Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

CIRCULAR NO.SU/ Sci. & Tech./Sub-Campus, Osmanabad/NEP/14/2023

It is hereby inform to all concerned that, the syllabi prepared by the Departmental Committee and recommended by the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted **the following curriculum of All Post Graduate Degree Courses as per Norms of National Education Policy – 2020 under the Faculty of Science & Technology run at University Department, Dr.Babasaheb Ambedkar Marathwada University, Sub-Campus, Osmanabad** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

Sr.No.	Syllabi of Deptt of BAMU, Sub Campus, Osmanabad.	Semester
1.	M.Sc. Chemistry specialization Analytical Chemistry, Organic Chemistry, Drug Chemistry.	Ist and IInd Semester
2.	M.Sc.Microbiology	Ist and IInd Semester
3.	M.Sc.Mathematics	Ist and IInd Semester
4.	M.Sc.Physics	Ist Semester
5.	M.Sc.Water & Land Management	Ist and IInd Semester

This is effective from the Academic Year 2023-24 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.SU/NEP/2023/8541-49
Date:- 08.08.2023.

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Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **Head of the Department, All Departments, Dr.Babasaheb Ambedkar Marathwada University, Sub-Campus, Osmanabad.**
2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation, Dr.BAMU,A'bad.
2] The Section Officer,[M.Sc.Unit] Examination Branch,Dr.BAMU,A'bad.
3] The Programmer [Computer Unit-1] Examinations, Dr.BAMU,A'bad.
4] The Programmer [Computer Unit-2] Examinations, Dr.BAMU,A'bad.
5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.BAMU,A'bad.
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DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD-431004 (MS), INDIA

FACULTY OF SCIENCE AND TECHNOLOGY

Master of Science in Physics

(M. Sc. in Physics)

(2 Years P.G. Program)

As Per

National Education Policy-2020

Course Structure and Curriculum

(Outcome-based Curriculum)

For University Departments
Department of Physics
Sub Centre, Dharashiv

Dr. Babasaheb Ambedkar Marathwada University,
Aurangabad-431 004 (MS)

Effective from the Academic Year 2023-24

9/8/2023

PREFACE

The National Education Policy (NEP) 2020, implemented in India, marks a significant stride towards a holistic and transformative educational framework. This policy aims to revolutionize the country's education system by fostering a learner-centric approach, promoting critical thinking, and nurturing creativity among students. With its emphasis on early childhood education, vocational training, and multi-disciplinary learning, the NEP 2020 seeks to equip students with relevant skills for the 21st-century world. It also focuses on bridging the digital divide and leveraging technology for effective teaching and learning. By encouraging flexibility in curriculum and assessment methods, promoting the mother tongue as a medium of instruction, and ensuring inclusive education, the NEP 2020 endeavors to build a robust and inclusive education ecosystem that prepares learners for the challenges and opportunities of the future.

On the other hand Outcome Based Education (OBE) is the educational approach which focuses on student centric education in the context of the development of personal, social, professional and knowledge (KSA) requirements in one's career and life. It is the decade ago curriculum development methodology. The educational triangle of *LEARNING-ASSESSMENT-TEACHING* is the unique nature of the OBE approach. The curriculum practices such as the Competency Based Curriculum, Taylor's Model of Curriculum Development, Spadys' Curriculum principles, Blooms taxonomy and further use of assessment methodologies like, Norm-reference testing and Criterion reference testing, etc is being practiced since decades. It is also interesting to know that, globally, different countries and universities adopts the curriculum development models/approaches such as, CDIO (Conceive-Design-Implement-Operate), Evidenced Based Education, Systems' Approach, etc as the scientific and systematic approaches in curriculum design.

The authorities of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M.S.) in-lieu of accreditation standards of National Assessment and Accreditation Council, decided to opt for National Education and Policy and Outcomes Based Education (OBE). As the part of the decision, different meetings, workshops and presentations were held at the campus of university.

This document is the outcome of different meetings and workshops held at university level and department level. The detailed document is designed and the existing curriculum of the department is transformed in to the framework of NEP with OBE. This is the first step towards the implementation of NEP with OBE in the university departments and affiliated colleges. The document will serve all stakeholders in the effective implementation of the curriculum. The OBE is continuous process for quality enhancement and it will go a long way in order to enhance the competencies and employability of the graduates/Post-graduates of the university departments and affiliated colleges.

Course Structure and Curriculum for

Master of Science (M. Sc.) in Physics

Illustrative Course and Credit Distribution Structure for

Two Years Post Graduate Programme with Multiple Entry Exit Options

Year / level	Sem.	Major subject		RM	OJT /FP	RP	Credits	Degree
		DSC Core Mandatory	DSE (Elective)					
First year 6.0	I	3(4) +2=14	4	4	--	--	22	PG Diploma (after 3 years degree)
	II	3(4) +2=14	4	--	4	--	22	
Cum. Cr. For PG Diploma		28	08	4	4	--	44	
Exit option with Post-graduate Diploma (44 credits) after first year or two semester with completion of courses equivalent to 44 credits								
Second Year 6.5	III	3(4)+2=14	4	---	---	4	22	PG Degree after 3 years UG or PG Degree after 4 years UG
	IV	3(4)=12	4	---		6	22	
Cum. Cr. For 1 year PG Degree		26	8			10	44	
Cum. Cr. For 2 years PG Degree		54	16	4	4	10	88	
2 Years -4 sem.PG Degree (88 credits) after three year UG Degree or 1 Year -2 sem. PG Degree (44 credits) after four year UG degree								

Note- DSC - is Discipline specific Core courses and are mandatory
Major – Comprising Mandatory – based on core subjects
DSE- Discipline Specific Elective based on specialization
OJT – On-the- Job Training
FP – Field Project (Corresponding to the Major (Specialization) Subject
RP – Research Project (Corresponding to the Major (Specialization) Subject
Internship/Apprenticeship - (Corresponding to the Major (Specialization) Subject

Course and Credit Distribution Structure for
Two Years Post Graduate Programme with Multiple Entry Exit Options

Class: M. Sc. First Year, Semester: First Semester, Subject: Physics

Course Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Discipline Specific Core Course (DSC) Mandatory	PHYT/MJ/516	Linear and Digital Electronics	2	--	2	--	14
	PHYT/MJ/517	General Condensed Matter Physics	2	--	2	--	
	PHYT/MJ/518	General Nuclear Physics	2	--	2	--	
	PHYT/MJ/519	Atomic and Molecular Physics	2	--	2	--	
	PHYP/MJ/540	Practical Based on PHYT/MJ/516	--	4	--	2	
	PHYP/MJ/541	Practical Based on PHYT/MJ/517	--	4	--	2	
	PHYP/MJ/542	Practical Based on PHYT/MJ/518	--	4	--	2	
DSE (Choose any one from pool of Course)	PHYT/DSE/520 PHYP/DSE/543	8086 Microprocessor and Programming Practical Based on PHYT/DSE/520	2	4	2	2	4
	OR						
	PHYT/DSE/521 PHYP/DSE/544	Electrical Properties of Solids and Superconductivity Practical Based on PHYT/DSE/521	2	4	2	2	
RM	PHYT/RM/548	Review of literature for Research Project	2	--	2	--	4
		Formulation of Topic	2	--	2	--	
			14	16	14	8	22

Course and Credit Distribution Structure for
Two Years Post Graduate Programme with Multiple Entry Exit Options

Class: M. Sc. First Year, Semester: Second Semester, Subject: Physics

Course Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Discipline Specific Core Course (DSC) Mandatory	PHYT/MJ/566	Quantum Mechanics	2	--	2	--	14
	PHYT/MJ/567	Mathematical Methods in Physics	2	--	2	--	
	PHYT/MJ/568	Statistical Mechanics	2	--	2	--	
	PHYT/MJ/569	Electrodynamics	2	--	2	--	
	PHYP/MJ/590	Practical Based on PHYT/MJ/566	--	4	--	2	
	PHYP/MJ/591	Practical Based on PHYT/MJ/567	--	4	--	2	
	PHYP/MJ/592	Practical Based on PHYT/MJ/568	--	4	--	2	
DSE (Choose any one from pool of Course)	PHYT/DSE/570 PHYP/DSE/593	The 8051 Microcontroller Practical Based on PHYT/DSE/570	2	4	2	2	4
	OR						
	PHYT/DSE/571 PHYP/DSE/594	Thin Film and Vacuum Technology Practical Based on PHYT/DSE/571	2	4	2	2	
OJT/FILED PROJECT	PHYP/OJT/FP/598		--	8	--	4	4
			10	24	10	12	22

Preamble:

Dr. Babasaheb Ambedkar Marathwada University proposes to offer a two years / one year Master programme in Science (M. Sc.) in Physics. The curriculum design of this program is undertaken in the following framework (assumptions).

a) Although there has been remarkable progress in all sectors of education in last couple of decades, there has been increasing crisis for truly able manpower to address the growing demands for work sectors. This has led to the widening gap between the supply and demand for skilled manpower across teaching institutions, R&D organizations and industries. Such inadequacy of knowledge acquisition and dissemination has translated directly into unemployment among an increasing number of post-graduates who pass-out every year and are forced to bare-trained in order to become marketable.

