जम्मू केंद्रीय विश्वविद्यालय
Central University of Jammu
राया–सूचानी (बागला), जिला सांबा–181143 जम्मू (जम्मू एवं कश्मीर)
Rahya- Suchani (Bagla), District Samba-181143, Jammu (J&K)

No. CUJ/Acad/II-14/6/2022/455

28/7 July, 2022

NOTIFICATION No. 111 / 2022

Sub: **Course Scheme and Syllabus of 9th & 10th Semesters of Integrated B.Sc. (Hons.) – M.Sc. Course in Physics w.e.f. Academic Session 2020-21 – Reg.**

Ref: Notification No. 68 of 2018 dated 02.11.2018

In continuation to Notification under reference, it is hereby notified for the information of all concerned that Academic Council has approved inclusion of two courses in 9th & 10th Semesters of Integrated B.Sc. (Hons.) – M.Sc. Course in Physics w.e.f. Academic Session 2020-21. Revised course scheme and syllabus is as follows:-

Semester 9th

Course Code	Course Title	Credit	CIA	MSE	ESE	Max Marks
	Core Courses					
ICPHY9C001T	Atomic & Molecular Physics	4	25	25	50	100
ICPHY9C002T	Nuclear and Particle Physics	4	25	25	50	100
ICPHY9C003T	Condensed Matter Physics	4	25	25	50	100
ICPHY9C001L	Special Physics Lab	4	25	25	50	100
	Elective Course (Any One)					
ICPHY9E001T	Materials Science – I	4	25	25	50	100
ICPHY9E002T	Advanced Statistical Physics					
ICPHY9E003T	Special Paper – I (Nuclear Theory-I)					
	Interdisciplinary Course					
ICPHY9I001T	Laser Physics	4	25	25	50	100
Total		**24**	-	-	-	**600**

Semester 10th

Course Code	Course Title	Credit	CIA	MSE	ESE	Max Marks
	Core Courses					
ICPHY10C001D	Physics Dissertation	12	-	-	-	300
	Elective Course (Any One)					
ICPHY10E001T	Materials Science – II	4	25	25	50	100
ICPHY10E002T	Nonlinear Dynamics					
ICPHY10E003T	Special Paper -II (Nuclear Theory-II)					
	Interdisciplinary Course					
ICPHY10I001T	Atmospheric Physics	4	25	25	50	100
Total		**20**	-	-	-	**500**

28/07/2022

(Dr. Yashwant Singh)
Registrar (I/c)
registrar@cujammu.ac.in
01923-249658

Encl: Syllabus of (ICPHY9E003T) of 9th & (ICPHY10E003T) of 10th Semester

To:
Head, Department of Physics and Astronomical Sciences

Copy to:-
Controller of Examinations

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Department of Physics & Astronomical Sciences

Ref. No. CUJ/DPHYS/2022/ Date:

Course Learning Outcomes of Semester Xth of Integrated B.Sc. (Hons.) – M.Sc. Physics

At the successful completion of the courses the student is expected to master the following.

Course Name & Course Code	Course Learning Outcomes
Physics Dissertation (ICPHY10C001D)	• After the successful completion of the M.Sc. course the student is expected to acquire skills/hands on experience / working knowledge on various machine tools, lathes, shapers, drilling machines, cutting tools, welding sets, various machine etc. and working with wooden and metal blocks. He /she will also acquire skills in the usage of various instruments for making electrical and electronics measurements using multimeter, oscilloscopes, power supply, electronic switches etc..
Material Science -II (ICPHY10C001T)	Students will have achieved the ability to: • differentiate between different type of materials, and their structures. • explain the structural dependence of properties
Atmospheric Physics (ICPHY10I001T)	• Understand the basic concept of Atmospheric compositions, equation of state for dry and moist air, adiabatic process. • To study the Aerosols, Aerosols as Cloud Condensation Nuclei (CCN). • To study the Elementary principle of electricity electric field, electrostatic potential, and Lightning discharge. • To Study the Temporal and spatial variation of ozone; Umkehr effect, stratospheric ozone, ozone flux from stratosphere to the troposphere, tropospheric ozone, ozone depletion, nature of radiations, scattering (Rayleigh and Mie), black body radiations, radiative transfer, nature of solar radiations.

