a certificate to this effect signed by the competent authority where the student attended the event is taken.

d. A Student will not be promoted to the next semester unless he/she satisfies the attendance requirement of the present semester as applicable.

e. Students whose shortage of attendance is not condoned in any semester are not eligible to take their end semester examination of that particular semester and their registration for examination shall stand cancelled and no fee shall be refunded.

f. College medal will be awarded to a candidate who secures first position in the College on the basis of the marks of all the six semesters taken together. The general rules and conditions of the College/University for the Award of medal/prizes etc. will be applicable in the award of College medal to the topper of this examination

10. Examination:

10.1 Examination will be open to **regular candidates** who will fulfill the following requirements:

1. has been on the rolls of college throughout the academic terms
2. have good moral character
3. has attended 75% of the number of lectures delivered/practical in each paper, for late admission, lectures delivered will be counted from her/his date of admission.
4. In case of students, whose names are struck off on account of non payment of fee or other reasons shall not be accounted for.
5. The shortage in attendance of lectures by the candidate will be condoned as per rules approved by Academic Council from time to time.

10.2 Amount of examination fee to be paid by a candidate for each semester shall be as fixed by the College from time to time.

10.3 The minimum number of marks required to pass each semester examination will be 35% in each paper and 35% in the aggregate of the semester examination. Provided, that in papers with practicals, the percentage shall be required separately in written and practical/lab work.

10.4 Internal Assessment: The Assessment in each semester of B.Sc. Course will be 25% internal and 75% external for each Theory paper. There shall be Two Mid Semester tests in each Semester. Internal Assessment of 25% will be based on Continuous Comprehensive Assessment (CCA) pattern and the breakup will be as under:

(i) Mid Semester Tests : 50%
(ii) Assignment/Seminar/Class Test/Tutorial/Quiz etc. : 25%
(iii) Attendance : 25%
(iv) The candidate is required to secure atleast 35% marks both in external examination and in internal assessment separately in each paper in order to qualify in an examination.

10.5 A candidate placed under **reappear** in any paper, will be allowed two chances to clear the reappear, which should be availed within consecutive two years/chances

i.e. to pass in a paper the candidate will have a total of three chances, one as regular student and two as reappear candidate or rules as prescribed by University from time to time.

10.6 The **examination of reappear papers** of odd semesters will be held with regular examination of the odd semester and reappear examination of the even semester will be held with regular examination of even semester. But if a candidate is placed under reappear in the last semester of the course, he/she will be provided chance to pass the reappear with the examination of the next semester, provided his reappear of lower semester does not go beyond next semester

10.7 The Candidate shall also be entitled to grace marks under guidelines given by of University/ Academic Council from time to time.

10.8. Re-evaluation will be as per examination rules as approved by Academic Council.

10.9 A candidate who has passed B.Sc. Non Medical in +3 examination scheme from this College shall have two chances within a period of two years after passing the examination to improve division 55% marks. Improvement shall be allowed in not more than 50% of total theory papers offered in Part-I, II and III examination. However, previous marks of Practical/Internal Assessment will be carried forward in the paper(s) in which he/she appears for improvement.

10.10 Improvement Examinations:

a. A student who has been declared 'pass' in the Undergraduate course he/she was admitted to, may apply for improvement within a year from the declaration of the result of the final semester and he/she can take maximum of 50% of the total papers for that course for improvement.
b. A student shall have to appear in End semester examination of the paper chosen for improvement along with the regular students. No special exam shall be held for him/her.
c. If a student fails to improve upon the original marks obtained in the paper chosen for improvement, his/her original marks shall be retained and he/she shall not get a second chance for improvement.
d. Improvement examination in practical/MST paper shall not be allowed.
e. A student taking improvement examination shall have to pay a fee decided by the college.

11. Degree Requirement:

An undergraduate degree in a discipline may be awarded if a student completes atleast 12 core papers, 2 Ability Enhancement Compulsory Courses (AECC), 4 Skill Enhancement Courses (SEC) and 6 Discipline Specific Elective (DSE) papers as mentioned in the outline of the course. A student, who earns total specified credits according to the curriculum and fulfills such other conditions as mentioned in the curriculum of the programme, shall be issued the DMC and shall be awarded degree by Punjabi University Patiala. He/she must also pay all College dues as per rules. Moreover, there should be no case of indiscipline pending against him/her.

12. The Successful candidates shall be classified on the basis of 10-point grade following letter grades

Letter Grade	Marks	Grade Points
O (Outstanding)	91-100	10
A+ (Excellent)	81-90	9
A (Very Good)	71-80	8
B+ (Good)	61-70	7
B (Above Average)	51-60	6
C (Average)	41-50	5
P (Fair)	40	4
F(Fail)		0
D (Detained)		0
Ab (Absent)		0

Computation of SGPA and CGPA

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. 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) = $\sum$(Cix Gi) / $\sum$Ci

where Ci is the number of credits of the ith course and Gi is the grade 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 a student over all the semesters of a programme, i.e.

CGPA = $\sum$(Ci x 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 off to 2 decimal points and shall be reported in the transcripts.

Illustration of Computation of SGPA and CGPA and Format for Transcripts

(The table below gives an example to calculate SGPA for Semester I)

Illustration for SGPA (semester-I)
(The table below gives an example to calculate SGPA)

Course	Credit	Grade letter	Grade points	Credit points Credits × Grade
Core Course I	4	A	8	4×8=32
Core Course II	4	B+	7	4×7=28
Core Course III	6	A	8	6×8=48
CC-Practical paper I	2	C	5	2×8=16
CC-Practical paper II	2	B	6	2×6=12
Ability enhancement compulsory course I	5	B	6	5×6=30
Ability enhancement compulsory course II	2	A	8	2×8=16
Total	**25**			**Total Grade Points =182**

Thus, SGPA= 182 divided by 25= 7.28d

Illustration for CGPA (example)
(The table below gives an example to calculate CGPA)

SEMESTER 1	SEMESTER 2	SEMESTER 3	SEMESTER 4	SEMESTER 5	SEMESTER 6
CREDIT 25	CREDIT 28	CREDIT 25	CREDIT 25	CREDIT 25	CREDIT 25
SGPA 7.36	SGPA 7.8	SGPA 5.6	SGPA 6.0	SGPA 7.8	SGPA 7.8

Thus, **CGPA**= $\frac{25\times7.36+28\times7.8+25\times5.6+25\times6.0+25\times7.8+25\times7.8}{153}$

$=\frac{184+218.4+140+150+195+195}{153}$

= 7.07

Transcript (Format): Based on the above recommendations on Letter grades, grade points and SGPA and CGPA, the University may issue the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

13. The division obtained by each student is classified on the following basis:

	Division	CGPA
a)	1st with distinction	7.5 or more
b)	1st	6.0 or more but less than 7.5
c)	2nd	5.0 or more but less than 6.0

14. First, Second or Third position shall be awarded to the candidates, provided they meet the following conditions:

a. Rank shall be solely decided on the final CGPA, on completion of degree credit requirement.
b. The candidate has completed all the prescribed requirements, in the prescribed programme duration.
c. The candidate has passed / secured valid grades in all the prescribed courses, in the first attempt.
d. No disciplinary action is pending or has ever been lodged against him/her.
e. In case of an exceptional tie, both candidates shall be awarded the same rank.

15. Grade Card:

At the end of each semester, a student will be given a 'Grade Card' which will contain Course Code, Title, Credits, Grades Awarded, Earned Credits and Earned Point secured by him/her in each course, together with his/her SGPA in that semester. On the completion of the programme, a Final Grade Card will be issued to the student, giving full semester-wise details about the absolute marks and grades obtained by him/her in each course together with his/her SGPA and also the CGPA and Division awarded to him/her.

16. Equivalence:

Percentage (P) equivalent to CGPA earned by a candidate may be calculated using the following formula:

P=CGPAX10

17. In case the ordinance is silent about any issue, it will be decided by the College Principal in consultation with the Academic Advisory Committee of the college in the anticipation of approval of the same by Academic Counsel of the College.

Outline of Programme B. Sc. Non medical

Semester	Core Course (CC)	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)
I	**CC-I** Physics	**AECC-I** Punjabi*/Basic Punjabi** **AECC-II** Environmental and Road Safety Awareness	**SEC I** (choose any one) Physics Chemistry Computer Science Mathematics	
	CC-II Chemistry/Computer Science			
	CC-III Mathematics			
II	**CC-IV** Physics	**AECC-III** Punjabi*/Basic Punjabi** **AECC-IV** English **AECC-V** Drug Abuse	**SEC II** (choose any one) Physics Chemistry Computer Science Mathematics	
	CC-V Chemistry/Computer Science			
	CC-VI Mathematics			
III	**CC-VII** Physics	**AECC-VI** Punjabi*/Basic Punjabi**	**SEC III** (choose any one) Physics Chemistry Computer Science Mathematics	
	CC-VIII Chemistry/Computer Science			
	CC-IX Mathematics			
IV	**CC-X** Physics	**AECC-VII** Punjabi*/Basic Punjabi**	**SEC IV** (choose any one) Physics Chemistry Computer Science Mathematics	
	CC-XI Chemistry/Computer Science			
	CC-XII Mathematics			
V		**AECC-VIII** Punjabi*/Basic Punjabi**	**SEC V** (choose any one) Physics Chemistry Computer Science Mathematics	**DSE –I** Physics
				DSE-II Chemistry/ Computer Science
				DSE-III Mathematics
VI		**AECC-IX** Punjabi*/Basic Punjabi**	**SEC VI** (choose any one) Physics Chemistry Computer Science Mathematics	**DSE IV** Physics
				DSE-V Chemistry/ Computer Science
				DSE-VI Mathematics

*Language subjects will be taught as per state government rules.
** For students from other states

Ordinances Panel

Serial No.	Name and Affiliation	Designation	Signature
1.	Dr. Tajinder Singh Associate Professor, Department of Physics, Mata Gujri College, Fatehgarh Sahib	Chairman	
2.	Dr. Anup Thakur Associate Professor and Head Department of Physics Punjabi University Patiala	Vice Chancellor Nominee	11.05.23
3.	Dr. Raj Kumar Associate Professor School of Physics and Materials Science Thapar Institute of Engineering and Technology	Nominee of Academic Council	11/5/23
4.	Dr. Mahesh Kumar Assistant Professor, A.S. College, Khanna.	Nominee of Academic Council	
5.	Dr. Ramneek Kaur Assistant Professor,Department of Physics, Mata Gujri College, Fatehgarh Sahib	Member	
6.	Dr. Deepika Jain Assistant Professor,Department of Physics, Mata Gujri College, Fatehgarh Sahib	Member	
7.	Dr. Navjeet Kaur Assistant Professor, Department of Physics, Mata Gujri College, Fatehgarh Sahib	Member	
8.	Dr. Gurpreet Kaur Bhullar Assistant Professor,Department of Physics, Mata Gujri College, Fatehgarh Sahib	Member	
9.	Mr. Kapil Indosaw Ambala, Osaw Complex, Post Bag No.42, Jagadhi Road, Ambala, Haryana,133001	Industry Expert	Prince

PROGRAMME STRUCTURE B.Sc. N.M.

(For Physics Papers)

Semester	Core courses					Elective Course					Open Elective					Total Credits
	No of Papers	Credits L	T	P	Total Credits	No of Papers	Credits LTP			Total Credits	No of Papers	Credits L	T	P	Total Credits	
I	2	4	0	2	6											6
II	2	4	0	2	6											6
III	2	4	0	2	6	1	0	0	2	2						8
IV	2	4	0	2	6	1	0	0	2	2						8
V						3	4	0	4	8						8
VI						3	4	0	4	8						8

Total Credits: 44

SEMESTER WISE DETAILS OF THE PROGRAMME

B.Sc. Non-Medical

B.Sc. – I (Non- Medical)

SEMESTER I

Pass percentage 35%

Course	Course Code	Course Name	L T P(Credits)	No. of Lectures	Max. Marks (External+ Internal)
CC-I	BSNM-101	Mechanics	4 0 0 (4)	60	100 (75+25)
CC-I Practical	BSNM-101(P)	Mechanics Lab	0 0 2 (2)	60	50

B.Sc. – I (Non- medical)

SEMESTER II

Pass Percentage 35%

Course	Course Code	Course Name	L T P(Credits)	No. of Lectures	Max. Marks (External+ Internal)
CC-IV	BSNM-201	Electromagnetism	4 0 0 (4)	60	100 (75+25)
CC-IV Practical	BSNM-201(P)	Electromagnetism Lab	0 0 2(2)	60	50

SEMESTER WISE DETAILS OF THE PROGRAMME

B.Sc. Non-Medical

B.Sc. – II (Non- Medical)
SEMESTER III

Pass Percentage 35%

Course	Course Code	Course Name	L T P (Credits)	No. of Lectures	Max. Marks (External+ Internal)
CC-VII	BSNM-301	Statistical Mechanics and Optics	4 0 0 (4)	60	100 (75+25)
CC-VII Practical	BSNM-301(P)	Physics Lab	0 0 2 (2)	60	50
SEC-I	BSEC(P)-304	BSEC(P)-304Physics: Skill Enhancement Course-I Physics Workshop Skill	0 0 2 (2)	30	50

SEMESTER WISE DETAILS OF THE PROGRAMME
B.Sc. – II (Non- Medical)
SEMESTER-IV

Pass Percentage 35%

Course	Course Code	Course Name	L T P (credits)	No. of Lectures	Max. Marks (External+Internal)
CC-X	BSNM-401	Quantum Mechanics	4 0 0 (4)	60	100 (75+25)
CC-X Practical	BSNM-401(P)	Physics Lab	0 0 2 (2)	60	50
SEC-II	BSEC(P)-404	BSEC(P)-404 Physics: Skill Enhancement Course-II Applied Optics	0 0 2 (2)	30	50

SEMESTER WISE DETAILS OF THE PROGRAMME

B.Sc. – III (Non- Medical)

SEMESTER-V

Pass Percentage 35%

Course	Course Code	Course Name	L T P (Credits)	No. of Lectures	Max. Marks (External+ Internal)
DSE-I	BDSE(P)-501(i)/ BDSE(P)-501(ii)/ BDSE(P)501(iii)	Digital-Analog Circuits and Condensed Matter Physics Or Solid State Physics and Electronics Devices Or Basics of Solid State Electronics devices	4 0 0 (4)	60	100(75+25)
DSE-I Practical	BDSE(P)-501P(i)/ BDSE(P)-501P(ii)/ BDSE(P)501P(iii)	Digital-Analog Circuits and Condensed Matter Physics Lab Or Solid State Physics and Electronics Devices Lab Or Basics of Solid State Electronics devices Lab	0 0 2 (2)	60	50
SEC III	BSEC(P)-504	BSEC(P)-504 Physics: Skill Enhancement Course-III Basic Instrumentation Skills	0 0 2 (2)	30	50

Anup Thakur 11.05.23

11/5/23

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B.Sc. III (Non-Medical)
SEMESTER-VI

Pass Percentage 35%

Course	Course Code	Course Name	L T P (Credits)	No. of Lectures	Max . Marks (External+Internal)
DSE-IV	BDSE(P)-601 (i) Or BDSE(P)-601(ii) Or BDSE(P)-601(iii)	Nuclear & Particle Physics Or Nuclear Radiation Physics Or LASERs and applications	4 0 0 (4)	60	100 (75+25)
DSE-IV Practical	BDSE(P)-601(P)(i) Lab Or BDSE(P)-601P(ii)Lab Or BDSE(P)-601P(iii)Lab	Nuclear & Particle Physics Lab Or Nuclear Radiation Physics Lab Or LASERs and applications Lab	0 0 2 (2)	60	50
SEC-IV	BSEC(P)-604	BSEC(P) 604 Physics: Skill Enhancement Course-IV Radiation safety	0 0 2 (2)	30	50

SYLLABUS

Session 2023-24

B.Sc. (Non-Medical)
Program Code: BSNM

UNDERGRADUATE PROGRAMME
Choice Based Credit System (**CBCS**)

FACULTY OF SCIENCES

MATA GUJRI COLLEGE

FATEHGARH SAHIB
(An Autonomous College)
Affiliated to Punjabi University Patiala

Scheme of the Course

Semes -ter	Core Course (CC)	Ability Enhancement Compulsory Course(AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)
I	**CC-I** Physics **CC-II** Chemistry/Computer Science **CC-III** Mathematics	**AECC-I** Punjabi*/Basic Punjabi** **AECC-II** Environmental and Road Safety Awareness	**SEC I** (choose any one) Physics Chemistry Computer Science Mathematics	
II	**CC-IV** Physics **CC-V** Chemistry/Computer Science **CC-VI** Mathematics	**AECC-III** Punjabi*/Basic Punjabi** **AECC-IV**English **AECC-V** Drug Abuse	**SEC II** (choose any one) Physics Chemistry Computer Science Mathematics	
III	**CC-VII** Physics **CC-VIII** Chemistry/Computer Science **CC-IX** Mathematics	**AECC-VI** Punjabi*/Basic Punjabi**	**SEC III** (choose any one) Physics Chemistry Computer Science Mathematics	
IV	**CC-X** Physics **CC-XI** Chemistry/Computer Science **CC-XII** Mathematics	**AECC-VII** Punjabi*/Basic Punjabi**	**SEC IV** (choose any one) Physics Chemistry Computer Science Mathematics	
V		**AECC-VIII** Punjabi*/Basic Punjabi**	**SEC V** (choose any one) Physics Chemistry Computer Science Mathematics	**DSE –I** Physics **DSE-II** Chemistry/ Computer Science **DSE-III** Mathematics
VI		**AECC-IX** Punjabi*/Basic Punjabi**	**SEC VI** (choose any one) Physics Chemistry Computer Science Mathematics	**DSE IV** Physics **DSE-V** Chemistry/ Computer Science **DSE-VI** Mathematics
*Language subjects will be taught as per state government rules. ** For students from other states				

SYLLABUS

Session 2023-24

B.Sc-I (Non-Medical)
Program Code: BSNM

UNDERGRADUATE PROGRAMME
Choice Based Credit System (**CBCS**)

FACULTY OF SCIENCES

MATA GUJRI COLLEGE

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B.Sc. – I (Non- Medical)
SEMESTER I

Pass Percentage: 35%

Course	Course Code	Course Name	L T P(Credits)	No. of Lectures	Max. Marks (External+ Internal)
CC-I	**BSNM-101**	**Mechanics**	4 0 0 (4)	60	100 (75+25)
CC-I Practical	**BSNM-101(P)**	**Mechanics Lab**	0 0 2(2)	60	50
			Total Credits: 6		**Total Marks:150**

L-Lecture, T-Tutorial, P-Practical

B.Sc. – I (Non- medical)
SEMESTER II

Pass Percentage: 35%

Course	Course Code	Course Name	L T P(Credits)	No. of Lectures	Max. Marks (External+ Internal)
CC-IV	**BSNM-201**	**Electromagnetism**	4 0 0 (4)	60	100 (75+25)
CC-IV Practical	**BSNM-201(P)**	**Electromagnetism Lab**	0 0 2(2)	60	50
			Total Credits: 6		**Total Marks:150**

OUTCOMES
B.Sc– I (Non- Medical)
SEMESTER I

S. No.	Subject	Course Outcomes
1.	**Mechanics BSNM-101**	*On completion of this course, student will be able to understand* *1. Coordinate systems, Relative motion, inertial and non-inertial frames, the analogy between translational and rotational kinematics,* *2. rotational inertia, and properties of space and time.* *3. Lorentz transformation equations by using special theory of relativity,* *4. Behaviour of a damped and driven harmonic oscillator in both time and frequency domains.*

OUTCOMES
B.Sc– I (Non- Medical)
SEMESTER II

S. No.	Subject	Outcomes
1.	**Electromagnetism BSNM-201**	*On completion of this course, student will be able to describe* *1. electric and magnetic fields in matter,* *2. Dielectric properties and Electric Field in matter,* *3. Use of Faraday's Law in induction problems* *4. Maxwell's equations to various physical problems, the use of Coulomb's law and Gauss's law for the electrostatic force and Electromagnetic Wave Propagation*

B.Sc-I (Non-Medical)
(SEMESTER-I)
PHYSICS: MECHANICS
CODE: BSNM-101

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objectives: *This course provides knowledge about the various coordinate systems, conservation laws during motion of particles. It covers Special Theory of Relativity.Parameters of oscillatory motion are also discussed in detail.*

Course Outcomes: *On completion of this course, student will be able to understand*

- *Coordinate systems, Relative motion, inertial and non-inertial frames, the analogy between translational and rotational kinematics,*
- *rotational inertia and properties of space and time*
- *Lorentz transformation equations by using special theory of relativity,*
- *Behavior of a damped and driven harmonic oscillator in both time and frequency domains.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instructions for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION –A

Vectors (Basic Concepts): Review of Concepts of Vector Algebra.

