MAR ATHANASIUS COLLEGE (AUTONOMOUS)

KOTHAMANGALAM, KERALA – 686666

NAAC Accredited 'A^{+}' Grade Institution

Email: mac@macollege.in

www.macollege.in

SCHEME AND SYLLABUS

FOR

UNDERGRADUATE PROGRAMME

UNDER CHOICE BASED CREDIT SYSTEM

(MAC- UG-CBCS 2021)

(PHYSICS)

EFFECTIVE FROM THE ACADEMIC YEAR
2021-22

BOARD OF STUDIES IN PHYSICS (UG)

ACADEMIC COUNCIL

COMPOSITION – With Effect From 01-06-2020

Chairperson : **Dr. Shanti. A. Avirah**
Principal
Mar Athanasius College (Autonomous), Kothamangalam

Experts/Academicians from outside the College representing such areas as Industry, Commerce, Law, Education, Medicine, Engineering, Sciences etc.

1. **Dr. Winny Varghese**
   Secretary
   Mar Athanasius College Association
   Kothamangalam

2. **Prof. Dr. V.N. Rajasekharan Pillai**
   Former Vice-Chairman
   University Grants Commission,
   New Delhi.

3. **Dr. R.K. Chauhan**
   Former Vice-Chancellor, Lingaya's University,
   Faridabad, Haryana -121002

4. **Dr. Sheela Ramachandran**
   Pro-Chancellor,
   Atmiya University
   Rajkot.

5. **Prof. Kuruvilla Joseph**
   Senior Professor and Dean,
   Indian Institute of Space Science and Technology (IIST),
   Department of Space, Govt. of India, Valiyamala, Thiruvananthapuarm

6. **Dr. M.C. Dileep Kumar**
   Former Vice Chancellor
   Sree Sankaracharya Sanskrit University
   Kalady, Kerala, India

7. **Dr. Mathew. K.**
   Principal
   Mar Athanasius College of Engineering,
   Kothamangalam, Kerala - 686 666

8. **Adv. George Jacob**
Senior Advocate
High Court of Kerala

Nominees of the University not less than Professors

9. **Dr. Biju Pushpan**
   SAS SNDP Yogam College
   Konni

10. **Dr. Suma Mary Sacharia**
    UC College
    Aluva

11. **Dr. V.B. Nishi**
    Associate Professor
    Sree Shankara College, Kalady.

Member Secretary

12. **Dr. M.S.Vijayakumary**
    Dean – Academics
    Mar Athanasius College (Autonomous)
    Kothamangalam

Four teachers of the college representing different categories of teaching staff by rotation on the basis of seniority of service in the college.

13. **Dr. Bino Sebastian. V** (Controller of Examinations)

14. **Dr. Manju Kurian,** Asst. Professor, Department of Chemistry

15. **Dr. Smitha Thankachan**, Asst. Professor, Department of Physics

16. **Dr. Asha Mathai**, Asst. Professor, Department of Malayalam

Heads of the Departments

17. Dr. Densely Jose, Head, Department of Chemistry

18. Dr. Mini Varghese, Head, Department of Hindi

19. Ms. Shiny John, Head, Department of Computer Science

20. Dr. Igy George, Head, Department of Economics

21. Dr. Rajesh.K. Thumbakara, Head, Department of Mathematics

22. Dr. Aji Abraham, Head, Department of Botany

23. Dr. Selven S., Head, Department of Zoology

24. Dr. Deepa. S, Head, Department of Physics

25. Dr. Aswathy Balachandran, Head, Department of English

26. Dr. Diana Ann Issac, Head, Department of Commerce

27. Dr. Seena John, Head, Department of Malayalam

28. Ms. Diana Mathews, Head, Department of Sociology

29. Ms. Sudha. V, Head, Department of Statistics

30. Dr. Jani Chungath, Head, Department of History

31. Sri. Haary Benny Chettiamkudiyil, Head, Department of Physical Education

32. Ms. Shari Sadasivan, Head, Department of Marketing and International Business

33. Dr. Julie Jacob, Head, Department of Biochemistry

34. Ms. Nivya Mariyam Paul, Head, Department of Microbiology

35. Ms. Jaya VinnyEappen, Head, Department of Biotechnology

36. Ms. ShaliniBinu, Head, Department of Actuarial Science

37. Ms. Simi. C.V, Head, Post Graduate Department of History

38. Ms. Sari Thomas, Head, Post Graduate Department of Statistics

39. Ms. Sheeba Stephen, Head, Department of B.Com Model III- Tax Procedure and Practice

40. Ms. Dilmol Varghese , Head, Post Graduate Department of Zoology

41. Ms. Bibin Paul, Head, Post Graduate Department of Sociology

BOARD OF STUDIES IN PHYSICS (UG)

Sl No	Name	Official Address
1	Chairman	**Dr. Deepa S.** Assistant Professor of Physics (HOD) Mar Athanasius College Kothamangalam
2	Members	**Dr. S. Sankara Raman** Associate Professor Department of Opto-Electronics Kerala University
3		**Dr. Sajimol Augustine M.** Principal St: Teresas College Ernakulam
4		**Dr. Sajan D.** Assistant Professor Bishop Moore College Mavelikara
5		**Dr. C. Vijayan** Professor Department of Physics IIT Madras
6		**Mr. Jolly Cyriac** Managing Director Holmark Opto-Mechatronics Pvt. Ltd H M T Industrial Estate Kalamassery
7		**Dr. Benoy M.D.** Associate Professor of Physics M A College , Kothamangalam
8		**Dr. Smitha Thankachan** Assistant Professor of Physics M A College , Kothamangalam

9	Members	**Mr. Francis Xavier P.A.** Assistant Professor of Physics M A College , Kothamangalam
10		**Ms. Jassi J.** Assistant Professor of Physics M A College , Kothamangalam
11		**Dr. Saritha K. Nair** Assistant Professor of Physics M A College , Kothamangalam

TABLE OF CONTENTS

PREFACE

The BSc Physics syllabus of Mar Athanasius College (Autonomous), Kothamangalam is restructured to suit the credit and semester system to be followed by the affiliated colleges under Mahatma Gandhi (M.G.) University, Kottayam, from the academic year 2019- 2020. In the restructuring of the U.G. syllabus, the Board of Studies has taken into account the emerging trends in the various fields of theoretical and experimental physics. The focus is given to set high standards of comprehensive education by developing the intellectual strength of students and guiding them towards scientific and technical excellence compatible with the vision and mission of our institution. Wide discussion in this matter was carried out among the physics teaching faculty as well as the other dignitaries in the Board of Studies. In order to accommodate various front running fields in physics, and for the students to have options to select the courses of their interest, the Board has decided to present five choice based courses and three open courses in the U.G. syllabus. The Open courses are accommodated in the fifth semesters of the U G program and a choice based course in the sixth semester. The syllabus of physics practicals is also revised keeping in view of the advances in various fields of physics and technology. Thus, the 'Bachelor in Physics' course in Mar Athanasius college is envisaged to help students to understand the physical and natural world around them in an intellectual way.

Chairperson and Members

Board of Studies of Physics (UG)

Mar Athanasius College (Autonomous), Kothamangalam

LIST OF UNDERGRADUATE PROGRAMMES IN MAR ATHANASIUS COLLEGE (AUTONOMOUS), KOTHAMANGALAM

SL. NO.	PROGRAMME	DEGREE	FACULTY
1	ENGLISH	BA	LANGUAGE AND LITERATURE
2	HINDI	BA	LANGUAGE AND LITERATURE
3	ECONOMICS	BA	SOCIAL SCIENCES
4	SOCIOLOGY	BA	SOCIAL SCIENCES
5	HISTORY	BA	SOCIAL SCIENCES
6	MATHEMATICS	B.Sc	SCIENCE
7	CHEMISTRY	B.Sc	SCIENCE
8	PHYSICS	B.Sc	SCIENCE
9	BOTANY	B.Sc	SCIENCE
10	STATISTICS	B.Sc	SCIENCE
11	ZOOLOGY	B.Sc	SCIENCE
12	COMMERCE (SPECIALISATION - FINANCE AND TAXATION) – MODEL - I	B.Com	COMMERCE
13	COMMERCE - (SPECIALISATION – TAXATION) MODEL – III (SELF FINANCING)	B.Com	COMMERCE
14	BUSINESS ACCOUNTING AND TAXATION	B.Voc	COMMERCE
15	DATA ANALYTICS AND MACHINE LEARNING	B. Voc	SCIENCE

MAR ATHANASIUS COLLEGE (AUTONOMOUS)
KOTHAMANGALAM, KERALA - 686666

REGULATIONS OF THE UNDERGRADUATE PROGRAMMES

UNDER CHOICE BASED CREDIT SYSTEM

(MAC- UG-CBCS 2021)

(2021 Admission onwards)

PREAMBLE

Education prepares a man to live with dignity and liberty. The ultimate aim of education is to deepen man's understanding of the universe and of himself-in body, mind and spirit –and to disseminate this understanding throughout society and to apply it in the service of mankind. This aim is accomplished when quality is ensured in the process of learning. Ever since Independence there has been several attempts on the part of Central and State Governments, University Grants Commission, AICTE and similar regulatory bodies as well as universities and colleges to improve the quality of instruction offered. However, because of heavy demand for access and consequent expansion of colleges and universities together with constraints on resources, standards of education could not cope with expansion. The affiliating system, which played a useful role in managing access in the past, occupied disproportionate time on administration of the system and undermined the capacities of universities and colleges to work towards research and development. Even curricular reform took a back seat in many universities. While there is no alternative in the present context to the system of affiliation, there is a felt need to seek fresh strategies for innovation and experimentation in the entire range of higher education activities at the institutional level. In this scenario, the Government of India by Resolution dated 14 July 1964 appointed the Education Commission to advise the Government on the national pattern of education and policies for the development of education at all stages and in all aspects. The Education

Commission (1964 – 66) recommended "Autonomy" to Universities and colleges as instrumental in achieving and promoting academic excellence in higher education (Chapter XIII). In consonance with this recommendation, the University Grants Commission prepared Guidelines for Autonomy (Annexure II)duringXIth plan and the same has been revised subsequently during XIIth plan. In the context of UGC Guidelines, the Committee set up by the Kerala State Higher Education Council in December 2012 to recommend criteria for selection and steps for operationalization of "Autonomous Colleges" in Kerala, deliberated on the subject extensively. Accordingly, the 13th Kerala State Legislative Assembly as per the "the University Laws (Third Amendment) Bill, 2014 resolved to provide Autonomy to colleges and Universities in Kerala. Mar Athanasius College, Kothamangalam, in its pursuit of academic excellence, was accorded Autonomous Status as per the Letter No. F.22 – 1/2016 (AC), dated 9th March, 2016. Following the attainment of autonomous status, the expert committee constituted by the Principal has undertaken the task of designing a draft Regulations and Guidelines of all Undergraduate Programmes in the institution in 2016. During the academic year 2016-17(For the 2016 admission) the then prevailing M. G. University regulations were accepted by the institution without any change. In the academic year 2017 the institution prepared UG regulations after making necessary modifications. The total credit, internal assessment, evaluation of answer sheets, Question paper pattern and conduct of examination were strictly adhered to the parent university regulations. The modified regulation came in to force in academic year 2018(with effect 2018 admission onwards) and the same regulation continued until 2020-21. In due course as per the recommendations of the academic council held on 19.06.2020, the 2018 UG regulations has been hitherto, modified by incorporating the modifications put forward by M.G. University as per U.O No. 1417/AC A9/2020 MGU Dated10.03.2020. The framework of the Common Guidelines and regulations are presented in the ensuing pages.

1. TITLE

1.1. These regulations shall be called **"REGULATIONS FOR UNDERGRADUATE (UG) PROGRAMMES UNDER CHOICE BASED CREDIT SYSTEM, 2021 (MAC- UG-CBCS 21)"** of Mar

Athanasius College (Autonomous), Kothamangalam.

2. SCOPE

2.1 Applicable to all Undergraduate Programmes conducted by Mar Athanasius College (Autonomous), Kothamangalam with effect from 2021-22 admissions.

2.2 Medium of instruction is English except in the case of language courses other than English unless otherwise stated therein.

3. DEFINITIONS

3.1. ***'Academic Week'*** is a unit of five working days in which distribution of work is organized from Day One to Day Five, with five contact hours of one hour duration on each day.

3.2 „***Semester'*** means a term consisting of a minimum of 90 working days, inclusive of tutorials, examination days and other academic activities, within a period of six months.

3.3 ***'Programme'*** means a three year programme of study with examinations spread over six semesters. The successful completion of the programme leads to the award of a Bachelor Degree.

3.4 ***'Course'*** means a portion of a subject, which will be taught and evaluated in a semester (similar to a paper under Annual scheme). Each Course is to be designed under lectures / tutorials / laboratory / fieldwork / seminar/ project / practical training / assignments and evaluation etc., to meet effective teaching and learning needs.

3.5. ***'Common Course I'*** means a course that comes under the category of courses for English.

3.6 ***'Common Course II'*** means additional language (Malayalam or Hindi). 3.7.

'Core Course' means a course in the subject of specialization within an Under Graduate Programme.It includes a course on environmental studies and human rights.

3.8. ***'Complementary Course'*** means a course which would enrich the study of core courses.

3.9. ***'Choice Based Course'*** means a course that enables the students to familiarise the advanced areas of Core Course.

3.10. ***'Open course'*** means an optional course which the student is free to take at his/her will. Open Course shall be a non-major elective course offered by the Departments other than parent Department.

3.11 '***Certificate Course / Diploma Course'*** means courses that permit an opportunity to the students for academic enrichment in an area other than the traditional programmes to which he/she is admitted. Such courses will lead the candidate toward entry level employment in a professional field. The duration and general frame of the courses are subject to the regulations prescribed by the UGC from time to time. Certificate/Diploma courses shall be conducted over and above regular working hours.

3.12. *'**Credit'*** is the numerical value assigned to a course according to the relative importance of the syllabus of the programme**.**

3.13. ***'Grade'*** means a letter symbol (e.g: A, B, C, etc.) that indicates the broad level of performance of a student in a course/ semester/programme.

3.14. ***'Grade Point' (GP)***is the numerical indicator of the percentage of marks awarded to a student in a course.

3.15. **Institutional Average (IA)** means average marks secured (Internal + External) for a course at the college level

3.16. ***'Credit Point (CP)'***of a course is the value obtained by multiplying the Grade Point (GP) by the Credit (C) of the course. CP=GP x C.

3.17. ***'Cumulative Credit Point Average (CCPA)'*** is the value obtained by dividing the sum of credit points in all the courses taken by the student for the entire

programme by the total number of credits.

3.18. ***'Department'*** means any Teaching Department in the College.

3.19. '***Parent Department'*** means the department which offers core courses within an UnderGraduate Programme.

3.20. ***'Department Council'*** means the body of all teachers of a department in the college.

3.21. *'**Department Co-ordinator'*** means a teacher from the parent department nominated by the Department Council, who will advise the student in the academic matters.

3.22. ***'College Coordinator'*** is a teacher nominated by the Principal to co-ordinate the continuous evaluation undertaken by various departments within the college.

3.23. '***Grace Marks'*** means marks awarded to the candidates as per the orders issued by Mahatma Gandhi University, Kottayam, from time to time.

3.24. ***'Skill Enhancement Programme'*** means Programme intended to assist the students to acquire additional practical skill which should be conducted over and above the regular working hours.

3.25. Words and expressions used and not defined in this regulation shall have the same meaning assigned to them in the Act and Statutes of the Mahatma Gandhi University.

4. ELIGIBILITY FOR ADMISSION AND RESERVATION OF SEATS

4.1 Eligibility and Norms for admission and reservation of seats for various Undergraduate Programmes shall be according to the rules framed by the Mahatma Gandhi University/State Government from time to time.

5. DURATION

5.1 The duration of UG programmes shall be ***6 semesters***.

5.2 There shall be two semesters in an academic year. The **ODD** semester commences in **June** and on completion, the **EVEN** semester commences. There shall be two months‟ vacation during April and May in every academic year.

5.3 A student may be permitted to complete the Programme, on valid reasons, within a period of 12 continuous semesters from the date of commencement of the first semester of the programme.

6. REGISTRATION

6.1 The strength of students for each course shall remain as per existing regulations as approved by Mahatma Gandhi University, Kottayam.

6.2 The college shall send a list of students registered for each programme in each semester giving the details of courses registered to the University in the prescribed form within 45 days from the commencement of the Semester.

6.3 Those students who possess the required minimum attendance and progress during a semester and could not register for the semester examination are permitted to apply for Notional Registration to the examinations concerned, enabling them to get promoted to the next class.

7. SCHEME AND SYLLABI

7.1. The UG programmes shall include (a) Common courses I and II, (b) Core courses, (c) Complementary Courses, (d) Choice Based Course and(e) Open Course. Common course II is exempted in the case of B.Com Model III.

7.2. There shall be one Choice Based course (Elective Course) in the sixth semester. In the case of B.Com Programme there shall be an elective stream from third semester onwards.

7.3 Credit Transfer and Accumulation System can be adopted in the programme. Transfer of Credit consists of acknowledging, recognizing and accepting credits by an institution for programmes or courses completed at another institution. The Credit Transfer Scheme shall allow students pursuing a programme in one College to continue their education in another College

without break. Credit transfer shall be permitted as per the University Rules.

7.4. A separate minimum of 30% marks each for internal and external (for both theory and practical) and an aggregate minimum of 35% are required to pass a course. For a pass in a programme, a separate minimum of **Grade D** is required for all the individual courses. If a candidate secures **F Grade** for any one of the courses offered in a Semester/Programme only **F Grade will be awarded** for that Semester/Programme until he/she improves this to **D Grade** or above within the permitted period.

7.5. Students who complete the programme with "D" Grade under **"REGULATIONS FOR UNDERGRADUATE (UG) PROGRAMMES UNDER CHOICE BASED CREDIT SYSTEM, 2021"** of Mar Athanasius College (Autonomous), Kothamangalam will have **one betterment chance within 12 months**, immediately after the publication of the result of the whole programme.

7.6 The UG Board of Studies concerned shall design all the courses offered in the UG programme. The Boards shall design new courses and modify or re-design existing courses to facilitate better exposure and training for the students.

7.7. The syllabus of a course shall include the title of the course, contact hours, the number of credits and reference materials.

7.8. Students discontinued from previous regulations CBCS 2018 of Mar Athanasius College (Autonomous), Kothamangalam can pursue their studies in the Mar Athanasius College (Autonomous) Kothamangalam under "Regulations for

Under Graduate Programmes under Choice Based Credit System 2021"after obtaining readmission. These students have to complete the programme as per the Mar Athanasius College (Autonomous)"Regulations for Under Graduate Programmes under Choice Based Credit System 2021".

7.9. The practical examinations (external/internal) will be conducted only at the end of even semesters for all programmes. Special sanction shall be given for those programmes which are in need of conducting practical examinations at the end of odd semesters

8. PROGRAMME STRUCTURE

The structure of UG Programmes is as follows

Model I B.A/B.Sc.

a	Programme Duration	6 Semesters
b	Total Credits required for successful completion of the programme	120
c	Credits required from **common course I**	22
d	Credits required from **common course II**	16
e	Credits required from Core Course and Complementary Course including Project	79
f	Credits required from Open course	3
g	Minimum attendance required	75%

Model I B Com

a	Programme Duration	6 Semesters

b	Total Credits required for successful completion of the programme	120
c	Credits required from **common course I**	14
d	Credits required from **common course II**	8
e	Credits required from Core Course and Complementary Course	95
f	Credits required from Open course	3
g	Minimum attendance required	75%

Model III B Com

a	Programme Duration	6 semesters
b	Total Credits required for successful completion of the programme	120
c	Credits required from **Common Course I**	8
d	Credits required from Core + Complementary + Vocational courses including Project	109
E	Credits required from Open Course	3
G	Minimum attendance required	75%

9. EXAMINATIONS

9.1

The evaluation of each course shall contain two parts:

(i) Internal or In-Semester Assessment (ISA)

(ii) External or End-Semester Assessment (ESA)

The in-semester to end semester assessment ratio shall be 1:4.

Both Internal and External marks are to be rounded to the next integer.

9.2 For all courses (theory & practical), grades are given on a **10- point scale,** based on the total percentage of marks ***(ISA+ESA)*** as given below:

Percentage of Marks	Grade	Grade Point (GP)
95 and above	S Outstanding	10
85 to below 95	A+ Excellent	9
75 to below 85	A Very Good	8
65 to below 75	B+ Good	7
55 to below 65	B Above average	6
45 to below 55	C Satisfactory	5
35 to below 45	D Pass	4
Below 35	F Failure	0
	Ab Absent	0

10. CREDIT POINT(CP)AND CREDIT POINT AVERAGE (CPA)

1.Credit Point (CP)

Credit Point (CP) of a paper is calculated using the following formula.