   A scientifically designed framework, which will enable students at post graduate level to be ready to face the challenges of the demand driven socio-economic profile is therefore, a call of the day. Such a course should not be occupation specific and should enable students to choose from a variety of options for their career.

   This programme is designed to produce a skilled manpower in Physics with Sensors and process control as specialized sectors of training to improve the opportunities for the unemployed youths in both the private and public sectors.

b) According to a study conducted by the Associated Chambers of Commerce and Industry of India (ASSOCHAM), there will be a deficit of 40 million working professionals and the employers would face the difficulty of filling positions because of the dearth of suitable talent and skilled person all in their industry. **This programme aims to provide some solution for this problem and this would facilitate to improve:**

   (i) **Quality of training**
   (ii) **High drop-out rates**
   (iii) **Linkages with Universities and industry**
   (iv) **Inadequacy of resources.**

c) **This programme is intended to offer practical training and skills needed to pursue an occupation straight away. It will provide options to the students to be trained in directions which are directly aligned to land a job in a chosen profession or a skilled trade.**

d) **This program is intended to offer students with life-long independent and reflective learning skills in their career.**

Vision

To structure the Department of Electronics of University to be an Epitome of Excellence in Research and Development in the area of Sensor Technology by creating and imparting time responsive Quality Education to address Changing Scenario, keeping Research and Development at its core, for 'Anyone' at 'Anytime' and 'Anywhere'.

Mission

To achieve the vision, the Department / College will:

- Provide a platform for the students with broad spectrum of diversity to achieve Academic Excellence with in-built Employability in the area of Sensor Technology.
- Establish a unique learning environment to enable the students to face the challenges in the area of Sensor Technology.
- Identify the gaps between academics and industry, design the courses to impart technical and life skill as per the requirements of the region so as to improve employability and develop entrepreneurial capabilities.
- Adopt a perennial process for bringing in excellence in teaching pedagogy by providing ICT based state-of-the-art infrastructural facilitation
- Provide student centric learning environment and to establish platform for inclusive research leading to the development of creative thought process amongst research scholars keeping in mind societal needs.
- Establish centre of excellence in the area of Physics viz. Electronics devices, Spectroscopy, Nuclear Physics and Condensed Matter Physics to nurture innovative ideas shaping into products facilitating the spinoff and creating awareness to protect Intellectual Property (IP).
- Provide ethical and value based education by promoting activities addressing the societal needs.

Program Educational Objectives:

The objectives of M. Sc. (Physics) program are to produce graduates who –

1. Are equipped with time relevant knowledge of Physics to address multi-disciplinary demands of R & D organizations, educational institutes and automated process in modern industries in capacity of Scientist, Education Professionals, System Developers and System Integrators.

2. Have sound background to practice advanced concepts of electronics in the areas sensor technology, Semiconductor Devices in R & D organizations, educational institutes, industry and Government settings meeting the growing expectations of stakeholders.

3. Have an ability to pursue higher studies and succeed in academic and professional careers.

4. Have the ability to address professional demands individually and as a team member communicating effectively in technical environment using modern tools.

5. Recognize the need for and possess the ability to engage in lifelong learning and will be sensitive to consequences of their work both ethically and professionally for productive professional career.

Programme Outcomes (POs):

Graduates of the M. Sc. (Physics) program are expected to -

PO1. **The citizenship and society:** Apply broad understanding of ethical and professional skill in electronics technology in the context of global, economic, environmental and societal realities while encompassing relevant contemporary issues.

PO2. **Environment and sustainability**: Apply broad understanding of impact of electronics technology in a global, economic, environmental and societal context and demonstrate the knowledge of, and need for sustainable development.

PO3. **Ethics:** Apply ability to develop sustainable practical solutions for electronics technology related problems within positive professional and ethical boundaries.

PO4. **Individual and team work:** Function effectively as a leader and as well as team member in diverse/ multidisciplinary environments.

PO5. **Communication:** Communicate effectively on complex electronics technology related activities with the scientific community in particular and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO6. **Project management and finance**: Demonstrate knowledge and understanding of the first principles of electronics technology and apply these to one's own work as a member and leader in a team, to complete project in any environment.

PO7. **Life-long learning**: Recognize the need for lifelong learning and have the ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes:

PSO1. **Domain knowledge:** Apply the knowledge of electronics fundamental, Sensor Technology, and Semiconductor Devices to provide comprehensive solution of problems in complex electronics.

PSO2. **Problem Analysis:** Identify electronics related problems at varied complexity and analyze the same to formulate/ develop substantiated conclusion using first principles of Sensor Technology, Semiconductor Devices and scientific literature.

PSO3. **Design Development of solutions:** Design/ develop solutions for problems at varied complexity in the area Sensor Technology, and Semiconductor Devices to address changing challenges put forward by market demand/ stakeholder

PSO4. **Conduct Investigation of complex problems:** Use research-based knowledge and methods to design of experiments, analyze resulting data and interpret the same to provide valid conclusions.

PSO5. **Modern tools:** Create, select, and apply appropriate techniques, resources, and modern electronics and relevant IT tools including prediction and modeling to complex electronics technology related activities with clear understanding of the limitations

Course - Program outcome Matrix:

The Program Outcomes are developed through the curriculum (curricular/co-curricular-extra-curricular activities). The program outcomes are attained through the course implementation. As an educator, one must know, ***"to which POs his/her course in contributing?"*** So that one can design the learning experiences, select teaching method and design the tool for assessment. Hence, establishing the Course-PO matrix is essential step in the OBE. The course-program outcomes matrix indicates the co-relation between

the courses and program outcomes. The CO-PO matrix is the map of list of courses contributing to the development of respective POs.

The CO-PO MATRIX is provided in the following Table.

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PS O4	PSO 5
Semester-I												
PHYT/MJ/516	√			√			√	√	√	√	√	√
PHYT/MJ/517	√			√			√	√	√	√	√	√
PHYT/MJ/518	√			√			√	√	√	√	√	√
PHYT/MJ/519	√			√			√	√	√	√	√	√
PHYP/MJ/540	√				√	√	√	√	√	√	√	√
PHYP/MJ/541	√			√	√	√	√					
PHYP/MJ/542	√			√	√	√	√					
PHYT/DSE-520 to 521	√				√	√	√	√	√	√	√	√
PHYP/DSE/543-544	√			√	√	√	√					
PHYT/RM/548	√				√	√	√	√	√	√	√	√
Semester-II												
PHYT/MJ/566	√			√			√	√	√	√	√	√
PHYT/MJ/567	√			√			√	√	√	√	√	√
PHYT/MJ/568	√			√			√	√	√	√	√	√
PHYT/MJ/569	√			√			√	√	√	√	√	√
PHYP/MJ/590	√				√	√	√	√	√	√	√	√
PHYP/MJ/591	√			√	√	√	√					
PHYP/MJ/592	√			√	√	√	√					
PHYT/DSE-570 to 571	√				√	√	√	√	√	√	√	√
PHYP/DSE/593-594	√			√	√	√	√					
PHYP/OJT/FP/598	√				√	√	√	√	√	√	√	√

Target levels for Attainment of Course Outcomes:

The course outcome attainment is assessed in order to track the graduates' performance w.r.t target level of performance. The CO-PO attainment is the tool used for continuous improvement in the graduates' abilities through appropriate learning & teaching strategies. In order to assess students' performance with respect to abilities (at the end of course teaching/by the end of program) the course outcome attainment are measured/calculated. In order to calculate the program outcome attainment, the course outcome attainment is calculated. Prior to that, the course-program outcome mapping is done.