Coordinate Systems: Coordinate Systems (Cartesian, Spherical Polar, Cylindrical and Plane Polar), Displacement, Velocity and Acceleration of a Particle Moving in a Plane and Space in Different Coordinate Systems, Solid Angle.

Conservation Laws and Properties of Space and Time: Properties of Space and Time, Conservative Force,Homogeneity of Space and Conservation of Linear Momentum, Isotropy of Space and Conservation of Angular Momentum, Homogeneity of Flow of Time and Conservation of Energy.

Inverse Square Law Force: Basic Forces in Nature, Central Force, Centre of Mass, Equivalent One Body Problem, Motion of a Body under Central Force, Equation of Orbit in Inverse Square Force Field and Turning Points, Kepler's Laws.

Frames of Reference: Inertial Frames of Reference, Galilean Transformation, Galilean Invariance: Galilean Invariance of Space and Time Intervals, Transformation of Velocity and Acceleration under Galilean Transformations, Invariance of Newton's laws of Motion, Invariance of Laws of Conservation of Linear momentum and Energy, Non-Inertial Frames and Fictitious Forces, Variation of acceleration due to Gravity with Latitude, Coriolis Force and its Applications.

SECTION –B

Rotational Motion: Rigid Body, Moment of Inertia of Rigid Body, Rotation of Angular Momentum Vector about a Fixed Axes, Angular Momentum of a Rigid Body about Principal Axes and Moment of Inertia Tensor, Kinetic Energy of Rotation of a Rigid Body about Principal Axes.

Special Theory of Relativity: Michelson-Morley Experiment, Postulates of Special Theory of Relativity, Lorentz Transformation, Length Contraction, Time Dilation, Variation of Mass with Velocity, Relativistic Mass Variation Formula, Mass-energy Equivalence.

Oscillations: Simple Harmonic Motion, Differential Equation of SHM and its Solutions, Kinetic and Potential Energy, Total Energy and their Time Averages, Damped Simple Harmonic Oscillations, Logarithmic Decrement, Forced Oscillations: Differential Equation for Forced Mechanical and Electrical Oscillators.

Reference Books:

1. University Physics. FW Sears, MW Zemansky and HD Young13/e, 1986. Addison Wesley.
2. Mechanics Berkeley Physics course,v. 1: Charles Kittel, et. Al. 2007, Tata McGraw Hill.
3. Physics – Resnick, Halliday& Walker 9/e, 2010, Wiley.
4. Engineering Mechanics, Basudeb Bhattacharya, 2nd edn, 2015, Oxford University Press.
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

B.Sc-I (Non Medical)
(SEMESTER-I)
PAPER: MECHANICS LAB
CODE: BSNM-101 (P)

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 18

List of Experiments:

1. Study the dependence of solenoid field on number of turns and current.
2. Study the dependence of moment of inertia on distribution of mass using objects of different shapes but same mass.
3. To study rotational motion using a flywheel and hence show that the torque is proportional to angular acceleration.
4. Study the Phase relationship between voltage and current using impedance triangle.
5. To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and to determine the value of acceleration due to gravity 'g'.
6. To study the resonance in Series LCR circuit for different resistances and find Q-values.
7. To determine the Young's Modulus by bending of beam.
8. To determine g and velocity of freely falling body using Digital Timing Technique.
9. To measure acceleration due to gravity and height of a person/building using Timing Ball.
10. To determine unknown self inductance of a coil by Anderson's bridge.
11. To study working of energy meter.
12. To determine elastic constants of a wire by Searle's method.
13. To determine the modulus of rigidity of a wire by Maxwell's needle.
14. To determine the Young's modulus of a wire by optical lever method.
15. To study one dimensional collision using two hanging spheres of different materials.

B.Sc-I (Non Medical)
(SEMESTER-II)
PHYSICS: ELECTROMAGNETISM
CODE: BSNM-201

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objectives: *The course on Electromagnetism has been designed to make the students confident about electric fields and potential in matter, magnetic fields in vacuum as well as matter, the physics of electromagnetic induction and electromagnetic wave propagation.*

Course Outcomes: *On completion of this course, student will be able to describe*

- *Electric and magnetic fields in matter,*
- *Dielectric properties and Electric Field in matter,*
- *Use of Faraday's Law in induction problems*
- *Maxwell's equations to various physical problems, the use of Coulomb's law and Gauss's law for the electrostatic force and Electromagnetic Wave Propagation*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instructions for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION –A

Vector Analysis: Gradient, Divergence, Curl and their Significance, Vector Integration, Line, Surface and Volume Integrals of Vector Fields, Gauss Divergence Theorem and Stoke's Theorem.

Electrostatics: Electrostatic Field, Electric Flux, Gauss's Theorem, Applications of Gauss's Theorem- Electric Field due to Infinite Line Charge, Uniformly Charged Spherical Shell and Solid Sphere, Plane Charged Sheet.

Electric Potential: Electric Potential as Line Integral of Electric Field, Electric Potential due to Line Charge, Dipole, Quadrupole, Arbitrary Charge Distribution (moments of charge

distribution), Uniformly Charged Circular Ring, Circular Disc and Solid Sphere, Calculation of Electric Field from Potential.

Electric Field in matter: Polarization, Polarization Vector, Atomic Polarizability, Relation between Electric Susceptibility and Dielectric Constant, Gauss's Law in Dielectrics: Displacement Vector, Displacement Current, Energy Stored in Capacitor having Dielectric Medium, Capacitance of Parallel Plate Capacitor with Dielectric Slab filled between the Plates.

SECTION –B

Magnetism: Magnetostatics: Biot-Savart's Law & its Applications to Straight Current Carrying Conductor, Circular Coil and Solenoid, Ampere's Circuital Law and its Applications, Divergence and Curl of Magnetic Field, Magnetic Vector Potential, Magnetic Properties of Materials: Magnetic Intensity, Magnetic Induction, Magnetic Susceptibility and Permeability, Differential and Integral form of Ampere's Law in Magnetism.

Electromagnetic Induction: Faraday's Laws of Electromagnetic Induction, Lenz's Law, Self and Mutual Inductance, Reciprocity Theorem.

Maxwell`s Equations and Electromagnetic Wave Propagation: Maxwell's Equations, Poynting Vector, Equation of Continuity of Current, Electromagnetic Wave Equation for a Dielectric Medium, Nature of electromagnetic waves.

Reference Books:

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
2. Electricity and Magnetism, J.H. Fewkes& J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
5. D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

B.Sc-I (Non Medical)
(SEMESTER-II)
PAPER: ELECTROMAGNETISM LAB
CODE: BSNM-201(P)

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 18

List of Experiments:

1. To determine the moment of Inertia of Flywheel.
2. Measurement for logarithmic decrement, coefficient of damping, relaxation time and quality factor of a damped simple pendulum.
3. To determine the value of 'g' by Kater's pendulum.
4. To study the induced EMF as a function of velocity of the magnet.
5. To study the magnetic field produced by a current carrying solenoid using a search coil and to find the value of permeability of air.
6. To find the efficiency of electric kettle with varying input voltage.
7. To determine the capacitance of an unknown capacitor using flashing and quenching of neon bulb.
8. To determine the Poisson's ratio for rubber.
9. To measure the period of oscillation of pendulum by changing the angle and length of pendulum.
10. To study the resonance in parallel LCR circuit for different resistances and find Q-values.
11. To study the linear motion under virtually frictionless conditions by using linear air track with digital timer.
12. To measure unknown capacitances using De-Sauty's bridge.
13. To determine the low resistance using Carey Foster Bridge.
14. To determine the value of an air capacitance by De-Sauty method and to find permittivity of air.
15. To find the value of unknown resistance using Kelvin Double Bridge.

SYLLABUS

Session 2023-24

B.Sc.-II (Non-Medical)
Program Code: BSNM

UNDERGRADUATE PROGRAMME
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B.Sc. – II (Non- Medical)
SEMESTER III

Pass Percentage 35%

Course	Course Code	Course Name	L T P (Credits)	No. of Lectures	Max. Marks (External+ Internal)
CC-VII	**BSNM-301**	**Statistical Mechanics and Optics**	4 0 0 (4)	60	100 (75+25)
CC-VII Practical	**BSNM-301(P)**	**Physics Lab**	0 0 2 (2)	60	50
SEC-I	**BSEC(P)-304**	**BSEC(P)-304 Physics: Skill Enhancement Course-I Physics Workshop Skill**	0 0 2 (2)	30	50
			Total Credits:8		**Total Marks:200**

B.Sc. – II (Non- Medical)
SEMESTER-IV

Pass Percentage 35%

Course	Course Code	Course Name	L T P (credits)	No. of Lectures	Max. Marks (External+Internal)
CC-X	**BSNM-401**	**Quantum Mechanics**	4 0 0 (4)	60	100 (75+25)
CC-X Practical	**BSNM-401(P)**	**Physics Lab**	0 0 2 (2)	60	50
SEC-II	**BSEC(P)-404**	**BSEC(P)-404 Physics: Skill Enhancement Course-II Applied Optics**	0 0 2 (2)	30	50
			Total Credits:08		**Total Marks:200**

OUTCOMES
B.Sc. II (Non Medical)
SEMESTER-III

S. No.	Subject	Outcomes
1.	**Statistical Mechanics and Optics BSNM-301**	*On completion of this course, student will be able to* • *Identify and describe the statistical nature of concepts and laws in thermodynamics.* • *Use the statistical physics methods such as Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein distribution.* • *Apply the concepts and principles of Black-Body radiation to analyze radiation phenomenon.* • *Use the principles of wave motion and superposition to explain the physics of polarization, interference and diffraction.* • *Describe the operation of optical devices including polarizers and interferometers.*

OUTCOMES
B.Sc. II (Non Medical)
SEMESTER-IV

S. No.	Subject	Outcomes
1.	**Quantum Mechanics BSNM-401**	*On completion of this course, student will be able to* • *Understand the basic knowledge about non relativistic quantum mechanics.* • *Understand the time-dependent and time-independent Schrodinger wave equation for simple potentials and harmonic oscillator.* • *Show an understanding of wave mechanics in one and three dimensions and Describe the structure of the hydrogen atom and show an understanding of quantization of angular momentum* • *Know about spin, angular momentum sates, angular momentum addition rules and identical particles.*

B.Sc-II (Non Medical)
(SEMESTER-III)

PHYSICS: STATISTICAL MECHANICS AND OPTICS
CODE: BSNM-301

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objective: *The emphasis of course is the evaluation of the laws of classical thermodynamics for macroscopic systems using the properties of its atomic particles.The objective of the course is to expose the students to the topics like fundamentals of interference, diffraction and polarization.*

Course Outcomes: *On completion of this course, student will be able to*

- *Identify and describe the statistical nature of concepts and laws in thermodynamics.*
- *Use the statistical physics methods such as Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein distribution.*
- *Apply the concepts and principles of Black-Body radiation to analyze radiation phenomenon.*
- *Use the principles of wave motion and superposition to explain the physics of polarization, interference and diffraction and the operation of optical devices including polarizers and interferometers*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instructions for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Statistical Mechanics: Basic Ideas of Statistical Physics, Scope of Statistical Physics, Basic Ideas about Probability, Distribution of Four Distinguishable Particles in Two Compartments of Equal Size, Concept of Macrostate, Microstates, Thermodynamical Probability, Concept of Constraints and their effects on Thermodynamic System, Static and Dynamic system.

Distribution of Particles: Basic Idea about Most Probable State, Distribution of n Particles in Two Compartments, Deviation from the State of Maximum Probability, Distribution of n distinguishable Particles in k Compartments of Unequal Sizes.

Classical Statistics: Phase Space and Division into Elementary Cells, Three Kinds of Statistics, Basic Approach in Three Statistics, Maxwell Boltzmann (MB) Law of Distribution of Molecular Speeds.

Quantum Statistics: Need of Quantum Statistics, Bose Einstein (BE) Statistics, Basic Idea about Black Body Radiation, Derivation of Plank's Law of Radiation, Deduction of Wien's Displacement Law and Stefan's Law from Plank's Law, Fermi Dirac (FD) Statistics, Comparison of MB, BE and FD Statistics.

SECTION-B

Wave Optics: Electromagnetic Nature of Light, Definition and Properties of Wavefront, Huygens Principle, Temporal and Spatial Coherence.

Interference: Interference: Division of Amplitude and Division of Wavefront, Lloyd's Mirror and Fresnel's Biprism, Interference in Thin Films, Fringes of Equal Inclination, Fringes of Equal Thickness, Newton's Rings: Measurement of Wavelength and Refractive Index, Michelson's Interferometer: Determination of Wavelength, Wavelength Difference and Refractive Index.

Diffraction: Fraunhoffer Diffraction: Double Slit & Multiple Slits, Diffraction Grating, Resolving Power of Diffraction Grating and Telescope, Fresnel Diffraction: Half-Period Zones, Zone Plate, Distinction Between Fresnel Diffraction and Fraunhoffer Diffraction.

Polarization: Plane Polarized Light-Production and Analysis, Circular and Elliptical Polarization, Malus Law, Nicol Prism, Double Refraction, Birefringence.

Reference Books:

1. Statistical Physics and Thermodynamics, V.S Bhatia (Shoban Lal Nagin Chand, Jalandhar)
2. Statistical Physics and Thermodynamics, A.K Sikri (Pardeep Pub.)
3. Statistical Mechanics: An Introductory Text, Bhattacharjee, J.K (Allied Pub. Delhi)
4. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill.
5. Principles of Optics, B.K.Mathur, 1995, Gopal Printing.
6. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication.
7. University Physics. FW Sears, MW Zemansky and HD Young 13/e, 1986. Addison-Wesley.

B.Sc–II (Non Medical)
(SEMESTER-III)
PAPER: PHYSICS LAB
CODE: BSNM-301(P)

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 18

List of Experiments:

1. Verify the laws of Probability distribution by throwing similar coins and dice.
2. To determine the value of Stefan's constant.
3. To study the Adiabatic expansion of a gas and hence to calculate the value of ϒ (the ratio between two specific heats of a gas).
4. To determine the coefficient of thermal conductivity of metal by using Searle's apparatus.
5. To determine the coefficient of thermal conductivity of a bad conductor by using Lee's method.
6. To find height of an inaccessible object using sextant.
7. To study the refractive index of simple prism.
8. To study the refractive index of doubly refracting prism.
9. To determine the minimum deviation of prism.
10. To determine the refractive index of liquid using spectrometer.
11. To determine the Cauchy's constants.
12. To determine the resolving power of telescope.
13. To determine the principal points of a lens system.
14. To determine the wavelength of sodium light by Newton's ring method.
15. To measure the light intensity of plane polarized light as a function of analyzer position and to verify Malus law.

B.Sc- II (Non Medical)
(SEMESTER-III)
PAPER: PHYSICS WORKSHOP SKILLS
CODE: BSEC(P)-304

Maximum Marks: 50 Time allowed: 3 Hours
Pass Marks: 35 % No. of Lectures: 30

Course Objective*: The emphasis of this course is to enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode.*

Course Outcomes*: On Completion of this course, student will be familiar with*

- *meter scale,*
- *Vernier calliper,*
- *Screw gauge,*
- *Manufacturing methods like cutting, welding, soldering and the lever mechanism.*

SECTION-A

Introduction: Measuring units, conversion to SI and CGS, Familiarization with meter scale, Vernier calliper, Screw gauge and their utility, Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc, Use of Sextant to measure height of buildings, mountains, etc.

Mechanical Skill: Concept of workshop practice, Overview of manufacturing methods: casting, foundry, machining, forming and welding, Types of welding joints and welding defects, Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood, Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines, Cutting tools, lubricating oils, Cutting of a metal sheet using blade. Smoothening of cutting edge of sheet using file, Drilling of holes of different diameter in metal sheet and wooden block, Use of bench vice and tools for fitting, Make funnel using metal sheet.

SECTION-B

Electrical and Electronic Skill: Use of Multimeter, Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB, Operation of oscilloscope, Making regulated power supply, Timer circuit, Electronic switch using transistor and relay.

Introduction to prime movers: Mechanism, gear system, wheel, Fixing of gears with motor axel, lever mechanism, lifting of heavy weight using lever, braking systems, pulleys, working principle of power generation systems, Demonstration of pulley experiment.

Reference Books:

1. A text book in Electrical Technology-BL Theraja–S. Chand and Company.
2. Performance and design of AC machines–M.G.Say, ELBSEdn.
3. Mechanical workshop practice, K. C. John, 2010, PHI Learning Pvt. Ltd.
4. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN:0750660732]
5. New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN:0861674480]

B.Sc-II (Non Medical)
(SEMESTER-IV)
PHYSICS: QUANTUM MECHANICS
CODE: BSNM-401

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objective: *The emphasis of course is to introduce the students to the need and development of quantum mechanics and normalization of quantum mechanics, Schrodinger equation in 1-D and 3-D as well as interaction with radiation using one and many electron atomic spectra concept.*

Course Outcomes: *On completion of this course, student will be able to*

- *Understand the basic knowledge about non relativistic quantum mechanics.*
- *Understand the time-dependent and time-independent Schrodinger wave equation for simple potentials and harmonic oscillator.*
- *Show an understanding of wave mechanics in one and three dimensions and describe the structure of the hydrogen atom and show an understanding of quantization of angular momentum Know about spin, angular momentum sates, angular momentum addition rules and identical particles.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instructions for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION–A

Wave Mechanics: Brief Introduction to Need and Development of Quantum Mechanics, Wave Particle Duality, de-Broglie Hypothesis, Wave Function of a Free Particle, Uncertainty Principle and its Applications, Gaussian Wave Packet, Ehrenfest's Theorem, Schrodinger Equation for a Free Particle.

Time Dependent Schrodinger Equation: Time Dependent Schrodinger Equation, Properties of Wave Function, Interpretation of Wave Function, Probability and Probability Current Densities, Conditions for Physical Acceptability of Wave Functions, Normalization and Orthogonality, Linearity and Superposition Principles, Eigen values and Eigen functions, Position, Momentum & Energy operators, Expectation Values of Position and Momentum.

Time Independent Schrodinger Equation: Hamiltonian, Stationary States and Energy Eigen values, Problems in One Dimension: Particle in one dimensional infinite potential well, The Step Potential, Rectangular Potential Well, Harmonic Oscillator.

SECTION-B

Problem in Three Dimensions: Schrodinger Equation in Spherical Coordinates, Separation of Schrodinger Equation for Spherically Symmetric Potential Energy, Spherical Harmonics, Hydrogen Atom: energy and wave functions, Degeneracy, Physical Interpretation of Quantum Numbers.

One Electron Atomic Spectra: Spectrum of Hydrogen Atom, Fine Structure and Electron Spin, Total Angular Momentum of Electron, Electron Magnetic Moment: Orbital Magnetic Moment and Spin Magnetic Moment, Stern Gerlach Experiment and Space Quantization, Spin Orbit Interaction, Fine Structure of Hydrogen, Frank and Hertz Experiment.

