GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Deemed to be University)

VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A^{++} Grade

GITAM School of Science

CURRICULUM AND SYLLABUS

2 Year Postgraduate Programme
PPHYS02: M.Sc. Physics

w.e.f. 2025-26 admitted batch

(Updated on May 2025)

Academic Regulations

Applicable for the Postgraduate Programmes in the Schools of Humanities & Social Sciences and Science (except M.C.A)

https://www.gitam.edu/academics/academic-regulations

GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT

Vision

GITAM will be an exceptional knowledge-driven institution advancing on a culture of honesty and compassion to make a difference to the world.

Mission

- Build a dynamic application-oriented education ecosystem immersed in holistic development.
- Nurture valuable futures with global perspectives for our students by helping them find their ikigai.
- Drive impactful integrated research programmes to generate new knowledge, guided by integrity, collaboration, and entrepreneurial spirit.
- Permeate a culture of kindness within GITAM, fostering passionate contributors.

Quality Policy

To achieve global standards and excellence in teaching, research, and consultancy by creating an environment in which the faculty and students share a passion for creating, sharing and applying knowledge to continuously improve the quality of education.

GITAM School of Science

Vision

Nurturing a high-quality Science Education and Research by providing a best learning ecosystem to create world class academicians and researchers.

Mission

- To teach the most renewed curriculum that lay the foundation for students to start exciting careers in academia, research, and industry.
- To foster an environment of healthy curiosity, an innovative mindset, and a strong desire to contribute to the science world.
- To advance our understandings of the natural processes of Physical, Chemical and Biological systems for a better habitable world.
- To inculcate a strong sense of empathy, integrity, and trust in the GITAM Fraternity with a strong commitment towards society and environment.

VISION AND MISSION OF THE DEPARTMENT

VISION

To provide high-quality education and research in the physics by nurturing an immersive and enjoyable blended learning environment and evolving into a centre of product-based research with an industrial partnership.

MISSION

- An interdisciplinary curriculum to teach students to solve complicated challenges and innovate to meet social demands, from technology to sustainability.
- Foster a dynamic academic environment that promotes curiosity, critical thinking, and application-oriented learning in physics so students can excel in their careers.
- Translate material science, quantum technologies, and IoT research findings into commercialized novel products.
- Inculcate a culture of honesty, compassion, and kindness, motivating students to make meaningful contributions to society.

Programme Educational Objectives (PEOs)

PEO 1: Provide a comprehensive understanding of fundamental physics theories to support advanced academic or industrial pursuits.

PEO 2: Make students proficient in applying theoretical and experimental techniques to solve complex physics problems.

PEO 3: Instill communication, critical thinking, and problem-solving skills necessary for interdisciplinary research that benefits society.

PEO 4: Instill ethical values and a commitment to lifelong learning within the academic and scientific community.

PEO Articulation

	PEO1	PEO2	PEO3	PEO4
M1	3	2	2	2
M2	2	3	3	2
M3	2	2	3	2
M4	2	2	2	3

3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

At the end of the Programme the students would be able to demonstrate:

PO1: The graduates should be able to demonstrate the acquisition of:

- Advanced knowledge about a specialized field of enquiry with a critical understanding of the emerging developments and issues relating to one or more fields of learning.
- Advanced knowledge and understanding of the research principles, methods, and techniques applicable to the chosen field(s) of learning or professional practice.
- Procedural knowledge required for performing and accomplishing complex and specialized and professional tasks relating to teaching, and research and development.

PO2: The graduates should be able to demonstrate the acquisition of:

- Advanced cognitive and technical skills required for performing and accomplishing complex tasks related to the chosen fields of learning.
- Advanced cognitive and technical skills required for evaluating research findings and designing and conducting relevant research that contributes to the generation of new knowledge.
- Specialized cognitive and technical skills relating to a body of knowledge and practice to analyze and synthesize complex information and problems.

PO3: The graduates should be able to demonstrate the ability to:

- Apply the acquired advanced theoretical and/or technical knowledge about a specialized field of enquiry or professional practice and a range of cognitive and practical skills to identify and analyze problems and issues, including real-life problems, associated with the chosen fields of learning.
- Apply advanced knowledge relating to research methods to carry out research and investigations to formulate evidence-based solutions to complex and unpredictable problems.