Target level for Attainment of Program Outcomes:

The program outcome attainment is assessed in order to track the graduates' performance w.r.t target level of performance. The CO-PO attainment is the tool used for continuous improvement in the graduates' abilities through appropriate learning and teaching strategies. In order to assess students' performance with respect to abilities (at the end of course teaching/by the end of program) the course outcome attainment and program outcome attainment is measured/calculated. The program outcome attainment is governed by curricular, co-curricular and extra-curricular activities including the stakeholders' participation. The direct method and indirect method is adopted to calculate the PO attainment. The direct method implies the attainment by course outcomes contributing to respective program outcomes. And indirect method is the satisfaction/feed-back survey of stakeholders. In order to calculate the program outcome attainment, the course outcome attainment is calculated. Prior to that, the course-program outcome mapping is done.

The set target level is the set benchmark to ensure the continuous improvements in the learners/ graduates' performance.

Course Attainment Levels:

a. CO attainment is defined/set at three levels;
b. The CO attainment is based on end term examination assessment and internal assessment;
c. The Co attainment is defined at three levels in ascending order-
    i. e.g. For end term and internal examination;
    ii. Level-1: 20% students scored more than class average
    iii. Level-2: 30% students score more than class average;
    iv. Level-3: 40% students score more than class average.

d. The target level is set (e.g. Level-2). It indicates that, the current target is level-2; 30% students score more than class average. The CO attainment is measured and the results are obtained. Based on the results of attainment, the corrective measures/remedial action are taken.
e. CO Attainment = 80% (Attainment level in end term examination) + 20% (Attainment level in internal examination).

Program attainment Level:

a. PO attainment is defined at five levels in ascending order;
b. The PO attainment is based on the average attainment level of corresponding courses (Direct Method) and feed-back survey (Indirect method);
c. The PO attainment levels are defined / set as stated below;
    i. Level-1: Greater than 0.5 and less than 1.0 (0.5>1) - Poor
    ii. Level-2: 1.0>1.5 - Average
    iii. Level-3: 1.5>2.0 - Good
    iv. Level-4: 2.0>2.5 - Very Good
    v. Level-5: 2.5>3.0 - Excellent
d. The PO attainment target level is set/defined (say, Level-4). It implies that, the department is aiming at minimum level-4 (very good) in the performance of abilities by the graduates. Based upon the results of attainment, the remedial measures are taken;
e. PO Attainment = 80% (Average attainment level by direct method) + 20% (Average attainment level by indirect method).

Examples of CO Attainment:

FOR EXAMPLE: COURSE CODE/TITLE: DSC-12

e.g. For end term and internal examination;

i. Level-1: 20% students scored more than class average
ii. Level-2: 30% students score more than class average;
iii. Level-3: 40% students score more than class average

Average of Total Marks in Examination: 61.00 % Students score more than 61 is 4/12 i.e. 33.33% i.e. Levl-2

A (CO) DSC-12 = 100(2)

= 2.00

Hence, the attainment level is Level-2 and the set target level is Level-2 and therefore the CO is fully attained.

Table No. 1.0: CO Attainment Level

Course Code	CO attainment Value	Attainment	Fully Attained/Not attained	Remedial measures
PHYT/MJ/516	1	2	Not Attained	Assignment, tutorials, exercise and Remedial coaching.
PHYT/MJ/517	2	2	Fully Attained	
PHYT/MJ/518	1	2	Not Attained	Assignment, tutorials, exercise and Remedial coaching.
PHYT/MJ/519	3	2	Fully Attained	
PHYT/MJ/520-521	3	2	Fully Attained	
RM	2	2	Fully Attained	
PHYT/MJ/566	0	2	Not Attained	Assignment, tutorials, exercise and Remedial coaching.
PHYT/MJ/567	3	2	Fully Attained	
PHYT/MJ/568	3	2	Fully Attained	
PHYT/MJ/569	1	2	Not Attained	Assignment, tutorials, exercise and Remedial coaching.
PHYT/MJ/570-571	3	2	Fully Attained	

Example of PO Attainment:

The attainment of PO will have to be calculated after declaration of IInd year result every year.

Table No. 2.0 PO Attainment Level

PO/PSO number	Description of PO/PSO	Attainment level	Target level	Fully attained/ Not Attained	Remedial Measures

i) Planned Actions for Course Attainment:

ii) Planned Actions for Program Outcome Attainment:

After calculating attainment of COs and POs, gap needs to be identified and a comprehensive plan needs to be prepared for bridging the gaps.

Eligibility:

Those who have completed B. Sc. With Physics as an optional subject or Hons from any recognized University/ Institution are eligible for registration subject to the rules and regulations laid down by Dr. Babasaheb Ambedkar Marathwada University, Aurangabad time to time.

Candidates seeking admission to the first Semester of M. Sc. in Physics must possess following eligibility criteria.

- Must have passed B. Sc., (10 + 2 + 3) degree with Physics as one of the optional subjects OR have passed B. Sc. (Hons.) with Physics.

Course Fees:

Rs. 1541/- per year (For Open Category) and Rs. 541/- per year (For reserve category)

Number of Seats:

The Intake capacity of M. Sc. Physics will be ----- as under

Admission / Promotion Process:

In response to the advertisement for registration, interested students will have to register themselves. One of the following methods will be adopted for admission.

- Admission will be done on the basis of performance of students at Common Entrance Test (CET). The CET will be conducted in the month of June every year.

  OR
- Admission process declared by the University

There is Full Carry on for M. Sc. i.e. **irrespective** of individual performance in first year; a student will be promoted to Second Year. However, for obtaining M. Sc. Degree, a student will have to complete all semesters successfully within 4 years/08 semesters. It also offers multiple exit/entry. Students can exit after completion of one year and can enter into the system (second year) with 5 years from the date of first time registration.

Dropout students will be allowed to register for respective semester as and when the concerned courses are offered by the department, **HOWEVER HE / SHE SHOULD NOT EXCEED MORE THAN TWICE THE DURATION OF THE COURSE FROM THE DATE OF FIRST REGISTRATION AT PARENT DEPARTMENT / COLLEGE.** The admission of the concern student will be automatically cancelled if he / she fails to complete the M. Sc. degree within a period of maximum four years / eight semesters.

Choice Based Credit System (CBCS):

The choice based credit system is going to be adopted by the University. This provides flexibility to make the system more responsive to the changing needs of our students, the professionals and society. It gives greater freedom to students to determine their own pace of study. The credit based system also facilitates the transfer of credits. Students will have to earn 88 credits for the award of two years Master of Science (M. Sc.)

Credit-to-contact hour Mapping:

(a) One Credit would mean equivalent of 15 periods of 60 minutes each for theory lecture.

(b) For lab course/ workshops/internship/field work/project, the credit weightage for equivalent hours shall be 50% that for lectures /workshop

(c) For self-learning, based on e-content or otherwise, the credit weightage for equivalent hours of study should be 50% or less of that for lectures/workshops.

Attendance:

Students must have 75 % of attendance in each course for appearing examination, otherwise he / she will be strictly not allowed for appearing the semester examination of each course. Frequent absence from regular lecture/practical course may lead to disqualification from continuous assessment test (CAT) process in respective subject.

Departmental Committee:

The Departmental Committee (DC) of the Department will monitor smooth functioning of the program.

Results Grievances / Redressal Committee

Grievances / redressal committee will be constituted in the department to resolve all grievances relating to the evaluation. The committee shall consist of Head of the department, the concerned teacher of a particular course and senior faculty member of Department of Committee. The decision of Grievances / redressal committee will have to be approved by Department committee.

Evaluation Methods:

- The assessment will be based on **40:60 ratio** of **continuous assessment test (CAT) and end semester examination**. **Separate and independent passing in continuous assessment test (CAT) and end semester examination will be mandatory**. In case of failure in CAT of a particular course, students will have to appear for the same CAT, at his/her own responsibility in the next academic year, when the same course is offered during regular academic session. However, in case of failure in **end semester examination** in particular course(s), exam will be conducted in immediate subsequent semester.

- In case a student fails in certain course(s) in a particular semester and the same course(s) are modified/ revised/ removed from the curriculum in due course, the student will have to appear as per the newly framed curriculum and/or pattern in subsequent semester, at his/her own responsibility.

Continuous Assessment Test (CAT):

Three CAT, each of 20 marks would be conducted at different phases (25 %, 50 % and 75 % of completion of syllabus OR 25, 50 and 75 working days out 90 working days of the semester) throughout the semester. Each concurrent assessment (CAT-I, II, III) will be mapped to the course learning outcomes. Total performance in CAT (i.e. 40 %) would be based on best two out of three CAT examination. Course teacher will have liberty to choose from variety of assessment tools/ methods (class test, assignment, tutorial, seminar, case study, field work, project work, quiz) which may be deemed to appropriate for assessing the relevant course outcome.