Many electron atoms: Identical Particles, Symmetric and Antisymmetric Wave Functions, Pauli's Exclusion Principle, Symmetry of Spin Functions, Spin-Orbit Coupling in Atoms-LS and JJ coupling Schemes, Spectral Notations for Atomic States, Terms of Equivalent and Non-equivalent Electrons, Energy Level Diagram and Spectrum of Helium atom, Alkali Metal Spectra, Fine Structure in Sodium Spectrum (Sodium D-lines), Zeeman Effect: Normal and Anomalous Zeeman Effect, Lande-g Factor.

Reference Books:

1. A Text book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, 2nd Ed., 2010, McGraw Hill.
2. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., 2002, Wiley.
3. Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGraw Hill.
4. Quantum Mechanics, G.Aruldhas, 2nd Edn. 2002, PHI Learning of India.

Additional Books for Reference:

1. Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.
2. Introduction to Quantum Mechanics, David J. Griffith, 2nd Ed. 2005, Pearson Education.
3. Quantum Mechanics, Walter Greiner, 4th Edn., 2001, Springer.

B.Sc-II (Non Medical)
(SEMESTER-IV)
PAPER: PHYSICS LAB
BSNM-401(P)

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 18

List of Experiments:

1. To find the angle of elevation of a tall building using Sextant.
2. To determine the ionization potential of mercury.
3. Study the variation of light intensity and to verify inverse square law using photovoltaic cell.
4. To determine Planck's constant using photocell.
5. To study the characteristics of Solar-Cell.
6. To determine mechanical equivalent of heat with Joule's Calorimeter.
7. To measure the rotation of the polarization plane through optically active liquids and determine the concentration of sugar solution by using advanced polarimeter.
8. To verify Bragg's Law experimentally and hence deduce wavelength of light used.
9. To determine the wavelength of a spectral lines of mercury using prism.
10. To determine the wavelength of a spectral lines of mercury using diffraction grating.
11. To determine the dispersive power of a given plane diffraction grating.
12. To determine the resolving power of a diffraction grating.
13. To determine the wavelength of sodium light using Fresnel Biprism.
14. To find the wavelength of light by using Michelson Interferometer.
15. To study the diffraction of light by single slit, double slit and multiple slits by using Diode Laser Diffraction experiment.

B.Sc- II (Non Medical)
(SEMESTER-IV)
PAPER: APPLIED OPTICS
CODE: BSEC(P)-404

Maximum Marks: 50 Time allowed: 3 Hours
Pass Marks: 35 % No. of Lectures: 30

Course Objective: *This course is designed to explain the basic underlying physical principles of optics, optical phenomena and optical equipment, to introduce and demonstrate a range of optical instruments and techniques including geometrical and physical optics.*

Course Outcomes*: On completion of this course, students will be able to*

- *understand the theory of laser action,*
- *light amplification,*
- *principle and application of Holography and fibre optics.*

Instructions: Theory includes only qualitative explanation. Minimum five experiments should be performed covering minimum three sections.

SECTION-A

(i) Sources andDetectors

Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients, Light amplification, Characterization of laser beam, He-Ne laser, Semiconductor lasers.

Experiments on Lasers:

a. Determination of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid state laser.
b. To find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid state laser.
c. To find the polarization angle of laser light using polarizer and analyser.
d. Thermal expansion of quartz using laser.

Experiments on Semiconductor Sources and Detectors:

a. V-I characteristics of LED
b. Study the characteristics of solid state laser
c. Study the characteristics of LDR
d. Photovoltaic Cell
e. Characteristics of IR sensor

(ii) Fourier Optics

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens

Experiments on Fourier Optics:

a. Fourier optic and image processing

1. Optical image addition/subtraction
2. Optical image differentiation
3. Fourier optical filtering
4. Construction of an optical 4f system

b. Fourier Transform Spectroscopy

Fourier Transform Spectroscopy (FTS) is a powerful method for measuring emission and absorption spectra, with wide application in atmospheric remote sensing, NMR spectrometry and forensic science.

Experiment:

To study the interference pattern from a Michelson interferometer as a function of mirror separation in the interferometer. The resulting interferogram is the Fourier transform of the power spectrum of the source. Analysis of experimental interferograms allows one to determine the transmission characteristics of several interference filters. Computer simulation can also be done.

SECTION-B

(iii) Holography

Basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram, application of holography in microscopy and character recognition.

Experiments on Holography and interferometry:

1. Recording and reconstructing holograms
2. Constructing a Michelson interferometer or a Fabry Perot interferometer
3. Measuring the refractive index of air
4. Constructing a Sagnac interferometer
5. Constructing a Mach-Zehnder Interferometer
6. White light Hologram

(iv) Photonics: Fibre Optics

Optical fibres and their properties, Principal of light propagation through a fibre, The numerical aperture, Attenuation in optical fibre and attenuation limit, Single mode and multimode fibres: Fibre Bragg Grating.

Experiments on Photonics: Fibre Optics

a. To measure the numerical aperture of an optical fibre.
b. To study the variation of the bending loss in a multimode fibre.
c. To determine the mode field diameter (MFD) of fundamental mode in a single-mode fibre by measurements of its far field Gaussian pattern.
d. To measure the near field intensity profile of a fibre and study its refractive index profile.
e. To determine the power loss at a splice between two multimode fibre.

Reference Books:

1. Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw Hill.
2. LASERS: Fundamentals & applications, K. Thyagrajan & A. K. Ghatak, 2010, Tata McGraw Hill.
3. Fibre optics through experiments, M. R. Shenoy, S. K. Khijwania, et. al. 2009,Viva Books.
4. Non-linear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.
5. Optics, Karl Dieter Moller, Learning by computing with model examples, 2007, Springer.
6. Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt. Ltd.
7. Optoelectronic Devices and Systems, S. C. Gupta, 2005, PHI Learning Pvt. Ltd.
8. Optical Physics, A. Lipson, S. G. Lipson, H. Lipson, 4th Edn., 1996, Cambridge Univ. Press.

Skill Enhancement Course (any four) (Credit: 02 each) - SEC 1 to SEC 4

1. Physics Workshop Skills
2. Computational Physics Skills
3. Electrical circuits and Network Skills
4. Basic Instrumentation Skills
5. Renewable Energy and Energy Harvesting
6. Technical Drawing
7. Radiation Safety
8. Applied Optics
9. Weather Forecasting
10. Basics of Electrical Gadgets

PHYSICS WORKSHOP SKILLS

Total Credits: 02
Total Lectures: 30

Course Objective*: The emphasis of this course is to enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode.*

Course Outcomes*: On Completion of this course, student will be familiar with meter scale, Vernier calliper, Screw gauge, manufacturing methods like cutting, welding, soldering and the lever mechanism.*

SECTION-A

Introduction: Measuring units, conversion to SI and CGS, Familiarization with meter scale, Vernier calliper, Screw gauge and their utility, Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc, Use of Sextant to measure height of buildings, mountains, etc.

Mechanical Skill: Concept of workshop practice, Overview of manufacturing methods: casting, foundry, machining, forming and welding, Types of welding joints and welding defects, Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood, Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines, Cutting tools, lubricating oils, Cutting of a metal sheet using blade. Smoothening of cutting edge of sheet using file, Drilling of holes of different diameter in metal sheet and wooden block, Use of bench vice and tools for fitting, Make funnel using metal sheet.

SECTION-B

Electrical and Electronic Skill: Use of Multimeter, Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB, Operation of oscilloscope, Making regulated power supply, Timer circuit, Electronic switch using transistor and relay.

Introduction to prime movers: Mechanism, gear system, wheel, Fixing of gears with motor axel, lever mechanism, lifting of heavy weight using lever,

braking systems, pulleys, working principle of power generation systems, Demonstration of pulley experiment.

Reference Books:

1. A text book in Electrical Technology - B L Theraja – S. Chand and Company.
2. Performance and design of AC machines – M.G. Say, ELBS Edn.
3. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
4. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
5. New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

COMPUTATIONAL PHYSICS SKILLS

Total Credits: 02

Total Lectures: 30

Course Objective: *The objective of this course is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics.*

Course Outcomes: *On completion of this course, student will be able to understand the importance of computers in physics, concept of flowchart, algorithms and some fundamental Linux commands, basic elements of FORTRAN, types of logic statements, graphical analysis and its limitations.*

SECTION-A

Introduction: Importance of computers in Physics, paradigm for solving physics problems for solution**,** Usage of linux as an Editor.

Algorithms and Flowcharts: Algorithm: Definition, properties and development. Flowchart: Concept of flowchart, symbols, guidelines, types. Examples: Cartesian to Spherical Polar Coordinates, Roots of Quadratic Equation, Sum of two matrices, Sum and Product of a finite series, calculation of sin (x) as a series, algorithm for plotting (1) lissajous figures and (2) trajectory of a projectile thrown at an angle with the horizontal.

Scientific Programming: Some fundamental Linux Commands (Internal and External commands). Development of FORTRAN, Basic elements of FORTRAN: Character Set, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program. Operators: Arithmetic, Relational, Logical and Assignment Operators. Expressions: Arithmetic, Relational, Logical, Character and Assignment Expressions. Fortran Statements: I/O Statements (unformatted/formatted), Executable and Non-Executable Statements, Layout of Fortran Program, Format of writing Program and concept of coding, Initialization and Replacement Logic, Examples from physics problems.

Control Statements: Types of Logic (Sequential, Selection, Repetition), Branching Statements (Logical IF, Arithmetic IF, Block IF, Nested Block IF, SELECT CASE and ELSE IF Ladder statements), Looping Statements (DO-CONTINUE, DO-END DO, DO-WHILE, Implied and Nested DO Loops),

Jumping Statements (Unconditional GOTO, Computed GOTO, Assigned GOTO) Subscripted Variables (Arrays: Types of Arrays, DIMENSION Statement, Reading and Writing Arrays), Functions and Subroutines (Arithmetic Statement Function, Function Subprogram and Subroutine), RETURN, CALL, COMMON and EQUIVALENCE Statements), Structure, Disk I/O Statements, open a file, writing in a file, reading from a file, Examples from physics problems.

Programming:

1. Exercises on syntax on usage of FORTRAN
2. Usage of GUI Windows, Linux Commands, familiarity with DOS commands and working in an editor to write sources codes in FORTRAN.
3. To print out all natural even/ odd numbers between given limits.
4. To find maximum, minimum and range of a given set of numbers.
5. Calculating Euler number using exp(x) series evaluated at x=1

SECTION-B

Scientific word processing: Introduction to Latex: TeX/Latex word processor, preparing a basic LaTeX file, Document classes, Preparing an input file for LaTeX, Compiling LaTeX File, LaTeX tags for creating different environments, Defining LaTeX commands and environments, Changing the type style, Symbols from other languages, Equation representation: Formulae and equations, Figures and other floating bodies, Lining in columns- Tabbing and tabular environment, Generating table of contents, bibliography and citation, Making an index and glossary, List making environments, Fonts, Picture environment and colors, errors.

Visualization: Introduction to graphical analysis and its limitations. Introduction to Gnuplot, importance of visualization of computational and computational data, basic Gnuplot commands: simple plots, plotting data from a file, saving and exporting, multiple data sets per file, physics with Gnuplot (equations, building functions, user defined variables and functions), Understanding data with Gnuplot.

Hands on exercises:

1. To compile a frequency distribution and evaluate mean, standard deviation etc.
2. To evaluate sum of finite series and the area under a curve.
3. To find the product of two matrices
4. To find a set of prime numbers and Fibonacci series.
5. To write program to open a file and generate data for plotting using Gnuplot.
6. Plotting trajectory of a projectile projected horizontally.
7. Plotting trajectory of a projectile projected making an angle with the horizontally.
8. Creating an input Gnuplot file for plotting a data and saving the output for seeing on the screen. Saving it as an eps file and as a pdf file.
9. To find the roots of a quadratic equation.
10. Motion of a projectile using simulation and plot the output for visualization.
11. Numerical solution of equation of motion of simple harmonic oscillator and plot the outputs for visualization.
12. Motion of particle in a central force field and plot the output for visualization.

Reference Books:

1. Introduction to Numerical Analysis, S.S. Sastry, 5^{th} Edn., 2012, PHI Learning Pvt. Ltd.
2. Computer Programming in Fortran 77". V. Rajaraman (Publisher:PHI).
3. LaTeX–A Document Preparation System", Leslie Lamport (Second Edition, Addison-Wesley, 1994).
4. Gnuplot in action: understanding data with graphs, Philip K Janert, (Manning 2010)
5. Schaum's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co.
6. Computational Physics: An Introduction, R. C. Verma, et al. New Age International Publishers, New Delhi(1999)
7. A first course in Numerical Methods, U.M. Ascher and C. Greif, 2012, PHI Learning
8. Elementary Numerical Analysis, K.E. Atkinson, 3^{rd} Edn., 2007, Wiley India Edition.

ELECTRICAL CIRCUITS AND NETWORK SKILLS

Total Credits: 02

Total Lectures: 30

Course Objective: *The objective of this course is to enable the students to design and troubleshoots the electrical circuits, networks and appliances through hands-on mode.*

Course Outcomes: *On completion of this course, student will be familiar with basic electrical equipments and understand electric circuit elements and their symbols. Students will be able to take readings from electrical circuits and understand the working of generators and transformers.*

SECTION-A

Basic Electricity Principles: Voltage, Current, Resistance, and Power, Ohm's law, Series, parallel, and series-parallel combinations, AC Electricity and DC Electricity, Familiarization with multimeter, voltmeter and ammeter.

Understanding Electrical Circuits: Main electric circuit elements and their combination, Rules to analyze DC sourced electrical circuits, Current and voltage drop across the DC circuit elements, Single-phase and three-phase alternating current sources, Rules to analyze AC sourced electrical circuits, Real, imaginary and complex power components of AC source, Power factor, Saving energy and money.

Electrical Drawing and Symbols: Drawing symbols, Blueprints, Reading Schematics, Ladder diagrams, Electrical Schematics, Power circuits, Control circuits, Reading of circuit schematics, tracking the connections of elements and identify current flow and voltage drop.

Generators and Transformers: DC Power sources, AC/DC generators, Inductance, capacitance, and impedance, Operation of transformers.

SECTION-B

Electric Motors: Single-phase, three-phase & DC motors, Basic design, Interfacing DC or AC sources to control heaters & motors, Speed & power of ac motor.

Solid-State Devices: Resistors, inductors and capacitors, Diode and rectifiers,

Components in Series or in shunt, Response of inductors and capacitors with DC or AC sources.

Electrical Protection: Relays, Fuses and disconnect switches, Circuit breakers, Overload devices, Ground-fault protection, Grounding and isolating, Phase reversal, Surge protection, Interfacing DC or AC sources to control elements (relay protection device).

Electrical Wiring: Different types of conductors and cables, Basics of wiring-Star and delta connection, Voltage drop and losses across cables and conductors, Instruments to measure current, voltage, power in DC and AC circuits, Insulation, Solid and stranded cable, Conduit, Cable trays, Splices: wirenuts, crimps, terminal blocks, split bolts, and solder, Preparation of extension board.

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand & Co.
2. A text book of Electrical Technology - A K Theraja
3. Performance and design of AC machines - M G Say ELBS Edn.

BASIC INSTRUMENTATION SKILLS

Total Credits: 02
Total Lectures: 30

Course Objective: *This course is to get exposure with various aspects of instruments and their usage through hands-on mode. Experiments mentioned in the course are to be done in continuation of the topics.*

Course Outcomes: *On completion of this course, student will be able to explain*

- *the Basics of measurement and types of errors,*
- *specifications and significance of a multimeter and voltmeter,*
- *types of millivoltmeters and their significance,*
- *features of CRO and CRT, working of Signal generators*

SECTION-A

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc., Errors in measurements and loading effects, Types of errors.

Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance, Colour coding for resistors, Specifications of a multimeter and their significance.

Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity, Specifications of an electronic Voltmeter/ Multimeter and their significance.

AC millivoltmeter: Type of AC millivoltmeters: specifications and their significance.

Digital Instruments: Principle and working of digital Voltmeters, Comparison of analog & digital instruments.

Digital Multimeter: Working of a digital multimeter, accuracy and resolution, Difference between digital and analog multimeters.

SECTION-B

Cathode Ray Oscilloscope: Block diagram of basic CRO, Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, Time base operation, Specifications of a CRO and their significance, Use of CRO for the measurement of voltage (dc and ac frequency, time period, Special features of

dual trace, introduction to digital oscilloscope, probes)

Signal Generators: Explanation and specifications of low frequency signal generators.

The test of lab skills will be of the following test items:

1. Use of an oscilloscope.
2. CRO as a versatile measuring device and to study the working of CRO.
3. Use of Digital multimeter/VTVM for measuring voltages
4. Winding a coil / transformer.

Laboratory Exercises:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. Measurement of voltage, frequency, time period and phase angle using CRO.
4. Measurement of rise, fall and delay times using a CRO.
5. Measurement of R, L and C using a LCR bridge/universal bridge
6. To study the 4 bit digital to analog convertor.
7. To study the diode as a clipper.
8. To trace different wave shapes using CRO.
9. Find the value of resistance using colour codes and verify using multimeter.
10. To learn the working of Dual trace oscilloscope.

Open Ended Experiments:

1. Using a Dual Trace Oscilloscope
2. Converting the range of a given measuring instrument (voltmeter, ammeter)

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Performance and design of AC machines - M G Say ELBS Edn.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Logic circuit design, Shimon P. Vingron, 2012, Springer.
5. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.

6. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
7. Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, Springer
8. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

RENEWABLE ENERGY AND ENERGY HARVESTING

Total Credits: 02
Total Lectures: 30

Course Objective: *The objective of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible.*

Course Outcomes: *On completion of this course, student will be able to understand*

- *the concept of fossil fuels,*
- *sources of energy, solar energy, solar cell, photovoltaic cell,*
- *wind energy, ocean energy, hydroenergy, piezoelectric energy harvesting, electromagnetic energy harvesting etc.*

SECTION-A

Fossil fuels and Alternate Sources of energy: Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources, An overview of development in Solar energy, Offshore Wind Energy, Tidal Energy, Hydroelectricity, Energy Harvesting.

Solar energy: Solar energy, its importance, storage of solar energy, applications solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar cell, Need and characteristics of photovoltaic (PV) systems, Idea about different type of Solar Cells, Solar-to-Electrical-based Energy harvesting.

SECTION-B

Wind Energy harvesting: Fundamentals of Wind energy, wind power, Basic idea about wind energy harvesting and storage.

Ocean Energy: Ocean Energy, Wave Energy Devices, Tide Energy forms, Ocean Thermal Energy.

Hydro Energy: Hydro power resources, basics of hydropower technologies, environmental impact of hydropower resources.

Piezoelectric Energy harvesting: Introduction, Principal of operation, Physics of piezoelectric effect materials, Sources of energy from human activity.

Electromagnetic Energy Harvesting: Linear generators, recent applications, Carbon captured technologies and storage, Socio-economic Assessment:

Environmental issues and Renewable sources of energy, Energy efficiency and sustainability.

Demonstrations and Experiments

1. Demonstration of Training modules on Solar energy, wind energy, etc.
2. Conversion of vibration to voltage using piezoelectric materials
3. Conversion of thermal energy into voltage using thermoelectric modules.

Experiments:

1. Study of solar cell and characteristics
2. To study current vs voltage characterstics of CdS Photoresistor at constant irradiance.
3. To measure the photocurrent as a function of irradiance at a constant voltage.
4. To determine the Planck's constatnt.
5. To study the inverse square law using photocell.

Reference Books:

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
5. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).

TECHNICAL DRAWING

Total Credits: 02
Total Lectures: 30

Course Objective: *The objective of this course to increase the ability of students to perform basic sketching techniques, draw orthographic projections and sections and become familiar with auto CAD two dimensional drawings.*

Course Outcomes: *On completion of this course, students will be able to understand drafting instruments, lettering, curves, cycloids, 2D and 3D geometrical construction, surfaces of right and oblique solids, orthographic projection, CAD drawing, basic printing and many more.*

SECTION-A

Introduction: Drafting Instruments and their uses, lettering: construction and uses of various scales: dimensioning as per I.S.I. 696-1972, Engineering Curves: Parabola: hyperbola: ellipse: cycloids, involute: spiral: helix and loci of points of simple moving mechanism, 2D geometrical construction, Representation of 3D objects, Principles of projections.

