



UNIVERSITY OF CALICUT

Abstract

General & Academic - CBCSS PG Regulations 2019 - Scheme and Syllabus of M.Sc Physics Programme w.e.f 2020 Admission onwards -Prepared as per Outcome Based Education - Implemented- Subject to ratification by the Academic Council - Orders Issued.

G & A - IV - J

U.O.No. 5811/2021/Admn

Dated, Calicut University.P.O, 31.05.2021

- Read:-*1)U.O.No.9200/2019/Admn, Dated 12.07.2019.
2)Email , Dated 30.05.2021, from the Chairperson, Board of Studies in Physics PG.
3)Remarks of the Dean, Faculty of Science, Dated 31.05.2021.
4)Orders of the Vice Chancellor in the file of even no, Dated 31.05.2021.

ORDER

1. Scheme and Syllabus of MSc Physics Programme in accordance with CBCSS PG Regulations 2019, with effect from 2019 admission has been implemented in the University ,vide paper read (1) above.
2. The Chairman, Board of Studies in Physics PG, vide paper read (2) above, has forwarded the revised Scheme and Syllabus of M.Sc Physics Programme , prepared as per Outcome Based Education(OBE) in accordance with CBCSS PG Regulations 2019, w.e.f 2020 admission, after circulating among the members of the board , as per Chapter 3(34) of Calicut University First Statute, 1976.
3. The Scheme and Syllabus of M.Sc Physics Programme (CBCSS-PG-2019), prepared as per Outcome Based Education(OBE), has been approved by the Dean, Faculty of Science, vide paper read (3) above and by the Vice Chancellor, subject to ratification by the Academic Council, vide paper read (4) above.
4. The Scheme and Syllabus of M.Sc Physics (CBCSS) programme prepared as per Outcome Based Education (OBE) , in tune with CBCSS PG Regulations 2019, is therefore implemented with effect from 2020 Admission , under affiliated colleges of the University, subject to ratification by the Academic Council.
5. Orders are issued accordingly.(Revised syllabus appended).

Ajitha P.P

Joint Registrar

To

All affiliated Colleges

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Section Officer



UNIVERSITY OF CALICUT

Scheme and Syllabus for

M.Sc (Physics) Programme (CBCSS-PG-2020)

for affiliated colleges (w.e.f. 2020 admission)

Programme objective :

Physics is ultimately mechanics and it furnishes the official framework. It encompasses classical mechanics, quantum mechanics, electrodynamics and statistical mechanics. These are the four pillars upon which the structure of physics is built. In spite of having large number of branches and specializations in physics, the driving source that keeps them united under a common umbrella is mechanics. Any branch of physics which has its roots in the soil of mechanics grows as physics, otherwise it becomes nonphysics. The above mentioned four branches are the foundation subjects in physics. Frontier subjects are those in which current research is going on, such as atomic physics, molecular physics, nuclear physics, plasma physics, solid state physics, materials science, astrophysics etc. Frontier subjects are always rooted in the foundation subjects. Mathematical physics is the theoretical tool and electronics is the experimental tool for exploring physics. In this programme, all the foundation subjects and few frontier subjects are offered as core courses. Because of the time constraint, few other frontier subjects are offered as elective courses. Practicals include general physics, electronics, modern physics and computational physics. A project work also has to be carried out as part of the masters programme. The programme objective is to provide quality education with a firm foundation in physics.

Programme specific outcomes:

On successful completion of the M.Sc Physics programme, students will

P.O.1 acquire a comprehensive knowledge in physics.

P.O.2 will develop a broad understanding of the physical principles of the universe.

P.O.3 acquire laboratory skills to design advanced experiments and high precision measurements.

P.O.4 be proficient in computing and interfacing techniques.

P.O.5 be empowered for critical thinking and innovation in dealing with scientific problems and experiments.

P.O.6 develop advanced laboratory techniques and instrumentation skills for a career in research.

P.O.7 develop independent research skills through projects.

P.O.8 be provided with opportunities to further their knowledge in frontier areas through elective courses.

P.O.9 be empowered for planning career in physical sciences and also in taking up jobs in other fields in the contemporary society.

P.O.10 be able to communicate effectively and participate actively in team work.

