

**GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)**

(Deemed to be University)

VISAKHAPATNAM \* HYDERABAD \* BENGALURU

Accredited by NAAC with A<sup>++</sup> Grade

**GITAM School of Science**



**CURRICULUM AND SYLLABUS**

**4 Year Undergraduate Programme**

**UPHYS07: B.Sc. Physics**

w.e.f. 2024-25 admitted batch

(Updated on July 2024)

# Academic Regulations

**Applicable for the Undergraduate Programmes in the  
Schools of Business(except B.Com), Humanities & Social Sciences  
and Science (except B.Sc.(CSCS), B.Optomety, B.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**

To nurture outstanding Science Education and build a vibrant world-class research and innovation ecosystem.

## **Mission**

1. To provide a flexible, responsive, and adaptive curriculum that emphasizes experiential learning and allows students to realize their full potential.
2. To develop high-impact research knowledge and solutions to improve the communities in which we live.
3. To promote a culture of high curiosity, enterprising mindset and keen desire to contribute to society.
4. To inculcate empathy, integrity, and trust in the GITAM fraternity with a strong commitment towards society and environment.

## **VISION AND MISSION OF THE DEPARTMENT**

### **VISION**

### **MISSION**

**UPHYS07: B.Sc. Physics**  
**(w.e.f.2023-24 Admitted Batch)**

**Programme Educational Objectives (PEOs)**

- PEO 1:** To introduce the foundations of various concepts in the Physics.
- PEO 2:** To develop a deep understanding of the Physics and allied areas from empirically grounded work in local and global contexts.
- PEO 3:** To foster a scientific temper in students.
- PEO 4:** To instill research capabilities among the students.
- PEO 5:** To enhance the ability of students towards the use of Physics knowledge in developing applications

**PEO Articulation**

	<b>PEO1</b>	<b>PEO2</b>	<b>PEO3</b>	<b>PEO4</b>	<b>PEO5</b>
<b>M1</b>	3	2	2	2	3
<b>M2</b>	2	3	3	3	3
<b>M3</b>	2	2	3	3	3
<b>M4</b>	2	3	2	1	2

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

## UPHYS07: B.Sc. Physics

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

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

- PO1:** Complex problem-solving:
- To solve different kinds of problems in familiar and non-familiar contexts and apply the learning to real-life situations.
- PO2:** Critical thinking:
- Apply analytic thought to a body of knowledge, including the analysis and evaluation of policies, and practices, as well as evidence, arguments, claims, beliefs, and the reliability and relevance of evidence.
  - Identify relevant assumptions or implications and formulate coherent arguments.
  - Identify logical flaws and holes in the arguments of others.
  - Analyze and synthesize data from a variety of sources and draw valid conclusions and support them with evidence and examples.
- PO3:** Creativity:
- Create, perform, or think in different and diverse ways about the same objects or scenarios.
  - Deal with problems and situations that do not have simple solutions.
  - Innovate and perform tasks in a better manner.
  - View a problem or a situation from multiple perspectives.
  - Think 'out of the box' and generate solutions to complex problems in unfamiliar contexts.
  - Adopt innovative, imaginative, lateral thinking, interpersonal skills and emotional intelligence.
- PO4:** Communication Skills:
- Listen carefully, read texts and research papers analytically and present complex information in a clear and concise manner to different groups / audiences.
  - Express thoughts and ideas effectively in writing and orally and communicate with others using appropriate media.
  - Confidently share views and express herself / himself.
  - Construct logical arguments using correct technical language related to a field of learning, work/vocation, or an area of professional practice, and convey ideas, thoughts, and arguments using language that is respectful and sensitive to gender and other minority groups.
- PO5:** Analytical reasoning/thinking:
- Evaluate the reliability and relevance of evidence.
  - Identify logical flaws in the arguments of others.
  - Analyze and synthesize data from a variety of sources-draw valid conclusions and support them with evidence and examples, and address opposing viewpoints.
- PO6:** Research-related skills:
- A keen sense of observation, inquiry, and capability for asking relevant/ appropriate questions.
  - The ability to problematize, synthesize, and articulate issues and design research proposals.
  - The ability to 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.
  - The capacity to develop appropriate methodology and tools for data collection.
  - The appropriate use of statistical and other analytical tools and techniques.