End Semester Examination:

- The question paper of end semester examination must be designed to test all levels of cognitive domain and should include all types questions- essay, short, quantitative problems/ numerical, MCQs etc. The end semester theory examination for each theory course will be of 60 marks. The total marks shall be 100 for 4 credit theory course (60 marks end semester examination + 40 marks CAT) and 50 for 2 credit theory course (30 marks end semester examination + 20 marks CAT)
- End Semester examination time table will be declared by the University (as per the university annual calendar).
- Pattern of semester end examination question paper will be as below:
    - The end semester examination of theory course will have two parts (20 + 40 = 60 Marks)
    - Part A will be consisting of 10 questions having 2 marks each (multiple choice questions / fill in the blanks/ answer in sentence) as compulsory questions and it should cover entire course curriculum (20 Marks)
    - Part B will carry 6 questions (10 marks for each question) (02 questions from each of 03 units) and students will have to attempt any 04 questions out of 06 (40 Marks).

- 20 to 30% weightage can be given to problems/ numerical wherein use of non-programmable scientific calculator may be allowed.
- Number of sub questions (with allotment of marks) in a question may be decided by the examiner.

Earning Credits:

At the end of every semester, a letter grade will be awarded in each course for which a student had registered. A student's performance will be measured by the number of credits that he/she earned by the weighted Grade Point Average (GPA). The SGPA (Semester Grade Point Average) will be awarded after completion of respective semester and the CGPA (Cumulative Grade Point Average) will be awarded at the final exit.

Grading System:

- The grading reflects a student-own proficiency in the course. A ten point rating scale shall be used for the evaluation of the performance of the students to provide letter grade for each course and overall grade for the Master Programme. Grade points are based on the total number of marks obtained by him / her in all heads of the examination of the course. The grade points and their equivalent range of marks are shown in Table-I

Table – I: Ten point grade and grade description

Marks Obtained (%)	Grade Point (GPA/CGPA)	Letter Grade	Description
90-100	9.00- 10	O	Outstanding
80-89	8.00-8.99	A^+	Excellent
70-79	7.00-7.99	A	Very Good
60-69	6.00-6.99	B^+	Good
55-59	5.50-5.99	B	Above Average
50-54	5.00-5.49	C	Average
40-49	4.00-4.99	P	Pass
Below 40	Below 4.0	F	Fail
Absent	Absent	Ab	Absent

- Non-appearance in any examination / assessment shall be treated as the students have secured zero marks in that subject examination / assessment.
- Minimum P grade (4.00 grade points) shall be the limit to clear / pass the course / subject. A student with F grade will be considered as "failed" in the concerned course and he / she has to clear the course by appearing in the next successive semester examinations.
- Every student shall be awarded grade points out of maximum 10 points in each subject (based on 10 point scale). Based on the grade points obtained in each subject, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and CGPA will be given at final exit.

Computation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average)

Grade in each subject / course will be calculated based on the summation of marks obtained in all five modules.

The computation of SGPA and CGPA will be as below

- Semester Grade Point Average (SGPA) is the weighted average points obtained by the students in a semester and will be computed as follows

$$SGPA = \frac{\text{Sum (Course Credits) X Number of Grade Points in concerned Course Gained by the Student}}{\text{Sum (Course Credits)}}$$

The SGPA will be mentioned on the grade card at the end of every semester.

- The Cumulative Grade Point Average (CGPA) will be used to describe the overall performance of a student in all semester of the course and will be computed as under.

$$CGPA = \frac{\text{Sum (All four Semester SGPA)}}{\text{Total Number of Semester}}$$

The SGPA and CGPA shall be rounded off to the second place of decimal.

Grade Card

Results will be declared by the Centre and the grade card (containing the grades obtained by the student along with SGPA) will be issued by the university after completion of every semester. The grade card will be consisting of following details.

- Title of the courses along with code opted by the student.
- Credits associated with the course.
- Grades and grade points secured by the student.
- Total credits earned by the student in a particular semester.
- Total credits earned by the students till that semester.
- SGPA of the student.
- CGPA of the student (at final exit).

Cumulative Grade Card

The grade card showing detail grades secured by the student in each subject in all semesters along with overall CGPA will be issued by the University at final exit.

AS PER NEP 2020

SEMESTER – I

Course Name: Linear and Digital Electronics

Course Code: PHYT/MJ/516, Course Type: MJ,

Contact Hours: 30, Credits: 02, Hours/Week: 02, Max. Marks: 50

COURSE OBJECTIVES:

1. To establishes the general method for analyzing and predicting the performance of operational amplifiers and related circuits.
2. To develop the students for designing realistic circuits to perform specified operations.
3. To enable the students to select available devices for intended operations.

COURSE OUTCOMES (COs) :

At the end of the course, students will be able to:

1 Discuss the general properties of an operational amplifier.

2 Define the terms, input impedance, output impedance, bandwidth, input offset voltage, input offset current, CMRR, open loop voltage and slew rate.

3 Design an inverting and non-inverting amplifier circuit or its special cases to meet the given requirement.

4 Analyze or design op-amp for the intended operations: A stable Multivibrator, Monostable Multivibrator, Wien bridge Oscillator and some related circuits.

5 Explain gates, its related circuits, truth table and its realization.

6 Analyze or designing of combinational and sequential circuits.

COURSE CONTENT :

Unit I: Operational amplifier: (12 Contact Hours)

Symbol and terminals, the ideal op-amp, the practical op-amp. Operational amplifier parameters: Input offset voltage, Input offset current, Input bias current, Input impedance, Output impedance, Open loop voltage gain, Common – Mode rejection ratio, Slew rate. Inverting, non – inverting amplifier. Applications of Operational Amplifier and Timing Circuits: Adder, Subtractor, Integrator, differentiator, Comparator & Schmitt's trigger; Wave form generators: Astable Multivibrator, Monostable Multivibrator, and Wien Bridge Oscillator using IC741. Integrated circuit timer: Monostable, Astable Multivibrator using IC-555.

Unit II: Numbers systems, Codes and Combinational Logic: (08 Contact Hours)

Decimal, Binary, & Hexadecimal numbers systems, and its arithmetic's. BCD code. AND, OR, NOT operations, NAND and NOR operations, NAND and NOR as building blocks, Exclusive –OR operation. Boolean algebra, Standard Representation for Logical Functions, Half & Full adder, Parallel 4-bit adder, encoder (decimal to binary), Decoder (Decimal to BCD), BCD to seven segment decoder, Multiplexer: (4:1) and (8:1), Demultiplexer: (1:8) and (1:16) and their applications.

Unit III: Sequential Logic: (10 Contact Hours)

Flip-Flops: S-R, D- type, T-type, J-K and J-K master-slave. Shift registers: Serial in Serial out, Serial in parallel out, Parallel in Parallel out, Parallel in Serial out. Ripple counters: Mod-16, Mod – 12 and Mod- 10. Synchronous counters: Mod-8 and Mod-16.

Text Books, Reference books and Websites

1. Operational amplifier with Linear integrated circuits, by William D Staney Fourth Edition, LPE PEARSON Education, 2004, ISBN 81-297-0463-3.
2. Op-Amp and Linear Integrated Circuits, By R. A. Gaykwad 4th. Ed, Prentice Hall of India, 2002, ISBN 81 –203–2058–1.
3. Operational amplifier & Linear integrated circuits, 6/e Robert F. Coughlin, Frederick F. Driscoll Modern Digital Electronics, by R P Jain, 3'rd Edition, Tata McGraw – Hill Publishing Company Ltd. 2003,ISBN 0-07-049492-4.
4. Digital Electronics, Second Edition, Tokheim, 1985, ISBN 0-07-064980-4.
5. Principles of Electronics, V. K. Mehta, Rohit Mehta, S. Chand and Company Ltd. 2012, ISBN: 81-219-2450-2.
6. Digital Fundamentals, by Thomas L Floyd, 2nd Edition Charles E. Merrill Publishing Company.
7. Electronic Devices, by Thomas L Floyd, Charles E. Merrill Publishing Company.

Course Name: General Condensed Matter Physics

Course Code: PHYT/MJ/517, Course Type: MJ,

Contact Hours: 30, Credits: 02, Hours/Week: 02, Max. Marks: 50

Learning Objectives: This course deals with crystalline solids and is projected to make available students with the basic physical concept and mathematical tools used to portray solids. The course deals with groups of materials, as in the periodic table, in terms of their structure, electronic, optical, and thermal properties. Specific objectives are: To show how crystal symmetry leads to substantial mathematical simplifications when dealing with solids. To describe basic experimental measurements, to show typical data sets and to compare these with theory.