Projections: Straight lines, planes and solids, Development of surfaces of right and oblique solids, Section of solids.

Object Projections: Orthographic projection, Interpenetration and intersection of solids, Isometric and oblique parallel projection of solids.

SECTION-B

CAD Drawing: Introduction to CAD and Auto CAD, precision drawing and drawing aids, Geometric shapes, Demonstrating CAD- specific skills (graphical user interface, Create, retrieve, edit, and use symbol libraries, Use inquiry commands to extract drawing data), Control entity properties, Demonstrating basic skills to produce 2- D and 3-Ddrawings. 3D modeling with Auto CAD (surfaces and solids), 3D modeling with sketch up, annotating in Auto CAD with text and hatching, layers, templates & design center, advanced plotting (layouts, viewports), office standards, dimensioning, internet and collaboration, Blocks, Drafting symbols, attributes, extracting data, basic printing, editing tools, Plot/Print drawing to appropriate scale.

Reference Books:

1. K. Venugopal, and V. Raja Prabhu. Engineering Graphic, New Age International
2. AutoCAD 2014 & AutoCAD 2014/Donnie Gladfelter/Sybex/ISBN:978-1-118-57510-9
3. Architectural Design with Sketch up/Alexander Schreyer/John Wiley & Sons/ISBN: 978-1-118-12309-6

RADIATION SAFETY

Total Credits: 02
Total Lectures: 30

Course Objective: *The objective of this course is to aware students regarding radiation hazards and radiation safety. The laboratory skills and experiments listed below the course are to be done in continuation of the topics.*

Course Outcomes: *On completion of this course, student will be able to understand*

- *the atomic structure, X-rays, Bremstrahlung,*
- *interaction of radiations, photons, neutrons and charged particles with matter,*
- *basic knowledge about radiation detectors, dosimeters .*
- *radiation safety methods.*

SECTION-A

Basics of Atomic and Nuclear Physics: Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron, The composition of nucleus and its properties, mass number, isotopes of element, binding energy, stable and unstable isotopes.

Interaction of Radiation with matter: Types of Radiation: non-ionizing Radiation. Ionizing Radiations: Alpha, Beta, Gamma and Neutron and their sources, Radioactive sources and consumer products.

Interaction of Photons: Photo electric effect, Compton Scattering, Pair Production.

Interaction of Charged Particles: Heavy charged particles -Beth-Bloch Formula, Mass Stopping Power, Range, Straggling, Beta Particles- Collision and Radiation loss (Bremsstrahlung).

Radiation detection and monitoring devices: Radiation Quantities and Units, Basic idea of different units of activity, Radiation units - exposure - absorbed dose – units: rad, gray, KERMA (Kinetic Energy Released in Matter), Air KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Concentration (DAC).

Radiation detection: Basic concept and working principle of gas detectors (Ionization Chamber and Geiger Muller Counter), Basic concept and working principle of Scintillation Detectors **(**Inorganic and Organic Scintillators), dosimetry.

SECTION-B

Radiation safety management: Biological effects of ionizing radiation, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection (ICRP) principles, introduction of safety and risk management of radiation and General radiation safety (ALARA), Radiation postings, nuclear waste and disposal management, Brief idea about Accelerator driven Sub-critical system (ADS) for waste management.

Application of nuclear techniques: Brief idea about Application in medical science (e.g., MRI, PET Gamma Camera, radiation therapy), Archaeology.

Experiments:

1. Study the background radiation levels using Radiation meter

Characteristics of Geiger Muller (GM) Counter:

1. To study the intensity of radiations using dosimeter.
2. Study of characteristics of GM tube and determination of operating voltage and plateau length using background radiation as source (without commercial source).
3. Study of counting statistics and standard deviation using background radiation using GM counter.
4. Study of radiation in various materials (e.g. K_2SO_4 etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.
5. Study of absorption of beta particles in Aluminum using GM counter.
6. Detection of α-particles using reference source & determining its half-life using spark counter.
7. Gamma spectrum of Gas Light mantle (Source of Thorium).
8. To find the dead time of GM counter.

Reference Books:

1. W.E. Burcham and M. Jobes – Nuclear and Particle Physics – Longman (1995)
2. G.F.Knoll, Radiation detection and measurements

3. Thermoluninescense Dosimetry, Mcknlay, A.F., Bristol, Adam Hilger (Medical Physics Handbook 5)
4. W.J. Meredith and J.B. Massey, "Fundamental Physics of Radiology". John Wright and Sons, UK, 1989.
5. J.R. Greening, "Fundamentals of Radiation Dosimetry", Medical Physics Hand Book Series, No.6, Adam Hilger Ltd., Bristol 1981.
6. Practical Applications of Radioactivity and Nuclear Radiations, G.C. Lowental and P.L. Airey, Cambridge University Press, U.K., 2001
7. A. Martin and S.A. Harbisor, An Introduction to Radiation Protection, John Willey & Sons, Inc. New York, 1981.
8. NCRP, ICRP, ICRU, IAEA, AERB Publications.
9. W.R. Hendee, "Medical Radiation Physics", Year Book – Medical Publishers Inc. London, 1981
10. Sustainability 2021,13 12643. https://doi.org/10.3390/su132212643

APPLIED OPTICS

Total Credits: 02
Total Lectures: 30

Course Objective: *This course is designed to explain the basic underlying physical principles of optics, optical phenomena and optical equipment, to introduce and demonstrate a range of optical instruments and techniques including geometrical and physical optics.*

Course Outcomes*: On completion of this course, students will be able to understand the theory of laser action, light amplification, principle and application of Holography and fibre optics.*

Instructions: Theory includes only qualitative explanation. Minimum five experiments should be performed covering minimum three sections.

SECTION-A

(i) Sources and Detectors Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients, Light amplification, Characterization of laser beam, He-Ne laser, Semiconductor lasers.
Experiments on Lasers: a. Determination of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid state laser. b. To find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid state laser. c. To find the polarization angle of laser light using polarizer and analyzer d. Thermal expansion of quartz using laser **Experiments on Semiconductor Sources and Detectors:** a. V-I characteristics of LED b. Study the characteristics of solid state laser c. Study the characteristics of LDR d. Photovoltaic Cell e. Characteristics of IR sensor

(ii) Fourier Optics

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens

Experiments on Fourier Optics:

a. Fourier optic and image processing

1. Optical image addition/subtraction
2. Optical image differentiation
3. Fourier optical filtering
4. Construction of an optical 4f system

b. Fourier Transform Spectroscopy

Fourier Transform Spectroscopy (FTS) is a powerful method for measuring emission and absorption spectra, with wide application in atmospheric remote sensing, NMR spectrometry and forensic science.

Experiment:

To study the interference pattern from a Michelson interferometer as a function of mirror separation in the interferometer. The resulting interferogram is the Fourier transform of the power spectrum of the source. Analysis of experimental interferograms allows one to determine the transmission characteristics of several interference filters. Computer simulation can also be done.

SECTION-B

(iii) Holography

Basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram, application of holography in microscopy and character recognition

Experiments on Holography and interferometry:

1. Recording and reconstructing holograms
2. Constructing a Michelson interferometer or a Fabry Perot interferometer
3. Measuring the refractive index of air
4. Constructing a Sagnac interferometer
5. Constructing a Mach-Zehnder interferometer
6. White light Hologram

(iv) Photonics: Fibre Optics

Optical fibres and their properties, Principal of light propagation through a fibre, The numerical aperture, Attenuation in optical fibre and attenuation limit, Single mode and multimode fibres: Fibre Bragg Grating

Experiments on Photonics: Fibre Optics

a. To measure the numerical aperture of an optical fibre
b. To study the variation of the bending loss in a multimode fibre
c. To determine the mode field diameter (MFD) of fundamental mode in a single-mode fibre by measurements of its far field Gaussian pattern
d. To measure the near field intensity profile of a fibre and study its refractive index profile
e. To determine the power loss at a splice between two multimode fibre

Reference Books:

1. Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill.
2. LASERS: Fundamentals & applications, K.Thyagrajan & A.K.Ghatak, 2010, Tata McGraw Hill
3. Fibre optics through experiments,M.R.Shenoy, S.K.Khijwania, et.al. 2009, Viva Books
4. Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.
5. Optics, Karl Dieter Moller, Learning by computing with model examples, 2007, Springer.
6. Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt. Ltd.
7. Optoelectronic Devices and Systems, S.C. Gupta, 2005, PHI Learning Pvt. Ltd.
8. Optical Physics, A.Lipson, S.G.Lipson, H.Lipson, 4^{th} Edn., 1996, Cambridge Univ. Press.

WEATHER FORECASTING

Total Credits: 02
Total Lectures: 30

Course Objective: *The objective of this course is not just to impart theoretical knowledge to the students but to enable them to develop an awareness and understanding regarding the causes and effects of different weather phenomenon and basic forecasting techniques.*

Course Outcomes: *On completion of this course, students will be able to understand the structure, composition, layering and characteristics of atmosphere, wind speed direction, absorption, emission, and scattering in atmosphere, global wind systems, thunderstorms, cyclones, cause of climate change, global warming, weather forecasting etc.*

SECTION-A

Introduction to atmosphere: Elementary idea of atmosphere: physical structure and composition; compositional layering of the atmosphere; variation of pressure and temperature with height; air temperature; requirements to measure air temperature; temperature sensors: types; atmospheric pressure: its measurement; cyclones and anticyclones: its characteristics.

Measuring the weather: Wind; forces acting to produce wind; wind speed direction: units, its direction; measuring wind speed and direction; humidity, clouds and rainfall, radiation: absorption, emission and scattering in atmosphere; radiation laws.

SECTION-B

Weather systems: Global wind systems; air masses and fronts: classifications; jet streams; local thunderstorms; tropical cyclones: classification; tornadoes; hurricanes.

Climate and Climate Change: Climate: its classification; causes of climate change; global warming and its outcomes; air pollution; aerosols, ozone depletion, acid rain, environmental issues related to climate.

Basics of weather forecasting: Weather forecasting: analysis and its historical background; need of measuring weather; types of weather forecasting; weather forecasting methods; criteria of choosing weather station; basics of choosing site and exposure; satellites observations in weather forecasting; weather maps; uncertainty and predictability; probability forecasts.

Demonstrations and experiments:

1. Study of synoptic charts & weather reports, working principle of weather station.
2. Processing and analysis of weather data:
   (a) To calculate the sunniest time of the year.
   (b) To study the variation of rainfall amount and intensity by wind direction.
   (c) To observe the sunniest/driest day of the week.
   (d) To examine the maximum and minimum temperature throughout the year.
   (e) To evaluate the relative humidity of the day.
   (f) To examine the rainfall amount month wise.
3. Exercises in chart reading: Plotting of constant pressure charts, surfaces charts, upper wind charts and its analysis.
4. Formats and elements in different types of weather forecasts/ warning (both aviation and non aviation)

Reference books:

1. Aviation Meteorology, I.C. Joshi, 3rd edition 2014, Himalayan Books
2. The weather Observers Hand book, Stephen Burt, 2012, Cambridge University Press.
3. Meteorology, S.R. Ghadekar, 2001, Agromet Publishers, Nagpur.
4. Text Book of Agrometeorology, S.R. Ghadekar, 2005, Agromet Publishers, Nagpur.
5. Why the weather, Charls Franklin Brooks, 1924, Chpraman & Hall, London.
6. Atmosphere and Ocean, John G. Harvey, 1995, The Artemis Press.

BASICS OF ELECTRICAL GADGETS

Total Credits: 02

Total Lectures:30

Course Objective: *The objective of this course is to enable the students to design and troubleshoots the electrical circuits, networks and appliances through hands-on mode.*

Course Outcomes: *On completion of this course, student will be to*

- *familiar with basic electrical equipment*
- *understand electric circuit elements and their symbols.*
- *Students will be able to take readings from electrical circuits and understand the working of generators and transformers.*

SECTION-A

Basic Electricity Principles: Voltage, Current, Resistance, and Power, Ohm's law, Series, parallel, and series-parallel combinations, Voltmeter and Ammeter, energy meter and its installation, Reading of an energy meter, checking the energy meter paying for electricity, Use of Test Pen/Voltage Tester while installing electric equipment, Fuse implementation.

Vande de Graff Generator: Electrostatic Charges, lightning, Ions in Motion (Volta's Hail Strom), Potential Difference, Corona Discharge, Principle, Construction and working of Vande de Graff Generator.

SECTION-B

Ring Launcher: Electromagnetic induction, brief introduction to solenoid, experimental set-up, principle and working of ring launcher kit. Parameters effecting ring launching.

Components of electronic gadgets Photostat machine, printer, bar code:

Bar Code: Sensor, iIlumination system (reflection), Decoder, Use of bar code Reader, Pen-type Reader, Photodiode.

Photostat machine: Photoreceptor drum, Toner, Corona wires, Light source and lenses, Process of working (charge, expose, develop, transfer, Fuse, Clean).

Printer: Memory Card, USB connector Port, Cartridge, LCD panel, Control Panel.

Titles of experiments

1. To study energy-meter.
2. To learn utility of Test Pen/Voltage Tester while installing electric equipment.
3. To study implementation and use of fuse in circuit.
4. To study the Corona discharge in Vande Graff Generator kit.
5. To study conduction of electricity and electrostatic charges.

6. To study attraction and repulsion between the charged body.
7. To study ions in motion and electrostatic wind.
8. To demonstrate ring launcher experiment.
9. Demonstration of the internal components of electronic gadgets.
10. To study characteristics of Photodiode.

Reference Books:

1. A textbook in Electrical Technology-B L Theraja-S Chand & Co.
2. A textbook of Electrical Technology-A K Theraja

SYLLABUS

Session 2023-24

B.Sc.-III (Non-Medical)
Program Code: BSNM

UNDERGRADUATE PROGRAMME
Choice Based Credit System (**CBCS**)

FACULTY OF SCIENCES

MATA GUJRI COLLEGE

FATEHGARH SAHIB
(An Autonomous College)
Affiliated to Punjabi University Patiala

B.Sc. – III (Non- Medical)

SEMESTER-V

Course	Course Code	Course Name	L T P (Credits)	No. of Lectures	Max . Marks (External+ Internal)
DSE-I	**BDSE(P)-501(i)/ BDSE(P)-501(ii)/ BDSE(P)-501(iii)**	**Digital-Analog Circuits and Condensed Matter Physics Or Solid State Physics and Electronics Devices Or Basics of Solid State Electronic Devices**	4 0 0 (4)	60	100(75+25)
DSE-I Practical	**BDSE(P)-501P(i)/ BDSE(P)-501P(ii)/ BDSE(P)-501P(iii)**	**Digital-Analog Circuits and Condensed Matter Physics Lab Or Solid State Physics and Electronics Devices Lab Or Basics of Solid State Electronic Devices Lab**	0 0 2 (2)	60	50
SEC III	**BSEC(P)-504**	**BSEC(P)-504 Physics: Skill Enhancement Course-III Basic Instrumentation Skills**	0 0 2 (2)	30	50
			Total Credits:08		**Total Marks:200**

B.Sc. III (Non-Medical) SEMESTER-VI Pass Percentage 35%					
Course	**Course Code**	**Course Name**	**L T P (Credits)**	**No. of Lectures**	**Max . Marks (External+Internal)**
DSE-IV	**BDSE(P)-601 (i) Or BDSE(P)-601(ii) Or BDSE(P)-601(iii)**	**Nuclear & Particle Physics Or Nuclear Radiation Physics Or LASERs and Applications**	4 0 0 (4)	60	100 (75+25)
DSE-IV Practical	**BDSE(P)-601(P)(i) Lab Or BDSE(P)-601P(ii)Lab Or BDSE(P)-601P(iii)Lab**	**Nuclear & Particle Physics Lab Or Nuclear Radiation Physics Lab Or LASERs and Applications Lab**	0 0 2 (2)	60	50
SEC-IV	**BSEC(P)-604**	**BSEC(P) 604 Physics: Skill Enhancement Course-IV Radiation Safety**	0 0 2 (2)	30	50
			Total Credits:08		**Total Marks:200**

OUTCOMES

B.Sc- III (Non- Medical)
SEMESTER V

S. No.	Subject	Outcomes
1.	**(i) Digital-Analog Circuits and Condensed Matter PhysicsBDSE(P)-501(i)** **OR**	*On completion of this course , student will be able to* • *Understand the fundamental concepts and techniques used in digital electronics.* • *Understand the biasing of transistors and design of simple amplifier circuits.* • *Understand the current voltage characteristics of semiconductor devices.* • *Have a basic knowledge of crystal systems and spatial symmetries and understand the concept of reciprocal lattices. Know the principles of structure determination by Bragg's diffraction.* • *Know the significance of Brillouin zones, Know the concept of phonons.*
	(ii) Solid State Physics and Electronics Devices BDSE(P)-501(ii) **OR**	*On completion of this course , student will be able to* • *Have a basic knowledge of crystal systems, spatial symmetries and reciprocal lattices and Know the principles of structure determination by Bragg's diffraction.* • *Understand the phenomenon of superconductivity.* • *Understand the biasing of transistors, design of simple amplifier circuits and current voltage characteristics of semiconductor devices.* • *Analyze the different oscillator circuits to determine the frequency of oscillation*.
	(iii) Basics of Solid State Electronic Devices BDSE(P)-501(ii)	*On completion of this course , student will be able to* . • *Understand the biasing of diode, transistors and design of simple amplifier circuits and understand the current voltage characteristics of semiconductor devices.* • *Have a basic knowledge of crystal systems and spatial symmetries.* • *Understand the concept of reciprocal lattices. Know the principles of structure determination by Bragg's diffraction.* • *Have a basic knowledge of operational amplifier and its applications.*

OUTCOMES
B.Sc. – III (Non- Medical)
SEMESTER-VI

S. No.	Subject	Outcomes
1	**(i) Nuclear & Particle Physics BDSE(P)-601(i)**	*On completion of this course , student will be able to* • *Understand the fundamental aspects of the structure of the nucleus andintrinsic properties of the atomic nucleus.* • *Explain the interaction of radiation with matter.* • *Understand the concepts of radioactive decay, nuclear reactions.* • *Describe the working of radiation detectors and accelerators.* • *Understand the classification and properties of elementary particles.* • *Understand that quarks and antiquarks combine to form baryons, antibaryons and mesons.*
	OR	
	(ii) Nuclear Radiation Physics BDSE(P)-601(ii)	*On completion of this course , student will be able to* • *Understand the fundamental aspects of the structure of the nucleus and intrinsic properties of the atomic nucleus.* • *Explain the interaction of radiation, charged particles and neutron swith matter.* • *Understand the concepts of radioactive decay, laws of radioactive decay and successive disintegration and Understand the types of nuclear reactions, kinematics of nuclear reaction and physical significance of Q-value of a nuclear reaction.* • *Describe the working of radiation detectors and accelerators.*
	OR	
	(iii) LASERs and applications BDSE(P)-601(iii)	*On completion of this course , student will be able to* • *Understand the concepts of lasers and properties of Laser.* • *Explain the construction and working of three level and four level laser.* • *Describe the types of Lasers such as Ruby Laser, Nd: YAG Laser, He-Ne Laser, CO_2 Laser, Excimer Laser, Dye Lasers, and Semiconductor Lasers.* • *Understand the application of lasers inIndustry as Laser Drilling, Laser Welding and Cutting.*

B.Sc-III(Non- Medical)
(SEMESTER-V)
PHYSICS DSE: DIGITAL-ANALOG CIRCUITS AND CONDENSED MATTER PHYSICS
CODE: BDSE(P)-501 (i)

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objective: *The objective of the course is to expose the students to the topics like binary numbers and digital circuits, lattice vibrations, energy band theory so that they are equipped with the techniques used in investigating these aspects of the matter in condensed phase.*

Course Outcomes: *On completion of this course, student will be able to understand*

- *the fundamental concepts and techniques used in digital electronics,*
- *biasing of transistors and design of simple amplifier circuits,*
- *crystal systems and spatial symmetries, Bragg's diffraction, concept of reciprocal lattices*
- *significance of Brillouin zones.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Digital Circuits: Binary Numbers. Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates, NAND and NOR Gates as Universal Gates, XOR and NOR Gates, De Morgan's Theorems, Boolean Laws, Simplification of Logic Circuit using Boolean Algebra, Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products and Product of Sums Method and (2) Karnaugh Map, Binary Addition, Binary Subtraction using 2's Complement Method), Half &Full Adders and Subtractors, 4-bit binary Adder/Subtractor.