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Program Outcomes of Semester Xth of Integrated B.Sc. (Hons.) – M.Sc. Physics

Course Objectives: It explain the importance of materials in materials science and engineering field and relate between material and engineering.

Course Name	Program Outcomes
Material Science -II (ICPHY10C001T)	The course includes the study of defects in crystals, magnetism, energy bands and dielectric and electrical properties of insulators. This course is of immense importance for the students seeking R & D opportunities in the field of theoretical condensed matter physics, material science, device fabrication, nanoscience and nanotechnology etc.

Program Specific Outcomes

At the end of this theory course in Solid State Physics, students would be able to

- Explain the concepts of point and space groups and experimental methods to find space groups, and to apply these for correct interpretation of x-ray diffraction data for crystal structure.
- Understand the influence of symmetry elements on physical properties of materials.
- Have understanding of exotic solids and their important applications.
- Appreciate the synthesis of few important Nanomaterials as well as characterization techniques.

Five years Integrated M.Sc. Physics			
Semester :	X	Type:	DSE
Course Name:	Special Paper-II (Materials Science –II)	Course Code:	
Credits:	4	L T P:	3-1-0

Unit I: Structural Analysis methods

Production and properties of X-ray; absorption of X-rays and filters; X-ray - diffraction directions, X-ray – and neutron diffraction methods. intensities, factors affecting intensity; working principles of diffractometer, counters and cameras. Indexing of XRD patterns; lattice parameter determination; determination of particle size and micro/macro strains.

Unit II: Thermal Analysis methods

Introduction – thermogravimetric analysis (TGA) – instrumentation – determination of weight loss and decomposition products – differential thermal analysis (DTA)- cooling curves - differential scanning calorimetry (DSC) – instrumentation – specific heat capacity measurements – determination of thermomechanical parameters.

Unit III: Spectroscopic methods

Optical microscopy techniques – Bright field optical microscopy – Dark field optical microscopy, Principles and instrumentation for UV-Vis-IR, FTIR spectroscopy; Raman spectroscopy; x-ray photoelectron spectroscopy(XPS); auger electron spectroscopy(AES) and their application.

Unit IV: Electron Microscopic methods

Construction and working principles of transmission electron microscopes; Scanning electron microscope; construction; interaction of electrons with matter; modes of operation; image formation of plane and fractured surfaces; Chemical analysis using electron beam devices like electron probe micro analysis, atomic force microscopy.

Unit V: Scattering Analysis methods

Principles and instrumentation for Particle size analysis techniques; dynamic light scattering; static light scattering image analysis; laser diffraction technique; zeta potential.

Text and References Books:

1. Elements of X-ray Diffraction, B. D. Cullity and S. R. Stock, Third edition, Prentice Hall, NJ.
2. Transmission Electron Microscopy: A Textbook for Materials Science, David B. Williams, C. Barry Carter, Springer.
3. Practical Electron Microscopy in Materials Science, J.W. Edington, 4 volumes reprinted by Tech Books, Herndon, USA.
4. Dynamic Light Scattering: With Applications to Chemistry, Biology, and Physics, B. J. Berne, R. Pecora, John Wiley & Sons, Inc., New York.

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Program Outcomes of Semester Xth of Integrated B.Sc. (Hons.) – M.Sc. Physics

Course Objectives: This course provides the primary window of research to each and every student. Students get acquainted with basics of research. Ethics and methodology of research are also taught to students.

Course Name	Program Outcomes
Physics Dissertation (ICPHY10C001D)	This course is based on preliminary research oriented topics both in theory and experiments. The students are given particular research problems under the supervision of faculty members of the department. Students have the opportunity to work on theoretical as well as experimental topics in physics. The different research areas in which students can do projects are theoretical condensed matter physics, experimental material science, nuclear radiation detectors, radiation physics and environmental radioactivity. The knowledge gained during their project work play a key role in the students' career to pursue Ph. D degree and start their carrier in research in scientific institutions.