PO4: The graduates should be able to demonstrate the ability to:

- Listen carefully, read texts and research papers analytically and present complex information in a clear and concise manner to different groups/audiences.
- Communicate, in a well-structured manner, technical information and explanations, and the findings/results of the research studies undertaken in the chosen field of study.
- Present in a concise manner view on the relevance and applications of the findings of recent research and evaluation studies in the context of emerging developments and issues.
- Meet one's own learning needs relating to the chosen fields of learning, work/vocation, and an area of professional practice.
- Pursue self-paced and self-directed learning to upgrade knowledge and skills, including research-related skills, required to pursue a higher level of education and research.
- Problematize, synthesize, and articulate issues and design research proposals.
- Define problems, formulate appropriate and relevant research questions, formulate hypotheses, test hypotheses using quantitative and qualitative data, establish

hypotheses, make inferences based on the analysis and interpretation of data, and predict cause-and-effect relationships.

- Develop appropriate tools for data collection for research.
- Use appropriate statistical and other analytical tools and techniques for the analysis of data collected for research and evaluation studies.
- Plan, execute, and report the results of an investigation.
- Follow basic research ethics and skills in practicing/doing ethics in the field/ in one's own research work.
- Make judgements and take decisions regarding the adoption of approaches to solving problems, including real-life problems, based on the analysis and evaluation of information and empirical evidence collected.
- Make judgement across a range of functions requiring the exercise of full responsibility and accountability for personal and/or group actions to generate solutions to specific problems associated with the chosen fields/subfields of study, work, or professional practice.

PO5: The graduates should be able to demonstrate the willingness and ability to:

- Embrace and practice constitutional, humanistic, ethical, and moral values in one's life.
- Adopt objective and unbiased actions in all aspects of work related to the chosen fields/subfields of study and professional practice.
- Participate in actions to address environmental protection and sustainable development issues.
- Support relevant ethical and moral issues by formulating and presenting coherent arguments.
- Follow ethical principles and practices in all aspects of research and unethical practices such as fabrication, falsification or misrepresentation of data or committing plagiarism.

PO6: The graduates should be able to demonstrate the acquisition of knowledge and skill sets required for:

- Adapting to the future of work and responding to the demands of the fast pace of technological developments and innovations that drive the shift in employers' demands for skills, particularly with respect to t h e transition towards more technology-assisted work involving the creation of new forms of work and rapidly changing work and production processes.
- Exercising full personal responsibility for the output of own work as well as for group/team outputs and for managing work that is complex and unpredictable requiring new strategic approaches.

PSO1: Students will develop expertise in allied areas of physics.

PSO2: Learn advanced experimental techniques through hands-on experience.

PSO3: Cultivate critical thinking skills to evaluate scientific literature and interpret results effectively and learn to collaborate on interdisciplinary research projects addressing complex scientific challenges.

Curriculum Structure

(Flexible Credit System)

Minimum Credit Requirements to Award Degree Under Each Category

Duration & Name of the Programme				S.No	Course Category		Minimum Credit Requirement		
Programme	Eligibility	Programme	Eligibility				2 Year PG (2nd year- Course Work alone)	2 Year PG (2nd year - Course Work and Research)	2 Year PG (2nd year - Research alone)
2-year PG Degree (with exit option at the end of first year)	3-year UG Degree	1 year & PG Diploma	3-year UG Degree	1	Programme Core Courses & Labs	PC	28	28	28
				2	Programme Electives Courses	PE	8	8	8
				3	Research Methodology	FC	4	4	4
				4	Seminar	FC	1	1	1
				5	Term Paper	FC	1	1	1
				6	Internship	FC	4	4	4
				Total (At the end of I Year)			46	46	46
		1 year & PG Degree	4-year UG Degree	7	Programme Core Courses	PC	40	20	0
				8	Programme Electives Courses	PE			
				9	Research Project	FC	0	20	0
				10	Research Dissertation	FC	0	0	40
				Total (At the end of II Year)			86	86	86

2 Year PG programme:

Semester I and II: Common Structure for Course Work, Course Work & Research and Research Alone