Semiconductor Devices and Amplifiers: Semiconductor Diodes: p and n type semiconductors, Barrier Formation in PN Junction Diode, Biasing of diode, V-I characteristics, Zener Diode and Voltage Regulation, Tunnel diode, LED, Half-wave Rectifiers, Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, Qualitative Analysis of Filter Circuit (RL, LC and π filter).

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations, Active, Cut-off and Saturation Regions, Current gains α and β, Relations between α and β, DC Load line and Q-point, Amplifying action of CE and CB configurations, h-parameter Equivalent Circuit, Analysis of CE amplifier using Hybrid Model, Input and Output Impedance, Current, Voltage and Power Gains.

Unipolar Junction Transistors: Structure and Operation of Junction Field Effect Transistor, Output and Transfer Characteristics, Metal Oxide Semiconductor Field Effect Transistor (MOSFET), Enhancement and Depletion MOSFET.

SECTION-B

Crystal Structure and Crystal Diffraction: Solids: Amorphous and Crystalline Materials, Crystal Structure, Basic Primitive Cell, Symmetry Operations for Two Dimensional Crystals, Two Dimensional and Three Dimensional Bravais Lattice, Crystal Planes and Miller Indices, Diffraction of X-rays by Crystals, Bragg's Law, Reciprocal Lattices (brief), Brillouin zones, Atomic scattering factor.

Lattice Vibrations: Lattice Vibrations of Mono-atomic Linear Lattices, Dulong and Petit's Law, Einstein Theory of Specific Heat of solids and its Drawbacks, Basics of Debye Models of Specific Heat of solids**,** T^3 law.

Superconductivity: Critical Temperature of superconductors, Critical magnetic field, Meissner effect, Type I and type II Superconductors, Isotope effect, BCS Theory.

TEXT BOOKS

1. Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
2. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
3.Elements of Modern Physics by S.H Patil
4. Basic Electronics and linear Circuits by N.N Bhargave, D.C Kulshreshtha and S.C Gupta.
5. Foundations of Electronics by D. Chatopadhyay, P.C Rakshit, B.Saha and N.N Purkit.

REFERENCE BOOKS

1. Solid State Physics by Puri and Babbar
2. Basic Electronics by D.C Tayal (Himalaya Pub.).
3. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
4. Digital Principles & Applications, A.P. Malvino, D.P. Leach &Saha, 7th Ed.,2011, Tata McGraw Hill.
5. Electronic devices and Circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.
6. Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.

B.Sc-III (Non-Medical)
(SEMESTER-V)
PAPER: PHYSICS LAB
BDSE(P)-501(i) (P)

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 18

List of Experiments:

1. To draw forward and reverse bias characteristics of a P-N junction diode.
2. To determine Boltzmann constant by V-I characteristics of P-N junction diode.
3. Measurement of reverse saturation current in a p-n junction diode at various temperatures and to find the approximate value of energy gap.
4. To study V-I characteristics of Zener diode.
5. To study the stabilization of output voltage of a power supply with Zener diode.
6. To draw output and mutual characteristics of FET.
7. To measure and plot common base (CB) characteristics of a transistor.
8. To study the characteristics of a transistor in common emitter (CE) configuration.
9. To draw square, sine and triangular wave by using CRO.
10. To measure voltage and time period of a periodic waveform using CRO.
11. To study and verify the truth tables of AND, OR, NOT, NAND, NOR and XOR gates.
12. To design a switch (NOT gate) using transistor and to verify & design AND, OR, NOT and XOR gates using NAND gates.
13. To convert a Boolean expression into logic circuits & to minimize a given logic circuit.
14. To study the characteristics of half adder, full adder and 4-bit Binary Adder.
15. To study half subtractor, full subtractor and Adder-Subtractor using Full Adder I.C's.

B.Sc-III (Non Medical)
(SEMESTER-V)
PHYSICS DSE: SOLID STATE PHYSICSAND ELECTRONICS DEVICES
BDSE(P)-501 (ii)

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objective: *The objective of the course is to expose the students to the topics like lattice vibrations, energy band theory, superconductivity as well as electronic devices and their qualitative analysis so that they are equipped with the techniques used in investigating these aspects of the matter in condensed phase.*

Course Outcomes: *On completion of this course, student will be able to describe the crystal systems and spatial symmetries, concept of reciprocal lattices and significance of Brilliouin zones, structure determination by Bragg's diffraction, phenomenon of superconductivity, biasing of transistors, V-I characteristics of semiconductor devices, design of simple amplifier and oscillator circuits, effect of positive and negative feedback on amplifier circuits.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Crystal Structure: Solids: Amorphous and Crystalline Materials. Crystal Structure, Lattice Translation Vectors, Lattice with a Basis Symmetry Operations for Two Dimensional Crystals, Two Dimensional Bravais Lattice, Three Dimensional Bravais Lattice, Basic Primitive Cell, Crystal Planes and Miller Indices.

Crystal Diffraction: Diffraction of X-rays by Crystals, Bragg's Law, Laue's theory of X-Ray diffraction, Derivation of Bragg's law from Laue's equations, X-Ray diffraction methods, Reciprocal Lattices (brief), Atomic scattering factor.

Lattice Vibrations: Lattice Vibrations of Mono-atomic Linear Lattices, Dulong and Petit's Law, Einstein Theory of Specific Heat of solids and its Drawbacks, Basics of Debye Models of Specific Heat of solids, T^3 law.

Semiconductors: Band Gap, Distinction between Metals, Insulators and Semiconductor, P and N type Semiconductors, Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient.

Superconductivity: Critical Temperature of superconductors, Critical magnetic field, Meissner effect, Type I and type II Superconductors, Isotope effect, Basics of BCS Theory.

SECTION-B

Diodes: P-N Junction Diode, Biasing of Diode, V-I Characteristics, Zener Diode, Zener Diode as a Voltage Regulator, Tunnel Diode, LED.

Rectification: Half Wave, Full Wave Rectifiers and Bridge Rectifiers, Efficiency, Ripple Factor, Qualitative Analysis of Filter Circuit (RL, LC and π filter).

Junction Transistor: Structure and Working, Relation between Different Currents in Transistor, Sign Conventions, Amplifying Action, Different Configurations of a Transistor and their Comparison, Common Base and Common Emitter Characteristics.

h-parameters: Working of Common Emitter Amplifier, Amplifier Analysis using h-parameters, Equivalent Circuits, Determination of Current Gain, Power Gain, Input and Output Impedance.

FET: Structure of Junction Field Effect Transistor, Operation of FET, Output and Transfer Characteristic, Metal Oxide Semiconductor Field Effect Transistor (MOSFET), Enhancement and Depletion MOSFET, FET amplifier and its Voltage Gain.

Oscillators: Barkhausen Criterion of Sustained Oscillations, LC (tuned collector, Hartley qualitative), RC Oscillators (Qualitative Analysis), Phase Shift and Wein Bridge.

TEXT BOOKS

1. Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
2. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
3.Elements of Modern Physics by S.H Patil.
4. Basic Electronics and linear Circuits by N.N Bhargave, D.C Kulshreshtha and S.C Gupta.
5. Foundations of Electronics by D. Chatopadhyay, P.C Rakshit, B.Saha and N.N Purkit.

REFERENCE BOOKS

1. Solid State Physics by Puri and Babbar.
2. Solid State Physics by S.O. Pillai.
3. Basic Electronics by D.C Tayal (Himalaya Pub.).
4. Digital Electronics by Malvino and Leech.

B.Sc-III (Non- Medical)
(SEMESTER-V)
PAPER: PHYSICS LAB
CODE: BDSE(P)-501(ii) (P)

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 18

List of Experiments:

1. To draw forward and reverse bias characteristics of a p-n junction diode.
2. Measurement of reverse saturation current in p-n junction diode at various temperatures and to find the approximate value of energy gap.
3. To draw V-I characteristics of Zener diode.
4. To study the stabilization of output voltage of a power supply with Zener diode.
5. To draw output and mutual characteristics of FET.
6. To measure and plot common emitter (CE) characteristics of a transistor.
7. To study the characteristics of a transistor in common base (CB) configuration.
8. To study the V-I characteristics of LED diode.
9. To determine voltage current characteristics of photodiode.
10. To set up an oscillator and study its output on CRO for different frequency values.
11. To draw the BH curve of iron using a Solenoid and determine the energy loss from hysteresis curve by using CRO.
12. To measure the resistivity of a semiconductor (Ge) crystal with temperature (from room temperature to 150 ^{o}C) by four probe method and to determine its energy band gap.
13. To measure the Dielectric Constant of a dielectric material with frequency.
14. To study the PE Hysteresis loop of a Ferroelectric Crystal.
15. To determine the Hall coefficient and mobility of charge carriers of a semiconductor material.

B.Sc-III (Non- Medical)
(SEMESTER-V)
PHYSICS DSE: BASICS OF SOLID STATE ELECTRONIC DEVICES
CODE: BDSE(P)-501 (iii)

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objective: *The objective of the course is to expose the students to the topics like semiconductor devices, two-terminal devices, bipolar junction transistors, field effect transistors, crystal structure, lattice vibrations, superconductivity so that they are equipped with the techniques used in investigating these aspects of the matter in condensed phase.*

Course Outcomes: *On completion of this course, student will be able to understand the fundamental concepts and techniques used in electronics, biasing of transistors and their application as rectifiers and amplifiers, crystal systems and spatial symmetries, Bragg's diffraction, concept of reciprocal lattices.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Crystal Structure and Crystal Diffraction: Solids: Amorphous and Crystalline Materials, Lattice Translation Vectors, Lattice with a Basis, Unit Cell, Symmetry Operations for Two Dimensional Crystals, Types of Lattices: Two Dimensional and Three Dimensional Bravais Lattices, Miller Indices, Basics of Reciprocal Lattice, Diffraction of X-rays by Crystals, Bragg's Law.

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic lattices, Phonons: Qualitative Description of the Phonons, Dulong and Petit's Law, Basics of Einstein and Debye theories of specific heat of solids, T^3 law.

Superconductivity: Superconductors, Critical Temperature, Critical magnetic field, Meissner effect, Type I and type II Superconductors, cooper pairs, BCS Theory, Isotope Effect.

SECTION-B

Semiconductor Diodes: p- and n-type semiconductors, Energy Band Diagram, p-n Junction Fabrication (Simple Idea), Barrier Formation in p-n Junction Diode, Current Flow Mechanism in Forward and Reverse Biased Diode, V-I characteristics.

Two-terminal Devices and their Applications: Zener diode and Voltage Regulation, Tunnel diode, Rectifier Diode: Half-wave Rectifiers, Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Average and RMS Current and Voltage, Ripple Factor and Rectification Efficiency, Qualitative Analysis of Filter Circuits.

Bipolar Junction transistor and Field-Effect Transistors: n-p-n and p-n-p Transistors, Characteristics of a transistor in CB, CE and CC mode, Current gains α and β, Relation between α and β, Common emitter amplifier, Structure and working of Junction Field Effect Transistor (JFET), Voltage Ampere Curves, Metal Oxide Semiconductor Field Effect Transistor (MOSFET): Depletion and Enhancement mode.

Operational Amplifiers and its applications: Characteristics of an Ideal and Practical Op-Amp, Open loop and Closed-loop Gain, CMRR, Offset, Slew Rate, Applications of Op-Amps: Inverting and non-inverting amplifiers, Concept of Virtual Ground and Virtual Short, Adder, Subtractor, Integrator, Differentiator.

TEXT BOOKS

1. Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
2. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
3.Elements of Modern Physics by S.H Patil
4. Basic Electronics and linear Circuits by N.N Bhargave, D.C Kulshreshtha and S.C Gupta.
5. Foundations of Electronics by D. Chatopadhyay, P.C Rakshit, B.Saha and N.N Purkit.

REFERENCE BOOKS

1. Electronic devices and Circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.
2. Electronic Principles, A. Malvino and D. J. Bates, 8th Edn. 2015, McGraw-Hill Education.
3. Solid State Electronic Devices, B.G. Streetman and S.K. Banerjee, 6th Edn. 2009, PHI.
4. Solid State Physics by Puri and Babbar.
5. Basic Electronics by D.C Tayal (Himalaya Pub.).
6. Integrated Electronics: Analog and Digital Circuits and Systems, J. Millman and C.C. Halkias, 2nd Edn. 2017, McGraw Hill Education.
7. Op-Amps and Linear Integrated Circuits, R. A. Gayakwad, 4th Edn. 2000, Pearson.

B.Sc-III (Non- Medical)
(SEMESTER-V)
PAPER: PHYSICS LAB
CODE: BDSE(P)-501(iii) (P)

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 18

List of Experiments:

1. To draw forward and reverse bias characteristics of a P-N junction diode.
2. To determine Boltzmann constant by V-I characteristics of P-N junction diode.
3. Measurement of reverse saturation current in a p-n junction diode at various temperatures and to find the approximate value of energy gap.
4. To study V-I characteristics of Zener diode.
5. To study the stabilization of output voltage of a power supply with Zener diode.
6. To draw output and mutual characteristics of FET.
7. To measure and plot common base (CB) characteristics of a transistor.
8. To study the characteristics of a transistor in common emitter (CE) configuration.
9. To study V-I characteristics of Solar Cell.
10. To draw square, sine and triangular wave by using CRO.
11. To measure voltage and time period of a periodic waveform using CRO.
12. To study the voltage gain of inverting amplifier using Op-amp.
13. To study the voltage gain of non-inverting amplifier using Op-amp.
14. To investigate the use of Op-Amp as an Integrator.
15. To investigate the use of Op-Amp as a Differentiator.

B.Sc-III(Non Medical)
(SEMESTER-V)
PAPER: BASIC INSTRUMENTATION SKILLS
CODE: BSEC(P)-504

Total Credits: 02 **Total Lectures:30**

Course Objective: *This course is to ge texposure with various aspects of instruments and their usage through hands-on mode .Experiments mentioned in the course are to be done in continuation of the topics.*

Course Outcomes: *On completion of this course, student will be able to explain*

- *the Basics of measurement and types of errors,*
- *specifications and significance of a multimeter and voltmeter,*
- *types of millivoltmeters and their significance,*
- *features of CRO and CRT, working of Signal generators*

SECTION-A

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc., Errors in measurements and loading effects, Types of errors.

Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance, Colour coding for resistors, Colour coding for capacitors, Specifications of a multimeter and their significance.

Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity, Specifications of an electronic Voltmeter/ Multimeter and their significance.

AC millivoltmeter: Type of AC milli voltmeters: specifications and their significance.

Digital Instruments: Principle and working of digital Voltmeters, Comparison of analog & digital instruments.

Digital Multimeter: Working of a digital multimeter, accuracy and resolution, Difference between digital and analog multimeters.

SECTION-B

Cathode Ray Oscilloscope: Block diagram of basic CRO, Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, Time base operation, Specifications of a CRO and their significance, Use of CRO for the measurement of voltage (dc and ac frequency, time period, Special features of dual trace, introduction

to digital oscilloscope, probes.

Signal Generators: Explanation and specifications of low frequency signal generators.

The test of lab skills will be of the following test items:

1. Use of an oscilloscope.
2. CRO as a versatile measuring device and to study the working of CRO.
3. Use of Digital multimeter/VTVM for measuring voltages.
4. Winding a coil/transformer.

Laboratory Exercises:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. Measurement of voltage, frequency, time period and phase angle using CRO.
4. Measurement of rise, fall and delay times using a CRO.
5. Measurement of R, L and C using a LCR bridge/universal bridge
6. To study the 4 bit digital to analog convertor.
7. To study the diode as a clipper.
8. To trace different wave shapes using CRO.
9. Find the value of resistance using colour codes and verify using multimeter.
10. To learn the working of Dual trace oscilloscope.

Open Ended Experiments:

1. Using a Dual Trace Oscilloscope
2. Converting the range of a given measuring instrument (voltmeter, ammeter)

Reference Books:

1. A textbook in Electrical Technology- B L Theraja- S Chand and Co.
2. Performance and design of AC machines- MG Say ELBSEdn.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Logic circuit design, Shimon P.Vingron, 2012, Springer.
5. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
6. Electronic Devices and circuits, S. Salivahanan& N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
7. Electronic circuits: Handbook of design and applications, U. Tietze, Ch. Schenk, 2008, Springer
8. Electronic Devices,7/e Thomas L. Floyd, 2008, Pearson India

B.Sc-III (Non Medical)
(SEMESTER-VI)
PHYSICS DSE: NUCLEAR & PARTICLE PHYSICS
CODE: BDSE(P)-601 (i)

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objective: *The emphasis of the course is to expose the students to the topics like nuclear forces, nuclear models, nuclear reactions, radioactivity, detectors and particle physics so that they are equipped with the techniques used in investigating these aspects of the matter at nuclear level.*

Course Outcomes: *On completion of this course, student will be able to explain the structure and intrinsic properties of the nucleus, concepts of radioactive decay, nuclear reactions, working of radiation detectors and accelerators, classification and properties of elementary particles, quarks, antiquarks and conservation laws obeyed by elementary particles.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, magnetic moment, electric moments, non-existence of electrons in the nucleus and neutron- proton model.

Nuclear Models: Liquid drop model approach, semi empirical mass formula, Successes of liquid drop model, condition of nuclear stability. Nuclear shell Model, magic numbers, basic assumption of shell model, concept of nuclear force.

Radioactivity decay: (a) Alpha decay: basics of α-decay processes, Gamow theory of alpha decay, Geiger Nuttal law, α-decay spectroscopy (b) β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis (c) Gamma decay: Gamma rays emission & kinematics, internal conversion.

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound reaction, Coulomb scattering (Rutherford scattering).

SECTION –B

Interaction of radiation and charged particles with matter: Energy loss of heavy charged particles due to ionization (Bethe Bloch formula), energy loss of electrons, Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production.

Detector for Nuclear Radiations: Gas detectors: ionization chamber, proportional counter and GM Counter, Scintillation and Semiconductor Detectors.

Particle Accelerators: Linear accelerator, Cyclotron, Synchrotrons.

Particle Physics: Particle interactions; basic features, types of particles and its families, Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

Reference Books:

1. Introductory Nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
2. Concepts of Nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
3. Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).
4. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons.
5. Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi.
6. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
7. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
8. Theoretical Nuclear Physics, J.M. Blatt &V.F.Weisskopf (Dover Pub. Inc., 1991).
9. Introductory Nuclear Physics, by Kulwant S. Thind, Manmohan Singh, Vijay Kumar and Leif Gerward, Susanta Lahiri (Vikas publisher, New Delhi, 2018).
10. Introductory Particle Physics, by Kulwant S. Thind, Manmohan Singh, Vijay Kumar and Leif Gerward, Susanta Lahiri(Vikas publisher, New Delhi, 2018)

B.Sc-III (Non- Medical)
(SEMESTER-VI)
PAPER: PHYSICS LAB
CODE: BDSE(P)-601 (i) (P)

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 18

List of experiments:

1. To study the variation of count rate with the applied voltage in GM counter and thereby determine the plateau, operating voltage and the slope of the plateau.
2. To determine the dead time of GM Counter.
3. To calculate the resolving time of GM Counter.
4. To study the statistical fluctuations of GM counter and to find its standard deviation.
5. To investigate the absorption of beta particles in aluminium foils using GM counter.
6. To calculate the standard deviation dose rate dependence using dosimeter.
7. To draw mutual and output characteristics of FET and find its parameters.
8. To study the characteristics of Tunnel diode.
9. To study the V-I and power curve of solar cells and to find maximum power and efficiency.
10. To study V-I characteristics of a thermistor.
11. To measure the efficiency and ripple factor of half wave and full wave rectifier.
12. To study the reduction in the ripples in the rectified output with RC, LC and π-filters.
13. To study the diode as clipping and clamping circuits using CRO.
14. To set up an oscillator and study its output on CRO for different frequencies.
15. To study the current versus voltage characteristics of CDS photo resistor at constant irradiance.