Learning Outcomes: The field of General Condensed Matter Physics investigates different classes of materials -metals, ceramics, electronic materials with an emphasis on the relationships between the underlying structure and the processing, properties, and performance of the materials. Research opportunities are offered as scientists and technologists, etc in national and international institutions.

COURSE CONTENTS:

Unit I: Crystal Structure: (12 Contact hours)

Lattice translation vectors and lattices, basis and crystal structure, primitive, non-primitive unit cells, Wigner- Seiz cells, 2d & 3d Bravais lattices, characteristics of cubic lattices, miller indices, symmetry elements, point group and space groups, different crystal structures: hexagonal close packed structure, s.c., b.c.c., f.c.c, sodium chloride, diamond, Xray-diffraction condition and Bragg's law, Experimental method on the basis of Ewald Construction, Electron and Neutron diffraction by crystals, Reciprocal lattice and Brillouin Zone.

Unit II: Lattice Dynamic and Specific Heat: (08 Contact hours)

Vibrations of one–dimensional monoatomic lattices: Firs Brillouin zone, Group velocity, long wavelength and force constant, Diatomic lattices, quantization of lattice vibrations, phonons, inelastic scattering of neutron by phonons, Einstein model, Debye model of lattice heat capacity, electronic heat capacity, anharmonicity, thermal expansion and thermal conductivity: thermal resistivity, density of modes of square lattice.

Unit III: Free electron model of metals and Energy bands in solids: (10 Contact hours)

Free electron gas in three dimensions, Fermi – Dirac distribution, heat capacity of electron gas, hall effect, Matthiessen rule, fermi surface, de Hass von Alfen effect, magnetoresistance, tight binding method, pseudopotentials. Origin of energy band gap, Bloch function, Kronig-Penny Model, number of states in a band, distinction between metals, insulators and semiconductors, concept of holes, equation of motion for electron and holes, effective mass of electron and holes.

References

1. Solid State Physics: An Introduction- Philip Hofmann, 2nd Edition, Willey-VCH (2015) ISBN: 978-3-527-41282-2, E-Book978-3-527-68206-5.
2. Introduction to solid state physics – C. Kittel, Willey Eastern Pvt. Ltd. (2015) ISBN 10: 8126535180 ISBN 13: 9788126535187.
3. Elementary Solid-State Physics – M. A. Omar, Addition Wesley Pvt. Ltd. ISBN 10: 0201607336 ISBN 13: 9780201607338.
4. Solid State Physics – A. J. Dekker, Published by Macmillan India (2000) ISBN 10: 0333918339/ISBN 13: 9780333918333.
5. Solid State Physics - Aschroft and Mermen, New York, Holt, Rinehart and Winston (1976).
6. Introduction to Solids – L. V. Azaroff McGraw Hill, New York (1960)
7. Solid State Physics – S. O. Pillai, New age International Pvt. Ltd (2015). ISBN 10: 8122436978 ISBN 13: 9788122436976.
8. Solid State Physics – M. A. Wahab (2011). ISBN 10: 8184870566 ISBN 13: 9788184870565.
9. Concept in Solid State Physics – J. P. Shrivastava, Prentice Hall Ltd.
10. Fundamentals of Solid-State Physics – Saxena, Gupta, Saxena, Pragati Prakashan, Publisher: Anu Books (2019) ASIN: B07YCMDBTT.
11. Dynamical stability and low-temperature lattice specific heat of one-dimensional fullerene polymers, Atsushi Shimizu, Shota Ono, Chemical Physics Letters Volume 694, 16 February 2018, Pages 14-17, https://doi.org/10.1016/j.cplett.2018.01.037.
12. Photoswitching mechanism of a fluorescent protein revealed by time-resolved crystallography and transient absorption spectroscopy, Joyce Woodhouse, Gabriela Nass Kovacs, Martin Weik, Nature Communications volume 11, Article number: 741 (2020).
13. Structural, morphological, physical and dielectric properties of Mn doped ZnO nanocrystals synthesized by sol–gel method, VD Mote, Y Purushotham, BN Dole, Materials & Design 96 (2016) 99-105.

Course Name: General Nuclear Physics

Course Code: PHYT/MJ/518, Course Type: MJ,

Contact Hours: 30, Credits: 02, Hours/Week: 02, Max. Marks: 50

Course objective: The themes dealt with in this paper:

- This course will introduce students to the fundamentals of General Nuclear Physics.
- It aims to provide a coherent and concise coverage of traditional nuclear physics.
- Important topics of current research interest will be also discussed, such as radioactivity, radiation detector and accelerators which plays an important role in the realization of this course.
- A General Nuclear Physics is a foundation course as it is a preparatory course for university-level art and design education.

Course outcomes (COs):

The present unit attempts to achieve the following learning outcomes:

- On successful completion of the course, students should be able to illustrate general considerations of Nuclear physics to atomic and nuclear system; make general orders of magnitude of estimation of physical effects.
- Explain how interaction of gamma radiation with matter; the working principle of radiation detector.

Unit I: General Properties of Nucleus:

Nuclear size and its determination, nuclear radii by electron scattering and mirror nuclei methods. Binding energy, mass defect, Packing fraction. Semi-empirical mass formula and its applications. Quantum numbers of nuclei, nuclear angular momentum, nuclear magnetic dipole moment, electric quadrupole moment.

Unit II: Radioactivity (Natural and Artificial):

The basis of the theory of radioactive disintegration, the disintegration constant, half-life and the mean life. Successive radioactive transformation, radioactive equilibrium, the natural radioactive series, units of radioactivity. The discovery of artificial radioactivity, the artificial radio nucleids, electron and positron emission, orbital electron capture, the artificial radio nucleids: alpha emitters.

Unit III: Nuclear Radiation detectors:

Types of detectors, ionization chamber, G.M. Counters, proportional counter, semiconductor detector, counting errors, counting efficiency, scintillation counter, energy decapitation in phosphor, photoemission from phosphor.

Books:

1. Introduction to Nuclear Physics; H.A. Enge, Addison- Wesley, 1975.
2. Nuclear Physics; I. Kaplan, 2nd edition, Narosa, 1989.
3. The atomic Nucleus; R.D. Evans, Mc Graw- Hill, New York 1955.
4. Nuclear Physics; R.R. Roy and B.P. Nigam, Wiley – Eastern Ltd, 1983.
5. Basic Nuclear physics; B. N. Shrivastava, Pragati prakashan, Meerut.
6. Theory of Nuclear Structure; M. K. Pal, East – weast press Ltd. 1982.
7. Nuclear Physics; D.C. Tayal, Himalaya Publishing House, Bombay.
8. Experimental Nuclear Physics; E.Serge, John Wiley and sons, New York, 1959.
9. Encyclopaedia of nuclear Physics 3 : M.Chandrabhanu first edition : 2011.
10. Atomic and Nuclear Physics: N Subrahmanyam Brijlal. first edition : 1984.
11. Atomic and Nuclear Physics : Shatendra Sharma 2008.
12. Nuclear Physics An Introduction: S B Patel 2011.
13. Nuclear Physics : Rajkumar First Edition 2010.
14. Fundamentals of Nuclear Physics : Prof Jahan Singh, Pragati Prakashan First Edition 2012.
15. Radiation Physics For Medical Physicists E.B Podgor Second,Enlarged Edition Springer 2009.
16. Physics and Engineering of Radiation Detection Syed Naeem Ahmed Queen's University, Kingston, Ontario Academic Press Inc. Published by Elsevier First edition 2007
17. Radiation, Ionization, and Detection in Nuclear Medicine: Tapan K.Gupta ISBN978-3-642-34076- 5(eBook) Springer-Verlag Berlin Heidelberg 2013

Course Name: Atomic and Molecular Physics

Course Code: PHYT/MJ/519, Course Type: MJ,

Contact Hours: 30, Credits: 02, Hours/Week: 02, Max. Marks: 50

Course Objectives: The themes dealt with in this paper:

1. The atom, the nucleus, the electron and the photon - four necessary steps for the development of quantum physics.
2. The structure of the atom. Atoms in electric and magnetic fields. Fine and hyperfine structure. X-ray spectroscopy. Molecular structure.
3. Rotation-, vibration- and electronic spectra. Chemical bonds. Optical spectroscopy.
4. Applying laser spectroscopic methods as well as other modern tools in atomic and molecular physics, special efforts will be made in laboratory work.

Course Outcomes (COs): The present unit attempts to achieve the following learning outcomes: At the end of the course the student should be able to;

1. The course is a continuation of the Atomic and Molecular Physics course.
2. Introductory Atomic- and Molecular Physics will be discussed more in detail.
3. A big part of the course will give a view of the modern experimental tools of Atomic- and Molecular Physics job prospects.