The duration of the M.Sc (Physics) programme shall be 2 years, split into 4 semesters. Each course in a semester has 4 credits (4C) with Practicals having 3 credits (3C). The total credits for the entire programme (Core & Elective) is 80. The credits for audit courses is 8. The scheme and syllabus of the programme, consisting of sections (a) Programme structure (b) Courses and credit distribution summary (c) Courses in various semesters (d) Constitution of clusters (e) The credits and hours (f) Evaluation and Grading (g) Internal evaluation/continuous assessment (h) Pattern of question papers and (I) Detailed syllabus are as follows.

a) PROGRAMME STRUCTURE

1. The programme shall include three types of courses : **Core courses, Elective courses and Audit Courses.**
2. Comprehensive Viva voce and Project Work / Dissertation shall be treated as Core Courses and these shall be done in the final semester.
3. Total credit for the programme shall be 80 (eighty), this describes the weightage of the course concerned and the pattern of distribution is as detailed below:
 - i. Total Credit for Core Courses (both theory & practical's) shall be 60 (sixty).
 - ii. Total Credit for Elective Course shall be 12 (twelve).
 - iii. Total Credits for Comprehensive Viva voce and Project Work combined together shall be 8 (eight) subject to a minimum of 4 (four) credit for Project Work.
4. Audit Courses: In addition to the above courses, there will be two Audit Courses (Ability Enhancement Course & Professional Competency Course) with 4 credits each. These have to be done one each in the first two semesters. The credits will not be counted for evaluating the overall SGPA & CGPA. Students have to obtain only minimum pass requirements in the Audit Courses. The details of Audit courses are given below.

Semester	Course Title	Suggested Area	Details
I	Ability Enhancement Course (AEC)	Internship / Seminar presentation / Publications / Industrial or Practical Training /Community linkage programme / Book reviews etc.	Seminar: Each student has to present a seminar on a selected topic in physics. A report has to be prepared and submitted before presenting the seminar. The abstract of the seminar has to be sent to the head of the department through the teacher in charge. Or It can be a course related to any topic from the suggested areas.
II	Professional Competency Course (PCC)	To test the skill level of students like testing the application level of different software such as Latex / Data visualization / Python/Any software relevant to the programme of study / Translations etc.	The students in their second semester will be trained on the use of Latex scientific document preparation system. (The syllabus will be part of the second semester). The latex codes for preparing the following items will be developed. 1. A question paper
			2. A review paper on a topic related to the seminar given in the first semester
			3. A power point presentation
			Evaluation of this will be based on a multiple choice written examination and an internal practical exam.
			Or
			It can be a course related to any topic from the suggested areas.

b) COURSES AND CREDIT DISTRIBUTION SUMMARY:

Semester	Courses	Teaching Hours	Credit	Total Credit
<i>I</i>	Core Courses (Theory/Practical)			<i>Vary from 18 to 22 in each Semester (For M.sc Physics programme, since conducting practical examination in each semester is not viable, practical exams will be conducted in even semesters. Hence the total credits for the various semesters are as given under: Sem I : 16 Sem II : 22 Sem III : 16 Sem IV : 26</i>
<i>II</i>	Core Courses (Theory/Practical)		<i>For Core course total credit can vary from 60 to 68. For Elective Course total credit can vary from 12 to 20.</i>	
<i>III</i>	i. Core Courses (Theory/Practical) ii. Elective Courses (Theory/Practical)		<i>Minimum Credit for one course shall not be less than 2 (two) and shall not exceed 5 (five).</i>	
<i>IV</i>	(i) Core Courses (Theory / Practical) including: (a) Comprehensive Viva voce (Optional) Project Work / Dissertation (ii) Elective Courses (Theory/ Practical)	<i>Teaching hours can be fixed by the concerned BoS for various courses and shall not exceed 25 hours per week @ 5 hours per day.</i>	<i>The maximum credit for comprehensive Viva voce and Project Work combined together shall be 8 (eight) subject to a minimum credit of 4 (four) for Project Work.</i>	
Total credit shall be				80

I	Audit Course I : Ability Enhancement Course (AEC)	Not coming in the normal work load	4 (Not added for SGPA / CGPA)	4
II	Audit Course II : Professional Competency Course (PCC)		4 (Not added for SGPA / CGPA)	4

c) COURSES IN VARIOUS SEMESTERS

Semester – I (16C)

- (PHY1C01) Classical Mechanics (4C)
- (PHY1C02) Mathematical Physics – I (4C)
- (PHY1C03) Electrodynamics and Plasma Physics (4C)
- (PHY1C04) Electronics (4C)
- (PHY1L01) General Physics Practical - I*
- (PHY1L02) Electronics Practical – I**
- (PHY1A01) Ability Enhancement Course (4C)

Semester – II (22C)

- (PHY2C05) Quantum Mechanics –I (4C)
- (PHY2C06) Mathematical Physics – II (4C)
- (PHY2C07) Statistical Mechanics (4C)
- (PHY2C08) Computational Physics (4C)
- (PHY2L03) General Physics Practical - II (3C)*
- (PHY2L04) Electronics Practical – II (3C)**
- (PHY2A02) Professional Competency Course (4C)

*External Practical Exam for PHY1L01 & PHY2L03 together will be conducted at the end of 2nd semester

** External Practical Exam for PHY1L02 & PHY2L04 together will be conducted at the end of 2nd semester.

Semester -III (16C)