- The ability to plan, execute and report the results of an experiment or investigation, the ability to acquire the understanding of basic research ethics and skills in practicing/doing ethics in the field/ in personal research work, regardless of the funding authority or field of study.
- PO7:** Coordinating/collaborating with others:
- Work effectively and respectfully with diverse teams.
  - Facilitate cooperative or coordinated effort on the part of a group.
  - Act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.
- PO8:** Leadership readiness/qualities:
- Mapping out the tasks of a team or an organization and setting direction.
  - Formulating an inspiring vision and building a team that can help achieve the vision, motivating and inspiring team members to engage with that vision.
  - Using management skills to guide people to the right destination.
- PO9:** Learning how to learn skills:
- Acquire new knowledge and skills, including 'learning how to learn skills, that are necessary for pursuing learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social, and cultural objectives, and adapting to changing trades and demands of the workplace, including adapting to the changes in work processes in the context of the fourth industrial revolution, through knowledge / skill development / re-skilling.
  - Work independently; identify appropriate resources required for further learning.
  - Acquire organizational skills and time management to set self-defined goals and targets with timelines.
  - Inculcate a healthy attitude to be a lifelong learner.
- PO10:** Digital and technological skills:
- Use ICT in a variety of learning and work situations.
  - Access, evaluate, and use a variety of relevant information sources, and use appropriate software for analysis of data.
- PO11:** Multicultural competence and inclusive spirit:
- The acquisition of knowledge of the values and beliefs of multiple cultures and a global perspective to honour diversity.
  - Capability to effectively engage in a multicultural group/society and interact respectfully with diverse groups.
  - Capability to lead a diverse team to accomplish common group tasks and goals.
  - Gender sensitivity and adopting a gender-neutral approach, as also empathy for the less advantaged and the differently-abled including those with learning disabilities.
- PO12:** Value inculcation:
- Embrace and practice constitutional, humanistic, ethical, and moral values in life, including universal human values of truth, righteous conduct, peace, love, non-violence, scientific temper, citizenship values.
  - Practice responsible global citizenship required for responding to contemporary global challenges, enabling learners to become aware of and understand global issues and to become active promoters of more peaceful, tolerant, inclusive, secure, and sustainable societies.
  - Formulate a position/argument about an ethical issue from multiple perspectives.
  - Identify ethical issues related to work, and follow ethical practices, including avoiding unethical behavior such as fabrication, falsification or misrepresentation of data, or committing plagiarism, and adhering to intellectual property rights.
  - Recognize environmental and sustainability issues and participate in actions to promote sustainable development.
  - Adopt an objective, unbiased, and truthful actions in all aspects of work.
  - Instill integrity and identify ethical issues related to work, and follow ethical practices.



- PO13:** Autonomy, responsibility, and accountability:
- Apply knowledge, understanding, and/or skills with an appropriate degree of independence relevant to the level of the qualification.
  - Work independently, identify appropriate resources required for a project, and manage a project through to completion.
  - Exercise responsibility and demonstrate accountability in applying knowledge and/or skills in work and/or learning contexts appropriate for the level of the qualification, including ensuring safety and security at workplaces.
- PO14:** Environmental awareness and action:
- Ability to apply the knowledge, skills, attitudes, and values required to take appropriate actions for.
  - Mitigating the effects of environmental degradation, climate change, and pollution.
  - Effective waste management, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development and living.
- PO15:** Community engagement and service:
- To participate in community-engaged services/ activities for promoting the wellbeing of society.
- PO16:** Empathy:
- To identify with or understand the perspective, experiences, or points of view of another individual or group, and to identify and understand other people's emotions.
- PSO1:** Acquire knowledge the core concept of Physics subjects and excel in Experimental and Theoretical Physics.
- PSO2:** The aptitude to employ modern tools and techniques for problem-solving across diverse domains within the field of Physics.
- PSO3:** Acquire research oriented learning that develops analytical and integrative problem-solving approaches.
- PSO4:** Acquire analytical and logical skills required for higher Education/Academics/ Industry.