Learning objectives:

1. The atom, the nucleus, the electron and the photon - four necessary steps for the development of quantum physics.
2. The structure of the atom. Atoms in electric and magnetic fields. Fine and hyperfine structure. X-ray spectroscopy. Molecular structure. Rotation-, vibration- and electronic spectra.
3. Chemical bonds. Optical spectroscopy. Applying laser spectroscopic methods as well as other modern tools in atomic and molecular physics, special efforts will be made in laboratory work.

Leaning Outcome:

1. The course is a continuation of the Atomic and Molecular Physics course.
2. Introductory Atomic- and Molecular Physics will be discussed more in detail.

3. A big part of the course will give a view of the modern experimental tools of Atomic- and Molecular Physics job prospects.

Course Contents:

Unit I: Introduction (10 hours)

Stern Gerlach experiment, Quantum states of an electron. Quantum numbers. Spectra of Hydrogen atom. Spin angular momentum, orbital angular momentum. Coupling of spin and orbit. Fine structure, spectroscopic terms, selection rules. Spectra of the alkali elements. Interaction energy in L-S and j-j coupling, Hund's rule and term reversal. Zeeman effect in one valence electron atoms, interaction energy, selection rules, Zeeman patterns. Paschen-Back effect, Pauli principle. Hyper fine structure (Qualitative).

Unit II: Rotational and Vibrational spectroscopy (12 hours)

Classification of molecules, Interaction of radiation with rotating molecule, IR spectra of diatomic molecules, Rigid rotator, energy levels, eigen functions and spectrum of rigid rotator, non-rigid rotator, isotopic substitution, effect of vibration on rotation, Intensities of rotational lines, information derived from rotational spectra. Vibrational course structure, Deslandres table, Diatomic molecule as a harmonic oscillator, energy levels, eigen functions and spectrum of harmonic oscillator, Morse potential, anharmonic oscillator, vibrating rotator with & without Born Oppenheimer approximation.

Unit III: Laser Fundamentals (8 hours)

Masers and lasers, methods of obtaining population inversion, Ammonia maser, Spontaneous and induced emission, Einstein's A and B coefficients, Properties of lasers, Principle & working of He-Ne, Ruby, semiconductor and color center.

References

1. Introduction to Atomic Spectra H. E. White McGraw Hill, First Edition ISBN-10: 0070697205 / ISBN-13: 978-0070697201.
2. Atomic Physics by Christopher J. Foot, Oxford University Press 2005. ISBN 10: 0198506961 / ISBN 13: 9780198506966
3. Fundamentals of Molecular Spectroscopy C.N Banwell & Elaine M. McCash. Tata McGraw Hill. ISBN 10: 0077079760 ISBN 13: 9780077079765

4. Spectra of diatomic molecules G. Herzberg, Krieger Malbar Florida (2015). ISBN 10: 5458354060 ISBN 13: 9785458354066.
5. Molecular structure and spectroscopy by G Aruldhas Prentice Hall of India (2009) ISBN 10: 8120332156 ISBN 13: 9788120332157.
6. Spectroscopy volume 2, Edited by B.P. Straughan and S.Walker, London Chapman and Hall. ISBN 10: 0470150319 ISBN 13: 9780470150313.
7. Laser & Non-linear Optics B. B. Laud. Wiley Eastern Limited (2011). ISBN 10: 8122430562 ISBN 13: 9788122430561
8. Laser Spectroscopy, Basic Concepts and Instrumentation by W. Demtroder, Springer. ISBN 10: 0387103430 ISBN 13: 9780387103433
9. Physics of atoms and molecules B. H. Bransden and C. J. Joachain Pearson Education. ISBN 10: 0306410494 ISBN 13: 9780306410499

Course Name: Practical Based on PHYT/MJ/516 (Linear and digital Electronics)

Course Code: PHYP/MJ/540, Course Type: MJ, Contact Hours: 60,

Credits: 02, Hours/Week: 02, Max. Marks: 50

Course objective: The themes dealt with in this paper:

This course deals with the basic foundation to specialization in Electronics and Industrial applications.

This course is an advanced which requires the special efforts and training.

This course will help the student to elaborate designing the electrical circuits, input and output characteristics and their uses in various electrical devices for various applications.

Course Outcomes: The present unit attempts to achieve the following learning outcomes:

- After completing this course the student will be prepare to explain the scope and possibilities of electrical circuits designed using OP-AMP, Multivibrators and counters for various applications for research career as well as in industries.
- The students will be able to design electrical circuits for various industrial applications.

Course Contents:

1. Determination of characteristics of OP-AMP 741 : CMRR and Slew rate
2. Determination of characteristics of OP-AMP 741 : input offset voltage and input bias current
3. Inverting and non-inverting amplifier using OP-AMP 741
4. Astable multivibrator using OP-AMP 741
5. Schmidt trigger using OP-AMP 741
6. Wien bridge Oscillator using IC 741
7. Monostable multivibrator using IC555
8. Decimal to BCD converter
9. Mod 16 counter
10. Diode Matrix ROM

Course Name: Practical Based on PHYT/MJ/517

(General Condensed Matter Physics)

Course Code: PHYP/MJ/541, Course Type: MJ,

Contact Hours: 60, Credits: 02, Hours/Week: 04, Max. Marks: 50

Course objective: The themes dealt with in this paper:

This course deals with the basic foundation to specialization in Condensed Matter Physics and applications.

This course is an advanced which requires the special efforts and training.

This course will help the student to elaborate characterization techniques of as prepared materials using XRD and UV-VIS spectra.

Course Outcomes: The present unit attempts to achieve the following learning outcomes:

- After completing this course the student will be prepare to explain the scope and possibilities of studies in structural properties of synthesized materials for various applications for research career as well as in industry.
- The students will be able to identify the structure, cell parameters, energy band gaps and optical properties of any given materials.

Course Contents:

1. Study the cubic structure of given XRD data and determine lattice parameters.
2. Study the hexagonal structure of given XRD data determine the lattice parameters.
3. Study the diamond structure using XRD data and determine of lattice parameters.
4. Study the Hall Effect and determine type and number of charge carriers.
5. Study the Hall Effect and determine type and Hall coefficient.
6. Study the Hall Effect and determine type and drift mobility.
7. Study the UV Vis Spectra of ZnO lattice.
8. Study the UV-Vis spectra of ZnS lattice.
9. Study the UV-Vis spectra of CdS structure.
10. Study of Specific heat of graphite.

Course Name: Practical Based on PHYT/MJ/518 (General Nuclear Physics)

Course Code: PHYP/MJ/542 Course Type: MJ,

Contact Hours: 60, Credits: 02, Hours/Week: 04, Max. Marks: 50

Course objective: The themes dealt with in this paper:

This course gives basic foundation to specialization in nuclear physics and Spectroscopy and applications.

The course is an advanced course and requires special efforts.

The course will help the student to explain characteristics of Geiger Muller counter/tube: Operating voltage, Dead time and counting statistics.

Course Outcomes: The present unit attempts to achieve the following learning outcomes:

- After completing this course the student will be prepare to explain the scope and possibilities of studies in nuclear physics for research career as well as in industry.
- The students able to explain the characteristics of Geiger Muller counter/tube: Operating voltage, Dead time and counting statistics.

Course Contents:

1. Determination of characteristics of Geiger Muller counter/tube: Operating voltage
2. Determination of dead time of a G. M. counter by double source method.
3. Determination of dead time of a G. M. counter by variable area method.
4. Statistical aspects of radioactivity measurements.
5. Beta backscattering as function atomic number.
6. Beta energy determination by feather's analysis.
7. To study the secular equilibrium.
8. To study the transient equilibrium.

Course Name: 8086 Microprocessor and Programming

Course Code: PHYT/DSE/520, Course Type: DSE,

Contact Hours: 30, Credits: 02, Hours/Week: 02, Marks: 50

Course Objectives:

1. To facilitate the students to understand
   a) The concepts of microprocessor.
   b) The concept of assembly language programming.
2. To provide an opportunity to the students to enter into entrepreneurship.

Course Outcomes:

Students will be able to –

1. Understand and explain Microprocessor architecture, physical configuration of memory, logical configuration of memory, and microprocessor programming.
2. Analyze the process of Industrial automation.
3. Start his / her own small scale industry for manufacturing microprocessor based automated devices.
4. Start his / her teaching career either in science or engineering colleges / institutes as this course is included in science as well as engineering discipline.