- (PHY3C09) Quantum Mechanics – II : (4C)
- (PHY3C10) Nuclear and Particle Physics (4C)
- (PHY3C11) Solid State Physics (4C)
- Elective -I (4C)
- Project*
- (PHY3L05) Modern Physics Practical-I[#]

Semester -IV (26C)

- (PHY4C12) Atomic and Molecular Spectroscopy (4C)
- Elective -II (4C)

Elective -III (4C)

(PHY4P01)	Project(4C) [#]
(PHY4L06)	Modern Physics Practical – II (3C) ^{##}
(PHY4L07)	Computational Physics Practical (3C)
(PHY4V01)	Comprehensive Viva voce (4C)

[#]Project will be started at 3rd semester and external evaluation for PHY4P01 will be conducted at the end of 4th semester.

^{##}External Practical Exam for PHY3L05 & PHY4L06 together will be conducted at the end of 4th semester

d) CONSTITUTION OF CLUSTERS

Elective -I Cluster:

(PHY3E01)	Plasma Physics
(PHY3E02)	Advanced Quantum Mechanics
(PHY3E03)	Radiation Physics
(PHY3E04)	Digital Signal Processing
(PHY3E05)	Experimental techniques
(PHY3E06)	Elementary Astrophysics
(PHY3E07)	Introduction to Nanoscience and Technology

Elective –II Cluster:

(PHY4E08)	Advanced Nuclear Physics
(PHY4E09)	Advanced Astrophysics
(PHY4E10)	Astrophysics and Astronomical Data Analysis
(PHY4E11)	Advanced Statistical Mechanics
(PHY4E12)	Materials Science
(PHY4E13)	Electronic Instrumentation
(PHY4E14)	Laser Systems, Optical Fibres and Applications
(PHY4E15)	Communication Electronics
(PHY4E16)	Synthesis, Characterization Techniques and Applications of Nanomaterials
(PHY4E17)	Astrophysics and Positional Astronomy

Elective –III Cluster:

(PHY4E18)	Quantum Field Theory
(PHY4E19)	Chaos and Non-linear Physics
(PHY4E20)	Advanced Condensed Matter Physics
(PHY4E21)	Modern Optics
(PHY4E22)	Physics of Semiconductors
(PHY4E23)	Microprocessors, Microcontrollers and Applications
(PHY4E24)	Biophysics
(PHY4E25)	Space Physics

e) THE CREDITS AND HOURS PER WEEK

The credits and hours proposed for various courses in different semesters are as given under.

Semester	No. of Theory Papers	Practicals	Theory		Practical		Project		Seminar / Tutorial	Viva voce Credits	Total hours	Total Credits
			Hrs	Cred	Hrs	Cred	Hrs	Cred				
I	4	1. Gen. Phys I 2. Electronics I	16	16	8	0	0	0	1	0	25	16
II	4	1. Gen. Phys II 2. Electronics II	16	16	8	6	0	0	1	0	25	22
III	4	1. Mod. Phys I	16	16	4	0	4	0	1	0	25	16
IV	3	1. Mod Phys II 2. Comp. Phys	12	12	8	6	4	4	1	4	25	26
Total Credits for the Programme											80	

f) EVALUATION AND GRADING

1. Evaluation:

- i. Accumulated minimum credits required for successful completion of the course shall be 80.
- ii. A project work of 4 credits is compulsory and it should be done in III & IV semesters. Also a comprehensive Viva Voce may be conducted by external examiners at the end of IV Semester and carries 4 credits.
- iii. Evaluation and Grading : The evaluation scheme for each course shall contain two parts;
 - (a) Internal / Continuous Assessment (CA) and (b) External / End Semester Evaluation (ESE). Of the total, 20% weightage shall be given to Internal evaluation / Continuous assessment and the remaining 80% to External/ESE and the ratio of the weightage between Internal and External is **1:4**.
 - iv. Primary evaluation for Internal and External shall be based on 6 letter grades (**A+, A, B, C, D and E**) with numerical values (Grade Points) of **5, 4, 3, 2, 1 & 0**, respectively.

Grade	Grade Points
A+	5
A	4
B	3
C	2
D	1
E	0

2. Grade Point Average: Internal and External components are separately graded and the combined grade point with weightage **1** for Internal and **4** for external shall be applied to calculate the **Grade Point Average (GPA)** of each course. Letter grade shall be assigned to each course based on the categorization based on the **Ten point Scale** shown below.