B.Sc-III (Non Medical)
(SEMESTER-VI)
PHYSICS DSE: NUCLEAR RADIATION PHYSICS

CODE: BDSE(P)-601 (ii)

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objective: *The objective of the course is to expose the students to the topics like basic structure of nucleus, interaction of radiation, charged particles and neutrons with matter, radioactivity, detectors, accelerators and nuclear reactions so that they are equipped with the techniques used in investigating these aspects of the matter at nuclear level.*

Course Outcomes: *On completion of this course, student will be able to understand the structure and intrinsic properties of the nucleus, interaction of radiation and charged particles with matter, working of radiation detectors and accelerators, concepts of radioactive decay, nuclear reactions and physical significance of Q-value of a nuclear reaction.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

General Properties of Nucleus: Constituents of nucleus, Nuclear size and shapes, mass, charge density, angular momentum, magnetic moment, electric moments, Nuclear forces, binding energy, average binding energy and its variation with mass number , N/A plot, non-existence of electrons in the nucleus.

Interaction of radiation with matter: Interaction of gamma rays: Different photon interaction processes viz. photoelectric effect, Einstein's photoelectric equation and experimental verification, Compton scattering and its theory, pair production, Classification of neutrons on the basis of energy.

Interaction of charged particles with matter: Energy loss of heavy charged particles due to ionisation: Bohr's formula for stopping power, Bethe-Bloch formula, Range-energy relationship, Straggling, Interaction of light charged particles with matter, Interaction of positrons with matter, Bremsstrahlung, Multiple Coulomb scattering.

SECTION-B

Radiation Detectors: Gas-filled detectors, Ionization, Proportional and Geiger-Muller counters, Scintillation and Semiconductor detectors.

Accelerators: Linear accelerator, Cyclotron, Betatron, Synchrotrons.

Radioactivity decay: Radioactivity, Modes of decay and successive radioactivity, Alpha decay, basic α-decay processes, Gamow's theory of α- emission, Geiger Nuttal law, β-decay, energy kinematics for β-decay, electron and positron emission, electron capture, neutrino hypothesis, Gamma decay, kinematics of Gamma decay, internal conversion.

Nuclear Reactions: Types of Reactions, kinematics of nuclear reactions, conservation laws, Q-value, reaction cross section, Concept of compound reaction, Nuclear transmutation.

Reference Books:

1. Introductory Nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
2. Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
3. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
4. Radiation Detection and Measurement, by G.F. Knoll (John Wiley & Sons, 2000).
5. Theoretical Nuclear Physics, J.M. Blatt &V.F.Weisskopf (Dover Pub.Inc., 1991)
6. Introductory Nuclear Physics, by Kulwant S. Thind, Manmohan Singh, Vijay Kumar and Leif Gerward, Susanta Lahiri (Vikas publisher, New Delhi, 2018)
7. Introductory Particle Physics, by Kulwant S. Thind, Manmohan Singh, Vijay Kumar and Leif Gerward, Susanta Lahiri (Vikas publisher, New Delhi, 2018)

B.Sc-III (Non-Medical)
(SEMESTER-VI)
PAPER: PHYSICS LAB
CODE: BDSE(P)-601 (ii) (P)

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 18

List of Experiments:

1. To draw Plateau of GM counter.
2. To determine the standard deviation of GM Counter.
3. To determine the dead time of GM Counter.
4. To verify the inverse square law using GM counter.
5. To calibrate dosimeter.
6. To calculate the standard deviation of dosimeter.
7. To detect the X-Rays by using dosimeter.
8. To draw mutual and output characteristics of FET and find its parameters.
9. To study characteristics of a thermistor.
10. To Study diode as clipping and clamping element.
11. To measure the efficiency and ripple factor of half wave and full wave rectifier.
12. To study the reduction in the ripples in the rectified output with RC, LC and π-filters.
13. To study the V-I and power curve of solar cells and to find maximum power and efficiency.
14. To set up an oscillator and study its output on CRO for different frequencies.
15. To draw square, sine and triangular wave by using CRO.

B.Sc-III (Non Medical)
(SEMESTER-VI)
PHYSICS DSE: LASERs and APPLICATIONS
CODE: BDSE(P)-601 (iii)

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objective: *The aim and objective of the course on laser physics and its applications is to expose the students to the topics like interaction of radiation with matter, understanding about laser fundamentals, different types of Lasers and introduction to Optics.*

Course Outcomes: *On completion of this course, student will be able to understand the basic fundamentals of laser, describe the construction and working of different types of lasers, explain the relation between Einstein coefficients, Discuss the applications of lasers-in medical field, in industry field, holography etc, explain the attenuation mechanisms.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION A

Introductory Concepts of Lasers: Spontaneous and Stimulated Emission, Concept of Population Inversion, Laser Idea, Properties of Laser Light.

Interaction of Radiation with Matter: Einstein's Theory, Rates of Absorption, Spontaneous and Stimulated Emission. Allowed and Forbidden Transitions, Broadening of Spectral Lines, Natural, Collision and Doppler Broadening.

Laser rate equation: Pumping Processes, Three Levels and Four Level Laser (Qualitative Idea Only), Optimum and Output Coupling, Laser Spiking, Optical Absorption.

SECTION-B

Resonators (Concept and Theory): Passive Optical Resonators: Photon Lifetime and Cavity Q, Threshold Condition, Q Switching, Mode Locking.

Types of Lasers: Lasers Construction, Ruby Laser, Nd: YAG Laser, He-Ne Laser, CO_2 Laser, Excimer Laser, Dye Lasers, Semiconductor Lasers.

Application of lasers: Holography, Laser Printing, Applications in Industry: Laser Drilling, Laser Welding and Cutting, Applications of Lasers for Data Storage, Medical Applications of Lasers.

Reference Books:

1. Lasers Fundamentals, W.T Silfvast (Second Edition), Cambridge.
2. Optics, Ajoy Ghatak (7th Edition), McGraw Hill.
3. Principles of Lasers, O. Svelto (Fourth Edition), Springer.
4. Lasers and its applications: A.K. Ghatak and K. Thyagrajan (Second Edition), Springer.
5. Lasers and Nonlinear Optics: B.B. Laud (Second Edition), Wiley Eastern.

B.Sc-III (Non-Medical)
(SEMESTER-VI)
PAPER: PHYSICS LAB
CODE: BDSE(P)-601 (iii) (P)

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 18

List of Experiments:

1. To determine the wavelength of sodium source using Michelson's interferometer.
2. To determine wavelength of sodium light using Newton's Rings.
3. To determine diameter of Newton's Rings.
4. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
5. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
6. To measure the rotation of the polarisation plane through optically active liquids and determine the concentration of sugar solution.
7. To determine wavelength of sodium light using Fresnel Biprism.
8. To study the Diffraction of light by single slit using Diode Laser.
9. To study the Diffraction of light by double slit using Diode Laser.
10. To study the Diffraction of light by multiple slit using Diode Laser.
11. Diffraction of light by fine wire, cross wire and wire mesh using Diode Laser.
12. To observe the diffraction patterns by holes, single slit and double slit, mesh, grating, grid, opaque spots using Laser kit.
13. To demonstrate Fresnel's diffraction using Laser kit.
14. To measure wavelength of light using a millimeter scale as a grating using Laser kit.
15. To demonstrate fringes of equal inclination using Laser kit.

B.Sc- III (Non Medical)
(SEMESTER-VI)
PAPER: RADIATION SAFETY
CODE: BSEC(P)-604

Maximum Marks: 50 Time allowed: 3 Hours
Pass Marks: 35 % No. of Lectures: 30

Course Objective: *The objective of this course is to aware students regarding radiation hazards and radiation safety. The laboratory skills and experiments listed below the course are to be done in continuation of the topics.*

Course Outcomes: *On completion of this course, student will be able to understand*

- *the atomic structure, X-rays, Bremstrahlung,*
- *interaction of radiations, photons, neutrons and charged particles with matter,*
- *basic knowledge about radiation detectors, dosimeters .*
- *radiation safety methods.*

SECTION-A

Basics of Atomic and Nuclear Physics: Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron, The composition of nucleus and its properties, mass number, isotopes of element, binding energy, stable and unstable isotopes.

Interaction of Radiation with matter: Types of Radiation: non-ionizing Radiation. Ionizing Radiations: Alpha, Beta, Gamma and Neutron and their sources, Radioactive sources and consumer products.

Interaction of Photons: Photo electric effect, Compton Scattering, Pair Production.

Interaction of Charged Particles: Heavy charged particles -Beth-Bloch Formula, Mass Stopping Power, Range, Straggling, Beta Particles- Collision and Radiation loss (Bremsstrahlung).

Radiation detection and monitoring devices: Radiation Quantities and Units, Basic idea of different units of activity, Radiation units - exposure - absorbed dose – units: rad, gray, KERMA (Kinetic Energy Released in Matter), Air KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Concentration (DAC).

Radiation detection: Basic concept and working principle of gas detectors (Ionization Chamber and Geiger Muller Counter), Basic concept and working principle of Scintillation Detectors **(**Inorganic and Organic Scintillators), dosimetry.

SECTION-B

Radiation safety management: Biological effects of ionizing radiation, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection (ICRP) principles, introduction of safety and risk management of radiation and General radiation safety (ALARA), Radiation postings, nuclear waste and disposal management, Brief idea about Accelerator driven Sub-critical system (ADS) for waste management.

Application of nuclear techniques: Brief idea about Application in medical science (e.g., MRI, PET Gamma Camera, radiation therapy), Archaeology.

Experiments:

1. Study the background radiation levels using Radiation meter

Characteristics of Geiger Muller (GM) Counter:

1. To study the intensity of radiations using dosimeter.
2. Study of characteristics of GM tube and determination of operating voltage and plateau length using background radiation as source (without commercial source).
3. Study of counting statistics and standard deviation using background radiation using GM counter.
4. Study of radiation in various materials (e.g. K_2SO_4 etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.
5. Study of absorption of beta particles in Aluminum using GM counter.
6. Detection of α-particles using reference source & determining its half-life using spark counter.
7. Gamma spectrum of Gas Light mantle (Source of Thorium).
8. To find the dead time of GM counter.

Reference Books:

1. W.E. Burcham and M. Jobes–Nuclear and Particle Physics–Longman(1995)
2. G.F. Knoll, Radiation detection and measurements.

3. Thermoluninescence Dosimetry, Mcknlay, A.F., Bristol, Adam Hilger (Medical Physics Handbook 5)
4. W.J. Meredith and J.B.Massey, “Fundamental Physics of Radiology”. John Wright and Sons, UK, 1989.
5. J. R. Greening, “Fundamentals of Radiation Dosimetry”, Medical Physics Hand Book Series, No.6, Adam Hilger Ltd., Bristol 1981.
6. Practical Applications of Radioactivity and Nuclear Radiations, G.C. Lowental and P. L. Airey, Cambridge University Press, U.K., 2001
7. A. Martin and S. A. Harbisor, An Introduction to Radiation Protection, John Willey & Sons, Inc. New York, 1981.
8. NCRP, ICRP, ICRU, IAEA, AERB Publications.
9. W.R. Hendee, “Medical Radiation Physics”, Year Book– Medical Publishers Inc. London, 1981.
10. Sustainability 2021, 13 12643. https://doi.org/10.3390/su132212643

DISCIPLINE SPECIFIC ELECTIVE PAPERS (DSE): (Credit: 06 Each)

(2 papers to be selected: 01 each for Odd semester and even semester as listed below)

1. Digital-Analog Circuits and Condensed Matter Physics
2. Elements of Modern Physics
3. Mathematical Physics
4. Solid State Physics and Electronics Devices
5. Embedded System: Introduction to microcontroller
6. Nuclear and Particle Physics
7. Medical Physics
8. Nuclear Radiation Physics
9. Basics of Solid State Electronic Devices
10. LASERs and applications

B.Sc-III (Non- Medical)
(SEMESTER-V/VI)
PHYSICS DSE: DIGITAL-ANALOG CIRCUITS AND CONDENSED MATTER PHYSICS

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objective: *The objective of the course is to expose the students to the topics like binary numbers and digital circuits, lattice vibrations, energy band theory so that they are equipped with the techniques used in investigating these aspects of the matter in condensed phase.*

Course Outcomes: *On completion of this course, student will be able to understand the fundamental concepts and techniques used in digital electronics, biasing of transistors and design of simple amplifier circuits, crystal systems and spatial symmetries, Bragg's diffraction, concept of reciprocal lattices and significance of Brillouin zones.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Digital Circuits: Binary Numbers. Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates, NAND and NOR Gates as Universal Gates, XOR and NOR Gates, De Morgan's Theorems, Boolean Laws, Simplification of Logic Circuit using Boolean Algebra, Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products and Product of Sums Method and (2) Karnaugh Map, Binary Addition, Binary Subtraction using 2's Complement Method), Half &Full Adders and Subtractors, 4-bit binary Adder/Subtractor.

Semiconductor Devices and Amplifiers: Semiconductor Diodes: p and n type semiconductors, Barrier Formation in PN Junction Diode, Biasing of diode, V-I characteristics, Zener Diode and Voltage Regulation, Tunnel diode, LED, Half-wave Rectifiers, Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, Qualitative Analysis of Filter Circuit (RL, LC and π filter).

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations, Active, Cut-off, and Saturation Regions, Current gainsαandβ,Relations between α and β, DC Load line and Q-point, Amplifying action of CE and CB configurations, h-parameter Equivalent Circuit, Analysis of CE amplifier using Hybrid Model, Input and Output Impedance, Current, Voltage and Power Gains.

Unipolar Junction Transistors: Structure and Operation of Junction Field Effect Transistor, Output and Transfer Characteristics, Metal Oxide Semiconductor Field Effect Transistor (MOSFET), Enhancement and Depletion MOSFET.

SECTION-B

Crystal Structure and Crystal Diffraction: Solids: Amorphous and Crystalline Materials, Crystal Structure, Basic Primitive Cell, Symmetry Operations for Two Dimensional Crystals, Two Dimensional and Three Dimensional Bravais Lattice, Crystal Planes and Miller Indices, Diffraction of X-rays by Crystals, Bragg's Law, Reciprocal Lattices (brief), Brillouin zones, Atomic scattering factor.

Lattice Vibrations: Lattice Vibrations of Mono-atomic Linear Lattices, Dulong and Petit's Law, Einstein Theory of Specific Heat of solids and its Drawbacks, Basics of Debye Models of Specific Heat of solids**,** T^3 law.

Superconductivity: Critical Temperature of superconductors, Critical magnetic field, Meissner effect, Type I and type II Superconductors, Isotope effect, BCS Theory.

TEXT BOOKS

1. Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
2. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
3.Elements of Modern Physics by S.H Patil
4. Basic Electronics and linear Circuits by N.N Bhargave, D.C Kulshreshtha and S.C Gupta.
5. Foundations of Electronics by D. Chatopadhyay, P.C Rakshit, B. Saha and N.N Purkit.

REFERENCE BOOKS

1. Solid State Physics by Puri and Babbar
2. Basic Electronics by D.C Tayal (Himalaya Pub.).
3. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
4. Digital Principles & Applications, A.P. Malvino, D.P. Leach &Saha, 7th Ed.,2011, Tata McGraw Hill.
5. Electronic devices and Circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata McGraw Hill.
6. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.

B.Sc-III (Non-Medical)
(SEMESTER-V/VI)
PAPER: PHYSICS LAB

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 20

List of Experiments:

1. To draw forward and reverse bias characteristics of a P-N junction diode.
2. To determine Boltzmann constant by V-I characteristics of P-N junction diode.
3. Measurement of reverse saturation current in a p-n junction diode at various temperatures and to find the approximate value of energy gap.
4. To study V-I characteristics of Zener diode.
5. To study the stabilization of output voltage of a power supply with Zener diode.
6. To draw output and mutual characteristics of FET.
7. To measure and plot common base (CB) characteristics of a transistor.
8. To study the characteristics of a transistor in common emitter (CE) configuration.
9. To draw square, sine and triangular wave by using CRO.
10. To measure voltage and time period of a periodic waveform using CRO.
11. To study and verify the truth tables of AND, OR, NOT, NAND, NOR and XOR gates.
12. To design a switch (NOT gate) using transistor and to verify & design AND, OR, NOT and XOR gates using NAND gates.
13. To convert a Boolean expression into logic circuits & to minimize a given logic circuit.
14. To study the characteristics of half adder, full adder and 4-bit Binary Adder.
15. To study half subtractor, full subtractor and Adder-Subtractor using Full Adder I.C's.

B.Sc-III (Non- Medical)
(SEMESTER-V/VI)
PHYSICS DSE: ELEMENTS OF MODERN PHYSICS

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objectives: *The objective of the course is to provide students with insight of the exciting results and reasoning of the physical phenomena on the basis of modern physics.*

Course Outcomes: *On completion of this course, student will be able to understand the concept of Photo-electric effect, Compton scattering, Wave-particle duality, Momentum and Energy operators, semi-empirical mass formula and binding energy, radioactivity, fission and fusion.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Planck's quantum, Planck's constant and light as a collection of photons; Photo-electric effect and Compton scattering, De Broglie wavelength and matter waves, Davisson Germer experiment, Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra, Bohr's quantization rule and atomic stability, calculation of energy levels for hydrogen like atoms and their spectra.

Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle.

Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of wavefunction, probabilities and normalization.

SECTION-B

One dimensional infinitely rigid box- energy eigen values and eigen functions, normalization; Quantum dot as an example, Quantum mechanical scattering and tunnelling in one dimension -across a step potential and across a rectangular potential barrier, Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle, Nature of nuclear force, semi-empirical mass formula and binding energy

Radioactivity: stability of nucleus, Law of radioactive decay; Mean life & half-life; α-decay; βdecay - energy released, spectrum and Pauli's prediction of neutrino; γ-ray emission.

Fission and fusion-mass defect, relativity and generation of energy; Fission-nature of fragments and emission of neutrons, Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions.

Reference Books:

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill.
2. Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A. Dubson, 2009, PHI Learning.
3. Six Ideas that Shaped Physics: Particle Behave like Waves, Thomas A. Moore, 2003, McGraw Hill.
4. Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill.
5. Modern Physics, R.A. Serway, C.J. Moses, and C. A. Moyer, 2005, Cengage Learning.
6. Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill.

B.Sc-III (Non-Medical)
(SEMESTER-V/VI)
PAPER: PHYSICS LAB

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 20

List of Experiments:

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine work function of material of filament of directly heated vacuum diode.
3. To determine value of Planck's constant using LEDs of at least 4 different colours.
4. To determine the ionization potential of mercury.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the absorption lines in the rotational spectrum of Iodine vapour.
7. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photo sensor and compare with incoherent source (Sodium light).
8. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light.
9. To determine the value of e/m by magnetic focusing.
10. To setup the Millikan oil drop apparatus and determine the charge of an electron.

B.Sc-III (Non- Medical)
(SEMESTER-V/VI)
PHYSICS DSE: MATHEMATICAL PHYSICS

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objectives: *The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis if problems, seen and unseen.*

Course Outcomes: *On completion of this course, student will be able to understand Partial derivatives, Fourier Series, Legendre, Bessel, Hermite and Laguerre Differential Equations, Frobenius method, beta and gamma functions,complex numbers and Cauchy's Integral formula.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials, Integrating factor with simple illustration, Constrained Maximization using Lagrange Multipliers, **Fourier Series**: Periodic functions, Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only), Expansion of periodic functions in a series of sine and cosine functions, Complex representation of Fourier series, Expansion of functions with arbitrary period, Expansion of non-periodic functions over an interval, Even and odd functions and their Fourier expansions, Applications, Summing of Infinite Series.

Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance, Frobenius method and its applications to differential equations, Legendre, Bessel, Hermite and Laguerre Differential Equations, Properties of Legendre Polynomials: Rodrigues Formula, Orthogonality, Simple recurrence relations.

SECTION-B

Some Special Integrals: Beta and Gamma Functions and Relation between them, Expression of Integrals in terms of Gamma Functions, Error Function (Probability Integral).

Partial Differential Equations: Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry.

Complex Analysis: Brief Revision of Complex Numbers. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables, Analyticity and Cauchy-Riemann Conditions, Examples of analytic functions, Singular functions: poles and branch points, order of singularity, branch cuts, Integration of a function of a complex variable, Cauchy's Inequality, Cauchy's Integral formula.

Reference Books:

1. Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
2. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
3. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
4. An Introduction to Ordinary Differential Equations, Earl A Coddington, 1961, PHI Learning.
5. Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
6. Essential Mathematical Methods, K.F. Riley and M.P. Hobson, 2011, Cambridge University press.
7. Partial Differential Equations for Scientists and Engineers, S.J. Farlow, 1993, Dover Publications.
8. Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Books.

B.Sc-III (Non-Medical)
(SEMESTER-V/VI)
PAPER: PHYSICS LAB

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 20

List of Experiments:

Basics of scientific computing	Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow & overflow-emphasize the importance of making equations in terms of dimensionless variables, Iterative methods
Errors and error Analysis	Truncation and round off errors, Absolute and relative errors, Floating point computations.
Review of C & C++ Programming fundamentals	Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements) (*If-statement. If-else Statement. Nested if Structure. Else-if Statement. Ternary Operator. Goto Statement. Switch Statement. Unconditional and Conditional Looping. While-Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops*), Arrays (*1D&2D*) and strings, user defined functions, Structures and Unions, Idea of classes and objects
Programs: using C/C++ language	Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending-descending order, Binary search
Random number generation	Area of circle, area of square, volume of sphere, value of pi (**π**)
Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods	Solution of linear and quadratic equation, solving $\alpha = \tan\alpha$; $I = I_0 \left(\frac{\sin\alpha}{\alpha}\right)^2$ in optics
Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation	Evaluation of trigonometric functions e.g. *sin θ, cos θ, tan θ, etc.*
Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method	Given Position with equidistant time data to calculate velocity and acceleration and vice-versa. Find the area of B-H Hysteresis loop

Solution of Ordinary Differential Equations (ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods	First order differential equation • Radioactive decay • Current in RC, LC circuits with DC source • Newton's law of cooling • Classical equations of motion Attempt following problems using RK 4 order method: • Solve the coupled differential equations $\frac{dx}{dt} = y + x - \frac{x^3}{3}$; $\frac{dy}{dx} = -x$ for four initial conditions x(0) = 0, y(0) = -1, -2, -3, -4. Plot x vs y for each of the four initial conditions on the same screen for $0 \le t \le 15$ The differential equation describing the motion of a pendulum is $\frac{d^2\vartheta}{dt^2} = -\sin(\vartheta)$. The pendulum is released from rest at an angular displacement α, i. e. $\vartheta(0) = \alpha$ and $\vartheta'(0) = 0$. Solve the equation for α = 0.1, 0.5 and 1.0 and plot ϑ as a function of time in the range $0 \le t \le 8\pi$. Also plot the analytic solution valid for small ϑ ($\sin(\vartheta) = \vartheta$

B.Sc-III (Non Medical)
(SEMESTER-V/VI)
PHYSICS DSE: SOLID STATE PHYSICS AND ELECTRONICS DEVICES

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objective: *The objective of the course is to expose the students to the topics like lattice vibrations, energy band theory, superconductivity as well as electronic devices and their qualitative analysis so that they are equipped with the techniques used in investigating these aspects of the matter in condensed phase.*

Course Outcomes: *On completion of this course, student will be able to describe the crystal systems and spatial symmetries, concept of reciprocal lattices and significance of Brilliouin zones, structure determination by Bragg's diffraction, phenomenon of superconductivity, biasing of transistors, V-I characteristics of semiconductor devices, design of simple amplifier and oscillator circuits, effect of positive and negative feedback on amplifier circuits.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Crystal Structure: Solids: Amorphous and Crystalline Materials. Crystal Structure, Lattice Translation Vectors, Lattice with a Basis Symmetry Operations for Two Dimensional Crystals, Two Dimensional Bravais Lattice, Three Dimensional Bravais Lattice, Basic Primitive Cell, Crystal Planes and Miller Indices.

Crystal Diffraction: Diffraction of X-rays by Crystals, Bragg's Law, Laue's theory of X-Ray diffraction, Derivation of Bragg's law from Laue's equations, X-Ray diffraction methods, Reciprocal Lattices (brief), Atomic scattering factor.

Lattice Vibrations: Lattice Vibrations of Mono-atomic Linear Lattices, Dulong and Petit's Law, Einstein Theory of Specific Heat of solids and its Drawbacks, Basics of Debye Models of Specific Heat of solids, T^3 law.

Semiconductors: Band Gap, Distinction between Metals, Insulators and Semiconductor, P and N type Semiconductors, Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient.

Superconductivity: Critical Temperature of superconductors, Critical magnetic field, Meissner effect, Type I and type II Superconductors, Isotope effect, Basics of BCS Theory.

SECTION-B

Diodes: P-N Junction Diode, Biasing of Diode, V-I Characteristics, Zener Diode, Zener Diode as a Voltage Regulator, Tunnel Diode, LED.

Rectification: Half Wave, Full Wave Rectifiers and Bridge Rectifiers, Efficiency, Ripple Factor, Qualitative Analysis of Filter Circuit (RL, LC and π filter).

Junction Transistor: Structure and Working, Relation between Different Currents in Transistor, Sign Conventions, Amplifying Action, Different Configurations of a Transistor and their Comparison, Common Base and Common Emitter Characteristics.

h-parameters: Working of Common Emitter Amplifier, Amplifier Analysis using h-parameters, Equivalent Circuits, Determination of Current Gain, Power Gain, Input and Output Impedance.

FET: Structure of Junction Field Effect Transistor, Operation of FET, Output and Transfer Characteristic, Metal Oxide Semiconductor Field Effect Transistor (MOSFET), Enhancement and Depletion MOSFET, FET amplifier and its Voltage Gain.

Oscillators: Barkhausen Criterion of Sustained Oscillations, LC (tuned collector, Hartley qualitative), RC Oscillators (Qualitative Analysis), Phase Shift and Wein Bridge.

TEXT BOOKS

1. Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
2. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
3.Elements of Modern Physics by S.H Patil.
4. Basic Electronics and linear Circuits by N.N Bhargave, D.C Kulshreshtha and S.C Gupta.
5. Foundations of Electronics by D. Chatopadhyay, P.C Rakshit, B.Saha and N.N Purkit.

REFERENCE BOOKS

1. Solid State Physics by Puri and Babbar.
2. Solid State Physics by S.O. Pillai.
3. Basic Electronics by D.C Tayal (Himalaya Pub.).
4. Digital Electronics by Malvino and Leech.

B.Sc-III (Non- Medical)
(SEMESTER-V/VI)
PAPER: PHYSICS LAB

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 20

List of Experiments:

1. To draw forward and reverse bias characteristics of a p-n junction diode.
2. Measurement of reverse saturation current in p-n junction diode at various temperatures and to find the approximate value of energy gap.
3. To draw V-I characteristics of Zener diode.
4. To study the stabilization of output voltage of a power supply with Zener diode.
5. To draw output and mutual characteristics of FET.
6. To measure and plot common emitter (CE) characteristics of a transistor.
7. To study the characteristics of a transistor in common base (CB) configuration.
8. To study the V-I characteristics of LED diode.
9. To determine voltage current characteristics of photodiode.
10. To set up an oscillator and study its output on CRO for different frequency values.
11. To draw the BH curve of iron using a Solenoid and determine the energy loss from hysteresis curve by using CRO.
12. To measure the resistivity of a semiconductor (Ge) crystal with temperature (from room temperature to 150 ^{o}C) by four probe method and to determine its energy band gap.
13. To measure the Dielectric Constant of a dielectric material with frequency.
14. To study the PE Hysteresis loop of a Ferroelectric Crystal.
15. To determine the Hall coefficient and mobility of charge carriers of a semiconductor material.

B.Sc-III(Non- Medical)
(SEMESTER-V/VI)
PHYSICS DSE: EMBEDDED SYSTEM: INTRODUCTION TO MICROCONTROLLERS

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objectives: *The objective of the course is to introduce the students with the architecture and operation of typical microprocessors and microcontrollers.*

Course Outcomes: *On completion of this course, students will be able to understand the fundamental principles of design of embedded systems and its process, microcontroller technology both for hardware and software, architecture and addressing modes of 8051,assembly language program in 8051, importance of different peripheral devices and their interfacing to microcontrollers.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Embedded system introduction: Introduction to embedded systems and general purpose computer systems, architecture of embedded system, classifications, applications and purpose of embedded systems, challenges and design issues in embedded systems, operational and non-operational quality attributes of embedded systems, elemental description of embedded processors and microcontrollers, Review of microprocessors: Organization of Microprocessor based system, 8085μp pin diagram and architecture, concept of data bus and address bus, 8085 programming model, instruction classification, subroutines, hardware and software interrupts.

8051 microcontroller: Introduction and block diagram of 8051 microcontroller, architecture of 8051, overview of 8051 family, 8051 assembly language programming, Data types and directives, Flag bits and Program Status Word (PSW) register, Jump, loop and call instructions.

8051 I/O port programming: Introduction of I/O port programming, pin out diagram of 8051 microcontroller, I/O port programming in 8051, (Using Assembly Language), I/O programming: Bit manipulation.

Programming of 8051: 8051addressing modes and accessing memory using various addressing modes, arithmetic & logic instructions, 8051 programming in C:- for time delay and I/O operations and manipulation, for arithmetic & logic operations, for ASCII and BCD conversions.

SECTION-B

Timer and counter programming: Programming 8051 timers, counter programming.

Serial port programming with and without interrupt: Introduction to 8051 interrupts, programming timer interrupts, programming external hardware interrupts and serial communication interrupt, interrupt priority in the 8051.

Interfacing 8051 microcontroller to peripherals: Parallel and serial ADC, DAC interfacing, LCD interfacing.

Programming Embedded Systems: Structure of embedded program, infinite loop, compiling, linking and locating, downloading and debugging.

Embedded system design and development: Embedded system development environment, file types generated after cross compilation, disassembler/decompiler, simulator, emulator and debugging, embedded product development life-cycle, trends in embedded industry.

Reference Books:

1. Embedded Systems: Architecture, Programming & Design, R. Kamal, 2008, Tata McGraw Hill.
2. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.
3. Embedded Microcomputor System: Real Time Interfacing, J.W. Valvano, 2000, Brooks/Cole.
4. Embedded Systems and Robots, Subrata Ghoshal, 2009, Cengage Learning.
5. Introduction to embedded system, K.V. Shibu, 1st Edition, 2009, McGraw Hill.
6. Microcontrollers in practice, I. Susnea and M. Mitescu, 2005, Springer.
7. Embedded Systems: Design & applications, 1/e S.F. Barrett, 2008, Pearson Education India.
8. Embedded Microcomputer systems: Real time interfacing, J.W.Valvano 2011, Cengage Learning.

B.Sc-III (Non- Medical)
(SEMESTER-V/VI)
PAPER: PHYSICS LAB

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 20

List of Experiments using 8051:

1. To find that the given numbers is prime or not.
2. To find the factorial of a number.
3. Write a program to make the two numbers equal by increasing the smallest number and decreasing the largest number.
4. Use one of the four ports of 8051 for O/P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's.
5. Program to glow first four LED then next four using TIMER application.
6. Program to rotate the contents of the accumulator first right and then left.
7. Program to run a countdown from 9-0 in the seven segment LED display.
8. To interface seven segment LED display with 8051 microcontroller and display 'HELP' in the seven segment LED display.
9. To toggle '1234' as '1324' in the seven segment LED.
10. Interface stepper motor with 8051 and write a program to move the motor through a given angle in clock wise or counter clockwise direction.

B.Sc-III(Non Medical)
(SEMESTER-V/VI)
PHYSICS DSE: NUCLEAR & PARTICLE PHYSICS

Maximum Marks: 100	Time allowed: 3 Hours
External Marks: 75	Pass Marks: 35 %
Internal Marks: 25	No. of Lectures: 60

Course Objective: *The emphasis of the course is to expose the students to the topics like nuclear forces, nuclear models, nuclear reactions, radioactivity, detectors and particle physics so that they are equipped with the techniques used in investigating these aspects of the matter at nuclear level.*

Course Outcomes: *On completion of this course, student will be able to explain the structure and intrinsic properties of the nucleus, concepts of radioactive decay, nuclear reactions, working of radiation detectors and accelerators, classification and properties of elementary particles, quarks, antiquarks and conservation laws obeyed by elementary particles.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, magnetic moment, electric moments, non-existence of electrons in the nucleus and neutron- proton model.

Nuclear Models: Liquid drop model approach, semi empirical mass formula, Successes of liquid drop model, condition of nuclear stability, Nuclear shell Model, magic numbers, basic assumption of shell model, concept of nuclear force.

Radioactivity decay:(a) Alpha decay: basics of α-decay processes, Gamow theory of alpha decay, Geiger Nuttal law, α-decay spectroscopy (b) β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis (c) Gamma decay: Gamma rays emission & kinematics, internal conversion.

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound reaction, Coulomb scattering (Rutherford scattering).

SECTION –B

Interaction of radiation and charged particles with matter: Energy loss of heavy charged particles due to ionization (Bethe Bloch formula), energy loss of electrons, Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production.

Detector for Nuclear Radiations: Gas detectors: ionization chamber, proportional counter and GM Counter, Scintillation and Semiconductor Detectors.

Particle Accelerators: Linear accelerator, Cyclotron, Synchrotrons.

Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

Reference Books:

1. Introductory Nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
2. Concepts of Nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
3. Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).
4. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons.
5. Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi.
6. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde(IOP- Institute of Physics Publishing, 2004).
7. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
8. Theoretical Nuclear Physics, J.M. Blatt &V.F. Weisskopf (Dover Pub.Inc., 1991).
9. Introductory Nuclear Physics, by Kulwant S. Thind, Manmohan Singh, Vijay Kumar and Leif Gerward, Susanta Lahiri (Vikas publisher, New Delhi, 2018).
10. Introductory Particle Physics, by Kulwant S. Thind, Manmohan Singh, Vijay Kumar and Leif Gerward, Susanta Lahiri (Vikas publisher, New Delhi, 2018)

B.Sc-III (Non- Medical)
(SEMESTER-V/VI)
PAPER: PHYSICS LAB

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 20

List of experiments:

1. To study the variation of count rate with the applied voltage in GM counter and thereby determine the plateau, operating voltage and the slope of the plateau.
2. To determine the dead time of GM Counter.
3. To calculate the resolving time of GM Counter.
4. To study the statistical fluctuations of GM counter and to find its standard deviation.
5. To investigate the absorption of beta particles in aluminium foils using GM counter.
6. To calculate the standard deviation dose rate dependence using dosimeter.
7. To draw mutual and output characteristics of FET and find its parameters.
8. To study the characteristics of Tunnel diode.
9. To study the V-I and power curve of solar cells and to find maximum power and efficiency.
10. To study V-I characteristics of a thermistor.
11. To measure the efficiency and ripple factor of half wave and full wave rectifier.
12. To study the reduction in the ripples in the rectified output with RC, LC and π-filters.
13. To study the diode as clipping and clamping circuits using CRO.
14. To set up an oscillator and study its output on CRO for different frequencies.
15. To study the current versus voltage characteristics of CDS photo resistor at constant irradiance.

B.Sc-III (Non- Medical)
(SEMESTER-V/VI)
PHYSICS DSE: MEDICAL PHYSICS

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objectives: *The course is designed to provide both theoretical knowledge and practical skills in medical physics to perform various tasks at hospitals and other clinical institutions as medical physicists.*

Course Outcomes: *On completion of this course, student will learn about the structure and function of important biomolecules and cellular systems, methods for measuring the effects of radiation and techniques for radiation therapies of cancer.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

PHYSICS OF THE BODY-I

Basic Anatomical Terminology: Standard Anatomical Position, Planes, Familiarity with terms like- Superior, Inferior, Anterior, Posterior, Medial, Lateral, Proximal and Distal.

Mechanics of the body: Skeleton, forces, and body stability. Muscles and dynamics of body movement, Physics of Locomotors Systems: joints and movements, Stability and Equilibrium.

Energy household of the body: Energy balance in the body, Energy consumption of the body, Heat losses of the body, Thermal Regulation.

Pressure system of body: Physics of breathing, Physics of cardiovascular system.

PHYSICS OF THE BODY-II

Acoustics of the body: Nature and characteristics of sound, Production of speech, Physics of the ear, Diagnostics with sound and ultrasound.

Electrical system of the body: Physics of the nervous system, Electrical signals and information transfer.

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-I

X-Rays: Electromagnetic spectrum, production of x-rays, x-ray spectra, Brehmsstrahlung, Characteristic x-ray. **X-ray tubes & types**: Coolidge tube, x-ray tube design, tube cooling stationary mode, Rotating anode x-ray tube, Tube rating, quality and intensity of x-ray. X-ray generator circuits, half wave and full wave rectification, filament circuit, kilo voltage circuit, types of X-Ray Generator, high frequency generator, exposure timers and switches, HT cables, HT generation.

Radiation Physics: Radiation units exposure, absorbed dose, units: rad, gray, relative biological effectiveness, effective dose, inverse square law. Interaction of radiation with matter, Compton & photoelectric effect, Rem & Sievert, linear attenuation coefficient.

Radiation Detectors: Thimble chamber, condenser chambers, Geiger Muller counter, Scintillation counters and Solid State detectors, ionization chamber, Dosimeters, survey methods, area monitors, TLD, Semiconductor detectors.

Medical Imaging Physics: Evolution of Medical Imaging, X-ray diagnostics and imaging, Physics of nuclear magnetic resonance (NMR), NMR imaging, MRI Radiological imaging, Ultrasound imaging, Physics of Doppler with applications and modes, X-ray film, film processing, fluoroscopy.

Computed Tomography Scanner: Principle & function, display, generations, mammography, Thyroid uptake system and Gamma camera (only principle, function and display).

SECTION-B

Radiation Oncology Physics: External Beam Therapy (Basic Idea): Telecobalt, Conformal Radiation Therapy (CRT), 3DCRT, IMRT, Image Guided Radiotherapy, EPID, Rapid Arc, Proton Therapy, Gamma Knife, Cyber Knife. Contact Beam Therapy (Basic Idea):, Radiotherapy, kilo voltage machines, deep therapy machines, Medical linear accelerator, deep x-ray, Radiation protection, external beam characteristics, dose maximum and build up – bolus, percentage depth dose, tissue maximum ratio and tissue phantom ratio, Planned target Volume and Gross Tumour Volume.

Radiation and Radiation Protection: Principles of radiation protection, protective materials-radiation effects, somatic, genetic stochastic and deterministic effect. Personal monitoring devices: TLD film badge, pocket dosimeter, OSL dosimeter, Radiation dosimeter. Natural radioactivity, Biological effects of radiation, Radiation monitors**,**Steps to reduce radiation to Patient, Staff and Public. Dose Limits for Occupational workers and Public. AERB: Existence and Purpose.

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-II Diagnostic nuclear medicine: Radiopharmaceuticals for radioisotope imaging, Radioisotope imaging equipment, Single photon and positron emission tomography. Therapeutic nuclear medicine: Interaction between radiation and matter Dose and isodose in radiation treatment. Medical Instrumentation: Basic Ideas of Endoscope and Cautery, Sleep Apnea and Cpap Machines, Ventilator and its modes.