Course Contents:

Unit - I: Introduction (10 Hrs.)

Overview of Microcomputer structure and operation, memory, input / output, CPU, address bus, data bus, control bus, 8086 microprocessor family overview, 8086 internal architecture: execution unit, (flag register, general purpose register, ALU), Bus interface unit, segment register, stack pointer register, pointer and index register [Refer Douglas and Hall book for above articles], Pin out and pin functions of 8086 : The pin out, power supply requirements, DC characteristics, input characteristics, output characteristics, pin connections (common pins, maximum mode pins and minimum mode pins) Addressing Modes: Data addressing modes: Register addressing, Immediate addressing, Direct addressing, register indirect addressing, base plus index addressing, register relative addressing, base relative plus index

addressing, Programme memory addressing modes: Direct program memory addressing, relative program memory addressing, indirect program memory addressing; stack memory addressing modes.

Unit - II: Data Movement, Arithmetic and Logical Instructions (10 Hrs.)

MOV revised: machine language, the op code, MOD field, register assignments, R/M memory addressing, special addressing, **PUSH/POP** : PUSH, POP, initializing the stack; **Miscellaneous data transfer instructions**: XCHG, IN and OUT, **Arithmetic and Logic Instructions: Addition, subtraction and comparison: Addition**: Register addition,immediate addition, memory to register addition, array addition, increment addition, addition with carry; **Subtraction**: Register subtraction, immediate subtraction, decrement subtraction, subtraction with barrow; **Comparison, Multiplication and division**: **Multiplication**: 8 bit multiplication, 16 bit multiplication; **Division**: 8 bit division, 16 bit division; **Basic Logic Instructions**: AND, OR, Ex-OR, TEST, NOT, NEG; **Shift and Rotate: Shift**: left shift, right shift; **Rotate**: Rotate left, rotate right

Unit-III: Program Control Instructions and Assembly Language Programming (10 Hrs.)

The Jump Group: Unconditional jump: short jump, near jump, far jump, indirect jumps using an index; **Conditional Jumps**: LOOP, conditional LOOPs; **Procedures**: CALL, near CALL, far CALL, indirect memory address, RET; **Machine Control and Miscellaneous Instructions**: Controlling the carry flag bit, wait, HLT, NOP; Assembly Language **Programming**: **Assembler directives**: ASSUME, DB, DD, DQ, DT, DW, END, ENDP, ENDS, EQU, EVEN, EXTRN, GLOBAL, GROUP, INCLUDE, LABEL, LENGTH, NAME, OFFSET, ORG, PROC, PTR, PUBLIC, SEGMENT, SHORT, TYPE [Refer Douglas and Hall book for above articles] **Assembly Language Programming**: Sum of an array, factorial, largest / smallest from given array, sorting of numeric array, square root.

References:

1. The Intel Microprocessors, Architecture Programming and interfacing, Barry B Brey ; Sixth Edition ; Prentice Hall International, Publications, (2002), ISBN-10: 0130607142, ISBN-13: 978-0130607140

2. The Intel Microprocessors, Architecture Programming and interfacing, Barry B Brey ;Eighth Edition ; Prentice Hall International, Publications (2009), ISBN 0-13-502645-8
3. Microprocessors and Interfacing: Programming and Hardware, Douglas V Hall: II Edition; Tata McGraw-Hill (1990), ISBN-10: 0070257426, ISBN-13: 978-0070257429.
4. Microcomputer Systems: The 8086 / 8088 Family; Architecture, Programming and Design, Yu-Cheng Liu and Glenn A. Gibson, Prentice Hall International, Publications (1986), ISBN-10: 013580499X, ISBN-13: 9780135804995.
5. The 8086/8088 Family: Design, Programming and Interfacing, John, Uffenbeck, Prentice Hall International, Publications (1986), ISBN-10: 0132467526, ISBN-13: 978-0132467520

Course Name: Electrical Properties of Solids and Superconductivity

Course Code: PHYT/DSE/521, Course Type: DSE,

Contact Hours: 30, Credits: 02, Hours/Week: 02, Max. Marks: 50

Learning Objectives: The course aims at giving the students,

- In depth knowledge and know-how within the theory of superconductivity in order to understand and describe the principles behind various superconducting applications.
- Distinguish between perfect conduction and perfect diamagnetism, and give a qualitative description of the Meissner effect, describe different theories of superconductivity and their ranges of validity.
- Get familiarized with the types of polarization of dielectrics in static and alternating electric fields.
- Acquiring of knowledge concerning the electrical behaviour of dielectric and ferroelectric materials. Will be able to experimentally investigate ferroelectric and dielectric materials.

Learning Outcome: At the end of the course the student will be able to,

- Describe different theories of superconductivity and basic properties of superconductors.
- Explain type-I and type-II superconductivity based on thermodynamic calculations of the Gibbs free energy for a superconductor.
- Will learn to understand the relationship between material structure and electrical properties of materials.
- Will acquire knowledge about different types of dielectric and ferroelectric materials.
- A student can develop research/teaching career in the field of Superconductivity/ Dielectrics.

Course Contents:

Unit - I: Dielectric Properties of Solids (12 Hrs.)

Fundamental definitions, Local field, Clausius- Mossotti relation, Polarization mechanisms in dielectrics: induced, orientational, electronic, ionic, interfacial and lattice polarizations; combined mechanisms, frequency and temperature effects on polarization, Classical theory of electronic polarizability, dipolar polarizability. Langevin's theory of dipolar polarizability

dielectric loss, dielectric breakdown, determination of dielectric constant, properties and different types of insulating materials, Debye theory, Onsager equation, Applications. Ferroelectric properties of Solids: Fundamentals, Curie-Weiss law, Classification of ferroelectric materials, Theory of spontaneous polarization of BaTiO3 , antiferroelectricity and ferrielectricity, Ferroelectric domains, Piezoelectricity, Pyroelectricity, Applications

Unit - II: Basic properties of Superconductors (10 Hrs.)

Some fundamental Phenomena associated with Superconductivity (Zero resistance, persistent currents, superconducting transition temperature Tc, isotope effect, perfect diamagnetism and Meissner effect, penetration depth and critical field, Characteristics Length,). Type-I and Type-II Superconductors, Intermediate states, mixed states, Supercurrents and Critical Currents., Quantization of Magnetic Flux. Thermodynamics of superconducting transition: First order and second order transition, specific heat above and below Tc, thermal conductivity;

Unit III: Theories of Superconductivity (8 Hrs.)

London Equations, BCS theory: Coherence of the BCS Ground State and the Meissner-Ochsenfeld Effect ,Electron -Electron Interaction via Lattice Cooper Pairs, BCS Wave function; Tunneling phenomenon, energy level diagram, ac And dc Josephson Effects, quantum interference. Novel High Temperature superconductors, Applications.

References:

1. Introduction to Solid State Physics, C. Kittel; 7th Edition; Wiley Eastern Pvt. Ltd. (2011); ISBN-978-81-265-1045-0.
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3. Introduction to Solids, L.V.Azaroff; TMH Edition; 3rd reprint (2009); TATA McGraw Hill;ISBN-13: 978-0-07-099-219-1; ISBN-10: 0-07-099-219-3
4. Solid State Physics, M.A.Wahab; 2nd Edition; 3rd reprint (2008); Narosa Publishing House Pvt. Ltd; ISBN: 978-81-7319-603-4.
5. Solid state physics, S.O.Pillai; 6th Edition; New Age international Pvt. Ltd.; (2005); ISBN: 81-224-1682-9.
6. Solid State Physics, Vimal Kumar Jain; Ane Books Pvt. Ltc; (2013); ISBN: 978-93-8116-297-2.

7. Modern Physics and Solid State Physics (Problems and Solutions), S.O.Pillai; Revised 3rd Edition; New Age International Publishers; ISBN: 81-224-1704-3.
8. Elementary Solid State Physics, M. Ali Omar; 5th Impression (2009); Pearson Education.inc; ISBN: 978-81-7758-377-9.
9. Fundamentals of Solid State Physics, Saxena, Gupta, Saxena,; 5th Edition; Pragati Prakashan; (2012); ISBN:978-93-5006-539-6.
10. Solid State Physics, Neil W. Ashcroft, N. Devid Mermin; 9th Indian Reprint (2010); CENGAGE Learning India Pvt. Ltd. (India Edition); ISBN-13: 978-81-315-0052-1.