CP = C × GP

Where: C is the Credit and GP is the Grade point

2. Credit Point Average (CPA)

Credit Point Average (CPA) of a Course (Common Course I, Common Course II, complementary Course I, Complementary Course II, and Core Course) is calculated using the following formula.

$$CPA = TCP/TC$$

Where:
TCPis the Total Credit Point of course and
TC is the Total Credit of that category of course

3. Semester Credit Point Average (SCPA)

Semester Credit Point Average (SCPA) of a Semester is calculated using the following formula.

$$SCPA = TCP/TC$$

Where:
TCP is the Total Credit Point of that semester and
TC is the Total Credit of that semester

4. Cumulative Credit Point Average (CCPA)

Cumulative Credit Point Average (CCPA) is calculated using the following formula.

$$CCPA = TCP/TC$$

Where;
TCP is the Total Credit Point of that Programme and
TC is the Total Credit of that programme

Grades for the different semesters and overall programme are given based on the corresponding CPA as shown below:

CPA	Grade
9.5 and above	S Outstanding
8.5 to below 9.5	A^+ Excellent
7.5 to below 8.5	A Very Good
6.5 to below 7.5	B^+ Good
5.5 to below 6.5	B Above average
4.5 to below 5.5	C Satisfactory
4to below 4.5	D Pass
Below 4	F Failure

11. MARK DISTRIBUTION FOR EXTERNAL AND INTERNAL EVALUATION

The end semester examinations of all semesters shall be conducted by the college at the end of each semester. Internal evaluation is to be done by continuous assessment. For all courses without practical total marks of external examination is 80 and total marks of internal evaluation is 20. Marks distribution for external and internal assessments and the components for internal evaluation with their marks are shown below:

11.1 FOR ALL COURSES WITHOUT PRACTICAL

a) Marks of External Examination : 80

b) Marks of Internal Evaluation : 20

All the four components of the internal assessment are mandatory.

Components of Internal Evaluation of theory	**Marks**
Attendance	**5**
Assignment /Seminar/Viva	**5**
Test papers (2x5)	**10**
Total	**20**

11.2 FOR ALL COURSES WITH PRACTICAL

a) Marks of External Examination :60

b) Marks of Internal Evaluation : 15

11.2.1 FOR THEORY

Components of In-Semester Evaluation of Theory	**Marks**
Attendance	**5**
Assignment /Seminar/Viva	**2**
Test papers (2x4)	**8**
Total	**15**

11.2.2 FOR PRACTICAL EXAMINATION

a) External 40

b) Internal 10

Components of In-Semester Evaluation of Practical	**Marks**

Attendance	2
Test papers (1x4)	4
Record*	4
Total	**10**

*Marks awarded for Record should be related to the number of experiments recorded and duly signed by the teacher concerned in charge.

All three components of internal assessments are Mandatory.

11.3 PROJECT EVALUATION: (Maximum Marks 100)

All students are to do a project in the area of core course. This project can be done individually or in groups (not more than five students) for all subjects which may be carried out in or outside the campus. Special sanction shall be obtained from the Principal to those new generation programmes and programmes on performing arts where students have to take projects which involve larger groups. The projects are to be identified during the II semester of the programme with the help of the supervising teacher. The report of the project in duplicate is to be submitted to the department at the sixth semester and are to be produced before the examiners (Internal and External) appointed by the Controller of Examinations. External Project evaluation and Viva /

Presentation is compulsory for all subjects and will be conducted at the end of the programme.

For Projects

a) Marks of External Evaluation :80

b) Marks of Internal Evaluation : 20

Components of External Evaluation of Project	**Marks**

Dissertation (**External)**	50
Viva – Voce (**External)**	30
Total	**80**

*Marks for Dissertation may include study tour report if proposed in the syllabus

***Components of Internal Evaluation of Project**	**Marks**
Punctuality	5
Experimentation/Data collection	5
Knowledge	5
Report	5
Total	**20**

11.4 ATTENDANCE EVALUATION FOR ALL COURSES

(Theory/Practical)

Percentage of attendance	**Marks**
90 and above	5
85 – 89	4
80-84	3
76-79	2
75	1
Below 75	0

(Decimals are to be rounded to the next higher whole number)

12. ASSIGNMENTS

Assignments are to be done from first to fourth Semesters. At least one assignment should be done in each semester.

13. SEMINAR/VIVA VOCE

A student shall present a seminar in the Fifth semester for each course and appear for Viva-voce in the sixth semester for each course.

14. INTERNAL ASSESSMENT TEST PAPERS

Two Test papers are to be conducted in each semester for each course. The evaluations of all components are to be published and are to be acknowledged by the candidates. All documents of internal assessments are to be kept in the college for one year and shall be made available for verification. The responsibility of evaluating the internal assessment is vested on the teacher (s), who teache the course.

14.1 GRIEVANCE REDRESSAL MECHANISM

Internal assessment shall not be used as a tool for personal or other type of vengeance. A student has every right to know, how the teacher arrived at the marks. In order to address the grievance of students, a three -level Grievance Redressal Mechanism is envisaged. A student can approach the upper level only if grievance is not addressed at the lower level.

Level 1: At the level of the concerned Course Teacher

Level2: Department Level: The Department cell chaired by the Head of the Department, Faculty Advisor and the Course Teacher concerned as members.

Level 3: **College level**: A committee with the Principal as Chairman, and HOD of concerned Department, Academic Coordinator, and two teachers of the College Grievance Cell as members.

14.2 Academic coordinator shall make arrangements for giving awareness of the internal evaluation components to students immediately after commencement of first semester.

14.3 The in-semester evaluation report in the prescribed format should reach the Controller of Examinations as per the academic calendar.

14.4 The evaluation of all components is to be published in the Department and is to be acknowledged by the candidates. All academic records of in-semester assessments are to be kept in the Department for three years and shall be made available for

verification. The responsibility of evaluating the in-semester assessment is vested on the teacher(s), who teach the course.

15. EXTERNAL EXAMINATION

The end semester examination of all Programmes shall be conducted by the College at the end of each semester.

15.1 Students having a minimum of 75% average attendance for all the courses only can register for the examination. A candidate having a shortage of attendance of 10 days in a semester subject to a maximum of 2 times during the whole period of the programme can apply for Condonation in prescribed form on genuine grounds. This Condonation shall not be counted for internal assessment. Condonation of shortage of attendance, if any, should be obtained at least 7 days before the commencement of the concerned semester examination.

It shall be the discretion of the Principal to consider such applications and condone the shortage on the merit of each case in consultation with the concerned Faculty Advisor and Head of the Department.

Unless the shortage of attendance is condoned, a candidate is not eligible to appear for the examination.

Benefit of attendance may be granted to students attending University/College union/Co-curricular activities by treating them as present for the days of absence, on production of participation/attendance certificates, within one week, from competent authorities and endorsed by the Head of the institution. This is limited to a maximum of 10 days per semester and this benefit shall be considered for internal assessment also.

Those students who are not eligible to attend the end semester examination due to shortage of attendance, even with Condonation, should take re-admission along with the next batch.

15.2 Those candidates who cannot appear for End Semester Examination or who

have failed in the end semester examinations of Fifth and Sixth Semester shall be eligible to appear for supplementary examination by paying separate fees. For reappearance/ improvement, for other semesters the students can appear along with the next batch. Notionally registered candidates can also apply for the said supplementary examinations.

15.3 A student who registers his/her name for the end semester examination will be eligible for promotion to the next semester.

15.4 A student who has completed the entire curriculum requirement, but could not register for the Semester examination can register notionally, for getting eligibility for promotion to the next semester.

15.5 A candidate who has not secured minimum marks/credits in internal examinations can re-do the same registering along with the End Semester examination for the same semester, subsequently. There shall be no improvement for internal evaluation.

15.6 Answer scripts of the external examination shall be made available to the students for scrutiny on request and revaluation/scrutiny of answer scripts shall be done as per the request of the candidate by paying fees.

16. PATTERN OF QUESTIONS

Questions shall be set to assess knowledge acquired, standard application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. The question setter shall ensure that questions covering all skills are set. He/she shall also submit a detailed scheme of evaluation along with the question paper. A question paper shall be a judicious mix of short answer type, short essay type /problem solving type and long essay type questions.

Pattern of Questions for External Examination for Course without Practical

Sl. No.	Pattern	Marks	Choice of questions	Total Marks
1	Short answer/ Problem Type	2	10/12	20
2	Short essay/	5	6/9	30

	Problems			
3	**Essay/Problem**	**15**	**2/4**	**30**
Total				**80**

Pattern of Questions for End Semester Examination for Course with Practical

Sl. No.	**Pattern**	**Marks**	**Choice of questions**	**Total Marks**
1	**Short answer/ Problem Type**	**1**	**10/12**	**10**
2	**Short essay/ Problems**	**5**	**6/9**	**30**
3	**Essay/Problem**	**10**	**2/4**	**20**
Total				**60**

17. RANK CERTIFICATE

The institution publishes rank list of top 3 candidates for each programme after the publication of 6th semester results. Rank certificate shall be issued to the candidate who secure first position in the rank list. Candidates shall be ranked in the order of merit based on the CCPA scored by them. Grace marks awarded to the students should not be counted fixing the rank/position. Rank certificate shall be signed by the

Principal and Controller of Examinations.

18. MARK CUM GRADE CARD

The College under its seal shall issue to the students a MARK CUM GRADE CARD on completion of each semester, which shall contain the following information:

(a) Name of the University

(b) Name of the College

(c) Title & Model of the Under-Graduate Programme

(d) Name of the Semester

(e) Name and Register Number of the student

(f) Code, Title, Credits and Maximum Marks (Internal, External and Total) of each course opted in the semester.

(g) Internal, External and Total Marks awarded, Grade, Grade point and Credit point in each course opted in the semester

(h) Institutional average of the Internal Exam and Average of the External Exam in each course.

(i) The total credits, total marks (Maximum and Awarded) and total credit points in the semester

(j) Semester Credit Point Average (SCPA) and corresponding Grade.

(k) Cumulative Credit Point Average (CCPA), CPA corresponding to Common courses I and II, Core Course, Complementary Course and Open Course.

(m) The final Mark cum Grade Card issued at the end of the final semester shall contain the details of all courses taken during the final semester examination

and shall include the final grade(SCPA) scored by the candidate from **1st to 5th** semesters, and the overall grade for the total programme.

19. There shall be 2 level monitoring committees for the successful conduct of the scheme. They are:

1. Department Level Monitoring Committee (DLMC), comprising HOD and

two senior most teachers as members.

2. College Level Monitoring Committee (CLMC), comprising Principal, College Council secretary and A.O/Superintendent as members.

20. SKILL ENHANCEMENT PROGRAMME

In addition to the requirement prescribed for the award of Bachelor degree, each student shall participate in the Skill Enhancement Programme (SEP) conducted by each department for a total duration of 40 hours spread over Semester I to Semester VI of all Programmes. SEP is intended to train the students and to inculcate extra skills that enable them to be competent in academic and non-academic matters equally. Separate certificate shall be issued by the institution to the candidate on successful completion of the programme. SEP shall be conducted over and above the regular working hours of each programme.

21. CERTIFICATE/DIPLOMA COURSES: Certificate/Diploma courses such as basics of accounting, animation, photography, garment designing, etc. may be conducted for all Programmes as per the discretion of the Board of Studies of the concerned department. The Board of Studies should prepare the curriculum and Syllabi of Certificate/Diploma courses including contact hours and reference materials. Separate certificate will be issued to the candidate on successful completion of the course. An extra Credit of 2 will be awarded to all the candidates on successful completion of the certificate courses and same shall be inscribed in the cumulative grade card and the degree certificate of each candidate.

21. A FACTORY VISIT / FIELD WORK/VISIT TO A REPUTED RESEARCH INSTITUTE/ STUDENT INTERACTION WITH RENOWNED ACADEMICIANS may be conducted for all Programmes.

22. TRANSITORY PROVISION

Notwithstanding anything contained in these regulations, the Principal shall, for a period of one year from the date of coming into force of these regulations, have the power to provide by order that these regulations shall be applied to any Programme with such modifications as may be necessary from time to time.

Annexure I – Model Mark cum Grade Card

Mar Athanasius College(Autonomous) Kothamangalam

Kothamangalam College P.O. Kothamangalam.

Section:

Student ID:

Date:

MARK CUM GRADE CARD

Name of candidate :

Name of College :

Permanent Register Number (PRN) : Degree:

Name of the Programme :

Name of Examination :First Semester Exam Month &Year

Date of publication of result :

Course Code	Course Title		Marks									
			External		Internal		Total					

	Common Course I Common Course II Core Course Complementary Course I Complementary Course II/ Vocational Course Total Total credit points (TCP) Total credit (TC) SCPA: Grade:												

Annexure II Model Mark cum Grade Card (VI Semester)

Mar Athanasius College (Autonomous) Kothamangalam
Kothamangalam College P.O. Kothamangalam.

Section:
Student ID:
Date:

MARK CUM GRADE CARD

Name of candidate :
Name of College :
Permanent Register Number (PRN) : Degree:
Name of the Programme :
Name of Examination :Sixth Semester Exam Month &Year
Date of publication of result :

Course Code	Course Title		Marks										
			External		Internal		Total						
	Core 9 Core 10 Core 11 Core 12 Choice Based Course Project SCPA Grade												

		Credit	CPA	Grade	Month & Year	Result

	Semester I Semester II Semester III Semester IV Semester V Semester VI					
	Common Course I Common Course II Complementary Course I Complementary Course II Core Course Open Course					
	Overall programme CCPA:					

Annexure III

Reverse side of the Mark cum Grade Card

(COMMON TO ALL SEMESTERS)

Description of the Evaluation Process

Grade and Grade Point

The Evaluation of each Course comprises of Internal and External Components in the ratio 1:4 for all Courses.

Grades and Grade Points are given on a 10-point Scale based on the percentage of Total Marks (Internal + External) as given in Table 1.

(Decimals are to be rounded to the next whole number)

Credit point and Credit point average. Grades for the different Semesters and overall Programme are given based on the corresponding CPA, as shown in Table I.

Table 1

Percentage of Marks	Grade	Grade Point (GP)
95 and above	S Outstanding	10
85 to below 95	A+ Excellent	9
75 to below 85	A Very Good	8
65 to below 75	B+ Good	7
55 to below 65	B Above average	6
45 to below 55	C Satisfactory	5
35 to below 45	D Pass	4
Below 35	F Failure	0
	Ab Absent	0

Credit point (CP) of a paper is calculated using the formula CP = C x G P, where C is the Credit; GP is the Grade Point.

Credit Point Average (CPA) of a Course/ Semester or Programme (cumulative) etc. iscalculated using the formula CPA =TCP/TC; where TCP is the Total Credit Point; TC is the Total Credit.

For converting SCPA into Percentage, multiply secured SCPA by 10 (SCPA x 10) For converting CCPA into percentage, multiply secured CCPA by 10 (CCPA x 10)

CPA	GRADE
Equal to 9.5 and above	S Outstanding
Equal to 8.5 and < 9.5	A+ Excellent
Equal to7.5 and < 8.5	A Very Good
Equal to 6.5 and < 7.5	B+ Good
Equal to5.5 and < 6.5	B Above Average
Equal to4.5 and < 5.5	C Satisfactory
Equal to 4 and < 4.5	D Pass
Below 4	F Failure

Note: A separate minimum of **30%** marks each for internal and external (for both theory andpractical) and aggregate minimum of **35%** are required for a pass for a course. For a pass in a programme, a separate minimum of **Grade D** is required for all the individual courses. If a candidate secures **F Grade** for any one of the courses offered in a Semester/Programme only **F grade** will be awarded for that Semester/Programme until he/she improves this to **D grade** or above within the permitted period.

ELIGIBILITY FOR ADMISSION

Bachelor of Science Programmes under Faculty of Science Admission to all B.Sc. Degree programmes shall be open only to candidates who have passed the Plus Two or equivalent examination or an examination recognised by Mahatma Gandhi University, Kottayam as equivalent thereto with the Main subject they propose to offer for the B.Sc. programme as one of the subjects. The eligibility criteria for admission to programmes are given below.			
Programme with core subject	**Complementary subjects**	**Eligibility**	**No. of Seats**
B.Sc. Physics (Model I)	Mathematics, Chemistry	Pass in plus two/equivalent exam with Physics as one of the optional subjects	38

SCHEME AND STRUCTURE OF PROGRAMME

Introduction

The Board of Studies in Physics proceeded with the task of restructuring the undergraduate course in Physics in Mar Athanasius College (Autonomous) as per the terms of reference and guidelines given by the **"REGULATIONS FOR UNDERGRADUATE (UG) PROGRAMMES UNDER CHOICE BASED CREDIT SYSTEM, 2018"** of Mar Athanasius College (Autonomous), Kothamangalam. The Board of Studies resolved to restructure the curriculum and syllabi of B.Sc. Degree course under the choice- based credit and semester system. Programme models proposed by the M.G. University and the Kerala State Higher Education Council are selected as the base for the task. The restructuring is attempted in such a way as to lay emphasis on student choice and self learning. The new structure would ultimately pave the way for a qualitative transformation of the existing system. While attempting the reforms, the existing conditions relating to infrastructure, workload and staff pattern have been properly taken care of and provision for full utilization of the existing faculty is proposed.

Since all the programmes within the same stream should have the same number of credits, we have chosen 120 credits as instructed. Total number of courses in BSc programme is stipulated as 30 which is spread over six semesters.

Aims and Objectives of the Programme

The Board of Studies in Physics (UG) recognizes that curriculum, course content and syllabus play vital roles in shaping education. The committee is of the view that assessment should support and encourage the broad instructional goals such as basic knowledge of the discipline of Physics including phenomenology, theories and techniques, concepts and general principles. This should also support the ability to ask physical questions and to obtain solutions to physical questions by use of qualitative and quantitative reasoning and by experimental investigation. The important student attributes including appreciation of the physical world and the discipline of Physics, curiosity, creativity and reasoned skepticism and

understanding links of Physics to other disciplines and to societal issues should gave encouragement. With this in mind, we aim to provide afirm foundation in every aspect of Physics and to explain a broad spectrum of modern trends in physics and to develop experimental, computational and mathematics skills of students.

The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of Physics by providing a more complete and logical framework in almost all areas of basic Physics.

Course design

The U.G. programme in Physics must include (a) Common courses, (b) Core courses, (c) Complementary courses, (d) Choice based courses, (e) Open courses and (f) Project. No course shall carry more than 4 credits. The student shall select any one Open course in Semester 5 offered by the various Departments which offers the core courses or physical education department, depending on the availability of infrastructure facilities, in the institution. The number of Courses for the restructured programme should contain 12 compulsory core courses, 1 open course, 1 choice based course from the frontier area of the core courses, 6 core practicals, 1 project in the area of core, 8 complementary courses, 2 complementary practicals otherwise specified, from the relevant subjects for complementing the core of study. There should be 10 common courses, or otherwise specified, which includes the first and second language of study.