**Curriculum Structure**  
*(Flexible Credit System)*

**Minimum Credit Requirements to Award Degree Under Each Category**

S.No.	Course Category and Category Code		Minimum Credit Requirement					
			3 Year Undergraduate		4 Year Undergraduate (Hons.)		4 Year Undergraduate (Hons.) with Research	
			Credits	(%)	Credits	(%)	Credits	(%)
1	Multidisciplinary Core Courses	MDC	12	10	12	7.5	12	7.5
2	Major Core	MC	42	35.00	74	46.25	62	38.75
3	Major Electives	ME	18	15	18	11.25	18	11.25
4	Minor	MI	24	20	32	20	32	20
5	Internship	INT	04	3.40	04	2.50	04	2.50
6	Ability Enhancement Courses – University Core	UC	08	6.60	08	05	08	05
7	Skill Enhancement Courses – University Core	UC	08	6.60	08	05	08	05
8	Value Added Courses – University Core	UC	04	3.40	04	2.50	04	2.50
9	Research Project / Dissertation	PROJ	--	00	--	00	12	7.50
<b>Total</b>			<b>120</b>	<b>100</b>	<b>160</b>	<b>100</b>	<b>160</b>	<b>100</b>

**Multi-disciplinary Core Courses (MDC): 12 credits**

Course Code	Level	Course Title	L	T	P	S	J	C
<b>Basket - Business (Minimum 4 credits)</b>								
HRMG1012	100	<a href="#">Principles of Management</a>	2	0	0	0	0	2
IENT1061	100	<a href="#">Introduction to Business Environment</a>	2	0	0	0	0	2
INFS1011	100	<a href="#">Technology and Business</a>	2	0	0	0	0	2
STGM1011	100	<a href="#">Introduction to Business Organization</a>	2	0	0	0	0	2
<b>Basket - Humanities and Social Sciences (Minimum 4 Credits)</b>								
SOCY1071	100	<a href="#">Introduction to the Humanities</a>	2	0	0	0	0	2
SOCY1081	100	<a href="#">Foundations of Social Sciences</a>	2	0	0	0	0	2
MSTU1081	100	<a href="#">Media and Communication</a> (Offered in Hyderabad Campus alone)	2	0	0	0	0	2
FPEA1221	100	<a href="#">Performing Arts in Indian Cinema</a>	2	0	0	0	0	2
LANG1261	100	<a href="#">The Art of Storytelling</a>	2	0	0	0	0	2
<b>Basket - Science (Minimum 4 Credits)</b>								
PHYS1371	100	<a href="#">Introduction to Astronomy and Astrophysics</a>	2	0	0	0	0	2
LFSC1001	100	<a href="#">Essentials of Life Processes</a>	2	0	0	0	0	2
LFSC1011	100	<a href="#">Fundamentals of Natural and Chemical Sciences</a>	2	0	0	0	0	2
MATH1371	100	<a href="#">Conceptual Mathematics</a>	2	0	0	0	0	2
CSCI1341	100	<a href="#">Fundamentals of Computer Science</a>	2	0	0	0	0	2
<b>Total Credits</b>								<b>12</b>