The Grade Range for both Internal & External shall be:

Letter Grade	Grade Range	Range of Percentage(%)	Merit /Indicator
O	4.25 – 5.00	85.00 – 100.00	Outstanding
A+	3.75 – 4.24	75.00 – 84.99	Excellent
A	3.25 – 3.74	65.00 – 74.99	Very Good
B+	2.75 – 3.24	55.00 – 64.99	Good
B	2.50 – 2.74	50.00 – 54.99	Above Average
C	2.25 – 2.49	45.00 – 49.99	Average
P	2.00 -2.24	40.00 – 44.99	Pass
F	< 2.00	Below 40	Fail
I	0	-	Incomplete
Ab	0	-	Absent

No separate minimum is required for internal evaluation for a pass, but a minimum **P** Grade is required for a pass in the external evaluation. However, a minimum **P** grade is required for pass in a course. A student who fails to secure a minimum grade for a pass in a course will be permitted to write the examination along with the next batch.

3. Semester Grade Point Average(SGPA)

The **SGPA** is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses taken by a student. After the successful completion of a semester, **Semester Grade Point Average (SGPA)** of a student in that semester is calculated using the formula given below.

Semester Grade Point Average - SGPA (S_i) = $\Sigma (C_i \times G_i) / Cr$ (SGPA= Total Credit Points awarded in a semester / Total credits of the semester)

where 'S_j' is the jth semester, 'G_i' is the grade point scored by the student in the ith course 'C_i' is the credit of the ith course, 'Cr' is the total credits of the semester.

4. Cumulative Grade Point Average (CGPA)

$$\text{Cumulative Grade Point Average (CGPA)} = \frac{\sum(C_i \times S_i)}{Cr} \text{ (CGPA = Total Credit points awarded in all semesters / Total credits of the programme)}$$

where C_i is the credit of the ith semester S_i is the **SGPA** of the ith semester and Cr is the total number of credits in the programme. The **CGPA** is also calculated in the same manner, taking into account all the courses undergone by a student over all the semesters of a programme. The **SGPA** and **CGPA** shall be rounded off to 2 decimal points.

For the successful completion of a semester, a student should pass all courses and score a minimum **SGPA** of 2.0. However, the students are permitted to move to the next semester irrespective of their **SGPA**.

5. Evaluation of Audit Courses:

The examination and evaluation shall be conducted by the college itself either in the normal structure or MCQ model from the Question Bank and other guidelines. The Question paper shall be for minimum 20 weightage and a minimum of 2 hour duration for the examination. The result has to be intimated / uploaded to the Controller of Examinations during the Third Semester as per the notification.

g) INTERNAL EVALUATION / CONTINUOUS ASSESSMENT(CA)

This assessment shall be based on a predetermined transparent system involving periodic written tests, assignments, seminars and viva voce in respect of theory courses and based on tests, lab skill and records / viva voce in respect of practical courses. The criteria and percentage of weightage assigned to various components for internal evaluation are as follows

Theory :			
Sl.No	Component	Percentage	Weightage
1	Examination /Test	40%	2
2	Seminars / Presentation	20%	1
3	Assignment	20%	1
4	Attendance	20%	1
Practical :			
1	Lab Skill	40%	4
2	Records/viva voce	30%	3
3	Practical Test	30%	3

Grades given for the internal evaluation are based on the grades A+, A, B, C, D & E, with grade points 5, 4, 3, 2, 1 & 0 respectively. The overall grades shall be as per the Ten Point scale. There shall be no separate minimum Grade Point for internal evaluation.

Project:**Internal evaluation:**

- a) Monthly progress - wt=2
- b) Regularity and attendance -wt=1
- c) Seminar and Viva Voce- wt=1

h) PATTERN OF QUESTION PAPERS

a) Theory: Every semester Directions for question paper setters:

Part A: Set each questions to be answered in 7.5 minutes duration and should extract the critical knowledge acquired by the candidate in the subject.

Part B: 30 minutes answerable questions, each may be asked as a single question or parts.

Derivation type questions can be also asked.

Part C: 20 minutes answerable questions each and as far as possible include numerical type questions.

<i>Division</i>	<i>Type</i>	<i>No. of Questions</i>	<i>Weightage</i>	<i>Total Weightage</i>
Part A	Short Answer	8 (No Choice)	1	8
Part B	Essay	2 out of 4	5	10
Part C	Problems	4 out of 7	3	12
Total weightage for a question paper				30

Theory papers must contain at least 4 lectures plus 1 Tutorial. Project is equivalent to one theory paper (4 hours) and one practical (4 hours).

Answer to each question may be evaluated based on

- (a) Idea/knowledge – wt=1
- (b) Logic/steps – wt=1
- (c) Analytic skill – wt=1
- (d) Correctness – wt=1

b) Practical exam: At the end of II and IV semesters and each will be of 6 hours duration.

c) Project evaluation: At the end of IV semester. Its evaluation is based on:

External evaluation:

- a) Presentation-wt= 4
- b) Project Report (Novelty, Creativity & work) - wt =8
- c) Project viva voce - wt =4

d) Comprehensive Viva Voce at the end of IV semester.