DETAILED DISTRIBUTION OF COURSES

Semester	Title of the Course	Hours/ week	Credits	Total hrs	Exam Duration	Marks	
						ISA	ESA
1	English I	5	4	90	3	20	80
	English II/ Common Course I	4	3	72	3	20	80
	Second Language I	4	4	72	3	20	80
	UG18PH1CR01 - Methodology and Perspectives of Physics	2	2	36	3	15	60
	Complementary I: Mathematics I	4	3	72	3	20	80
	Complementary II: Chemistry I	2	2	36	3	15	60
	Core Practical I: UG18PH1CR02 Mechanics and Properties of Matter	2	-	36	-	-	-
	Complementary II Practical I	2	-	36	-	-	-
2	English II	5	4	90	3	20	80
	English III/ Common Course II	4	3	72	3	20	80
	Second Language II	4	4	72	3	20	80
	UG18PH2CR01 – Mechanics and Properties of Matter	2	2	36	3	15	60
	Complementary I: Mathematics II	4	3	72	3	20	80
	Complementary II: Chemistry II	2	2	36	3	15	60
	Core Practical I: UG18PH2CR02 Mechanics and Properties of Matter	2	2	36	3	10	40
	Complementary II Practical I	2	2	36	3	10	40
3	English III	5	4	90	3	20	80
	II Lang/Common Course I	5	4	90	3	20	80
	UG18PH3CR01 – Optics, Laser and Fiber Optics	3	3	54	3	15	60
	Complementary I: Mathematics III	5	4	90	3	20	80
	Complementary II: Chemistry III	3	3	54	3	15	60
	Core Practical II: UG18PH3CR02 Optics and Semiconductor Physics	2	-	36	-	-	-
	Complementary II Practical II	2	-	36	-	-	-
4	English IV	5	4	90	3	20	80

	II Lang/ Common Course II	**5**	**4**	**90**	**3**	**20**	**80**
	UG18PH4CR01 - Semiconductor Physics	**3**	**3**	**54**	**3**	**15**	**60**
	Complementary I – Mathematics IV	**5**	**4**	**90**	**3**	**20**	**80**
	Complementary II: Chemistry IV	**3**	**3**	**54**	**3**	**15**	**60**
	Core Practical II: UG18PH4CR01 Optics and Semiconductor Physics	**2**	**2**	**36**	**3**	**10**	**40**
	Complementary II Practical II	**2**	**2**	**36**	**3**	**10**	**40**
5	**UG18PH5CR01 – Electricity and Electrodynamics**	**3**	**3**	**54**	**3**	**15**	**60**
	UG18PH5CR02 – Classical and Quantum Mechanics	**3**	**3**	**54**	**3**	**15**	**60**
	UG18PH5CR03–Digital Electronics and Programming	**3**	**3**	**54**	**3**	**15**	**60**
	UG18PH5CR04– Environmental Physics and Human Rights	**4**	**4**	**72**	**3**	**15**	**60**
	UG18PH5OP0X*-Open Course	**4**	**3**	**72**	**3**	**20**	**80**
	Core Practical III: UG18PH6CR03 Electricity, Magnetism and Laser	**2**	**-**	**36**	**-**	**-**	**-**
	Core Practical IV: UG18PH6CR04 Digital Electronics	**2**	**-**	**36**	**-**	**-**	**-**
	Core Practical V: UG18PH6CR05 Thermal Physics, Spectroscopy and C++ programming	**2**	**-**	**36**	**-**	**-**	**-**
	Core Practical VI: UG18PH6CR06 Acoustics, Photonics and Advanced Semiconductor Physics	**2**	**-**	**36**	**-**	**-**	**-**
6	**UG18PH6CR01 - Thermal and Statistical Physics**	**3**	**3**	**54**	**3**	**15**	**60**
	UG18PH6CR02 --Relativity and Spectroscopy	**4**	**3**	**72**	**3**	**15**	**60**
	UG18PH6CR03– Nuclear, Particle and Astrophysics	**3**	**3**	**54**	**3**	**15**	**60**
	UG18PH6CR04 - Solid State Physics	**4**	**3**	**72**	**3**	**15**	**60**
	UG18PH6CB0X*-Choice BasedCourse	**3**	**3**	**54**	**3**	**20**	**80**
	Core Practical III: UG18PH6CR03 Electricity, Magnetism and Laser	**2**	**2**	**36**	**3**	**10**	**40**
	Core Practical IV: UG18PH6CR04	**2**	**2**	**36**	**3**	**10**	**40**

	Digital Electronics						
	Core Practical V: UG18PH6CR05 Thermal Physics, Spectroscopy and C++ programming	**2**	**2**	**36**	**3**	**10**	**40**
	Core Practical VI: UG18PH6CR06 Acoustics, Photonics and Advanced Semiconductor Physics	**2**	**2**	**36**	**3**	**10**	**40**
	UG18PH6PR01 – Project and Industrial Visit	**-**	**1**	**-**	**-**	**20**	**80**

* X stands for 1,2,3,… depending upon open course and choice based course.

Choice Based Course

Sl.No.	Paper Code	Semester	Paper Title
1	UG18PH6CB01	VI	Information Technology
2	UG18PH6CB02	VI	Material Science
3	UG18PH6CB03	VI	Computational Physics
4	UG18PH6CB04	VI	Instrumentation
5	UG18PH6CB05	VI	Astronomy and Astrophysics

Open Course

Sl.No.	Paper Code	Semester	Paper Title
1	UG18PH5OC01	V	Our Universe
2	UG18PH5OC02	V	Physics in Daily Life

3	**UG18PH5OC03**	**V**	**Computer Hardware and Networking**

PROGRAMME OUTCOME AND PROGRAMME SPECIFIC OUTCOME

PROGRAMME OUTCOMES (PO):

At the end of the programme, the graduate will be able to

No.	Outcome
PO1	Apply and innovate
PO2	Achieve a desire for higher learning
PO3	Work as a team with enhanced communication and coordination skills
PO4	Attain skills for employment and entrepreneurship
PO5	Acquire awareness on socio-cultural and environmental issues
PO6	Develop a sense of ethics, self-discipline and sustainability

PROGRAMME SPECIFIC OUTCOMES (PSO):

At the end of the B.Sc. Physics programme the student will be able to:

No.	Outcome	PO-PSO Mapping
PSO1	Learn physics through lectures, laboratory sessions, Tutorials and interaction with eminent academicians.	1, 2, 4
PSO2	Kindle the urge for higher studies, entrepreneurship and lifelong learning.	2, 4
PSO3	Enhance communication, coordination and leadership skills.	3, 4
PSO4	Achieve holistic development by nurturing employability, sense of ethics, job dignity, discipline, time management, emotional intelligence and self awareness	3, 4, 6
PSO5	Enhance national and international competency.	1, 2, 3
PSO6	Develop social and environmental responsibleness.	5, 6
PSO7	Demonstrate writing, speaking, reading and listening competence in two languages	3, 4
PSO8	Acquire fundamental concepts of Mathematics and Chemistry as a tool for learning Physics.	1, 4

DETAILED SYLLABUS OF B.Sc.PHYSICS PROGRAMME

SEMESTER ONE

Title of Paper		**Methodology and Perspectives of Physics**
Course Code		**UG18**PH1CR01
Semester		I
Credits		2
Contact Hours		36
Course Type		Core
COURSE OUTCOMES (CO)		
On finishing the course, the student shall,		**PSO-CO Mapping**
CO1	Acquire adequate knowledge in number systems and binary arithmetic.	1,2, 4
CO2	Perform vector operations relevant to learning Physics.	1,2, 4
CO3	Outline coordinate systems to problems upcoming in other courses.	1, 2, 4
CO4	Revise the historical development of physics and its possibilities. Hence understand the values of lifelong learning.	1,3
CO5	Develop a historical perspective of universal laws and international developments in Physics.	2,5
CO6	Discuss science, scientific temper, and scientific methods.	3,4,5,6
CO7	Understand units, common laboratory instruments and evaluate errors in measurements.	1, 2, 4

Module I

Concepts and Development Physics: (8hours)

Development of physics in the last century and the birth of new scientific concepts with reference to s*cientific contributions of Galileo, Newton, Einstein, J J Thomson, Curies, Rayleigh, Max Plank, Heisenberg and Schrodinger* (qualitative understanding). Contributions of Indian physicists -*C V Raman, H J Babha, J C Bose, S N Bose, M Saha, S Chandrasekhar, Vikram Sarabhai* (Topics in this part require qualitative study only)

References:

1. Feynman lectures of Physics

2. Concepts of Modern Physics: ArtherBeisser,
3. Modern Physics: Kenneth Krane
4. Modern Physics: R Murugeshan
5. https://www.nobelprize.org/nobel_prizes/physics/laureates/

Module II **(18 hours)**

Number systems- Decimal, hexadecimal and Binary. Conversions, Binary arithmetic addition, subtraction and multiplication. 1's and 2's complement subtraction –signed binary numbers. Signed binary arithmetic, BCD code, ASCII code, Significance of binary number system in digital electronics, microprocessors and in computers

Introductory Vector Analysis - Applications of vectors in Physics. Differential and integral vector calculus: – The operator - physical significance of Gradient, Divergence and Curl, Line integral, surface integral and volume integral of vectors

Co-ordinate systems: Cartesian Co-ordinate system, plane polar and spherical polar coordinates, cylindrical coordinates (Basic ideas with examples in physics),

References:

1. Introduction to Electrodynamics, David J. Griffiths, Prentice Hall India Pvt. Ltd., Chapter1
2. Mathematical Physics: Charlie Harper
3. University Physics, Roger A Freedman, Hugh D Young 14th edition
4. Digital electronics: Albert Paul Malvino
5. Digital logic and computer design – M. Morris Mano, PHI.

Module III

Experimental methods and error analysis **(10 hrs)**

Experimental methods, least count of instruments, Instruments for measuring (a) Mass - Common Balance, (b) Length - Vernier Calipers, Screw Gauge, Travelling Microscope and SONAR, (c) Time - Pendulum Clock and Atomic Clock (d) Angle – Spectrometer and Stellar Parallax (e) Current - Ammeter: Conversion of galvanometer to ammeter (f) Voltage : Voltmeter: Conversion of galvanometer to voltmeter, Fundamental units.

Precision and accuracy of measurements, source of error in measurements, necessity of estimating errors, types of errors, reading error of instrument, calibration error, random error, systematic error, significant digits, order of magnitude and rounding of numbers, rounding error, absolute and relative errors, Errors of computation- addition, subtraction, multiplication, division, error in power and roots, Propagation of errors, analysis of data, standard deviation, calculation of mean value.

References:

1. Text book: Advanced course in Practical Physics by D Chattopadhyay- Chapter-1
2. Practical Physics, G L Squires, Third edn. Cambridge University Press.
3. The theory of Errors in Physical Measurements- J C Pal- New Central Book Agency-2010

COMPLEMENTARY PHYSICS FOR CHEMISTRY

Semester 1

UG18PH1CM01: PROPERTIES OF MATTER AND THERMODYNAMICS

Title of Paper	Properties of Matter & Thermodynamics	
Course Code	UG18PH1CM01	
Semester	I	
Credits	2	
Contact Hours	36	
Course Type	Complementary Physics for Chemistry	
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Understand the elastic characteristics of materials	1
CO2	Apply the theory to practical uses in bending of materials	2,4
CO3	Understand the theory and applications of properties of fluids such as surface tension and viscosity	1,2
CO4	Equip themselves for higher studies and develop an aptitude for research Apply the theory to develop problem solving skills.	3, 4
CO5	Identify and describe the concepts and laws in thermodynamics, in particular: entropy, temperature, Free energies and thermodynamic functions.	1, 2
CO6	Apply the concepts and principles of thermodynamics to heat engines.	4
CO7	Apply the concepts and laws of thermodynamics to solve problems in thermodynamic systems such as gases, heat engines and refrigerators etc.	4

Module I

Elasticity(13 hours)

Stress- strain- Hooke's law- Elastic moduli- Poisson's ratio- twisting couple-determination of rigidity modulus- static and dynamic methods- static torsion- torsion pendulum, bending of beams- cantilever, uniform and non-uniform bending, I section girder.

Module II

Surface tension **(3 hours)**

Molecular theory of surface tension - surface energy - excess pressure in a liquid drop, factors affecting surface tension - applications

Hydrodynamics **(7 hours)**

Streamline and turbulent flow - critical velocity - Coefficient of viscosity - Derivation of Poiseuille's equation, Stokes equation-Determination of viscosity by Poiseuille's method - Brownian motion – Viscosity of gases- Bernoulli's theorem.

Text Book: Elements of properties of matter, D S Mathur, Chapter- 14

Module III

Thermodynamics **(13 hours)**

Thermodynamic systems- thermodynamic equilibrium- thermodynamic processes-isothermal process- adiabatic process- zeroth law of thermodynamics, first law of thermodynamics- heat engine- the Carnot engine- refrigerator, concept of entropy-second law of thermodynamics- third law of thermodynamics- Maxwell's thermodynamic relations

Text Books:

1. Elements of properties of matter, D S Mathur- S Chand

2. Heat and Thermodynamics-Brijlal & Subrahmanyam (S.Chand)

References

1. Mechanics - H.S.Hans and S.P.Puri. (Tata McGraw-Hill)

2. Properties of Matter - Brijlal and N. Subrahmanyam (S. Chand and Co.)

3. Mechanics - J.C. Upadhyaya (Ram Prasad and sons)

4. Heat and Thermodynamics – Mark W Zemanski (Tata McGraw-Hill)

COMPLEMENTARY PHYSICS FOR MATHEMATICS

Semester I

UG18PH1CM01: PROPERTIES OF MATTER & ERROR ANALYSIS

Title of Paper	Properties of Matter & Error Analysis	
Course Code	UG18PH1CM01	
Semester	I	
Credits	3	
Contact Hours	72	
Course Type	Complementary Physics for Mathematics	
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Understand the elastic characteristics of materials	1
CO2	Apply the theory to practical uses in bending of materials	2, 4
CO3	Understand the theory and applications of properties of fluids such as surface tension and viscosity	1, 2
CO4	Apply the theory to develop problem solving skills	1, 4
CO5	Analyse data and accounting for errors.	1, 2

2 credits (36 hours)

Module I

Elasticity **(13 hours)**

Stress- strain- Hooke's law- Elastic moduli- Poisson's ratio- twisting couple-determination of rigidity modulus- static and dynamic methods- static torsion- torsion pendulum, bending of beams- cantilever, uniform and non-uniform bending, I section girder.

Module II

Surface tension **(3 hours)**

Molecular theory of surface tension - surface energy - excess pressure in a liquid drop, factors affecting surface tension - applications

Hydrodynamics **(7 hours)**

Streamline and turbulent flow - critical velocity - Coefficient of viscosity - Derivation of Poiseuille's equation, Stokes equation-Determination of viscosity by Poiseuille's method - Brownian motion – Viscosity of gases – Bernoulli's theorem.

Module III (13 hours) Error Analysis

Basic ideas – uncertainties of measurement – importance of estimating errors – dominant errors – random errors – systematic errors - rejection of spurious measurements. Estimating and reporting errors – errors with reading scales, errors of digital instruments– number of significant digits –absolute and relative errors – standard deviation. Propagation of errors – sum and differences – products and quotients – multiplying by constants – powers

References:

1. *Elements of properties of matter, D S Mathur*
2. *Advanced course in Practical Physics by D Chattopadhyay*
3. *Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)*
4. *Concepts of Modern Physics- A. Beiser (Tata McGraw-Hill, 5th Edn.)*
5. *Modern Physics- G. Aruldas and P. Rajagopal (PHI Pub)*
6. *Physics- Resnick and Halliday*
7. *An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, John R. Taylor - Univ. Science Books*

SEMESTER TWO

Title of Paper		**Mechanics & Properties of Matter**
Course Code		UG18PH2CR02
Semester		II
Credits		2
Contact Hours		36
Course Type		Core
COURSE OUTCOMES (CO)		
On finishing the course, the student shall,		**PSO-CO Mapping**
CO1	Revise the basics of wave motion and oscillators, analyse the working of oscillating systems and simple harmonic motion	1,2,5
CO2	Revise the basics of properties of matter, definition and evaluation Elastic moduli.	1,2.5
CO4	Analyse fluid motion and compute surface tension and viscosity of fluids	1,2,5

Module I

Wave motion **(4 hours)**

General equation of wave motion, plane progressive harmonic wave, energy density, intensity of a wave, superposition of waves, beats, transverse waves in stretched strings, modes.

Text Book: Mechanics by D.S. Mathur – Chapter 9.

Oscillations **(8 hours)**

Periodic motion, simple harmonic motion and harmonic oscillator, energy of a harmonic oscillator, examples of harmonic oscillator – simple and compound pendulum. Theory of Damped harmonic oscillator. Theory of forced oscillator, resonance, applications.

Text Book: Mechanics by D.S. Mathur – Chapter 7, 8.

Module -II

Rotational mechanics **(7 Hours)**

Angular velocity- angular acceleration- angular momentum- conservation- torque-moment of inertia- Parallel and perpendicular axes theorems - calculation of moment of inertia-(rod, ring, disc, cylinder, and sphere). Theory of flywheel.

Text Book: Mechanics by D.S. Mathur – Chapter 10.

Module III

Elasticity(10 hours)

Basic ideas on elasticity – Young's modulus, bulk modulus, rigidity modulus, Poisson's ratio, relations connecting various elastic constants. Work done per unit volume in a strain. Bending of beams, bending moment, flexural rigidity. Young's modulus – uniform and non-uniform bending, cantilever. I –section girders. Determination of rigidity modulus using Static and Dynamic methods.

Text Book: Mechanics by D.S. Mathur – Chapter 12, 13.

Hydrodynamics (7 hours)

Streamline and turbulent flows, coefficient of Viscosity – Determination of viscosity by Poiseuille's method. Equation of continuity, energy possessed by a liquid, Bernoulli's theorem.

Surface tension, surface energy, excess pressure in a liquid drop and bubble, factors affecting surface tension, applications.

Text Book: Mechanics by D.S. Mathur – Chapter 14.

Text books:

1. Mechanics by J.C. Upadhayaya, Ramprasad Pub.
2. Mechanics -D.S.Mathur, S.Chand.

3. Advanced course in Practical Physics by D Chattopadhyay, Central Book
4. Properties of Matter and Acoustics by Murugeshan and K. Sivaprasath, S.Chand

References:

1. Mechanics- Hans and Puri, TMH
2. Classical Mechanics by J.C. Upadhyaya, Himalaya Pub.
3. Classical Mechanics-Takwale and Puranik, TMH.
4. Classical mechanics- K.SankaraRao, PHI.
5. Properties of Matter by Mathur, S. Chand,
6. Mechanics by Somnath Datta, Pearson
7. Mechanics by H.D Young and R.A Freedman, Pearson.

Semester 2

UG18PH2CM02: MECHANICS AND SUPERCONDUCTIVITY

Title of Paper	Mechanics and Superconductivity	
Course Code	UG18PH2CM02	
Semester	II	
Credits	2	
Contact Hours	36	
Course Type	Complementary Physics for Chemistry	
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Understand the theory of different types of motion such as linear motion, rotational motion and oscillations	1
CO2	Apply the theory to practical uses of mechanics.	1, 2, 8
CO3	Understand the theory of waves.	1
CO4	Apply the theory to develop problem solving skills.	1, 2
CO5	Invoke curiosity by introducing the theory of superconductivity and its applications	1, 2

Module I

Motion under gravity

(5 hours)

Velocity- acceleration- force – acceleration due to gravity - compound pendulum (symmetric and asymmetric) radius of gyration –centripetal acceleration and force - centrifugal force

Rotational dynamics **(10 hours)**

Angular velocity- angular momentum- torque- conservation of angular momentum-angular acceleration- moment of inertia- parallel and perpendicular axes theorems-moment of inertia of rod, ring, disc, cylinder and sphere- flywheel

Module II

Oscillations **(9 hours)**

Periodic and oscillatory motion- simple harmonic motion- differential equation, expression for displacement, velocity and acceleration- graphical representation- energy of a particle executing simple harmonic motion damped oscillation- forced oscillation and resonance.

Waves **(4 hours)**

Waves-classifications- progressive wave- energy of progressive wave- superposition of waves-theory of beats- Doppler effect.

Module III

Superconductivity **(8 hours)**

Super conducting phenomenon- Occurrence- BCS theory (qualitative) Meissner Effect-Type I and Type II superconductors- Josephson effects (qualitative) - High temperature superconductors- Applications of Superconductivity

Text Books:

1. *Elements of properties of matter, D S Mathur- S Chand*
2. *Mechanics- D S Mathur- S Chand*
3. *Solid State Physics- P K Palanisamy- Scitech*

References

1. *Properties of Matter- Brijlal and N. Subrahmanyam (S. Chand and Co.)*
2. *A text book on oscillations waves and acoustics, M.Ghosh , D Bhattacharya*
3. *Solid State Physics- R. K. Puri and V.K. Babbar (S. Chand and Co.)*
4. *Elementary Solid State Physics,Ali Omar*
5. *Modern Physics- Murugeshan- S Chand*

Semester II

UG18PH2CM02: MECHANICS AND ASTROPHYSICS

Title of Paper	Mechanics and Astrophysics	
Course Code	UG18PH2CM02	
Semester	II	
Credits	3	
Contact Hours	72	
Course Type	Complementary Physics for Mathematics	
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Understand the theory of different types of motion such as linear motion, rotational motion and oscillations	1, 2
CO2	Apply the theory to practical uses of mechanics	2
CO3	Understand the theory of waves	1, 2
CO4	Apply the theory to develop problem solving skills	2
CO5	Invoke curiosity to the field of origin and evolution of universe	1, 5

2credits (36hours)

Module I

Motion under Gravity (5 hours)

Velocity- acceleration- force – acceleration due to gravity - compound pendulum (symmetric and asymmetric) radius of gyration – Kater's Pendulum- centripetal acceleration and force - centrifugal force

Rotational Dynamics (10 hours)

Angular velocity- angular momentum- torque- conservation of angular momentum-angular acceleration- moment of inertia- parallel and perpendicular axes theorems-moment of inertia of rod, ring, disc, cylinder and sphere- flywheel

Module II

Oscillations (9 hours)

Periodic and oscillatory motion- simple harmonic motion- differential equation, expression for displacement, velocity and acceleration- graphical representation- energy of a particle executing simple harmonic motion - damped oscillation- forced oscillation and resonance.