**Major Core (MC): 42 credits**

Course Code	Level	Course Title	L	T	P	S	J	C
PHYS1261	100	<a href="#">Mechanics</a>	2	0	2	0	0	3
PHYS1271	100	<a href="#">Mathematical Physics I</a>	3	0	0	0	0	3
PHYS2401	200	<a href="#">Waves and Optics</a>	2	0	2	0	0	3
PHYS2002	200	<a href="#">Electricity &amp; Magnetism</a>	2	0	2	0	0	3
PHYS2321	200	<a href="#">Mathematical Physics II</a>	3	0	0	0	0	3
PHYS2411	200	<a href="#">Computational Physics</a>	2	0	2	0	0	3
PHYS2391	200	<a href="#">Thermal Physics</a>	2	0	2	0	0	3
PHYS2341	200	<a href="#">Modern Physics</a>	2	0	2	0	0	3
PHYS2371	200	<a href="#">Quantum Mechanics I</a>	3	0	0	0	0	3
PHYS2241	200	<a href="#">Classical Mechanics</a>	3	0	0	0	0	3
PHYS2331	200	<a href="#">Mathematical Physics III</a>	3	0	0	0	0	3
PHYS3391	300	<a href="#">Statistical Mechanics</a>	3	0	0	0	0	3
PHYS3281	300	<a href="#">Electrodynamics</a>	3	0	0	0	0	3
PHYS3381	300	<a href="#">Solid State Physics</a>	3	0	0	0	0	3
<b>Total Credits</b>								<b>42</b>

**Major Electives (ME): 18 credits**

Minimum number of credits to be earned: 18.

Course Code	Level	Course Title	L	T	P	S	J	C
<b>(Any One course to be chosen)</b>								
PHYS2271	200	<a href="#">Digital Electronics</a>	3	0	0	0	0	3
PHYS2311	200	<a href="#">Electronic instrumentation</a>	3	0	0	0	0	3
PHYS2521	200	<a href="#">Electronic Product Design and Development</a>	2	1	0	0	0	3
PHYS2531	200	<a href="#">Hand-on Scientific Visualization</a>	3	0	0	0	0	3
PHYS3191	300	<a href="#">Physics of Nanomaterials</a>	3	0	0	0	0	3
PHYS3351	300	<a href="#">Quantum Mechanics II</a>	3	0	0	0	0	3
PHYS3341	300	<a href="#">Nuclear and Particle Physics</a>	3	0	0	0	0	3
PHYS3132	300	<a href="#">Essentials of Biophysics</a>	3	0	0	0	0	3
PHYS3221	300	<a href="#">Atomic and Molecular Physics</a>	3	0	0	0	0	3
PHYS3451	300	<a href="#">Basics of Quantum Computing</a>	3	0	0	0	0	3
PHYS4201	400	<a href="#">Essential Physics for Characterization</a>	3	0	0	0	0	3
PHYS4211	400	<a href="#">Introduction to Material Modelling and Simulation</a>	3	0	0	0	0	3