Course Code	Category	Level	Course Title	L	T	P	S	J	C
Semester - I									
25PHYS6001	PC	600	Mathematical Methods for Physics	4	0	0	0	0	4
25PHYS6011	PC	600	Electromagnetic Theory	4	0	0	0	0	4
25PHYS6021	PC	600	Classical Mechanics	4	0	0	0	0	4
25PHYS6031	PC	600	General Physics Laboratory	0	0	4	0	0	2
25PHYS6041	PC	600	Computational Physics Laboratory (using MATLAB and Python)	0	0	4	0	0	2
Choose any one of the following electives:									
25PHYS6051	PE	600	Microwave Circuits and Devices	4	0	0	0	0	4
25PHYS6061	PE	600	Astrophysics	4	0	0	0	0	4
25PHYS6071	PE	600	Advanced Python Programming for Physics	4	0	0	0	0	4
			Total Credits						**20**
Semester - II									
25PHYS6081	PC	600	Quantum Mechanics	4	0	0	0	0	4
25PHYS6091	PC	600	Atomic and Molecular Physics	4	0	0	0	0	4
25PHYS6101	PC	600	Modern Physics Laboratory	0	0	4	0	0	2
25PHYS6111	PC	600	Spectroscopy and Microscopy Techniques/Measurements Laboratory	0	0	4	0	0	2
25PHYS6444	FC	600	Research Methodology	4	0	0	0	0	4
25PHYS6777	FC	600	Term Paper	0	0	0	0	2	1
25PHYS6666	FC	600	Seminar	0	0	0	0	2	1
25PHYS6333	FC	600	Internship	0	0	0	0	8	4
Choose any one of the following electives:									
25PHYS6121	PE	600	Atmospheric Physics	4	0	0	0	0	4
25PHYS6131	PE	600	Bioelectromagnetics	4	0	0	0	0	4
25PHYS6141	PE	600	Physics of Semiconductor devices	4	0	0	0	0	4
			Total Credits						**26**

2nd Year - Research alone:

Course Code	Category	Level	Course Title	L	T	P	S	J	C
Semester - III									
25PHYS7888	FC	700	Research Dissertation - I	0	0	0	0	40	20
			Total Credits						**20**
Semester – IV									
25PHYS7999	FC	700	Research Dissertation - II	0	0	0	0	40	20
			Total Credits						**20**

2nd Year – 'Course Work alone' & 'Coursework and Research':

Semester – III (Common Structure for 'Course Work alone' & 'Course Work and Research')									
Course Code	**Category**	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
25PHYS7001	PC	700	Solid State Physics	4	0	0	0	0	4
25PHYS7011	PC	700	Statistical Mechanics	4	0	0	0	0	4
25PHYS7021	PC	700	Computational Materials and Statistical Physics Laboratory	0	0	4	0	0	2
25PHYS7031	PC	700	Material Characterization Laboratory	0	0	4	0	0	2
Choose any two of the following electives:									
25PHYS7041	PE	700	Physics of Thin Films	4	0	0	0	0	4
25PHYS7051	PE	700	Advanced Quantum Mechanics	4	0	0	0	0	4
25PHYS7061	PE	700	Magnetism and Superconductivity	4	0	0	0	0	4
25PHYS7071	PE	700	Quantum Information and computing	4	0	0	0	0	4
25PHYS7081	PE	700	General Theory of Relativity	4	0	0	0	0	4
25PHYS7091	PE	700	Lasers and Nonlinear optics	4	0	0	0	0	4
			Total Credits						**20**

Course Work alone

Semester - IV									
Course Code	**Category**	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
25PHYS7101	PC	700	Electronic Devices and Circuits	4	0	0	0	0	4
25PHYS7111	PC	700	Nuclear and Particle Physics	4	0	0	0	0	4
25PHYS7121	PC	700	Electronic Devices and Circuits Laboratory	0	0	4	0	0	2
25PHYS7131	PC	700	Nuclear Physics Laboratory	0	0	4	0	0	2
Choose any two of the following electives:									
25PHYS7141	PE	700	Quantum Optics and Photonic Computing	4	0	0	0	0	4
25PHYS7151	PE	700	Physical principles in Biological Systems	4	0	0	0	0	4
25PHYS7161	PE	700	Data-Driven Physics	4	0	0	0	0	4
25PHYS7171	PE	700	Topology in Quantum Materials	4	0	0	0	0	4
25PHYS7181	PE	700	Energy Storage Materials	4	0	0	0	0	4
25PHYS7191	PE	700	Physics of Strongly Correlated Systems	4	0	0	0	0	4
			Total Credits						**20**

Coursework and Research

Semester – IV									
Course Code	**Category**	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
25PHYS7555	FC	700	Research Project	0	0	0	0	40	20
			Total Credits						**20**

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