Waves **(4 hours)**

Waves-classifications- progressive wave- energy of progressive wave- superposition of waves-theory of beats- Doppler Effect.

Module III

Astrophysics **(8 hours)**

Temperature and color of a star- elements present in a stellar atmosphere- mass of star-life time of a star- main sequence stars-HR diagram- evolution of stars- white dwarf-supernova explosion- neutron star- black hole- (all topics to be treated qualitatively)

References

1. *Elements of properties of matter, D S Mathur Mechanics- H.S.Hans and S.P.Puri. (Tata McGraw-Hill)*
2. *Mechanics, D S Mathur*
3. *Modern Physics- R. Murugeshan, Er. Kirthiga Sivaprasad*
4. *A text book on oscillations waves and acoustics, M.Ghosh , D Bhattacharya*
5. *Introduction to Astrophysics-Baidyanath Basu.*
6. *Mechanics by D.S. Mathur and P.S. Hemne, S. Chand.*
7. *Waves, Mechanics & Oscillations- S B Puri*

BSc PHYSICS PRACTICALS

Minimum of experiments to be done in each paper is 14.

Minimum number of experiments for appearing practical examination is 8.

Maximum possible number of repetitions must be done to reduce error in a measuring quantity.

Do calculation of percentage error for all experiments.

The S.I. units must be specified along with the results.

Division of internal marks for record (maximum 10 marks)

No. of Experiments	Marks
14 and above	4
12 & 13	3
10 & 11	2
8,9 & 10	1
Less than 8	0

Minimum of experiments to be done in each paper is 14.
SEMESTER 1&2 CORE_(First Year)

Title of Paper		**Core Practical I - Mechanics and Properties of Matter**
Course Code		UG18PH2CR01
Semester		I & II
Credits		2
Contact Hours		36
Course Type		Core - Laboratory Course
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Study the elastic behaviour and working of torsional pendulum	3, 4, 5

CO2	Study of bending behaviour of beams and analyse the expression for young's modulus	3, 4, 5
CO3	Understand the surface tension and viscosity of fluid, Perform experiments and interpret the results of observation, including making an assessment of experimental uncertainties and errors	3, 4, 5
CO4	Analyse the relationship between various types of experiments	3, 4, 5
CO5	Perform the procedure as per standard values 6. Understand the applications	3, 4, 5

1. Symmetric Compound Pendulum – Determination of acceleration due to gravity (g), radius of gyration(K) and moment of inertia (I)
2. Asymmetric Compound Pendulum – Determination of acceleration due to gravity (g), radius of gyration(K) and moment of inertia (I)
3. Kater's pendulum – Determination of acceleration due to gravity (g)
4. Torsion Pendulum – Determination of rigidity modulus (n) and moment of inertia (I)
5. Torsion Pendulum (Method of equal masses) – Determination of rigidity modulus (n) and moment of inertia (I)
6. Measurement of density of a solid – Sensibility method to find mass using beam balance and screw gauge / venier calipers for dimension measurements
7. Uniform bending – Pin and Microscope – Determination of Young's modulus
8. Non Uniform bending – Pin and Microscope – Determination of Young's modulus
9. Uniform bending – Optic Lever – Determination of Young's modulus
10. Non Uniform bending – Optic Lever – Determination of Young's modulus
11. Cantilever – Scale and telescope – Determination of Young's modulus
12. Cantilever – Pin and Microscope – Determination of Young's modulus
13. Vertical oscillations of a spring – Determination of Young's modulus
14. One dimensional elastic collision – Hanging sphere method – Law of conservation of energy and momentum
15. Static Torsion – Determination of rigidity modulus
16. Flywheel – Determination of moment of inertia
17. Constant pressure head – Determination of viscosity of a liquid
18. Variable pressure head – Determination of viscosity of a liquid
19. Stokes's method – Determination of viscosity of a liquid
20. Capillary rise method – Determination of surface tension
21. Quincke's method – Determination of surface tension

COMPLEMENTARY PHYSICS PRACTICALS

Title of Paper	Complementary Physics Practical	
Course Code	UG18PH2CM02	
Semester	I & II	
Credits	2	
Contact Hours	36	
Course Type	Complementary - Laboratory Course	
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Explore the fundamental concepts of physics	1, 2
CO2	Acquire knowledge on elementary ideas and importance of material properties, heat, sound, optics, electricity and magnetism.	1, 2
CO3	Apply the characteristics of electronic devices in practicals	4, 6
CO4	Carry out the practical by applying these concepts	4, 6
CO5	Perform experiments and interpret the results of observation, including making an assessment of experimental uncertainties and errors	2
CO6	Get depth knowledge of physics in day today life	1

Semester I & II
Complementary Physics Practical 1: UG18PH2CM01

1. Vernier Calipers -- Volume of cylinder (solid and hollow), sphere and beaker
2. Screw gauge – Radius of wire, volume of sphere and glass piece
3. Beam balance - Mass of a solid (sensibility method)
4. Spectrometer - Refractive Index of material of prism.
5. Diode characteristics- ac and dc resistance
6. Coefficient of viscosity of the liquid – Constant **OR** Variable pressure head method
7. Surface Tension – Capillary rise method
8. Determination of Young's Modulus- Cantilever (Scale and Telescope)
OR - Uniform bending (Optic lever method)
OR- Non-uniform bending (Pin and Microscope method)
9. Acceleration due to gravity (g)- Symmetric Compound Pendulum
OR Kater's pendulum
10. Symmetric Compound Pendulum - Determination of Radius of gyration and moment of inertia
11. Fly wheel – Moment of Inertia
12. Torsion pendulum -Rigidity modulus

13. Determination of moment of inertia of rotationally symmetric body (solid sphere **OR** cylinder **OR** disc) from their period of oscillation on a torsion axle
14. Spring constant - Hooke's law - oscillation
15. Resistivity of the material of the wire- Ohm's law and verification by multimeter
16. Construction of half wave rectifier with and without filter – Ripple factor
17. Laser- Transmission **OR** Reflection Grating- Determination of wavelength
18. Liquid lens - Refractive Index of glass using a liquid of known refractive index
19. Poisson's ratio of rubber
20. Temperature dependence of capacitance- polymer and ceramic capacitors
21. Resistance of a galvanometer and its figure of merit.

SEMESTER THREE

Semester-3 Core Course: III **54 hours (Credit – 3)**

UG18PH3CR03 - OPTICS, LASER AND FIBER OPTICS

Title of Paper	Optics, Laser and Fiber Optics	
Course Code	UG18PH3CR03	
Semester	III	
Credits	3	
Contact Hours	54	
Course Type	Core	
COURSE OUTCOMES (CO)		
On finishing the course, the student shall,		**PSO-CO Mapping**
CO1	To impart necessary foundation in Optics, which will enable the students for an intense study of these things at a later stage	1, 2
CO2	Learning the basic ideas of interference, diffraction and polarization	1, 2
CO3	Understand the concepts of fiber optics and laser.	1, 2
CO4	Recognize the application of optical fibers and laser in various real problems.	1, 2, 3
CO5	Recall the principles and basic equations and apply them to unseen problems.	1, 2
CO6	Formulate the equations of unique cases in the diverse categories of Optics.	1, 2 , 4, 5

Module I

Interference **(12 hours)**

Review of basic ideas of interference - Coherent waves - Optical path and phase change - superposition of waves - theory of interference - intensity distribution. Young's double slit experiment, Coherence - Conditions for interference.

Thin films - plane parallel film - interference due to reflected light - conditions for brightness and darkness - interference due to transmitted light - Haidinger fringes - interference in wedge shaped film - colours in thin films - Newton's rings - applications. Michelson interferometer – construction and working.

Text book: Optics by N. Subramanayam, Brijlal, M.N.Avadhanulu - Chapter 14 and 15.

Module II

Diffraction **(11 hours)**

Fresnel Diffraction – Huygens- Fresnel theory –zone plate –Difference between zone plate and convex lens. Comparison between interference and diffraction –diffraction pattern due to a straight edge, single silt. Fraunhoffer diffraction at a single slit, double slit, N slits, theory of plane transmission grating. Dispersive power and resolving power of grating.

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 17, 18 and 19.

Polarization **(12 hours)**

Concept of polarization – plane of polarization - production of plane polarized light by reflection - Brewster's law - production of plane polarized light by refraction. Malu's law - Polarization by double refraction - calcite crystal. - optic axis – Principal section - Double refraction - Huygens explanation of double refraction (Qualitative). o-ray and e-ray - Positive and Negative crystals – Phase difference between e-ray and o-ray - Superposition of waves linearly polarised at right angles. Types of polarized light - Retarders - Quarter wave plate and Half wave plate. Production and Detection of plane, elliptically and circularly polarized light - Optical Activity (Analytical treatment not required) - specific rotation.

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 20.

Module III

Laser **(11 hours)**

Absorption and emission of light - Absorption - spontaneous emission and stimulated emission, Einstein relations, Population inversion - Active medium - Pumping, different pumping methods, optical resonators (theory not required)– plane mirror and confocal resonators – Metastable state. pumping schemes - Three level and Four level Laser systems. Types of lasers - Ruby Laser, He-Ne laser, Semiconductor Laser - Laser beam Characteristics, coherence. Applications of Laser.

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 22 and 23.

Fiber Optics **(8 hours)**

Optical Fibre – Total internal reflection - Propagation of light in a fiber -acceptance angle, numerical aperture - Modes of propagation – Classification of fibres - single mode and multimode step index fiber –graded index fiber- V-number, - Attenuation- application of optical fibers - optical fiber communication – advantages of optical fibers.

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu Chapter.

References

1. Optics, E Hecht and AR Ganesan, Pearson
2. Optics, 3rd edition, Ajoy Ghatak, TMH
3. Optical Electronics, Ajoy Ghatak and K Thyagarajan, Cambridge
4. Optics and Atomic Physics, D P Khandelwal, Himalaya Pub. House
5. Optics, S K Srivastava, CBS Pub. N Delhi
6. A Text book of Optics, S L Kakani, K L Bhandari, S Chand.
7. Optics N.Subramanayam, Brijlal, M.N Avadhanulu S Chand.
8. Semiconductor optoelectronic devices: Pallab Bhattacharya, PHI 2009.
9. Lasers and Non linear Optics, BB Laud, New Age Int Pub. 2013
10. Laser Fundamentals, William T Silfvast, Cambridge Univ Press. 2012.
11. Optoelectronics an Introduction, J Wilson & JFB Hawkes, PHI 1999.
12. Fiber Optics and Optoelectronics, R P Khare, Oxford 2012..
13. Introduction to Optics, Frank L Pedrotti, Leno M Pedrotti& Leno S Pefrotti, Pearson 2014.
14. Optical fiber and fiber optic communication system (4th edition) Subir Kumar Sarkar, S Chand.

Semester-III: Complementary Physics for Chemistry Modern Physics & Magnetism

Title of Paper		**Modern Physics & Magnetism**
Course Code		UG18PH3CM03
Semester		III
Credits		3
Contact Hours		54
Course Type		Complementary Physics for Chemistry
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Acquire knowledge of the fundamental physics underpinning atomic and nuclear physics, understand the concepts and potential applications	1
CO2	Understand the general considerations of Quantum physics	1
CO3	Understand the radioactive decay processes and the potential applications	1
CO4	Understand and analyse the working of semiconductor devices like diodes and transistors	1
CO5	Apply the characteristics of diodes and transistors in designing rectifiers and amplifiers	1, 2
CO6	Understand the types of magnetic materials and causes of Earth's magnetism	1

Module I

Quantum Mechanics (12 hours)

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function & probability density- Schrödinger equation-time dependent and time independent particle in a potential box.

Spectroscopy (12 hours)

Basic features of Bohr atom model - formula for energy - vector atom model- various quantum numbers - coupling schemes – LS & JJ-Pauli's exclusion principle - magnetic moments of orbital electrons.

Optical spectra - spectral terms, selection rules, hyperfine structure; molecular spectra-rotational, vibrational and electronic spectra; Raman effect - experimental study,

quantum theory; fluorescence and phosphorescence; comparison of Raman, fluorescence and IR spectra; NMR (qualitative only).

Module II

Atomic nucleus and radioactivity (12 hours)

Atomic nucleus-classification-basic properties of nucleus-charge, mass, spin, magnetic moment binding energy and packing fraction-nuclear forces-salient features

Radioactivity- properties of alpha, beta and gamma-Soddy Fajan's displacement law, law of radioactive disintegration-decay constant -half life and mean life-radioactive equilibrium - measurement of radioactivity-radio carbon dating.

Module III

Electronics (10 hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p-n junction diode-Zener diode and its characteristics-voltage regulation-half wave and full wave rectifiers- bridge rectifier-ripple factor, efficiency - transistors-different configurations-characteristics. Bipolar junction transistor-Construction and operation.

Module IV

Magnetism (8 hours)

Properties of magnetic materials, Paramagnetism, Diamagnetism, Ferromagnetism, Hysteresis, Ferrites, Magnetostriction, Earth's magnetism-elements of earth's magnetism-dip, declination, horizontal and vertical components-magnetic maps-magnetographs-cause of earth's magnetism

Text Books:

1. *Modern Physics- R. Murugeshan, Er. Kirthiga Sivaprasad . S Chand*
2. *Principles of electronics, V K Mehta, S Chand*
3. *Electricity and magnetism, D C Tayal,*

References

1. *Functional Electronics, Ramanan (Tata McGraw-Hill)*
2. *Electricity and magnetism - Brijlal and N. Subrahmanyam (S. Chand and Co.)*

Semester III

UG18PH2CM03: MODERN PHYSICS AND ELECTRONICS

3 credits (54 hours)

Title of Paper		**Modern Physics & Electronics**
Course Code		UG18PH2CM03
Semester		III
Credits		3
Contact Hours		54
Course Type		Complementary Physics for Mathematics
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Acquire knowledge of the fundamental physics underpinning atomic and nuclear physics, understand the concepts and potential applications	1
CO2	Understand the general considerations of Quantum physics	1
CO3	Understand the radioactive decay processes and the potential applications	1
CO4	Understand and analyse the working of semiconductor devices like diodes and transistors	1
CO5	Apply the characteristics of diodes and transistors in designing rectifiers and amplifiers	1, 2
CO6	Understand the different number systems	1
CO7	Understand basic theorems	1
CO8	Analyse various gates and understand the truth table	1,2

Module I

Quantum Mechanics **(12 hours)**

Inadequacies of classical physics-experimental evidences-evidences for quantum theory-Planck's hypothesis-foundation of quantum mechanics-wave function & probability density- Schrödinger equation-time dependent and time independent particle in a potential box.

Spectroscopy **(12 hours)**

Basic features of Bohr atom model - formula for energy - vector atom model- various quantum numbers - coupling schemes – LS & JJ-Pauli's exclusion principle - magnetic moments of orbital electrons.

Optical spectra - spectral terms, selection rules, hyperfine structure; molecular spectra-rotational, vibrational and electronic spectra; Raman effect - experimental study, quantum theory; fluorescence and phosphorescence; comparison of Raman, fluorescence and IR spectra; NMR (qualitative only).

Module II

Atomic nucleus and radioactivity (12 hours)

Atomic nucleus-classification-basic properties of nucleus-charge, mass, spin, magnetic moment binding energy and packing fraction-nuclear forces-salient features

Radioactivity- properties of alpha, beta and gamma-Soddy Fajan's displacement law, law of radioactive disintegration-decay constant -half life and mean life-radioactive equilibrium - measurement of radioactivity-radio carbon dating.

Module III

Electronics (10 hours)

Current-voltage characteristics of a diode-forward and reverse bias-breakdown mechanism of p-n junction diode-Zener diode and its characteristics-voltage regulation-half wave and full wave rectifiers- bridge rectifier-ripple factor, efficiency - transistors-different configurations-characteristics.

Module IV

Digital Electronics (8 hours)

Different number systems – decimal, binary, octal, hexa decimal number systems-conversion between different number systems- binary mathematics – addition, subtraction (1's compliment and 2's compliment methods) - basic theorems of Boolean algebra- de Morgan's theorems – Simplification of Boolean equations - AND, OR, NOT, NAND, NOR, XOR gates- truth tables- half adder- full adder

References

1. *Modern Physics - R. Murugeshan, Er. Kirthiga Sivaprasad*
2. *Principles of electronics, V K Mehta*
3. *Digital principles and applications - A. P. Malvino and P. Leach*
4. *Concepts of Modern Physics: Arthur Beiser (TMH).*
5. *Basic Electronics , B L Thereja (S. Chand)*

SEMESTER FOUR

Semester-IV Core Course: IV **Credit-3 (54 hours)**

UG18PH4CR04 - SEMICONDUCTOR PHYSICS

Title of Paper	Semiconductor Physics	
Course Code	UG18PH4CR04	
Semester	IV	
Credits	3	
Contact Hours	54	
Course Type	Core	
COURSE OUTCOMES (CO)		
On finishing the course, the student shall,		**PSO-CO Mapping**
CO1	Revise basic concepts of semiconductors and apply the knowledge to the working of semiconductor devices.	1, 2
CO2	To impart ideas regarding bipolar junction transistors, transistor configurations and biasing	1, 2
CO3	Recognize the basic principles of feedback and their types and realize their application in the construction of amplifiers and oscillators.	1, 2, 6
CO4	Perform comparative learning of FET and BJT	1, 6
CO5	Understand the applicability of operational amplifiers and perform basic designs of inverting, non inverting, summing and buffer amplifiers	1, 6
CO6	Study modulation and demodulation in the field of communication.	1

Module I

Semiconducting diodes and applications

PN Junction, Depletion layer, Barrier potential, Biasing- forward and reverse, Reverse breakdown, Junction capacitance and diffusion capacitance- PN Junction diode – V-I characteristics–Diode parameters, Diode current Equation (derivation), Diode testing, Ideal diode. Zener diode and its reverse characteristics. Thermistors.

Rectification - Half wave, Full wave, Centre tapped, Bridge rectifier circuits - Nature of rectified output, Efficiency & Ripple factor-Filter circuits – Inductor Filter, Capacitor Filter, LC Filter, π Filter-Regulated Power supplies - Zener diode voltage regulator-Voltage

multipliers – Doubler & Tripler- Wave shaping circuits - Clipper-Positive, negative and biased – Clampers- Positive, negative and biased.

Text Book:

1. Basic Electronics- B.L.Theraja Chapters 13,14,15,17

2. A Text Book of Applied Electronics- R.S.Sedha Chapters-11, 12, 19, 20, 33

Module II

Transistors Configurations and Feed back (12 hours)

Bipolar junction transistors, Transistor biasing, CB, CC, CE configurations and their characteristics- Active, saturation and cut-off regions. Current gain α, β, γ and their relationships. Leakage currents- Thermal runaway. DC operating point and AC and DC Load line, Q-Point.

Basic principles of feedback, positive & negative feedback, Advantages of negative feedback, negative feedback circuits – voltage series & shunt, current series & shunt.

Amplifiers and Oscillators (12 hours)

Need for biasing-Stabilization- Voltage divider bias. Single stage transistor Amplifiers-CE amplifier - amplification factors. Decibel system, Variations in Amplifier gain with frequency.

Oscillatory Circuits, LC oscillators – Hartley Oscillator, Colpit's Oscillator, RC oscillators - Phase shift Oscillator. Astable and monostable multivibrator (basic idea only)

Text Book:

1. Basic Electronics-B.L.Theraja-Chapters 18, 19, 20, 22, 24, 25, 28, 29.

2. A Text Book of Applied Electronics-R.S.Sedha Chapters 14, 15, 22,24, 29, 31, 32

Module III

FET, Operational Amplifier & Modulation (16 hours)

FET -characteristics, FET- Parameters. Comparison between FET and BJT. OP- amp- Symbol and terminals. Characteristics of ideal OP-amp, CMRR, Applications- inverting, Non-inverting, Unity follower and Summing amplifiers. Types of modulation – AM, FM, Pulse modulation and Phase modulation (qualitative study only). Amplitude modulation- modulation index - Analysis of AM wave – Sidebands –bandwidth- AM Demodulation.

Text Book:

1. Basic Electronics-B. L. Theraja - Chapters 26, 30, 31

2. A Text Book of Applied Electronics-R.S.Sedha-Chapter-16, 35

References:

1. Principles of electronics, VK Mehta, S Chand
2. Basic Electronics(7th Edition), Malvino and Bates, TMH
3. Electronics Fundamentals and Applications- D. Chattopadhyay and P.G.Rakshit, New Age International Publishers.
4. Electronics: Fundamentals of Analog circuits, Thomas L. Floyd, David Buchla, Prentice Hall
5. Electronic Devices and Circuit Theory, Robert Boylestad, Louis Nashelsky, Prentice Hall
6. Basic Electronics, Debashis De , Pearson 2010
7. Basic Electronics, Santiram Kal, PHI 2010
8. Filter Analysis, Bhargava & Kulkshetra Chatopadhyay.