**Internship (INT)**

Course code	Level	Course Title	L	T	P	S	J	C
INTN3444	300	Internship	2	0	0	0	8	4

**University Core (UC): 20 credits**

Course code	Level	Course Title	L	T	P	S	J	C
<b>Ability Enhancement Courses</b>								
LANG1042	100	<a href="#">Academic Writing</a>	2	0	0	0	0	2
LANG1201	100	<a href="#">Critical Thinking</a>	2	0	0	0	0	2
IENT1051	100	<a href="#">Fundamentals of Entrepreneurship</a>	2	0	0	0	0	2
LANG1241	100	<a href="#">Communicative English - I</a>	0	0	4	0	0	2
LANG1251	100	<a href="#">Communicative English - II</a>	0	0	4	0	0	2
<b>Skill Enhancement Courses</b>								
CSCI1302	100	<a href="#">Introduction to Programming</a>	0	0	4	0	0	2
CSCI1312	100	<a href="#">Introduction to Data Science</a>	0	0	4	0	0	2
CLAD1041	100	<a href="#">Art of Persuasive Communication</a>	0	0	2	0	0	1
CLAD1051	100	<a href="#">Competence in Communication</a>	0	0	2	0	0	1
CLAD1061	100	<a href="#">Life Skills</a>	0	0	2	0	0	1
CLADXXXX	100	Soft Skills - 4	0	0	2	0	0	1
<b>Value Added Courses</b>								
ENVS1003	100	<a href="#">Environmental Studies</a>	3	0	0	0	0	3
POLS1051	100	<a href="#">The Indian Constitution *</a>	1	0	0	0	0	1
<b>Pass / Fail Courses (Mandatory)</b>								
FINA1081	100	<a href="#">Personal Financial Planning *</a>	1	0	0	0	0	1
PHPY1011	100	<a href="#">Gandhi and the Contemporary World * / UHV</a>	1	0	0	0	0	1
<b>Pass / Fail Courses (Any one course to be chosen)</b>								
DOSP1181	100	<a href="#">Yogasana</a>	0	0	0	2	0	1
MFST1002	100	<a href="#">Health and Wellbeing *</a>	0	0	2	0	0	1
DOSL1081	100	<a href="#">Student Life Activities (Participant)</a>	0	0	0	2	0	1
DOSL1091	100	<a href="#">Student Life Activities (Organizer)</a>	0	0	0	2	0	1
DOSL1101	100	<a href="#">Student Life Activities (Competitor)</a>	0	0	0	2	0	1
DOSL1111	100	<a href="#">Foundations of Student (Leadership)</a>	0	0	0	2	0	1
DOSL1042	100	<a href="#">Community Services – Volunteer</a>	0	0	2	0	0	1
DOSL1052	100	<a href="#">Community Services – Mobilizer</a>	0	0	2	0	0	1
DOSP1003	100	<a href="#">Badminton</a>	0	0	0	2	0	1
DOSP1033	100	<a href="#">Football</a>	0	0	0	2	0	1
DOSP1043	100	<a href="#">Volleyball</a>	0	0	0	2	0	1
DOSP1053	100	<a href="#">Kabaddi</a>	0	0	0	2	0	1
DOSP1073	100	<a href="#">Table Tennis</a>	0	0	0	2	0	1
DOSP1083	100	<a href="#">Handball</a>	0	0	0	2	0	1
DOSP1093	100	<a href="#">Basketball</a>	0	0	0	2	0	1
DOSP1113	100	<a href="#">Throw ball</a>	0	0	0	2	0	1
DOSP1142	100	<a href="#">Cricket</a>	0	0	0	2	0	1
DOSP1132	100	<a href="#">Functional Fitness</a>	0	0	0	2	0	1
DOSP1171	100	<a href="#">Martial Arts/Self Defence</a>	0	0	0	2	0	1

\* Massive Open Online Course (MOOC)

*Students pursuing 4<sup>th</sup> year of the Programme need to choose the courses from the respective basket of Honours or Honours with Research*

### Honours Courses

Minimum number of credits to be earned: 32.

Course Code	Level	Course Title	L	T	P	S	J	C
PHYS4001	400	<a href="#">Condensed Matter Physics</a>	4	0	0	0	0	4
PHYS4011	400	<a href="#">Great Experiments in Physics</a>	4	0	0	0	0	4
PHYS4021	400	<a href="#">Soft Condensed Matter Physics</a>	4	0	0	0	0	4
PHYS4031	400	<a href="#">Relativistic Physics</a>	4	0	0	0	0	4
PHYS4041	400	<a href="#">Quantum Information and Computation</a>	4	0	0	0	0	4
PHYS4051	400	<a href="#">Photonics and Laser Physics</a>	3	0	2	0	0	4
PHYS4061	400	<a href="#">Plasma Physics</a>	4	0	0	0	0	4
PHYS4071	400	<a href="#">Thin Film Technology</a>	4	0	0	0	0	4

### Honours with Research Courses

Minimum number of credits to be earned is 32 out of which 12 credits must be earned through Research Project / Dissertation