Course Name: Practical based on PHYT/DSE/520

Course Code: PHYP/DSE/543, Course Type: DSE,

Contact Hours: 60, Credits: 02, Hours/Week: 04, Max. Marks: 50

Learning Objectives:

1. To facilitate the students to understand
   a) The concepts of microprocessor and assembly language programming.
   b) The concept of interfacing devices at laboratory as well industrial level
2. To provide an opportunity to the students to enter into entrepreneurship.

Learning Outcome: Students will be able to learn

1. Microprocessor architecture, physical configuration of memory, logical configuration of memory, microprocessor programming and interfacing.
2. Students will be capable to perform following job
   a) Industrial automation using 8086 interfacing and programming.
   b) Start his / her own small scale industry for manufacturing microprocessor based automated devices.
3. Students will have option to start his / her teaching career either in science or engineering colleges / institutes as this course is included in science as well engineering discipline.

Experiments using 8086 Kit

1. Data transfer, addition, subtraction, multiplication, division and sum of series
2. Factorial and square of the number
3. Sorting of data (ascending / descending), square root of a number
4. Arithmetic mean of N- numbers and sum of square of Numbers
5. Interfacing of SPDT switches and 7 segment display as a position encoder / decoder
6. Interfacing of stepper motor
7. Interfacing of DC motor
8. Interfacing of DAC to generate ramp wave, triangular wave and square wave.
9. Interfacing of 8-bit ADC
10. Interfacing of LCD display

Experiments Using 8086 Assembler

11. Data transfer, addition, subtraction, multiplication, division and sum of series

12. Factorial and square of the number

13. Sorting of data (ascending / descending), square root of a Number.

14. Arithmetic mean of N- numbers and sum of square of Numbers

Course Name: Practical based on PHYT/DSE/521

Course Code: PHYP/DSE/544, Course Type: DSE,

Contact Hours: 60, Credits: 02, Hours/Week: 04, Max. Marks: 50

Learning objectives:

i) This activity introduces the fundamental principles of four probe resistivity ii) ferroelectricity iii) measurement of dielectric constant of different solid samples

Students will be able to:

i) Describe what can be detected by four probe resistivity technique ii) explain the impact of temperature iii) atom size, and impurities on the tests. Learning Outcomes: Acquisition of the following skills: i) Ability to explain basic/fundamental dielectric concepts ii) Ability to extort the relevant information from four probe resistivity papers. iii) Ability to find specific tools for solution of a given ferroelectric, superconducting problems.

Course Contents:

1. Resistivity Measurement of a given sample by four probe method.
2. Measurement of dielectric constant and its variation with temperature.
3. Determination of bulk density of different materials using immersion technique.
4. Measurement of dielectric constant of liquids.
5. Measurement of electrical conductivity of Graphite at room temperature.
6. Determination of specific heat of Graphite at different temperatures.
7. Measurement of dielectric constant of solids.
8. Porosity determination of Superconducting materials.
9. Determination of Bulk density of ferroelectric materials.
10. To measure ferroelectric hysteresis curves
11. Determination of Curie temperature of Ferroelectrics.

Note: 1) Other experiments may be added as per the availability of instruments.

2) Students should perform any eight experiments.

Course Name: Research Methodology

(Review of Literature for Research Project and Formulation of Topic)

Course Code: RM (PHYT/RM/548), Course Type: RM,

Contact Hours: 60, Credits: 04, Hours/Week: 04, Marks: 100

Course Objectives:

1. To define research and describe the research process and research methods
2. To understand qualitative research and methods used to execute and validate qualitative research
3. To know how to apply the basic aspects of the research process in order to plan and execute a research project.
4. To provide insight into the processes that lead to the publishing of research.
   To be able to present, review and publish scientific articles.

Course Outcomes:

Students will be able to -

1. Understand and explain research process.
2. Do systematic literature survey, formulation of a research topic, study design, analysis and interpretation of data.
3. To design a research approach for a specific research issue of their choice.
4. Select a suitable analytical method for a specific research approach.
5. Demonstrate a good understanding of how to write a research report.
6. critically assess published quantitative research with regard to the statistical methods and approaches adopted
7. create a research document for implementation research project

Course Contents:

RM Part - I: (02 Credit: 30 Contact Hours)

Unit - I: Research Fundamentals and Identification of Research Problem: (10 Hrs.)

Research Fundamentals

Introduction: Definition, objectives of the research, characteristics of the research, what makes people to do research, importance of research, Qualitative and Quantitative Research: Qualitative research - Quantitative research - Concept of measurement, causality, generalization, and replication. Merging the two approaches.

Identification of Research Problem

Defining the research problem: Identification of research problems, selection of research problem, facts one should know regarding selection of research problem, the process of research problem definition, some facts involved in defining research problem, Research Design: Concept and Importance in Research - Features of a good research design - Exploratory Research Design - concept, types and uses, Descriptive Research Designs - concept, types and uses. Experimental Design: Concept of Independent & Dependent variables, Case Studies,

Unit - II: Formulation of Research Problem **(10 Hrs.)**

Formulation of the problems: steps involved in defining a problem, formulation of the problems, Formulation of hypothesis: Concept of hypothesis, hypothesis testing, developing the research plan: implementation, interpreting and reporting the findings, Importance of hypothesis in decision making, Case Studies. Interpretation of Data. Measurement: Concept of measurement- what is measured? Problems in measurement in research- Validity and Reliability. Levels of measurement Nominal, Ordinal, Interval, Ratio.

Unit – III : Research Report and Proposal Writing **(10 Hrs.)**

Introduction, research proposal writing: costing, the research proposal, rationale for the study, research objectives, research methodology, target respondents, research Centres, sample size and sample composition, sampling procedures, research project execution, research units; An insight into research report and proposal, research project synopsis, research report writing : types of research reports, guidelines for writing reports; Steps in writing report, report presentation, typing the report, documentation and bibliography, formatting guidelines for writing a good research report / research paper, Paper Writing- Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Case Studies.

RM Part - II: (02 Credit: 30 Contact Hours)

1. Presentations,
2. Case studies,
3. Assignments,
4. Tutorials based on Module I to III

Students are expected to do the Followings

i) Select Broad topic of Research Project (to be implemented from second semester onwards)
ii) Read the Basic concepts / fundaments of broad topic
iii) Identify 10 SCOPUS / WEB OF SCIENCE Indexed Journals related to broad topic
iv) Search and download 20 research articles from above research Journals
v) Do systematic review of above 20 research articles
vi) While doing review of each of above mentioned 20 research articles, students are expected prepare notes on following points
    a) What are the objectives of the research article?
    b) What methodology has been adopted?
    c) What are prominent results?
    d) How these results of relevant to the latest development of the subject?
    e) What is novelty of research article?
    f) What are prominent shortcomings of this research a presented in this research article?
    g) What are your plans to address those shortcoming?
vii) Draft the fine-tuned title of research project
viii) Draft hypothesis
ix) Draft Objectives and Methodology
x) Draft expected outcome of the research project

At the end of the assignment, students are expected to prepare a report having following points

i) Fine-tuned title of Research Project
ii) Fundamental aspects of the fine-tuned research topic
iii) Hypothesis
iv) Objectives
v) Methodology
vi) Detailed Experimental plan
vii) Expected outcome
viii) References

References:

1. Research Methodology by Dr. S. L. Gupta, Hitesh Gupta; International Book House Pvt Ltd **(2013),** ISBN-10: 8191064278, ISBN-13: 978-8191064278

2. Basic Research Methods-Gerard Guthrie SAGE Publications, India, Pvt Ltd, New Delhi **(2010),** ISBN-10: 8132104579, ISBN-13: 978-8132104575
3. Research Methodology-methods and techniques By C. R. Kothari, New Age International Publishers **(2011)** ISBN 978-81-224-1522-3
4. Principles of Research Methodology- Phyllis G. Supino, Jeffrey S. Borer; Springer, Verlag New York **(2012),** ISBN-ebook: 1461433592, ISBN (Hardcover): 978-1461433590
5. Research Design Qualitative, Quantitative. and Mixed Methods Approaches- John W. Creswell; SAGE Publications Ltd, UK **(2011),** ISBN-9780857023452
6. Research Methodology -A Step-by-Step Guide for Beginners- Ranjit Kumar; Sage Publications Ltd **(2010)**, ISBN- 1849203016.
7. Scientific Writing and Communication- Angelika Hofmann; Oxford University Press, US **(2010),** ISBN-13-: 978-0 199947560, ISBN-10: 01 99947562
8. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded-Joshua Schimel, Oxford University Press, **(2011)**, ISBN: 9780199760237
9. Handbook of Scientific Proposal Writing- A.Yavuz Oruc; CRC Press, Taylor & Francis group **(2011)**, ISBN: 9781439869185

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