Semester IV

UG18PH4CM04_Complementary Physics for Chemistry Optics & Solid State Physics

Title of Paper		**Optics & Solid State Physics**
Course Code		UG18PH4CM04
Semester		IV
Credits		3
Contact Hours		54
Course Type		Complementary Physics for Chemistry
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	To have developed the idea of interference, diffraction and polarization and to solve problems related to the phenomena	1
CO2	Understand about different laser systems and its applications	1
CO3	Understand the basic concepts of optical fibres	1
CO4	Acquire knowledge about dielectrics, polarization and susceptibility and Gauss' law in dielectrics.	1
CO5	Recognise crystal structures, crystal lattice and types of lattices.	1, 2
CO6	Understand x-ray crystallography and Bragg's law	1

Module I

Interference (12 hours)

Light waves- phase difference and coherence, optical path and phase change, principle of superposition, Analytical treatment of interference - young's double slit experiment, conditions for interference, bandwidth - Interference in thin films - reflected system - colour of thin films - fringes of equal inclination and equal thickness. Newton's rings - reflected system - measurement of wavelength.

Diffraction (8 hours)

Fresnel and Fraunhofer diffractions. Fresnel's theory of approximate rectilinear propagation of light. Fraunhofer diffraction. Theory of Plane transmission grating - determination of wavelength - dispersive power of grating. Prism and grating spectra. resolving power, Rayleigh criterion, resolving power of grating.

Polarization **(3 hours)**

Polarization, types of polarization, Brewster's law, dichroism, birefringence – e ray and o-ray, polarizer and analyser, Malu's law, optical activity.

Module II

Laser Physics **(8 hours)**

Principle of operation of laser - Einstein's coefficients - population inversion - metastable states, optical resonator - components of laser - active medium, pump, optical resonant cavity - principal pumping schemes - three level (Ruby laser) and four level (He-Ne laser) - laser beam characteristics - applications of lasers.

Fiber Optics **(3 hours)**

Light propagation in optical fibers, acceptance angle, numerical aperture - step index fiber - graded index fiber.

Module III

Dielectrics **(8 hours)**

Dielectrics- polar and non-polar dielectrics- polarization- sources of polarization-Gauss's law in dielectrics- permittivity- dielectric displacement vector- dielectric constant-susceptibility-ferro-electricity.

Module IV

Crystallography **(12 hours)**

Crystal structure - crystal lattice and translation vectors - unit cell - types of lattices - Miller indices - lattice directions and planes - interplanar spacing - simple crystal structures - sc, fcc, bcc, hcp close packed structures - sodium chloride structure. X-ray crystallography - diffraction of x-rays - Bragg's law.

Text Books:

1. *Optics - Brijlal and N. Subrahmanyam - S Chand-2015*
2. *Electricity and Magnetism , D C Tayal*
3. *Solid State Physics, S O Pillai*

References:

1. *A text book of Applied Physics – A .K Jha*
2. *Electricity and Magnetism – R. Murugeshan (S Chand & Co.)*
3. *Solid state physics, P. K Palanisami*
4. *Lasers – theory & applications- Thyagarajan &Ghatak*

Semester IV

UG18PH2CM04_Complementary Physics for Mathematics:

OPTICS & ELECTRICITY

3 credits (54 hours)

Title of Paper		**Optics and Electricity**
Course Code		UG18PH2CM04
Semester		III
Credits		3
Contact Hours		54
Course Type		Complementary Physics for Mathematics
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	To have developed the idea of interference, diffraction and polarization and to solve problems related to the phenomena	1
CO2	Understand about different laser systems and its applications	1
CO3	Understand the basic concepts of optical fibres	1
CO4	Acquire knowledge about dielectrics, polarization and susceptibility and Gauss' law in dielectrics.	1
CO5	Study the voltage-current relation of alternating current circuits containing L, C and R	1, 4, 5

Module I

Interference **(12 hours)**

Light waves- phase difference and coherence, optical path and phase change, principle of superposition, Analytical treatment of interference - young's double slit experiment, conditions for interference, bandwidth - Interference in thin films - reflected system - colour of thin films - fringes of equal inclination and equal thickness. Newton's rings - reflected system - measurement of wavelength.

Diffraction **(8 hours)**

Fresnel and Fraunhofer diffractions. Fresnel's theory of approximate rectilinear propagation of light. Fraunhofer diffraction. Theory of Plane transmission grating - determination of wavelength - dispersive power of grating. Prism and grating spectra. resolving power, Rayleigh criterion, resolving power of grating.

Polarization **(3 hours)**

Polarization, types of polarization, Brewster's law, dichroism, birefringence – e ray and o-ray, polarizer and analyser, Malu's law, optical activity.

Module II

Laser Physics **(8 hours)**

Principle of operation of laser - Einstein's coefficients - population inversion - metastable states - components of laser - active medium, pump, optical resonant cavity - principal pumping schemes - three level (Ruby laser) and four level (He-Ne laser) - laser beam characteristics - applications of lasers.

Fiber Optics **(3 hours)**

Light propagation in optical fibers, acceptance angle, numerical aperture - step index fiber - graded index fiber.

Module III

Dielectrics **(8 hours)**

Dielectrics- polar and non-polar dielectrics- polarization- sources of polarization-Gauss's law in dielectrics- permittivity- dielectric displacement vector- dielectric constant-susceptibility-ferro-electricity.

Module IV

Varying Currents **(12 hours)**

Transient currents – Growth and decay of current in an inductive circuit – charging and

discharging of a capacitor through a resistance - Peak, mean, rms and effective values of a.c, Ac circuits-AC through RC, LC, LR and LCR series circuits resonance-sharpness of resonance-power factor.

References:

1. *Optics - Brijlal and N. Subrahmanyam, S Chand-2015*
2. *Electricity and Magnetism , D C Tayal*
3. *Electricity and Magnetism- J. H. Fewkes & John Yarwood*
4. *Electricity and Magnetism – R. Murugeshan*
5. *Nuclear Physics –Irvin Kaplan*
6. *Lasers – theory & applications- Thyagarajan & Ghatak*
7. *Concepts of Modern Physics- A. Beiser*
8. *Laser Physics and Applications, V K Jain (Narosa Publication)*
9. *Optical Fiber Communications, John M Senior*

BSc PHYSICS PRACTICALS

Minimum of experiments to be done in each paper is 14.

Minimum number of experiments for appearing practical examination is 8.

Maximum possible number of repetitions must be done to reduce error in a measuring quantity.

Do calculation of percentage error for all experiments.

The S.I. units must be specified along with the results.

Division of internal marks for record (maximum 10 marks)

No. of Experiments	Marks
14 and above	4
12 & 13	3
10 & 11	2
8,9 & 10	1
Less than 8	0

SEMESTER 3&4 (Second Year)
Core Practical II: UG18PH4CR02
Optics and Semiconductor Physics

Title of Paper	Core Practical II-Optics and Semiconductor Physics	
Course Code	UG18PH4CR02	
Semester	III & IV	
Credits	2	
Contact Hours	36	
Course Type	Core - Laboratory Course	
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Design and execute a general physics experiment	1,2

CO2	Apply basic data collection, plotting and data analysis techniques.	3,4
CO3	Apply theoretical knowledge for analysing errors in experimentally measured data.	3,4

1. Liquid Lens – Determination of optical constants of a convex lens – water and mercury given
2. Liquid Lens – Determination of refractive index of a liquid – water and unknown liquid
3. Spectrometer – Prism – Determination of refractive index of material of the prism
4. Spectrometer – Hollow Prism – Determination of refractive index of liquid
5. Spectrometer – Small angled prism – Normal incidence – Determination of refractive index of material of the prism
6. Spectrometer – i – d curve – Determination of refractive index of material of the prism
7. Newton's rings – Determination of wavelength of sodium light
8. The air wedge – Determination of diameter of thin wire
9. Zener characteristics – forward and reverse – Study of dynamic and static properties
10. Transistor characteristics – Common Emitter Configuration
11. Half wave rectifier – Study of ripple factor and load regulation with and without filter circuit
12. Full wave rectifier – (center tap) – Study of ripple factor and load regulation with and without filter circuit
13. Full wave rectifier – (bridge) – Study of ripple factor and load regulation with and without filter circuit
14. FET – characteristics – Determination of parameters
15. Voltage regulator using zener diode – Study of line and load regulations
16. Clippers – positive, negative and biased – Study of output waveforms
17. Clampers – positive, negative and biased – Study of output waveforms
18. OPAMP characteristics – Study of CMRR and open loop gain
19. OPAMP – inverter, non inverter and buffer – Study of gain
20. LC Oscillator – Colpit's /Hartley – using transistor
21. Phase shift oscillator – using transistor

Semester III & IV:

Title of Paper		**Complementary Physics Practical**
Course Code		UG18PH4CM04
Semester		III & IV
Credits		2
Contact Hours		36
Course Type		Complementary - Laboratory Course
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	To gain practical knowledge by applying the experimental methods to correlate with the physics theory.	1, 3, 4
CO2	To study the elastic and magnetic properties of materials and to learn the usage of electrical and optical systems for various measurements	1
CO3	Apply the analytical techniques and graphical analysis to the experimental data and interpret the results.	1, 3

1. Determination of Young's Modulus- Cantilever (Pin & Microscope)
OR Uniform bending (pin and microscope)**OR** Non-uniform bending (optic lever)
2. Asymmetric Compound Pendulum- Determination of moment of inertia and Acceleration due to gravity (g)
3. Torsion pendulum (Equal mass method) - Rigidity modulus and Moment of Inertia
4. Spectrometer – Dispersive power of prism
5. Spectrometer – Dispersive power of a Grating
6. Newton's rings -Wave length
7. Characteristics of Zener diode- ac and dc resistance
8. Conversion of Galvanometer into voltmeter
9. Carey Foster's Bridge -Measurement of resistivity
10. Tangent Galvanometer – Ammeter calibration
11. Potentiometer-Calibration of low range ammeter **OR** voltmeter
12. Construction of full wave rectifier (center-tap **OR** bridge) with and without filter – Ripple factor
13. Construction of regulated power supply using Zener diode- line and load regulation
14. Laser diffraction- width of single slit **OR** thickness of wire
15. Refractive index of liquid- Liquid Lens **OR** Spectrometer and Hollow Prism
16. Air wedge-thickness of wire
17. Static Torsion - Rigidity modulus
18. Deflection and Vibration Magnetometer-m & Bh
19. Field along the axis of circular coil- determination of Bh

20. Searle's Vibration Magnetometer - magnetic moment
21. Gates – AND, OR, NOT- verification of truth tables

References

1. *Practical Physics – C L Arora- S Chand*
2. *Properties of Matter -D.S. Mathur*
3. *Optics -Subrahmanyam& Brijlal*
4. *Electricity &Magnetism -Sreevastava*
5. *Electronics Lab Manual (Vol.1) -K. A. Navas*
6. *Laboratory manual for electronic devices and circuits-David A Bell*
7. *Practical Physics- Joseph Ittiavirah, Premnath and Abraham*

SEMESTER FIVE

Semester-V Core Course: V **Credits-3 (54 hours)**

UG18PH5CR01 - ELECTRICITY AND ELECTRODYNAMICS

Title of Paper	Electricity and Electrodynamics	
Course Code	UG18PH5CR01	
Semester	V	
Credits	3	
Contact Hours	54	
Course Type	Core	
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Define the various fields in electrostatics, magnetostatics and electrodynamics, and to understand how they are related 2	1, 2, 4
CO2	Understands electric and magnetic fields in matter	1, 2, 4
CO3	Apply basic laws in electrostatics and magnetostatics to find field due to different media	2, 4
CO4	Apply the theory to develop problem solving skills.	1, 2
CO5	Will understand the significance of Maxwell's equations and be able to explain the conservation of charge and energy.	1, 2
CO6	Study the voltage-current relation of all alternating current circuits and some of their applications.	1, 4, 5
CO7	Solve complex problems involving linear electrical networks with network theorems	1, 5

Module I

Alternating Current and Network Theorems **(15 hours)**

EMF induced in a coil rotating in a magnetic field - AC applied to resistive, inductive and capacitance circuits - AC applied to LR and RC circuits - Analysis of LCR series circuits - LCR parallel resonant circuit – comparison - Power in ac circuits - Wattless current - choke coil - transformer on no load- skin effect.

Ideal voltage source and current source - Superposition theorem - Reciprocity theorem - Thevenin's theorem - Norton's theorem - Maximum power transfer theorem.

Text Book:Electricity and Magnetism, R. Murugeshan- Chapters 13, 30 and 18

Module II

Transient Current and Thermo electricity (8 hours)

Growth and decay of current in an LR circuit- Charging and discharging of a capacitor through a resistor - Growth and decay of charge in an LCR circuit.

Seebeck effect - Laws of thermo emf - Peltier effect- Thomson effect- Thermoelectric diagrams -Thermocouple (qualitative study) - Explanation of thermoelectric effects based on electron theory.

Text Book: Electricity and Magnetism, R. Murugeshan- Chapters 12, 8 and 32.

Module III

Electrostatics and Magnetostatics (19 hours)

Fundamental theorems of divergence and curl (physical concepts) - Electric field - Dielectric polarisation-Continuous charge distribution- Divergence and curl of electrostatic field- Gauss's law and applications: solid sphere, - Electric potential - Poisson's and Laplace's equations - work and energy in electrostatics – The work done to move a charge – Energy of a point charge distribution and continuous charge distribution-Basic properties a conductor Lorentz Force law- Biot- Savart law- Divergence and curl of B- Applications of Amperes' law: long straight wire, infinite plane, solenoid – Comparison of electrostatics and magnetostatics- Magnetic vector potential – Magnetostatics boundary conditions

Electromagnetic induction- Faraday's law

Text Book: Introduction to Electrodynamics, David J Griffiths, Chapters 1, 2, 5 and 7

Module IV

Maxwell's Equations and Electromagnetic wave propagation (12 hours)

Maxwell's equations - Maxwell's equations in matter - Boundary conditions - Continuity equation -Poynting's theorem - The Wave equation (general idea on reflection at boundary and polarization) - Sinusoidal waves - Electromagnetic wave in vacuum - Wave equation for E and B - Monochromatic plane waves- Energy and momentum of electromagnetic waves

Text Book: Introduction to Electrodynamics, David J Griffiths-Chapters78and 9

References:

1. *Fundamentals of Magnetism and Electricity, D.N Vasudeva - S Chand*

1. *Principles of Electromagnetics, Mathew N.O Sadiku- 4th Ed. , Oxford*

1. *Electricity and Magnetism, KK Tewari- S Chand*

1. *Electricity and Electronics, Saxena, Arora and Prakash- Pragati Prakashan*

1. *Classical Electromagnetism, Jerrold Franklin- Pearson*

1. *Electromagnetic Fields and Waves, KD Prasad- Satya Prakashan*

1. *Field and wave Electromagnetics, David K Cheng- Pearson.*

Semester-V Core Course:VI **Credits-3 (54 hours)**

UG18PH5CR02 - CLASSICAL AND QUANTUM MECHANICS

Title of Paper	Classical and Quantum Mechanics	
Course Code	UG18PH5CR02	
Semester	V	
Credits	3	
Contact Hours	54	
Course Type	Core	
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Recognize the basic terms in Quantum Mechanics and Classical Mechanics.	1,2. 3
CO2	Understand and define the laws involved in Classical and Quantum Mechanics Mechanics	1
CO3	Gain deeper understanding of constraints, Lagrangian and Hamiltonian formalisms and their fundamental concepts.	1,2,5
CO4	Explain the ideas of degrees of freedom and identify them for a given mechanical system.	1
CO5	Provide elementary ideas on Classical Mechanics and will be able to write equations for real time problems using Classical Mechanics.	1
CO6	Apply the basic principles in Quantum Mechanics to construct and solve one particle equation	1
CO7	To acquire ability to design and particle equation in the free and bound states as well as to analyze and interpret these results.	1

Module I

Lagrangian and Hamiltonian Formulations of Classical Mechanics (15 hours)

Constraints, degrees of freedom, generalized co-ordinates, principle of virtual work, D'Alembert's principle, Lagrange's equations (no derivation required), Application of Lagrangian (Linear Harmonic oscillator, Planetary motion and Simple Pendulum only), Hamilton's Canonical equations of motion, Advantages of Hamilton's method, Applications of Hamilton's method (Linear Harmonic oscillator and Simple pendulum only). Hamilton's Principle. Derivation of Lagrange's equation from Hamilton's Principle.

Text book: Classical Mechanics by J.C. Upadhyaya-Chapter 2 & 3.

Classical Mechanics by G. Aruldhas

Module II

Historical development and origin of quantum theory (12 hours)

Failure of classical physics- Black Body radiation-Planck's radiation law, Photoelectric effect-Einstein's explanation, Compton effect, Bohr's correspondence principle-Wave particle Dualism, Dual nature of matter- De Broglie hypothesis, Davisson-Germer Experiment, De Broglie waves, Wave packet, Group and phase velocities

Text Book: A Textbook of Quantum Mechanics- G Aruldhas-Chapter 1

General Formalism of Quantum Mechanics (12 hours)

Eigen functions and eigen values- Hermitian operator- Postulates of Quantum Mechanics-wave function, Operators, Expectation value, uncertainty relation (Position, Momentum uncertainty)

Text Book: A Textbook of Quantum Mechanics- G Aruldhas-Chapter 3 and 8

Module III

Schrodinger equation and its applications (16 hours)

Time dependent Schrödinger equation- interpretation of wave function, Probability density, Probability current density, Ehrenfest theorem- Extension to three dimensions-Time independent Schrödinger equation- Stationary states- Admissibility conditions of wave

function-general properties of one dimensional Schrödinger equation, particle in a box, orthogonality of wave function.

Text Book: A Textbook of Quantum Mechanics- G Aruldhas.

Text Book:

1. *Classical Mechanics by J.C. Upadhyaya. Himalaya Pub.*
2. *Concepts of Modern Physics- Arthur Beiser, TMH*

References:

1. *Concepts of Modern Physics- Arthur Beiser, TMH*
2. *A Textbook of Quantum Mechanics- G Aruldhas- (2nd Edition)- PHI*
3. *Classical Mechanics-Takwale and Puranik, TMH.*
4. *Classical mechanics- K.SankaraRao, PHI*
5. *Introductory Quantum Mechanics- RI Liboff, Pearson*
6. *Quantum Physics- Gasiorowicz,John Wiely*
7. *Quantum Mechanics- Griffith, Pearson*

Title of Paper		**Digital Electronics and Programming**
Course Code		UG18PH5CR03
Semester		V
Credits		3
Contact Hours		54
Course Type		Core
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Understand basics of the programming language	1
CO2	Analyze, design and implement combinational logic circuits.	2
CO3	Compare object oriented programming and procedural oriented programming Languages	1
CO4	Analyze a given problem and develop an algorithm to solve the problem	1,2
CO5	Develop a digital logic and apply it to solve real life problems.	1, 2
CO6	Develop the skill for the use of C++ language constructs in the right way and write C++ program for simple real life applications	1, 2

Module I

Boolean algebra and logic gates **(12 hours)**

Basic gates NOT, OR, AND. Universal Logic Gates- NOR, NAND. XOR and XNOR Gates. Rules and Laws of Boolean algebra. Duality theorem -De Morgan's Theorems. analysis and simplification of logic circuits. Boolean equation and truth table - SOP and POS. Minterms and Maxterms. Standard SOP and Standard POS- Conversion between Standard SOP & Standard POS. Karnaugh Map (up to four variables). K map SOP minimization.

Module II

Combinational logic (6 hours)

Half Adder and Full Adder, Half and Full subtractor, 4-bit parallel Adder/Subtractor. Multiplexer, De-multiplexer, Encoder & Decoder.

Sequential logic (16 hours) Flip-flops, RS, Clocked RS, Master Slave JK FF, DFF, T Flip-flop, Buffer registers- Shift register-SISO and SIPO, Counters- Binary ripple counter. D/A converters (Ladder type), A/D Converter (Counter type).

Module III

Programming in C++ **(20 hours)**

Basic C++ program structure – comments - data types - variable types – constants - operators (arithmetic, relational, logical and assignment operators) - loops (for, while, do) – decisions (if, if-else, else if, switch) – arrays (Defining Arrays, Accessing Array Elements, Initializing Arrays) - basic ideas of structures, functions, objects and classes.

Text book: Object oriented programming in C++ - Robert Lafore.