Course Code	Level	Course Title	L	T	P	S	J	C
<b>(Any Three courses to be chosen)</b>								
PHYS4001	400	<a href="#">Condensed Matter Physics</a>	4	0	0	0	0	4
PHYS4011	400	<a href="#">Great Experiments in Physics</a>	4	0	0	0	0	4
PHYS4021	400	<a href="#">Soft Condensed Matter Physics</a>	4	0	0	0	0	4
PHYS4031	400	<a href="#">Relativistic Physics</a>	4	0	0	0	0	4
PHYS4041	400	<a href="#">Quantum Information and Computation</a>	4	0	0	0	0	4
<b>(Any two courses to be chosen)</b>								
PHYS4081	400	<a href="#">Medical Physics</a>	4	0	0	0	0	4
PHYS4051	400	<a href="#">Photonics and Laser Physics</a>	3	0	2	0	0	4
PHYS4061	400	<a href="#">Plasma Physics</a>	4	0	0	0	0	4
PHYS4071	400	<a href="#">Thin Film Technology</a>	4	0	0	0	0	4
<b>Research Project / Dissertation (PROJ)</b>								
DIST4888	400	Dissertation - I (Review of Literature & Research Proposal)	0	0	0	0	4	4
DIST4999	400	Dissertation – II	4	0	0	0	8	8

**Minor Courses**

One Minor is to be chosen from the following list of Minors.

The minimum number of credits to be earned up to 3 years of the programme is 24.

The minimum number of credits to be earned for the 4 year programme is 32.

**Minors List**

S.No.	Minor	Offered by School	Credits Required	
			3-Year UG	4-Year UG
1	<a href="#">Business Analytics (Except for GSB)</a>	Business	24	32
2	<a href="#">Business Management (Except for GSB)</a>	Business	24	32
3	<a href="#">Financial Markets (Except for GSB)</a>	Business	24	32
4	<a href="#">Psychology</a>	Humanities	24	32
5	<a href="#">Economics</a>	Humanities	24	32
6	<a href="#">English</a>	Humanities	24	32
7	<a href="#">Bharatanatyam</a>	Humanities	24	32
8	<a href="#">Carnatic Vocal</a>	Humanities	24	32
9	<a href="#">Choreography and Screen Dance</a>	Humanities	24	32
10	<a href="#">Kuchipudi</a>	Humanities	24	32
11	<a href="#">Mohiniyattam</a>	Humanities	24	32
12	<a href="#">Mridangam</a>	Humanities	24	32
13	<a href="#">Theatre Arts</a>	Humanities	24	32
14	<a href="#">Visual Arts</a>	Humanities	24	32
15	<a href="#">History</a>	Humanities	24	32
16	<a href="#">Mass communication (Hyd)</a>	Humanities	24	32
17	<a href="#">Visual Communication (Hyd)</a>	Humanities	24	32
18	<a href="#">Sociology</a>	Humanities	24	32
19	<a href="#">Political Science</a>	Humanities	24	32
20	<a href="#">Public Policy (Hyd)</a>	Public Policy	24	32
21	<a href="#">Chemistry</a>	Science	24	32
22	<a href="#">Data Science</a>	Science	24	32
23	<a href="#">Biochemistry</a>	Science	24	32
24	<a href="#">Bioinformatics</a>	Science	24	32
25	<a href="#">Biotechnology</a>	Science	24	32
26	<a href="#">Environmental Management</a>	Science	24	32
27	<a href="#">Environmental Science</a>	Science	24	32
28	<a href="#">Microbiology</a>	Science	24	32
29	<a href="#">Food Science and Technology</a>	Science	24	32
30	<a href="#">Mathematics</a>	Science	24	32
31	<a href="#">Statistics</a>	Science	24	32
32	<a href="#">Atmospheric Physics</a>	Science	24	32
33	<a href="#">Climate Science</a>	Science	24	32
34	<a href="#">Electronics</a>	Science	24	32
35	<a href="#">Physics</a>	Science	24	32
36	<a href="#">Quantum Computing</a>	Science	24	32
37	<a href="#">Computer Science</a>	Technology	24	32
38	<a href="#">Data Analytics</a>	Technology	24	32
39	<a href="#">Machine Learning</a>	Technology	24	32





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