Program Specific Outcomes

- The programme provides the candidate the required knowledge, general competence, and analytical skills on an advanced level, needed in industry, consultancy, education, research, or in public administration.
- The students would gain substantial knowledge in various branches of physics: Condensed matter Physics, astrophysics, and Nuclear Physics.
- This course would empower the student to acquire scientific and engineering skills and the required practical knowledge by performing experiments in general physics and electronics.
- Would also get some research oriented experience by doing theoretical and experimental projects in the last semester under the supervision of faculty.

Five years Integrated M.Sc. Physics			
Semester :	X	**Type:**	Core
Course Name:	Physics Dissertation	**Course Code:**	
Credits:	12	**L T P:**	0-0-18

The dissertation topics will be based on special papers or elective papers and topics of current interest.

A Departmental Committee will distribute the topics according to the skill and merit of the students.

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Program Outcomes of Semester Xth of Integrated B.Sc. (Hons.) – M.Sc. Physics

Course Objectives: To impart the basic and advanced knowledge of various processes and phenomena in the field of Atmosphere Science and Meteorology.

Course Name	Program Outcomes
Atmospheric Physics (ICPHY10I001T)	Develop deeper insights in multiple aspects of Atmospheric Science for better scientific understanding and interpretation of various atmospheric phenomena. Apply mathematical and computational tools and techniques to study atmospheric processes

Program Specific Outcomes

On completion of the course, the student should be able to:

- apply thermodynamics on dry and humid air
- determine if the atmosphere is stable or unstable from a vertical temperature profile
- describe how precipitation is created
- explain how motion (wind) is created in the atmosphere

Five years Integrated M.Sc. Physics			
Semester :	X	**Type:**	ID
Course Name:	Atmospheric Physics	**Course Code:**	
Credits:	4	**L T P:**	3-1-0

Unit I: Atmospheric Thermodynamics

Atmospheric compositions, equation of state for dry and moist air, adiabatic process, virtual temperature, humidity parameters, thermodynamic laws, potential temperature, pseudo adiabatic process, Clausius- Clapeyron equation, thermodynamic diagrams-general considerations, Emagram, Tephigram.

Unit II: Atmospheric Aerosols

Introduction to Aerosols, aerosol concentration and size distributions and its characteristics, sources of aerosols, transformation of aerosols, chemical composition of aerosols, transport of aerosols, sink of aerosols, residual time of aerosols, geographical distribution of aerosols, atmospheric effect of aerosols.

Unit III: Cloud Physics

Aerosols as Cloud Condensation Nuclei (CCN), heterogeneous and homogenous nucleation process, curvature and solute effect, condensation growth of cloud droplet by diffusion, collision and coalescence, collection efficiency, freezing nuclei, mechanism of growth of ice particles in cloud, formation of ice, rain making experiment, classification of clouds and hails.

Unit IV: Atmospheric Electricity

Elementary principle of electricity, electric field, electrostatic potential, charge separation in clouds, origin and distribution of ions, rate of ion pair production by cosmic rays as a function of height, conductivity, lightning discharge.

Unit V: Atmospheric Ozone Solar radiations

Temporal and spatial variation of ozone; Umkehr effect, stratospheric ozone, ozone flux from stratosphere to the troposphere, tropopsheric ozone, ozone depletion, nature of radiations, scattering (Rayleigh and Mie), black body radiations, radiative transfer, nature of solar radiations.

Text and References Books:

1. Introduction to theoretical Meteorology-S.Hess.
2. An introduction to Atmospheric Chemistry – By Peter V.Hobbs.
3. Tropical meteorology Vol.- I and II- G. C. Asnani.
4. Weather forecasting –A. A. Ramshastry.
5. Cloud physics-Rogers.
6. Cloud physics-Wallace &Bob.
7. Atmosphere, Weather and climate –K. Siddharth (Kisalaya Publication Pvt.Ltd).
8. Atmospheric Chemistry and Physics by John Seinfeld and S.N. Pandis, Wiley Interscience.