Text books:

1. *Digital fundamentals, Thomas L. Floyed (10th edition), Pearson*
2. *Digital principles and applications, Malvino, Leach and Saha (6th Edition) TMH*
3. *Digital electronics, S Salivahanan & S Arivazhagan VPH (2010)*
4. *Digital design, M Morris Mano, PHI*
5. *Object oriented programming in C++ - Robert Lafore.*

References:

1. *Digital logic and computer design - M Morris Mano, PHI*

2. *Digital Electronics- William H Gothmann, PHI*
3. *Digital circuits and design- S Salivahanan and S Arivazhakan, PHI*
4. *Digital Electronics- Sedha, S Chand*
5. *Digital computer electronics- Malvino, Brown, TMH*

Semester-V Course – VIII Credit – 4 (72 hours)

UG18PH5CR04– ENVIRONMENTAL PHYSICS AND HUMAN RIGHTS

Title of Paper	Environmental Physics and Human Rights
Course Code	UG18PH5CR04
Semester	V

Credits	4	
Contact Hours	72	
Course Type	Core	
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Acquire knowledge about the environment and issues concerning environment	5
CO2	Understand the causes of environmental pollution and methods to reduce it	5,7
CO3	Understand the renewable and non-renewable sources of energy	1
CO4	Develop skill in various waste management techniques.	3, 6
CO5	Understand the rights available to human beings and the various Acts which enforces Human Rights	7, 8
CO6	Familiarize with the Constitutional Provisions for assuring Human Rights in India.	5, 7
CO7	Recognize if there is any violation of Human Rights and invoke the remedies	5, 6, 7

Vision

The importance of environmental science and environmental studies cannot be disputed. The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. The United Nations Conference on Environment and Development held in Rio de Janerio in 1992 and World Summit on Sustainable Development at Johannesburg in 2002 have drawn the attention of people around the globe to the deteriorating condition of our environment. It is clear that no citizen of the earth can afford to be ignorant of environment issues.

India is rich in biodiversity which provides various resources for people. Only about 1.7 million living organisms have been described and named globally. Still many more remain to be identified and described. Attempts are made to conserve them in ex-situ and in-situ situations. Intellectual property rights (IPRs) have become important in a biodiversity-rich country like India to protect microbes, plants and animals that have useful genetic properties. Destruction of habitats, over-use of energy resource and environmental pollution has been found to be responsible for the loss of a large number of life-forms. It is feared that a large proportion of life on earth may get wiped out in the near future.

In spite of the deteriorating status of the environment, study of environment has so far not received adequate attention in our academic programme. Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment at every level in

college education. Accordingly, the matter was considered by UGC and it was decided that a six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the University/Colleges of India.

The syllabus of environmental studies includes five modules including human rights. The first two modules are purely environmental studies according to the UGC directions. The second two modules are strictly related with the core subject and fifth module is for human rights.

Objectives

• Environmental Education encourages students to research, investigate how and why things happen, and make their own decisions about complex environmental issues by developing and enhancing critical and creative thinking skills. It helps to foster a new generation of informed consumers, workers, as well as policy or decision makers.

• Environmental Education helps students to understand how their decisions and actions affect the environment, builds knowledge and skills necessary to address complex environmental issues, as well as ways we can take action to keep our environment healthy and sustainable for the future. It encourages character building, and develops positive attitudes and values.

• To develop the sense of awareness among the students about the environment and its various problems and to help the students in realizing the inter-relationship between man and environment and helps to protect the nature and natural resources.

• To help the students in acquiring the basic knowledge about environment and the social norms that provides unity with environmental characteristics and create positive attitude about the environment.

Module I (15 Hours)

Water Resources and Its Management (3 Hours)

Water resources: Use and over-utilization of surface and ground water, floods, drought, dams-benefits and problems. Water harvesting-Importance of rain water harvesting in Kerala.

Remote sensing (3 Hours)

Remote sensing-principles, spectral reflectance of earth's surface features, Remote sensing satellites and sensors, aerial photography, Applications of Remote Sensing in environmental monitoring and assessment.

Environmental Pollution (9 Hours)

Environment and human health; Environmental pollution- Primary and secondary pollutants; Air pollution- Sources, Effects and Control/Treatment methods; Acid Rain; Ozone

layer depletion; Green house gases; Global warming - Climatic effects; Water pollution- Sources, Effects and Control/Treatment methods; Groundwater pollution; Marine pollution; Soil pollution; Noise pollution- Sources and measurement indices of noise pollution, Noise exposure level and standards, Noise control measures, Impact of noise on human health, ; Environmental pollution due to environmental disasters; Consumerism and waste products; E-waste-an emerging environmental threat. Disaster management: floods, earthquake, cyclone and landslides.

Module II (12 Hours)

Waste Management (8Hours)

Waste minimization and resource conservation:- Source reduction, Recycling, Value-added products; Waste minimization promotional methods- awareness generation, control methods and economic benefits; Benefits of waste minimization; Management of solid wastes- Municipal solid wastes, Hazardous solid waste-characteristics and management of HSW, Waste treatment and disposal methods- physical, biological and chemical process.

Environment Impact Assessment and Control (4 Hours)

Basic ideas of environment impact assessment; Environment ethics; Environmental laws and constitutional provisions to control pollutions in India-The general acts; Air (prevention and control of pollution) act; Water (prevention and control of pollution) act; Wild life protection act; Forest conservation act; Environment protection acts.

Module III (13 Hours)

Non-renewable and Renewable Energy Sources (13 Hours)

Non-renewable energy sources:-Coal, Oil, Natural gas; Nuclear fission energy; Merits and demerits of non-renewable energy.
Renewable energy sources: Biomass energy- Biofuels, Biogas plant - Fixed dome type and moving drum type; Wind energy; Wave energy; Tidal energy; Hydroelectricity; Geothermal energy conversion; Ocean thermal energy conversion; Fusion energy; Hydrogen energy- Production and storage; Merits and demerits of each renewable energy sources; Storage of intermittently generated renewable energy.

Module IV (14 Hours)

Solar energy (14 Hours)

Sun as a source of energy- Solar radiation, Solar Constant, Spectral distribution; Solar pond - Convective and salt gradient types; Flat plate collector; Solar water heater - Direct and

indirect systems- Passive and active systems; Optical concentrator - Parabolic trough reflector - Mirror strip reflector - Fresnel lens collector; Solar desalination; Solar dryer - Direct and indirect type; Solar cooker; Solar heating of buildings; Solar green houses; Need and characteristics of photovoltaic (PV) systems; Solar cells - Principle, Equivalent circuits, V-I characteristics, fill factor, conversion efficiency; PV Sun tracking systems; Merits and demerits of solar energy.

.

Module - V (18 Hours)

Unit 1 - Human Rights

An Introduction to Human Rights, Meaning, concept and development –History of Human Rights-Different Generations of Human Rights- Universality of Human Rights- Basic International Human Rights Documents - UDHR ,ICCPR,ICESCR.-Value dimensions of Human Rights

Unit 2 - Human Rights and United Nations

Human Rights co-ordination within UN system- Role of UN secretariat- The Economic and Social Council- The Commission Human Rights-The Security Council and Human rights- The Committee on the Elimination of Racial Discrimination- The Committee on the Elimination of Discrimination Against Women- the Committee on Economic, Social and Cultural Rights- The Human Rights Committee- Critical Appraisal of UN Human Rights Regime.

Unit 3- Human Rights National Perspective

Human Rights in Indian Constitution – Fundamental Rights- The Constitutional Context of Human Rights-directive Principles of State Policy and Human Rights- Human Rights of Women-children –minorities- Prisoners- Science Technology and Human Rights- National Human Rights Commission- State Human Rights Commission- Human Rights Awareness in Education.

Reference Books:

1. Non-conventional energy sources - G.D Rai- Khanna Publishers, New Delhi
2. A textbook of Environmental Studies- E Bharucha - University Grants Commission, 2004
3. Environmental Science: Principles and Practice- R.C. Das and D.K. Behera - PHI Learning Pvt. Ltd
4. Renewable Energy Sources and Emerging Technologies: Edition 2, D.P. Kothari K. C. Singal,Rakesh Ranjan - PHI Learning Pvt. Ltd, 2011.
5. Solar energy - M P Agarwal - S Chand and Co. Ltd.
6. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
7. Renewable Energy, Power for a sustainable future, Edited by Godfrey Boyle, Oxford University Press, 2012.
8. Solar Energy: Resource Assesment Handbook- Dr. P Jayakumar APCTT 2009
9. A textbook of Environmental Studies- S.Satyanarayan, S.Zade, S.Sitre and P.Meshram - Allied Publishers, New Delhi, 2009

10. Remote Sensing: Principles and Interpretation, Floyd F. Sabins, Waveland Pr Inc; 3 edition (2007)

Human Rights

1. Amartya Sen, The Idea Justice, New Delhi: Penguin Books, 2009.

2. Chatrath, K. J.S., (ed.), Education for Human Rights and Democracy (Shimla: Indian Institute of Advanced Studies, 1998)

3. Law Relating to Human Rights, Asia Law House, 2001.

4. Shireesh Pal Singh, Human Rights Education in 21st Century, Discovery Publishing House Pvt.Ltd, New Delhi,

5. S.K.Khanna, Children and the Human Rights, Common Wealth Publishers, 1998. 2011.

6. Sudhir Kapoor, Human Rights in 21st Century, Mangal Deep Publications, Jaipur, 2001.

7. United Nations Development Programme, Human Development Report 2004: Cultural Liberty in Today's Diverse World, New Delhi: Oxford University Press, 2004

Semester-V Course – VIII **Open course** **Credit – 4 (72 hours)**

UG18PH5OP01- OUR UNIVERSE

Scope: *To help the students to comprehend the cosmos and its origin and to developscientific attitude and aptitude*.

Prerequisites: *This course in intended for the students of other disciplines. So asecondary level knowledge of mathematics and physics is enough to study this course. But an inquisitive mind and curiosity are essential from the part of a student.*

Title of Paper	OUR UNIVERSE
Course Code	UG185OP01
Semester	V
Credits	3
Contact Hours	72
Course Type	Open Course
COURSE OUTCOMES (CO)	

On finishing the course, the student shall,		**PSO-CO Mapping**
CO1	Understand the theories of the origin and evolution of our universe.	1, 3
CO2	Locate and identify celestial systems using naked eye and through a ground based telescope.	1, 2
CO3	Summarise the stellar evolution process and nucleosynthesis in stars and supernovae.	1,2
CO4	Acquire a global perspective on the state of the universe and how material shaped up around us	2, 5
C05	Generate interest for subjects other than core discipline	2

Module I

Our universe **(10 hours)**

Early models of universe- Geo centric model- Ptolemy-Aristotle. Copernican model - Sun at the centre. Galileo and his observations. Planetary paths-Kepler's laws(**No need of derivation**).

Galaxies-Hubble's classification – Spiral, elliptical & irregular galaxies. Milky way galaxy (**qualitative**).

Module II

Cosmology **(14 hours)**

Origin of the universe - Big bang theory – expansion of the universe – Hubble's law, age of the universe. Doppler effect and red shift(**qualitative**).

Stellar evolution – birth - red giant- death of a star. White dwarf- Chandrasekhar limit. Super novae- neutron star- black hole.

Text Books

1. Architecture of the universe. (cha 3,4,8 and 9) Necia H.Apfel and Allen Hynek-Benjamin Cummins Publishing Company.
2. Astronomy A Beginners guide to the universe sixth edition(Ch.12)-Chaisson Mc Millan
3. Cosmic vistas-A popular history of astronomy(chap 4,5,6,7,8) Biman Basu-national book trust,India
4. Astronomy; A Self Teaching Guide (cha 5&6)-Dinah L Moche

5. The Great Universe (cha 4,5,6,7) G.K Sasidharan-S.Chand

Module III

Observational Astronomy (24 hours)

Celestial sphere- cardinal points, celestial equator, ecliptic, equinoxes. Celestial co-ordinate systems-equatorial co-ordinate system-Right ascension & declination, Ecliptic and galactic co-ordinate systems. Diurnal motion of sun - Summer solstice and winter solstice. Time - apparent and mean solar time, International date line. Constellations-zodiacal constellations. Astronomical distance scales – AU, Parsec and light year. Stellar Parallax and distance to stars from parallax.

Optical Telescopes - Light gathering power, visual angle, angular magnification, Types of telescopes-refracting and reflecting – Newtonian and Cassegrain telescopes **(No need ofderivation of magnification**). HST, Radio telescopes, GMRT (India).

Text Books:

1. Astronomy A beginner's guide to the universe sixth edition(ch-1)-Chaisson Mc Millan
2. Astrophysics stars and galaxies (chap 2,4,20)K D Abhayankar
3. Joy of Star watching (**ch**- 3, 8 &10)- Biman Basu- National Book Trust, India
4. A textbook of Optics(ch-10) N.Subrahmanyan, Brijlal and M.N Avadhanulu
5. Astronomy; A Self Teaching Guide (cha 2&3)-Dinah L Moche
6. www.gmrt.ncra.tifr.in

Module IV

Solar system **(24 hours)**

The sun- solar atmosphere - Photosphere, chromospheres and corona. Sun spots. Definition of a planet- terrestrial planets & Jovian planets, Comparison of planets. Minor members of solar system- Asteroids, comets, meteors.

Universal law of gravitation. Earth's orbital motion-day to day changes-seasonal changes.

Text Books:

1. Architecture of the Universe (**ch**- 2, 14, 15, 17, 18, 19, 20)- Necia H. Apfel & Allen Hynek- The Benjamin Cummings publishing company, Inc.
2.
3. Astronomy A beginner's guide to the universe sixth edition(ch-1)-Chaisson Mc Millan
4. Astronomy; A Self Teaching Guide (cha 4,9,10,11)-Dinah L Moche
5. The great Universe – G.K Sasidharan-S.Chand

Semester-V: Open Course: **Credits-3 (72 Hrs)**

UG18PH5OP02- Physics in Daily Life

Module I

Unit 1 Motion **(8 Hours)**

Velocity, acceleration, momentum, Idea of inertia, force - laws of motion. Newton's law of gravitation, acceleration due to gravity, mass and weight, apparent weight, weightlessness.

Unit 2 Light **(12 Hours)**

Reflection, refraction, diffraction, interference, scattering (elementary ideas only) – examples from daily life – apparent depth, blue color of the sky, the twinkling of stars. Total internal reflection, mirage, the sparkling of diamond, primary and secondary rainbow – optical fibers. Concave and convex mirrors, lenses – focal length, power of a lens, refractive index, prism, dispersion (Qualitative idea only). Human eye, defects of the eye – myopia, hypermetropia, presbyopia and astigmatism and their correction by lens.

Module II

Unit 3 Electricity **(10 Hours)**

Voltage and current, ohms law. Electric energy, electric power, calculation of energy requirement of electric appliances – transformer, generator, hydroelectric power generation – wind power – solar power – nuclear power

Unit 4 Matter and energy **(18 Hours)**

Different phases of matter, fluids - surface tension, viscosity- capillary rise, Bernoulli's theorem (qualitative) and applications. Heat energy, temperature, different temperature scales – degree Celsius, Fahrenheit and Kelvin.

Waves – transverse and longitudinal waves, sound waves, Doppler Effect. Lasers, fluorescence, phosphorescence, electromagnetic waves – applications – microwave oven, radar.

Module III

Unit 5 Universe (10 hours)

Planets - solar system, moon- faces of moon, lunar and solar eclipses, constellations, Different types of stars, Galaxies, black hole. Satellites, Artificial satellites, Global positioning system, Geostationary satellite.

Reference Texts

1. Fundamentals of Physics with Applications by Arthur Beiser
2. Conceptual Physics by Paul G Hewitt

Unit 6 Energy sources (14 hrs)

World's reserve of energy sources - various forms of energy - non- renewable energy sources:- coal, oil, natural gas; merits and demerits - renewable energy sources:- solar energy, biomass energy, biogas energy, wind energy, wave energy, tidal energy, hydro energy, geothermal, fusion energy, hydrogen; merits and demerits (qualitative).

Sun as a source of energy - solar radiation - spectral distribution - flat plate collector- solar water heating – different types of solar water heaters - optical concentrator - solar desalination – solar dryer – solar cooker - solar photovoltaics - working principle.

Text Books for study

1. Renewable Energy sources; Their impact on Global Warming and Pollution,

Tasneem Abbasi and S.A. Abbasi (PHI Pvt. Ltd)

2. Non- conventional energy resources D.S Chauhan and S.K Srivastava (New

Age International)

1. Non-conventional Energy Sources- G.D. Rai (Khanna Publishers).
2. Fundementals of Physics with applications by Arthur Beiser
3. Conceptual Physics by Paul G Hewitt

Semester-V Course – VIII Open course Credit – 4 (72 hours)

UG185OP03 COMPUTER HARDWARE AND NETWORKING

Module I (24 hours)

Microprocessors – Basic concepts of Intel 80186, 80286, 80386, 80486 and Pentium processors. Motherboard, Expansion buses, Memory, upgrading / adding memory, BIOS Motherboard – removing, installing / configuring motherboards, BIOS set up, troubleshooting memory.

Module II (24 hours)

Data storage devices, IDE and SCSI controllers, hard disk, installing / upgrading CD ROM drives, DVD, Optical storage, Tape back – ups. Printers, Keyboards, pointing and positioning devices, digital camera, Scanners, Monitors, Hard disks- installing / upgrading, troubleshooting, formatting, Error codes, BIOS disk routines

MODULE III **(24 hours)**

Multimedia, Graphical accelerators, audio, modems, I/E add on, Networks, Power supplies, UPS

Printer installation, Software installation – DOS, Windows 95, 98, Linux, WindowsNT – installation,

Administration, Installing PASCAL, C, ORACLE, VISUAL BASIC, Software diagnostics –

PC tools, Norton utilities, XT/AT diagnostics, Viruses and anti-viruses.

References

1. *PC Hardware, a beginners guide – Ron Gilster*

2. *All about Motherboard: - Manahar Lotia, Pradeep Nair*

SEMESTER SIX

Semester-VI Core Course: IX **Credit-3**

(54hours)

Title of Paper		Thermal and Statistical Physics
Course Code		UG18PH6CR01
Semester		VI
Credits		3
Contact Hours		54
Course Type		Core
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Identify and describe the concepts and laws in thermodynamics, in particular: entropy, temperature, Free energies and thermodynamic functions.	1
CO2	Apply the concepts and principles of thermodynamics to heat engines	2
CO3	Apply the concepts and laws of thermodynamics to solve problems in thermodynamic systems such as gases, heat engines and refrigerators	1,2
CO4	Understand the statistical physics methods, such as microstate and macrostate, ensemble formulation, partition function and equipartition theorem	1
CO5	Apply the theory to develop problem solving skills.	1,2

UG18PH6CR01 – THERMAL AND STATISTICAL PHYSICS

Module I

Equation of state for gases **(5 hours)**

Equation of an ideal gas, behavior of real gases, Andrew's experiment on carbon dioxide**,** critical state, two phase region, intermolecular forces, van der Waals equation of state, van der Waals isotherms, critical constants, limitation of van der Waals equation.

Zeroth law of thermodynamics **(4 hours)**

Thermodynamic system, surroundings, variables, thermal equilibrium: zeroth law, thermodynamic equilibrium, thermodynamic processes, reversible and irreversible processes, equation of state, expansivity and compressibility.

First laws of thermodynamics **(7 hours)**

Internal energy, heat, work, cyclic processes, first law, heat capacity, energy equation and difference of specific heat capacities, indicator diagram work done in reversible isothermal expansion of ideal gas, work done in reversible adiabatic expansion of ideal gas.

Heat engines and second law of thermodynamics **(5 hours)**

Second law statements, heat engine, efficiency, Carnot's ideal heat engine, **work done by the engine per cycle**, reversibility, Carnot refrigerator, heat pump, Carnot theorem, absolute scale of temperature, Clausius- Clapeyron latent heat equation.

Text Book: Thermal and Statistical Physics, R.B. Singh, part-1 chapter 3, 4, 5 and6

Module II

Entropy **(5 hours)**

Definition of entropy, principle of increase of entropy, entropy and unavailable energy, change in entropy in heat conduction, change in entropy in reversible and irreversible process, efficiency of Carnot cycle from TS diagram, entropy of an ideal gas, entropy and disorder.

Thermodynamic relations **(8 hours)**

Maxwell's thermodynamic relations, TdS equations, energy equation, heat capacity equations, thermodynamic functions, third law of thermodynamics.

Conduction and radiation **(4 hours)**

Conduction, thermal conductivity, thermal conductivity of bad conductor Lee's disc experiment -thermal resistance, thermal radiation and its properties, fundamental definitions of energy flux, intensity and radiant emittance, Stefan's law, Stefan-Boltzmann law.

Text Book: Thermal and Statistical Physics, R.B. Singh, part-1 chapter7,8,10 and 11.