Reference Books:

1. Medical Physics, J.R. Cameron and J.G. Skofronick, Wiley (1978).
2. Basic Radiological Physics Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003).
3. Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry - Lippincot Williams and Wilkins (1990).
4. Physics of Radiation Therapy: F M Khan - Williams and Wilkins, Third edition (2003)
5. Physics of the human body, Irving P. Herman, Springer (2007).
6. The essential physics of Medical Imaging: Bushberg, Seibert, Leid holdt and MBoone Lippincot Williams and Wilkins, Second Edition (2002).
7. Handbook of Physics in Diagnostic Imaging: R.S. Livingstone: B.I. Publication Pvt Ltd.
8. The Physics of Radiology-H E Johns and Cunningham.

B.Sc-III (Non-Medical)
(SEMESTER-V/VI)
PAPER: PHYSICS LAB

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 20

List of Experiments:

1. Understanding the working of a manual Hg Blood Pressure monitor and measure the Blood Pressure.
2. Understanding the working of a manual optical eye-testing machine and to learn eye-testing.
3. Correction of Myopia (short sightedness) using a combination of lenses on an optical bench/breadboard.
4. Correction of Hypermetropia/Hyperopia (long sightedness) using a combination of lenses on an optical bench/breadboard.
5. To learn working of Thermoluminescent dosimeter (TLD) badges and measure the background radiation.
6. Familiarization with Geiger-Muller (GM) Counter and to measure background radiation.
7. Familiarization with Radiation meter and to measure background radiation.
8. Familiarization with the Use of a Vascular Doppler.

B.Sc-III (Non Medical)
(SEMESTER-V/VI)
PHYSICS DSE: NUCLEAR RADIATION PHYSICS

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objective: *The objective of the course is to expose the students to the topics like basic structure of nucleus, interaction of radiation, charged particles and neutrons with matter, radioactivity, detectors, accelerators and nuclear reactions so that they are equipped with the techniques used in investigating these aspects of the matter at nuclear level.*

Course Outcomes: *On completion of this course, student will be able to understand the structure and intrinsic properties of the nucleus, interaction of radiation, charged particles and neutrons with matter, working of radiation detectors and accelerators, concepts of radioactive decay, nuclear reactions and physical significance of Q-value of a nuclear reaction.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

General Properties of Nucleus: Constituents of nucleus, Nuclear size and shapes, mass, charge density, angular momentum, magnetic moment, electric moments, Nuclear forces, binding energy, average binding energy and its variation with mass number , N/A plot, non-existence of electrons in the nucleus.

Interaction of radiation with matter: Interaction of gamma rays: Different photon interaction processes viz. photoelectric effect, Einstein's photoelectric equation and experimental verification, Compton scattering and its theory, pair production, Classification of neutrons on the basis of energy.

Interaction of charged particles with matter: Energy loss of heavy charged particles due to ionisation: Bohr's formula for stopping power, Bethe-Bloch formula, Range-energy relationship, Straggling, Interaction of light charged particles with matter, Interaction of positrons with matter, Bremsstrahlung, Multiple Coulomb scattering.

SECTION-B

Radiation Detectors: Gas-filled detectors, Ionization, Proportional and Geiger-Muller counters, Scintillation and Semiconductor detectors.

Accelerators: Linear accelerator, Cyclotron, Betatron, Synchrotrons.

Radioactivity decay: Radioactivity, Modes of decay and successive radioactivity, Alpha decay, basic α-decay processes, Gamow's theory of α- emission, Geiger Nuttal law, β-decay, energy kinematics for β-decay, electron and positron emission, electron capture, neutrino hypothesis, Gamma decay, kinematics of Gamma decay, internal conversion.

Nuclear Reactions: Types of Reactions, kinematics of nuclear reactions, conservation laws, Q-value, reaction cross section, Concept of compound reaction, Nuclear transmutation.

Reference Books:

1. Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
2. Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
3. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
4. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
5. Theoretical Nuclear Physics, J.M. Blatt &V.F. Weisskopf (Dover Pub.Inc., 1991)
6. Introductory Nuclear Physics, by Kulwant S. Thind, Manmohan Singh, Vijay Kumar and Leif Gerward, Susanta Lahiri (Vikas publisher, New Delhi, 2018)
7. Introductory Particle Physics, by Kulwant S. Thind, Manmohan Singh, Vijay Kumar and Leif Gerward, Susanta Lahiri (Vikas publisher, New Delhi, 2018)

B.Sc-III (Non-Medical)
(SEMESTER-V/VI)
PAPER: PHYSICS LAB

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 20

List of Experiments:

1. To draw Plateau of GM counter.
2. To determine the standard deviation of GM Counter.
3. To determine the dead time of GM Counter.
4. To verify the inverse square law using GM counter.
5. To calibrate dosimeter.
6. To calculate the standard deviation of dosimeter.
7. To detect the X-Rays by using dosimeter.
8. To draw mutual and output characteristics of FET and find its parameters.
9. To study characteristics of a thermistor.
10. To Study diode as clipping and clamping element.
11. To measure the efficiency and ripple factor of half wave and full wave rectifier.
12. To study the reduction in the ripples in the rectified output with RC, LC and π-filters.
13. To study the V-I and power curve of solar cells and to find maximum power and efficiency.
14. To set up an oscillator and study its output on CRO for different frequencies.
15. To draw square, sine and triangular wave by using CRO.

B.Sc-III (Non- Medical)
(SEMESTER-V/VI)
PHYSICS DSE: BASICS OF SOLID STATE ELECTRONIC DEVICES

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objective: *The objective of the course is to expose the students to the topics like semiconductor devices, two-terminal devices, bipolar junction transistors, field effect transistors, crystal structure, lattice vibrations, superconductivity so that they are equipped with the techniques used in investigating these aspects of the matter in condensed phase.*

Course Outcomes: *On completion of this course, student will be able to understand the fundamental concepts and techniques used in electronics, biasing of transistors and their application as rectifiers and amplifiers, crystal systems and spatial symmetries, Bragg's diffraction, concept of reciprocal lattices.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION-A

Crystal Structure and Crystal Diffraction: Solids: Amorphous and Crystalline Materials, Lattice Translation Vectors, Lattice with a Basis, Unit Cell, Symmetry Operations for Two Dimensional Crystals, Types of Lattices: Two Dimensional and Three Dimensional Bravais Lattices, Miller Indices, Basics of Reciprocal Lattice, Diffraction of X-rays by Crystals, Bragg's Law.

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic lattices, Phonons: Qualitative Description of the Phonons, Dulong and Petit's Law, Basics of Einstein and Debye theories of specific heat of solids, T^3 law.

Superconductivity: Superconductors, Critical Temperature, Critical magnetic field, Meissner effect, Type I and type II Superconductors, cooper pairs, BCS Theory, Isotope Effect.

SECTION-B

Semiconductor Diodes: p- and n-type semiconductors, Energy Band Diagram, p-n Junction Fabrication (Simple Idea), Barrier Formation in p-n Junction Diode, Current Flow Mechanism in Forward and Reverse Biased Diode, V-I characteristics.

Two-terminal Devices and their Applications: Zener diode and Voltage Regulation, Tunnel diode, Rectifier Diode: Half-wave Rectifiers, Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Average and RMS Current and Voltage, Ripple Factor and Rectification Efficiency, Qualitative Analysis of Filter Circuits.

Bipolar Junction transistor and Field-Effect Transistors: n-p-n and p-n-p Transistors, Characteristics of a transistor in CB, CE and CC mode, Current gains α and β, Relation between α and β, Common emitter amplifier, Structure and working of Junction Field Effect Transistor (JFET), Voltage Ampere Curves, Metal Oxide Semiconductor Field Effect Transistor (MOSFET): Depletion and Enhancement mode.

Operational Amplifiers and its applications: Characteristics of an Ideal and Practical Op-Amp, Open loop and Closed-loop Gain, CMRR, Offset, Slew Rate, Applications of Op-Amps: Inverting and non-inverting amplifiers, Concept of Virtual Ground and Virtual Short, Adder, Subtractor, Integrator, Differentiator.

TEXT BOOKS

1. Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
2. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
3.Elements of Modern Physics by S.H Patil
4. Basic Electronics and linear Circuits by N.N Bhargave, D.C Kulshreshtha and S.C Gupta.
5. Foundations of Electronics by D. Chatopadhyay, P.C Rakshit, B.Saha and N.N Purkit.

REFERENCE BOOKS

1. Electronic devices and Circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.
2. Electronic Principles, A. Malvino and D. J. Bates, 8th Edn. 2015, McGraw-Hill Education.
3. Solid State Electronic Devices, B.G. Streetman and S.K. Banerjee, 6th Edn. 2009, PHI.
4. Solid State Physics by Puri and Babbar.
5. Basic Electronics by D.C Tayal (Himalaya Pub.).
6. Integrated Electronics: Analog and Digital Circuits and Systems, J. Millman and C.C. Halkias, 2nd Edn. 2017, McGraw Hill Education.
7. Op-Amps and Linear Integrated Circuits, R. A. Gayakwad, 4th Edn. 2000, Pearson.

B.Sc-III (Non-Medical)
(SEMESTER-V/VI)
PAPER: PHYSICS LAB

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 20

List of Experiments:

1. To draw forward and reverse bias characteristics of a P-N junction diode.
2. To determine Boltzmann constant by V-I characteristics of P-N junction diode.
3. Measurement of reverse saturation current in a p-n junction diode at various temperatures and to find the approximate value of energy gap.
4. To study V-I characteristics of Zener diode.
5. To study the stabilization of output voltage of a power supply with Zener diode.
6. To draw output and mutual characteristics of FET.
7. To measure and plot common base (CB) characteristics of a transistor.
8. To study the characteristics of a transistor in common emitter (CE) configuration.
9. To study V-I characteristics of Solar Cell.
10. To draw square, sine and triangular wave by using CRO.
11. To measure voltage and time period of a periodic waveform using CRO.
12. To study the voltage gain of inverting amplifier using Op-amp.
13. To study the voltage gain of non-inverting amplifier using Op-amp.
14. To investigate the use of Op-Amp as an Integrator.
15. To investigate the use of Op-Amp as a Differentiator.

B.Sc-III (Non Medical)
(SEMESTER-V/VI)
PHYSICS DSE: LASERs AND APPLICATIONS

Maximum Marks: 100 Time allowed: 3 Hours
External Marks: 75 Pass Marks: 35 %
Internal Marks: 25 No. of Lectures: 60

Course Objective:*The aim and objective of the course on laser physics and its applications is to expose the students to the topics like interaction of radiation with matter, understanding about laser fundamentals, different types of Lasers and introduction to Optics.*

Course Outcomes:*On completion of this course, student will be able to understand the basic fundamentals of laser, describe the construction and working of different types of lasers, explain the relation between Einstein coefficients,Discuss the applications of lasers-in medical field, in industry field, holography etc, explain the attenuation mechanisms.*

Instructions for the Paper Setter

The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus carrying 12 marks each. Section C will have 9 short answer type questions, which will carry 3 marks each and cover the entire syllabus uniformly.

Instruction for the candidates

The candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

SECTION A

Introductory Concepts of Lasers: Spontaneous and Stimulated Emission, Concept of Population Inversion, Laser Idea, Properties of Laser Light.

Interaction of Radiation with Matter: Einstein's Theory, Rates of Absorption, Spontaneous and Stimulated Emission. Allowed and Forbidden Transitions, Broadening of Spectral Lines, Natural, Collision and Doppler Broadening.

Laser rate equation: Pumping Processes, Three Levels and Four Level Laser (Qualitative Idea Only), Optimum and Output Coupling, Laser Spiking, Optical Absorption.

SECTION-B

Resonators (Concept and Theory): Passive Optical Resonators: Photon Lifetime and Cavity Q, Threshold Condition, Q Switching, Mode Locking

Types of Lasers: Lasers Construction, Ruby Laser, Nd: YAG Laser, He-Ne Laser, CO_2 Laser, Excimer Laser, Dye Lasers, Semiconductor Lasers.

Application of lasers: Holography, Laser Printing, Applications in Industry: Laser Drilling, Laser Welding and Cutting, Applications of Lasers for Data Storage, Medical Applications of Lasers.

Reference Books:

1. Lasers Fundamentals, W.T Silfvast (Second Edition), Cambridge.
2. Optics, Ajoy Ghatak (7th Edition), McGraw Hill.
3. Principles of Lasers, O. Svelto (Fourth Edition), Springer.
4. Lasers and its applications: A.K. Ghatak and K. Thyagrajan (Second Edition), Springer.
5. Lasers and Nonlinear Optics: B.B. Laud (Second Edition), Wiley Eastern.

B.Sc-III (Non-Medical)
(SEMESTER-V/VI)
PAPER: PHYSICS LAB

Maximum Marks: 50 Time Allowed: 3 Hours

Pass Marks: 20

List of Experiments:

1. To determine the wavelength of sodium source using Michelson's interferometer.
2. To determine wavelength of sodium light using Newton's Rings.
3. To determine diameter of Newton's Rings.
4. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
5. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
6. To measure the rotation of the polarisation plane through optically active liquids and determine the concentration of sugar solution.
7. To determine wavelength of sodium light using Fresnel Biprism.
8. To study the Diffraction of light by single slit using Diode Laser.
9. To study the Diffraction of light by double slit using Diode Laser.
10. To study the Diffraction of light by multiple slit using Diode Laser.
11. Diffraction of light by fine wire, cross wire and wire mesh using Diode Laser.
12. To observe the diffraction patterns by holes, single slit and double slit, mesh, grating, grid, opaque spots using Laser kit.
13. To demonstrate Fresnel's diffraction using Laser kit.
14. To measure wavelength of light using a millimetre scale as a grating using Laser kit.
15. To demonstrate fringes of equal inclination using Laser kit.

CERTIFICATE COURSE (FOR B.Sc. Part-I) Semester I and II

Semester- I
INTRODUCTION TO ELECTRICAL GADGETS

Maximum Marks : External 22
Internal 08
Total 30

Time Allowed : (1L+2P)=3 Hours
Total Teaching hours: 40
Pass Marks : 35 %

Out of 30 Marks, internal assessment (based on two mid-semester tests/ internal examination, written assignment/project work etc. and attendance) carries 08 marks, and the final examination at the end of the semester carries 22 marks.

Instruction for the Paper Setter

The question paper will consist of three sections A, B and C . Each of sections A and B will have four questions from respective sections of the syllabus and each question carries 03 marks. Section C consists of 10 marks, having 07 short answer type questions out of which the Candidate is to attempt any five questions of 02 marks each, which will cover the entire syllabus uniformly.

Instruction for the candidates

1) Candidates are required to attempt two questions each from section A and B, and the entire section C is compulsory and Consist of seven questions (Candidate is to attempt any five questions).
2) Use of non programmable calculator is allowed in the examination centre but this will not be provided by the University/College.

SECTION A

BASIC ELECTRICITY PRINCIPLES: Voltage, Current, Resistance, and Power, Ohm's law, Series, parallel, and series-parallel combinations, Voltmeter (ac and Dc) and Ammeter, energy meter and its installation. Reading of an energy meter, checking the energy meter paying for electricity. Use of Test Pen/Voltage Tester while installing electric equipment. Fuse implementation.

GROUNDING : Earth Concept, Shock hazard protection using Earth ground, Basic grounding practice.

STUDY OF DOMESTIC CIRCUITS : Installation of Switches, Sockets, Brackets, Buttons and blocks, Conduits, Cables and wires, Domestic Fitting.

SECTION B

TESTING DEVICES : Study of Test Lamp, Line Tester, Phase Tester and Continuity Tester. Testing using digital multimeter.

DIGITAL METER : A/D and D/A converter

SHIELDING: Guidelines, Protection from Electrostatic Discharge, Vand De graff generator (brief), Types of phases.

BASICS OF OSCILLOSCOPE : Analog and digital oscilloscopes, Self Testing, vertical and horizontal sensitivity, Identification of various types of pulses, Voltage, time and frequency measurement.

REFERENCES

1. A text book in ElectricalTechnology-BLTheraja-SChand&Co.
2. A textbook of ElectricalTechnology-AKTheraja.
3. Electronic Instruments and Instrumentation Technology by M.M.S. Anand

Semester-I

INTRODUCTION TO ELECTRICAL GADGETS

(Practical)

Time Allowed : 2 Hours (Practical)

Max. Marks : 20
Min. Pass Marks: 35%

The candidate is to mark five experiments on the question paper. The examiner will allot one question to be performed.

(i) One full experiment requiring the student to take some data, analyse it and draw conclusions-(candidates are expected to state their results with limits of error. (08)

(ii) Brief theory (04)

(iii) Viva-Voce (04)

(iv) Record (Practical File) (04)

List of of Practicals

1. To study energy-meter.
2. To learn utility of Test Pen/Voltage Tester while installing electric equipment.
3. To study implementation and use of fuse in circuit.
4. To study the Corona dischargein Vande Graff Generator kit.
5. To study conduction of electricity and electrostatic charges.
6. To study attraction and repulsion between the charged body.
7. To demonstrate ring launcher experiment.
8. To analyze the truth tables of various basic digital gates.
9. To study the characteristics of Zener diode and use as voltage stabilizer.
10. To find voltage, current relationship and power factor of a given R-L circuit.
11. Use of multimeter for testing electrical components.

Semester-II

OPTICAL FIBERS AND SOLAR POWER

Maximum Marks : External 22
Internal 08
Total 30

Time Allowed : 3 Hours
Total Teaching hours : 40
Pass Marks : 35 %

Out of 30 Marks, internal assessment (based on two mid-semester tests/ internal examination, written assignment/project work etc. and attendance) carries 08 marks, and the final examination at the end of the semester carries 22 marks.

Instruction for the Paper Setter

The question paper will consist of three sections A, B and C . Each of sections A and B will have four questions from respective sections of the syllabus and each question carries 03 marks. Section C, consists of 10 marks, having 07 short answer type questions out of which the Candidate is to attempt any five questions of 02 marks each, which will cover the entire syllabus uniformly.

Instruction for the candidates

1) Candidates are required to attempt two questions each from section A and B, and the entire section C is compulsory and Consist of seven questions (Candidate is to attempt any five questions).
2) Use of non programmable calculator is allowed in the examination centre but this will not be provided by the University/College.

SECTION A

Solar energy: Solar energy, its importance, storage of solar energy, applications solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar cell, Need and characteristics of photovoltaic (PV) systems

Type of Solar Cells. Types and characteristics.materials for production, Applications of solar cells. Solar-to-Electrical-based Energy harvesting. Efficiency of solar cell.

SECTION B

Optical Fibers: Optical Fibers and their properties, Principal of light propagation through a fibre, fabrication, components, numerical aperture,Losses in optical fiber.

Application of optical fiber: Fiber optics cables and use in communication.,

REFERENCES

1. Non-conventionalenergysources-G.DRai-KhannaPublishers,NewDelhi
2. Solarenergy-MPAgarwal-SChandandCo.Ltd.
3. Solarenergy-SuhasPSukhativeTataMcGraw-HillPublishingCompanyLtd.
4. Dr.PJayakumar,SolarEnergy: ResourceAssesmentHandbook,2009
5. J.Balfour,M.ShawandS.Jarosek, Photovoltaics, LawrenceJGoodrich(USA)

Semester-II
OPTICAL FIBERS AND SOLAR POWER
(Practical)

Time Allowed : 2Hours

Max. Marks : 20
Min. Pass Marks: 35%

The candidate is to mark five experiments on the question paper. The examiner will allot one question to be performed.

(i) One full experiment requiring the student to take some data, analyse it and draw conclusions-(candidates are expected to state their results with limits of error. (08)

(ii) Brief theory (04)

(iii) Viva-Voce (04)

(iv) Record (Practical File) (04)

List of of Practicals

1. To study of solar cell and characteristics.
2. To measure the photocurrent as a function of irradiance at a constant voltage.
3. To determine the Planck's constant using photocell
4. To study the inverse square law using photocell.
5. To study the characteristics of photocell.
6. To study current vs voltage characterstics of CdS Photoresistor at constant irradiance.
7. To measure the numerical aperture of an optical fibre.
8. To study the variation of the bending loss in a multimode fibre