Module III

Statistical mechanics (8 hours)

Microstates and macrostates, Phase space, density of states, mu space and Gamma space, principle of equal a priori probability, ergodic hypothesis, statistical equilibrium, ensemble,ensemble formulation of statistical mechanics, microcanonical, canonical and grand canonical ensemble, partition function, average energy of particle, equipartition theorem.

Statistical distributions (8 hours)

Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics, distribution laws.

Text Book: Thermal and Statistical Physics, R.B. Singh, part-2, Chapters 2, 3,4 and 5.

Text Book:

1. Thermal and Statistical Physics, R.B. Singh, New Age Pub. (2010)

References:

1. *An introduction to thermodynamics by Y.V.C. Rao (New Age Pub.)*
2. *An introduction to Thermal Physics by D.V. Schroeder (Pearson Pub.)*
3. *Heat and thermodynamics by Mark W Zemansky, Richard H Dittman & Amit K Chattopadhyay. MCH New Delhi.*
4. *Thermodynamics and Statistical physics Brij Lal, N.Subrahmanyam and P S Hemne (S. Chand &Co, Multi colour edition 2007).*
5. *Berkeley Physics Course Volume 5; Statistical Physics; Frederick Reif. McGraw Hill.*
6. *Statistical Mechanics, R.K. Pathria, Pergamon press, Oxford*

Semester-VI Core Course: X Credit-3 (72hours)

UG18PH6CR02 – RELATIVITY AND SPECTROSCOPY

Title of Paper	Relativity and Spectroscopy	
Course Code	UG18PH6CR02	
Semester	VI	
Credits	3	
Contact Hours	72	
Course Type	Core	
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Demonstrate an understanding of the basic principles of the special theory of relativity	1,2
CO2	Perform basic calculations in relativistic kinematics and dynamics.	1,2,4
CO3	Describe theories explaining the structure of atoms and the origin of the observed spectra	1,2,4
CO4	Identify atomic effect such as Zeeman effect and Stark effect and different types of atomic spectra.	1,2,4
CO5	Explain the observed dependence of atomic spectral lines on externally applied electric and magnetic fields.	1,2,3,4
CO6	Acquire the knowledge on different atom models and will be able to differentiate different atomic systems, different coupling schemes and their interactions with magnetic and electric fields	1,2,4
CO7	Develop a basic understanding of physics of atoms and molecules: definitions, units, laws and rules	1,2,3
CO8	Gain an ability of basic problems analysing and solving in physics of atoms and molecules	1,2,3,4

Module I **(18 hours)**

Special Theory of Relativity

Inertial and non inertial frames of reference- Galilean transformation, Significance of Michelson-Morley experiment, Postulates of Special Theory of Relativity, Lorentz transformation, Spatial contraction, Time dilation, composition of velocities, mass of moving particle, Equivalence of mass and energy. Introductory concept of general theory of relativity.

Text Book: Modern Physics, Kenneth S Krane.

Concepts of modern Physics, Arthur Beiser

Module II

Atomic Spectroscopy **(21 hours)**

Historical introduction. Electrostatic spectrum. Types of spectra. Absorption and emission of light by atoms, quantum theory, early atom models – Bohr model, electron spin and magnetic moment, Exclusion principle, Stern-Gerlach experiment, Vector atom model, quantum numbers associated with vector atom models, Total angular momentum and LS coupling, fine structure of Sodium D lines, Zeeman effect, quantum mechanical explanation for anomalous Zeeman effect, Paschen-Back effect.

Text Book: Molecular structure and Spectroscopy, G Aruldas.

Concepts of modern Physics, Arthur Beiser

Module III

Molecular Spectroscopy **(21 hours)**

Molecular energy levels. Electronic, rotational and vibrational energies, rotational spectra, explanation in terms of rigid rotator model, vibrational energy levels, explanation in terms of harmonic oscillator.

Electronic energy levels of atoms, Fluorescence and phosphorescence, Raman effect – experimental arrangement and result, classical theory and its failure, quantum theory of Raman effect.IR and Microwave spectroscopes.

Text Book: Fundamentals olf Molecular Spectroscopy, C.Banwell and E. Mccash.

Molecular structure and Spectroscopy, G Aruldas.

NMR and ESR Spectroscopy **(12 hours)**

NMR Spectroscopy- Basic principles and instrumentation- Medical applications of NMR.

Text Book: Molecular structure and Spectroscopy, G Aruldas – Chapter 10 (Sections 10.1, 10.2,10.3 and 10.19).

ESR Spectroscopy- Basic principles and instrumentation.

Text Book: Molecular structure and Spectroscopy, G Aruldas – Chapter 11 (Sections 11.1, 11.2 and 11.3).

Text Books:

1. *Molecular structure and spectroscopy, Aruldas 2nd ed. EEE.*
2. *Modern Physics, Kenneth S Krane (2nd Edition) -Wiley.*
3. *Concepts of modern Physics, Arthur Beiser (6th Edition) - SIE.*

References:

1. *Spectroscopy: Straughan and Walker –(Vol.1) John Wiley*
2. *Fundamentals of Molecular Spectroscopy: CN Banwell –(4th edition) TMH .*
3. *Introduction to Atomic Spectra, HE White, TMH*
4. *Elements of spectroscopy, Guptha, Kumar and Sharma (Pragathi Prakash)*
5. *Special Relativity- Resnick, (Wiley)*
6. *Mechanics – D.S.Mathur (S.Chand).*
7. *Mechanics by J.C. Upadhayaya (Ramprasad)*
8. *Semiconductor physics and optoelectronics- V Rajendran, J Hemaletha and M S M Gibson.*

Semester-VI Core Course: XI **Credit-3(54 hours)**

UG186CR03 – NUCLEAR, PARTICLE PHYSICS AND ASTROPHYSICS

Title of Paper	Nuclear, Particle Physics and Astrophysics
Course Code	UG186CR03
Semester	VI
Credits	3
Contact Hours	54
Course Type	Core

COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Acquire knowledge of the fundamental physics of nuclear physics	1, 2, 4, 5
CO2	Understand the concepts and potential applications of nuclear physics	1, 2, 4, 5
CO3	Apply quantum physics to nuclear systems	1, 2, 4, 5
CO4	Understand the existence of elementary particles.	1, 2, 4, 5
CO5	Analyse the production and decay reaction for fundamental particles	1, 2, 4, 5
CO6	Expand and evaluate the theoretical predictions for nuclear reactions.	1, 2, 4, 5
CO7	Understand the fundamental concepts regarding the birth and evolution of our universe	1, 2
CO8	Recognize the effect of the size of a star in determining its evolution	1

Module I

Nuclear structure (10 hours)

Nuclear composition – Discovery of neutron – Nuclear electrons - Nuclear properties: Nuclear radii – Spin and magnetic moment - Stable nuclei - Binding energy- Binding energy curve, Liquid drop model - Semi empirical binding energy formula with correction factors - Shell model - Nuclear forces- Meson theory of nuclear forces – Discovery of pion – Virtual Photons

Nuclear Radiation Detectors, Counters and Particle Accelerators (8 Hours)

Interactions between energetic particles and matter (basic concepts only) - Ionization chamber - Solid state detectors - Proportional counter - Geiger-Muller counter - The Wilson cloud chamber - Bubble chamber - Scintillation counters - Van de Graaff generator - Linear accelerator - Cyclotron - Betatron

Module II

Nuclear Transformations (15 hours)

Radioactive decay – Radiation hazards – Half life – Radiometric dating – Radioactive series - Alpha decay, tunnel theory of alpha decay, derivation for alpha decay constant - Beta decay, positron emission, electron capture, inverse beta decay – Gamma decay - The concept of interaction cross section, reaction rate – Nuclear reactions, Resonance, Center of mass

coordinate system, Q value of nuclear reaction – Nuclear fission – Nuclear reactors – Breeder reactors - Nuclear fusion in stars – Formation of heavier elements – Fusion reactors – Confinement methods

Cosmic rays (4 hours)

Latitude effect – Azimuth effect – Altitude effect - Primary cosmic rays – Secondary cosmic rays – Cosmic ray showers – Discovery of Positron – Mesons Van Allen belts – Origin of cosmic rays *B Sc Programme in Physics, Mahatma Gandhi University* 63
Curriculum and syllabus 2017 admissions onwards

Module III

Particle Physics (10 hours)

Interactions and Particles – Leptons – Neutrinos and Antineutrinos, other leptons – Hadrons – Resonance particles – Elementary particle quantum numbers – Basic concepts of symmetries and conservation principles – Basic concepts of Quarks – color, flavor, Quark confinement –Higgs boson

Astrophysics (7 hours)

Classification of stars – Hertzsprung - Russel diagram – Luminosity of a star – Stellar evolution - White Dwarfs - Chandrasekhar limit - Neutron stars - Black holes - Supernova explosion – Photon diffusion time.

Text Book*:*

1. Concepts of Modern Physics, Arthur Beiser, 6th Edition, Tata McGraw-Hill publishing company

2. Modern Physics, R Murugeshan and K. Sivaprasath, 15th Edition (Revised) (2010), S.Chand

References:

1. Atomic and Nuclear Physics, S N Ghoshal, S.Chand.

2. Nuclear and Particle Physics S L Kakani and Subhra Kakani -Viva Books 2008

3. Elements of Nuclear Physics, M L Pandya and R P S Yadav, Kedar Nath Ram Nath

4. Modern Physics, Kennth Krane, 2nd Edition, Wiley India (Pvt) Ltd.

5. Modern Physics , G. Aruldhas and P. Rajagopal, Prentice-Hall India

6. An Introduction to Astrophysics, Baidyanath Basu, 2nd Edition, Prentice-Hall India

Semester-VI Core Course: XII **Credit-3(54 hours)**

UG186CR04 Solid State Physics

Title of Paper		**Solid State Physics**
Course Code		UG186CR04
Semester		VI
Credits		3
Contact Hours		54
Course Type		Core
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Be able to differentiate between different Lattice types and explain the concepts of reciprocal lattice and crystal diffraction	1,2
CO2	Be able to explain the concept of energy bands and effect of the same on electrical properties	1,2
CO3	Explain various types of magnetic phenomenon, physics behind them, their properties and applications.	1,2
CO4	Explain superconductivity, its properties, important parameters related to possible applications	1,2
CO5	Understand the semiconducting properties of materials	1
CO6	Understand Hall Effect and principles of LED, Photodiodes	2
CO7	Acquire knowledge in dielectric properties of materials.	1
CO8	Understand polarizability and susceptibility	1

Module I

Crystal structure **(18 hours)**

Solid state, crystalline, polycrystalline and amorphous materials, crystal lattice, periodicity, translation vectors, unit cell, basis, symmetry operations, bravais lattice in two and three dimensions, miller indices, interplanar spacing, simple crystal structures-hcp, fcc, bcc and simple cubic, Structure of NaCl. X-ray diffraction from crystals- Bragg's law, powder method, reciprocal lattice - properties, reciprocal lattice to sc, bcc and fcc, Bragg's law in reciprocal lattice.

Text book: Solid State Physics by Puri and Babbar- Chapter 1 & 2

Module II

Bonding in solids **(6 hours)**

Inter-atomic forces, ionic bonding, bond dissociation and cohesive energy, madelung energy - covalent bonding, metallic bonding, hydrogen bonding, van der waals bonding (basic ideas only).

Text book: Solid State Physics by Puri and Babbar

Free electron theory and elementary band theory **(12 hours)**

Free electron gas in one dimension, three dimension, electronic specific heat, band theory, Bloch theorem, Kronig-Penney model (derivation not expected), energy-wave vector relations, different zone schemes, velocity and effective mass of electron, distinction between metals, insulators and semiconductors.

Semiconducting properties of materials **(12 hours)**

Intrinsic and extrinsic semiconductors - drift velocity, mobility and conductivity of intrinsic semiconductors - carrier concentration and Fermi level for intrinsic semiconductor - carrier concentration, conductivity and Fermi level for extrinsic semiconductor. Hall Effect, Direct and Indirect band gap, Principles of LED and Photodiodes.

Text book: Solid State Physics by Puri and Babbar Chapter 5, 6 and 7

Module III

Dielectric properties of materials **(6 hours)**

Polarization and susceptibility, local filed, dielectric constant and polarizability, sources of polarizability, Clausius-Mossoti relation, piezoelectricity.

Magnetic properties of materials **(8 hours)**

Response of materials to magnetic field, classification of magnetic materials, diamagnetism (qualitative), Langevin's classical theory of paramagnetism, ferromagnetism, Weiss theory, domain theory, antiferromagnetism and ferrimagnetism.

Superconductivity **(10 hours)**

Origin of superconductivity, response of magnetic field, Meissner effect, super current and penetration depth, critical field and critical temperature, type - I and type - II superconductors, thermodynamic and optical properties, isotope effect, Josephson effect and tunneling- SQUID BCS theory - Cooper pairs - Existence of bandgap.

Text book: Solid State Physics by Puri and Babbar Chapter 5, 6 and 7

Text book:

1. *Solid State Physics by Puri and Babbar (S.Chand)*

References:

1. *Solid State Physics, M.A. Wahab, (2nd Edition), Narosa*
2. *Introduction to Solid State Physics, Charles Kittel, (7th Edition), Wiley*
3. *Crystallography applied to solid state Physics, AR Verma, ON Srivastava, New age*
4. *Solid State Physics, AJ Dekker- Macmillian.*
5. *Solid State Physics, NW Ashcroft, ND Mermin – Cengage Learning.*
6. *Elementary Solid State Physics, M. Ali Omer, Pearson.*
7. *Solid state physics, R L Singal, KNRN &Co.*
8. *Solid state physics, S O Pillai, New age*

Semester-VI Choice Based Core Course – XIV-1 Credit-3 (54 hours)

PH6CBT01-– INFORMATION TECHNOLOGY

Scope: To learn about the fascinating world of information technology and to use the tools available in Internet and the World Wide Web for a deep study of the subjects related to physics in better way by the students themselves.

Prerequisites: Awareness of basic computer operations.

Module I (20 hours)

Information and its Use : Information Technology – Quality of information – Message transmission – Electronic Office – E mail – Document storage – Computers in Industry – Different types – Graphical user interface

Text book: "Information Technology – The Breaking Wave", D.Curtin, K.Sen and K.Morin, Tata McGraw Hill, 1999. Chapter – 1, 2

Computer Networks: Importance of Networks. Components of Networks. Classification of Networks: Broad cast networks-Switched networks. Switching Techniques. Types of Networks – LAN – MAN – WAN. Networking Models – OSI reference model – TCP/IP reference model-Comparison between the OSI and TCP/IP models. Network Topology – Bus- Star-Ring-Tree-Mesh-Cellular.

Text book: Computer Networks, A.S. Tanenbaum - Prentice Hall of India, Chapter - 1

Computer Fundamentals, P.K. Sinha 3rd Edn. BPB Publications, Chapter – 17

THE INTERNET: Internet Protocols – Internet Protocol (IP)-Transmission Control Protocol (TCP) -Internet Address – Structure of Internet Servers Address-Address Space- Services on Internet – Domain Name System-SMTP and Electronic mail – Http and World Wide Web-Usenet and News groups-FTP-Telnet-Network Security

-Digital Signature-E-mail Privacy-Internet Tools – Search Engines-Web browsers-Internet explorer, Netscape Navigator, Mozilla Firefox(Working Knowledge)

Text book: Computer Networks, A.S.Tanenbaum - Prentice Hall of India, Chapter –5, 6, 7

Computer Fundamentals, P.K. Sinha 3rd Edn. BPB Publications, Chapter – 18

Module – II **(20hours)**

THE HTML: What is HTML? Basic Tags of HTML – HTML-TITLE-BODY - Starting an HTML document – The <!DOCTYPE>declaration-setting boundaries with <HTML>-the HEAD element-the BODY element-the STYLE element and the SCRIPT element. - Formatting of text– Headers-Formatting Tags-PRE tag-FONT tag-Special Characters. Working with Images- META tag -Links – Anchor Tag -Lists – Unordered Lists-Ordered Lists-Definition Lists -Tables –TABLE, TR and TD Tags-Cell Spacing and Cell Padding-Colspan and Rowspan -Frames –Frameset-FRAME Tag-NOFRAMES Tag - Forms – FORM and INPUT Tag-Text Box-Radio Button-Checkbox-SELECT Tag and Pull Down Lists-Hidden-Submit and Reset

Text book: HTML4 – 2nd Edn. Rick Darnell, Techmedia, Chapter – 1, 2,3,4,5

Module – III **(14 hours)**

Basic Idea of DBMS: Need for Data Base – Database Systems versus File systems - View of Data - Data Abstraction-Instances and Schemas - Data Models – ER Model-Relational Model- Network Model-Hierarchical Model (general ideas) -Basic ideas about Structured Query Language.

Text book: Fundaments of Database System – Elmasri, Ramez and Navathe Shamkant B. 4th Edn.Person Education, India, 2004. Chapter – 1

MS – OFFICE/OPEN OFFICE (Working Knowledge): Word processors – PowerPoint - Spreadsheets – Databases

(No specific text book is preferred. MS office (97, 98, 2000, /Open Office which is installed in the lab can be used. Working practice must be given)

References

1. “Information Technology – The Breaking Wave”, D.Curtin, K.Sen and K.Morin,Tata McGraw Hill, 1999.
2. Computer Networks – A.S. Tanenbaum - Prentice Hall of India

3. Computer Fundamentals – P.K. Sinha 3rd Edn. BPB Publications

4. Internet and World Wide Web – Deitel

5. HTML4 – 2nd Edn. Rick Darnell, Techmedia

6. Database System Concepts – Silberschatz-Korth-Sudarshan 4th Edn – TataMac Graw Hill

7. "Information Technology and systems", Green, B.C., Longman Scientific
8. Networks – Tirothy S. Ramteke – 2nd Edn. Pearson Edn – New Delhi, 2004

9. Data and Computer Communucation, William Stalling, PHI, New Delhi.

10. Mastering HTML4 – Ray D.S. and Ray E.J. – BPB

11. HTML – The Complete Reference – Tata Mc Graw Hill

12. Fundaments of Database System – Elmasri, Ramez and Navathe Shamkant B. 4thEdn.v Pearson Education, India, 2004.

Semester-VI Choice Based Core Course – XIV-2 Credit-3 (54 hours)

PH6CBT02 – MATERIAL SCIENCE

Title of Paper	Materials Science	
Course Code	PH6CBT02	
Semester	VI	
Credits	3	
Contact Hours	54	
Course Type	Choice Based Course	
COURSE OUTCOMES (CO)		
After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Gain a deep understanding on material structures, material properties and its interaction with light	1, 2
CO2	Evaluate the design and structures of display devices, photovoltaic cells and solar cells	1, 4
CO3	Improve technical knowledge on analytical instruments used in research	5,6
CO4	Equip themselves for higher studies and develop an aptitude for research	1, 2, 4

Module I

Structure and Properties of Materials (18 hours)

Classification of materials- Advance materials- Level of structures, Microstructure and Macrostructure, Structure-Property relationships, Physical properties of materials-Imperfections in solids- Point defects, imperfections, dislocations- interfacial and bulk defects. Diffusion Mechanisms- Fick's first and second laws. Mechanical Properties-Stress strain relationship, Basic ideas of anelasticity, plastic deformation, tensile properties, ductility, malleability, brittleness, toughness, resilience, hardness, stiffness, endurance, creep and impact strength- Basic Thermal properties, Thermal cracking-Electrical and Magnetic properties- Dielectric strength and dielectric constant- Basic ideas of Chemical properties

Text Book: Callister's Material Science and Engineering-Adapted by R

Balasubramaniam, Wiley

Module II **(18 hours)**

Optical Properties of Materials

Absorption processes- Fundamental absorption-Exciton absorption- Free –carrier absorption-Photoconductivity- Photoelectric effect- Photovoltaic effect-Photoluminescence-colour centres-Generation of colour centres

Text Book: Solid State Physics, M.A. Wahab, Chapter-15

Modern Engineering Materials

Display devices- active and passive-Liquid crystals- Types of Liquid crystals- Nematic liquid crystals-Cholesteric liquid crystals- Smectic liquid crystals-General features of liquid crystals- Numeric display using LCD

Metallic glasses; Shape memory alloy; lead free solders

Text Book: Semiconductor Physics and Optoelectronics, V.Rajendran et al. Unit-II

Module III **(18 hours)**

Nanoscience

Metal nanoclusters-magic numbers, theoretical modelling, geometric and electronic structure, magnetic clusters; Semiconducting nano particles- Rare gas and molecular clusters- carbon nanostructures- Carbon clusters, CNT preparation, properties and applications; Quantum walls, wires and dots – preparation, Size and dimensionality effects, applications .

Text Book: Modern Physics by Murugeshan

Material Characterization Techniques

Qualitative study of Powder XRD, SEM, SPM, TEM, STM, AFM, PES and Raman spectroscopy.

Text Book: Nanotechnology-The science of small- MA Shah and KA Shah, Chapter 5

Text Books:

1. *Text Book: Callister's Material Science and Engineering-Adapted by R Balasubramaniam, Wiley*
2. *Solid State Physics (2nd ed.), M.A. Wahab, Narosa pub.*
3. *Nanotechnology-The science of small, MA Shah and KA Shah, Wiley.*
4. Text Book: Modern Physics by Murugeshan
5. *Semiconductor Physics and Optoelectronics, V.Rajendran et al., Vikas PublishingHouse.*

References:

1. *Crystallography applied to solid state Physics, A.R Verma, O.N Srivastava, New age*
2. *Nanotechnology, L.E Foster, Pearson.*
3. *Nanotechnology: Principles and Practices, 2nd edition, Sulabha K Kulkarni, Springer.*
4. *Introduction to Nanotechnology, C.P Poole, F.J Owens –Wiley*
5. *Textbook of Nanoscience and Nanotechnology, BS Murthy, P Shankar, Baldev Raj,BB Rath and J Murday- Universities Press-IIM*

Semester-VI Choice Based Core Course – XIV-3 Credit-3 (54 hours)

UG186CB03– COMPUTATIONAL PHYSICS

ALGORITHM OF ALL METHODS REQUIRED

MODULE I

Bisection Method - Newton Raphson method (two equation solution) – Regula-Falsi Method, Secant method - Fixed point iteration method - Rate of convergence and comparisons of these Methods

Solution of system of linear algebraic equations

Gauss elimination method with pivoting strategies-Gauss-Jordan method-LU Factorization, Iterative methods (Jacobi method, Gauss-Seidel method)

Module II (18 hours) Curve fitting: Regression and interpolation

Least squares Regression- fitting a straight line, parabola, polynomial and exponential curveFinite difference operators-forward differences, divided difference; shift, average and differential operators- Newton's forward difference interpolation formulae- Lagrange interpolation polynomial- Newton's divided difference interpolation polynomial

Module III (18 hours) Numerical Differentiation and Integration

Numerical Differentiation formulae - Maxima and minima of a tabulated function- Newton-Cote general quadrature formula - Trapezoidal, Simpson's 1/3, 3/8 rule –

Solution of ordinary differential equations

Taylor Series Method, Picard's method-Euler's and modified Euler's method –Heun's method- Runge Kutta methods for 1st and 2nd order

***Text Books**:*

1. *Numerical Methods, Balagurusamy, TMH*
2. *Numerical Methods for Scientists and Engineers- K Sankara Rao- PHI*
3. *Introductory Numerical Methods, S S Sastry, PHI.*

Semester-VI **Choice Based Core Course – XIV-4 Credit-3**

(54 hours)

UG18PH6CB04–INSTRUMENTATION

Module I (10 Hours)

Measurements and Measurement Systems

Measurements-Method of measurement-Instruments and measurement systems-

Mechanical, Electrical and Electronic instruments-Classification of Instruments-

Applications of Measurement Systems - Elements of generalized measurement systems

Text book: A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney. A.K- Chapter 1

Module II **(18 hours)**

Primary Sensing Elements and Transducers

Mechanical Devices as Primary Detectors – Mechanical Spring Devices – Pressure Sensitive Primary Devices – Flow Rate Sensing Elements - Transducers-Classification– Characteristics (Static and Dynamic) and Choice of Transducers – Characterization

Text book: Sensors and Transducers, Patranabis D., Chapter 1

A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney. A.K- Chapter 25

Module III **(18 hours)**

Resistive,Inductive and Capacitive Transducers

Potentiometers –Strain gauges (Theory, types) - Rosettes – Resistance thermometer – Thermistors (materials, Constructions, Characteristics) – Thermocouples-Self inductive transducer – Mutual inductive transducers – Linear Variable Differential Transformer – LVDT Accelerometer – RVDT – Synchros – Capacitive transducer – Variable Area Type – Variable Air Gap type – Variable Permittivity type – Capacitor microphone.

Miscellaneous Transducers **(8 hours)**

Light transducers (photo-conductive, photo emissive, photo-voltaic, semiconductor, LDR)–Piezoelectric transducer – Hall Effect transducers – Digital Encoding transducers

Text book: A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney. A.K- Chapter 1 and 25

Text books:

1. *A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney A.K, 18th Edition, Dhanpat Rai & Company Private Limited, 2007.*
2. *Sensors and Transducers, Patranabis D., 2nd edition, PHI, 2015.*

References:

1. *Measurement Systems-Applications and Design, Doebelin. E.A, Tata McGraw Hill*
2. *Sensors and Transducers, Patranabis. D, Prentice Hall of India*
3. *Principles of Measurement Systems John. P, Bentley,, III Edition, Pearson*
4. *Transducers and Instrumentation, Murthy.D.V.S,, Prentice Hall of India*
5. *Instrumentation- Devices and Systems, Rangan, Sarma, and Mani, Tata-McGrawHill*
6. *Electronic Instrumentation by H.S Kalsi, McGrawHill*
7. *Instrumentation measurements and analysis, Nakra & Choudhary, Tata-McGrawHill*
8. *Mechanical and industrial measurement by R.K. Jain, Khanna Publishers, New Delhi*

Semester-VI Choice Based Core Course – XIV-5 Credit-3 (54 hours)

UG18PH6CB05– ASTRONOMY AND ASTROPHYSICS

Module I

Observational astronomy

Astronomical distance scales – AU, Parsec and light year. Stellar Parallax and distance to stars from parallax. Magnitude scale - Apparent and absolute magnitudes. Variable stars as distance indicators. Cepheid variables. Astronomy in different bands of electromagnetic radiation- Optical, radio and X-ray astronomies, Radiation Laws.

Optical Telescopes. Types of telescopes-refracting and reflecting – Newtonian and Cassegrain telescopes. Magnification and f number. Resolving Power, Telescope mounts – alt-azimuth and equatorial mounts.

Text Book **:** K D Abhyankar Section 3.1 & 4.3, Ian Morison Chapter 5, Dinah L. Moché, Chapter 2 &3.

Module II

Celestial sphere (8 Hours)

Concept of celestial sphere - cardinal points, celestial equator, ecliptic, equinoxes. Diurnal motion of sun - summer solstice and winter solstice. Celestial co-ordinate systems: – Horizon system – Azimuth & Altitude, Equatorial system-Right ascension & declination, Ecliptic coordinate system.

Time - apparent and mean solar time, sidereal time. Twilight, Seasons- causes of seasons (qualitative ideas). International Date Line.

Text Book:K D Abhyankar, Chapter 2 & Dinah L. Moché, Chapter 1

Sun (5 Hours)

Sun - solar atmosphere and internal structure – Photosphere, chromosphere and corona. Radiation zone & Convection Zone. Sun spots, Activity Cycles, flares, prominences, coronal holes, Solar wind.

Text Book: Dinah L. Moché, Chapter 4, Ian Morison Chapter 2

Galaxies (3 hours)

Galaxies - our galaxy, galaxy types & turning fork diagram. Structure on the largest scale-clusters, super clusters and voids.

Text Book: Dinah L. Moché, Chapter 6

Module III

Astrophysics (14 hours)

Gravitational contraction - Virial theorem, Jeans mass. Energy production inside stars. Thermonuclear fusion. Hydrogen burning. p-p chain. CNO cycle. Evolution of stars – birth–protostar, hydrostatic equilibrium, red giant, late stages of evolution - white dwarfs & Chandrasekhar limit, Neutron stars, Supernovae, Pulsars, Black holes. Stellar Classification, H-R diagram - Main sequence stars

Text Book: K D Abhyankar, Chapter 10, Dinah L. Moché Chapter 5

Cosmology (12 hours)

Large scale structure of the universe – isotropy and homogeneity. Cosmological principle.

Standard big bang model - GUT, Planck Epoch, Inflation, Nucleosynthesis, Recombination & CMBR. Expanding universe - red shift. Hubble's law and Hubble parameter. Age of universe and its determination. Dark energy and Dark Matter (qualitative idea).

Text Book: Dinah L. Moché Chapter 7 & Ian Morison Chapter 9

References:

1. A short history of the Universe – Joseph Silk

2. Introduction to Astronomy and Cosmology, Ian Morison, John Wiley & Sons, Inc.

3. ASTRONOMY, A Self-Teaching Guide, Dinah L. Moché, John Wiley & Sons, Inc.
4. Introduction to cosmology- J V Narlikar
5. http://www.astro.cornell.edu/academics/courses/astro201/topics.html
6. http://www.ualberta.ca/~pogosyan/teaching/ASTRO_122/lectures/lectures.html
7. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
8. Astrophysics: Stars and Galaxies- K D Abhyankar

BSc PHYSICS PRACTICALS

Minimum of experiments to be done in each paper is 14.

Minimum number of experiments for appearing practical examination is 8.

Maximum possible number of repetitions must be done to reduce error in a measuring quantity.

Do calculation of percentage error for all experiments.

The S.I. units must be specified along with the results.

Division of internal marks for record (maximum 10 marks)

No. of Experiments	Marks
14 and above	4
12 & 13	3
10 & 11	2
8,9 & 10	1
Less than 8	0

SEMESTER	PAPER	PAPER CODE	TITLE
1 & 2	01	UG18PH2CR01	**Mechanics and Properties of Matter**
3 & 4	02	UG18PH4CR02	Optics and Semiconductor Physics
5 & 6	03	UG18PH6CR03	Electricity, Magnetism and LASER
5 & 6	04	UG18PH6CR04	Digital Electronics
5 & 6	05	UG18PH6CR05	Thermal Physics, Spectroscopy and C++ Programming
5 & 6	06	UG18PH6CR06	Acoustics, Photonics and advanced Semiconductor Physics

SEMESTER 5&6 (Third Year)

Title of Paper	Core Practical III-Electricity, Magnetism and Laser Core Practical IV-Digital Electronics, Core Practical V-Thermal Physics, Spectroscopy and C++ programming, Core Practical VI- Acoustics, photonics and Advanced Semiconductor Physics
Course Code	UG18PH6CR03, UG18PH6CR04, UG18PH6CR05, UG18PH6CR06
Semester	V &VI
Credits	8
Contact Hours	144
Course Type	Core - Laboratory Course
COURSE OUTCOMES (CO)	

After successful completion of the course student will be able to		**PSO-CO Mapping**
CO1	Study the emf, resistance, behaviour of the materials	1, 3, 4, 5
CO2	Realise the working of prism and grating and determine the resolving power and dispersive power	1, 3, 4, 5
CO3	Analyse the specific heat capacity, refractive index, as per the standard procedure	1, 3, 4, 5
CO4	Understand the standard values of the results	1, 3, 4, 5
CO5	Apply the concepts and principles of thermodynamics to find out the thermal conductivity of various materials	1, 3, 4, 5
CO6	Understands the basic concepts of computational methods in solving problems in physics	1, 3, 4, 5
CO7	Acquire knowledge to apply and develop numerical methods and apply to physical problems	1, 3, 4, 5

Core Practical III: UG18PH6CR03 - Electricity, Magnetism and Laser

1. Potentiometer – Measurement of resistance of wire
2. Potentiometer – Calibration of low range voltmeter
3. Potentiometer – Calibration of high range voltmeter
4. Potentiometer – Calibration of ammeter
5. Tangent galvanometer – Calibration of ammeter
6. Moving coil galvanometer – figure of merit
7. Conversion of galvanometer into voltmeter
8. Conversion of galvanometer into ammeter
9. Field along the axis of a circular coil – magnetic flux variation
10. Field along the axis of a circular coil – m and Bh
11. Searle's vibration magnetometer – magnetic moment
12. Deflection and vibration magnetometer – m and Bh
13. Carey Foster's bridge – Measurement of resistivity of wire
14. LCR seriesand parallel resonant circuit analysis
15. Verification of Thevenin's and Norton's theorems
16. Verification of Superposition and Maximum power transfer theorems.
17. Laser – Grating – Determination of wavelength
18. Laser – Determination of spot size and divergence
19. Optical fiber – Determination of numerical aperture
20. Single slit diffraction using laser – Determination of slit width
21. e/m – Thomson's apparatus – Bar magnet/magnetic focusing
22. Determination of Dielectric constant of a thin sheet/ a liquid

SEMESTER 5&6 (Third Year)

Core Practical IV: UG18PH6CR04 Digital Electronics

1. Realization of logic gates – AND, OR and NOT – Using diodes, transistors etc.
2. Realization of logic gates – AND, OR and NOT – Using universal gates
3. Verification of truth table of NAND, NOR, XOR and XNOR gates
4. Verification of De Morgan's theorems – Using IC 7400
5. BCD to 7 segment decoder
6. Realization of Half adder/ Full adder using gates – Verification of truth table
7. Astable Multivibrator using Transistor
8. Astable Multivibrator using IC 555
9. Monostable Multivibrator using Transistor
10. Monostable Multivibrator using IC 555
11. D/A converter using IC 741 – Using binary weighed resistor / R – 2R ladder type
12. A/D converter using IC 741
13. SR Flip Flops using IC 7400 – Verification of truth table
14. JK Flip Flops using IC 7400 & 7410 – Verification of truth table
15. Digital counter using IC 7490 / 7495 / 74194 / 74151 – Verification of truth table
16. Schmitt trigger using IC 741
17. Bistable multivibrator using IC 555
18. Multiplexer using gates
19. Demultiplexer using gates
20. Shift register – SISO
21. Shift register – SIPO
22. 4-Bit Binary to Gray conversion
23. 4-Bit Gray to Binary conversion

SEMESTER 5&6 (Third Year)

Core Practical V: UG18PH6CR05 Thermal Physics, Spectroscopy and C++ programming

1. Thermistor – Resistance - Temperature characteristics and temperature coefficient of resistance
2. Newton's law of cooling – Specific heat capacity of a liquid
3. Thermal conductivity of bad conductor – Lee's disc
4. Carey Foster's bridge – Temperature co-efficient of resistance
5. Study of Seeback effect/Peltier effect
6. Electrochemical equivalent of Copper
7. To determine e/k using transistor
8. Spectrometer – Cauchy's constants
9. Spectrometer – Resolving power of a prism.
10. Spectrometer – Resolving power of grating.

11. Spectrometer – Dispersive power of grating
12. Spectrometer – Dispersive power of prism
13. Computer programming in C++ – Conversion of temperature scale
14. Computer programming in C++ – Solving a quadratic equation
15. Computer programming in C++ – Generation of Fibonacci series
16. Computer programming in C++ – Conversion of a decimal number into binary number
17. Computer programming in C++ – Simple Pendulum – Calculation of 'g' from experimental data
18. Computer programming in C++ – Resistance colour code to numerical value conversion
19. Computer programming in C++ – For different initial velocity and angle of projection, find out time of flight, horizontal range, Maximum height of a Projectile
20. Computer programming in C++ – sorting the numbers in ascending and descending order
21. Computer programming in C++ – multiplication of two matrices

SEMESTER 5&6 (Third Year)
Core Practical VI: UG18PH6CR06
Acoustics, Photonics and Advanced Semiconductor Physics

1. Melde's string – Determination of frequency of given tuning fork
2. Sonometer – Determination of frequency of AC
3. Sonometer – Determination of frequency of given tuning fork, unknown mass and verification of laws of strings
4. Kundt's tube – Determination of velocity of sound
5. Spectrometer – Quartz prism – Refractive indices of quartz for the ordinary and extra –ordinary rays
6. Characteristics of LED – V- I characteristic for different colors
7. Characteristics of solar cell / photodiode – V- I characteristics
8. Characteristics of Light Depend Resistors
9. Planck's constant using LED's of at least 3 different colours
10. Weinbridge Oscillator using IC 741
11. Realization of XOR and Ex NOR using transistor
12. Sweep wave generator using transistor
13. Regulated power supply using zener diode and IC 741 – Study of line and load regulations
14. Regulated power supply using IC 78XX/79XX etc – Study of line and load regulations
15. Voltage regulator using zener diode and transistor – Study of line and load regulations
16. RC coupled common emitter amplifier – Study of frequency response and bandwidth
17. Voltage multipliers – doubler & tripler

18. Wave shaping R C circuits – Integrator and differentiator
19. OPAMP – adder and subtractor
20. Amplitude modulation using transistor
21. Pulse Width Modulation using IC 555

References:

1. Advanced course in Practical Physics by D Chattopadhyay
2. Practical Physics – Joseph Ittiavirah, Premnath and Abraham(2005)
3. Practical Physics, CL Arora, S.Chand
4. Practical Physics, Harnam Singh , S Chand
5. Electronics lab manual Vol 1 & 2, K A Navas.
6. A course of Experiments with He –Ne Laser – R.S Sirohi (2nd Edition) Wiley Eastern Ltd.
7. Electronics lab manual Vol 1 & 2, Kuryachan T D and Shyam Mohan S, Ayodhya pub.

****

PROJECT REPORT GUIDELINES

PROJECT EVALUATION: (Maximum Marks 100)

All students are to do a project in the area of core course. This project can be done individually or in groups (not more than five students) for all subjects which may be carried out in or outside the campus. Special sanction shall be obtained from the Principal to those new generation programmes and programmes on performing arts where students have to take projects which involve larger groups. The projects are to be identified during the II semester of the programme with the help of the supervising teacher. The report of the project in duplicate is to be submitted to the department at the sixth semester and are to be produced before the examiners (Internal and External) appointed by the Controller of Examinations. External Project evaluation and Viva /

Presentation is compulsory for all subjects and will be conducted at the end of the programme.

For Projects

a) Marks of External Evaluation :80

b) Marks of Internal Evaluation : 20

Components of External Evaluation of Project	**Marks**
Dissertation (**External)**	50
Viva – Voce (**External)**	30
Total	**80**

*Marks for Dissertation may include study tour report if proposed in the syllabus

***Components of Internal Evaluation of Project**	**Marks**
Punctuality	5
Experimentation/Data collection	5
Knowledge	5

Report	5
Total	**20**

COMPREHENSIVE VIVA GUIDELINES

For Projects

a) Marks of External Evaluation :80

b) Marks of Internal Evaluation : 20

Components of External Evaluation of Project	**Marks**
Dissertation (**External)**	50
Viva – Voce (**External)**	30
Total	**80**

ZERO CREDIT COURSES- STUDY TOUR/INDUSTRIAL VISIT/INTERNSHIP

Marks for Dissertation may include study tour report if proposed in the syllabus

Components of Internal Evaluation of Project	**Marks**
Punctuality	5
Experimentation/Data collection	5
Knowledge	5
Report	5
Total	**20**

MODEL QUESTION PAPERS

BSc Degree (CBS) Model Examination February-2020
Sixth Semester
UG18PH6CR03 - NUCLEAR, PARTICLE PHYSICS AND ASTROPHYSICS

Time: 3 Hours Max. Marks: 60

Part A (Short Answer/ Problem Type)

(Answer any **ten** questions. Each question carries **1** mark)

1. Obtain an estimate of nuclear density
2. Give the isospin quantum number of a pion triplet.
3. What are mirror nuclei?
4. Comment on nuclear magnetic moment.
5. State any two properties of nuclear forces.
6. What are virtual photons?.
7. What is the working principle of Van de Graaff generator?
8. Write down time independent Schrodinger equation.
9. What are resonance particles?
10. Distinguish between alpha and beta rays.
11. What is meant by activity of a radioactive sample?
12. What is latitude effect?

(10×1=10marks)

Part B (Short Essay/Problem)

(Answer any **six** questions. Each question carries **5**marks)

13. Explain nuclear binding energy. How it is related to nuclear stability
14. What are the important properties of nuclei?
15. Given the nuclear mass of iron as 55.85 u. Calculate its nuclear density
16. With necessary theory, explain the working of a Geiger Muller counter.
17. What is HR Diagram? Explain its significance.
18. Discuss beta decay on the basis of lepton number conservation
19. What is meant by mean life of an atom? Derive an expression connecting the mean life and disintegration constant?
20. Determine the activity of 1mg of a radioactive substance having atomic mass 222 amu. Given, the half life is 3.8 days.
21. Determine the time in which a gram of radium will disintegrate to 0.2g if the half life is 1620 years.

(6×5=30 marks)

Part C (Essay/Problem)

(Answer any **two** questions. Each question carries **10**mark**s**)

22. Give the classification of elementary particles. Explain the conservation laws and symmetries.
23. With necessary theory, explain the evolution of a star.
24. Explain liquid drop model of nucleus. Give semi empirical binding energy formula with correction factors.
25. Obtain an expression for a successive radioactive decay. Obtain condition for secular and transient equilibrium.

(2×10=20 marks)