

# Study & Evaluation Scheme of

## Master of Science (Physics)

[Applicable for Academic Session 2019-20]



**TEERTHANKER MAHAVEER UNIVERSITY**

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## Program Structure-M.Sc. Physics

### A. Introduction:

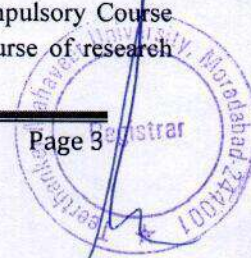
The main goal of physics is to explain how things move in space and time and to understand how the universe behaves. It studies matter, forces and their effects. Physics is a science of nature which deals the various phenomena including our daily life as well as interaction at smallest scales. It is not only satisfies our curiosity to understand galaxy and universe but also the backbone of engineering and technology. The scope of physics is broadly divided into classical and modern physics. The key areas of classical physics comprise special relativity, classical mechanics, statistical mechanics, thermodynamics and EM theory. The modern physics deals quantum mechanics, atomic physics, nuclear particle physics, condensed matter physics, laser physics etc. Development of new interdisciplinary subjects like nano-science, biophysics, and their applications from physics point of view added new dimension. Thus, the degree program in physics also intended to cover overlapping areas of physics with chemistry, biology, medical sciences and engineering. Further, subjects such as MATLAB studies can be helpful for students/faculty members to broaden their skills. Therefore, as a part of efforts to enhance employability, the curricula also include learning experience with industries and research laboratories as interns. In addition, national lab visits/industrial visits/projects are encouraged and added to the curriculum in order to enhance better exposure for research perspective. This modified syllabus drafted to enable the graduate prepare for national as well as international competitive examinations, such as GATE, UGC-CSIR NET, JEST, scientific officer exam in national research centers, UPSC Civil Services Examination as well as for GRE physics for abroad Ph.D. The Course is designed with several mathematical and computational tools along with domain knowledge enables them to develop several physical models required by various software as well as core industries which in turn enhances their job as well as entrepreneurship opportunities..

### B. Choice Based Credit System (CBCS)

Choice Based Credit System (CBCS) is a versatile and flexible option for each student to achieve his target number of credits as specified by the UGC and adopted by our University.

The following is the course module designed for the M.Sc. program:

- **Core competency:** Core courses of M.Sc. Physics are intended to provide deep understanding and interpreting skill of physical information – verbally, mathematically and graphically. The theoretical study along with laboratory courses also provides the connection between theoretical knowledge taught in textbooks/homework problems and the experimental foundations of this knowledge. A wide range of core courses provides a deep understanding of classical as well as modern physics and train the students to analyses, interpret not only the physical phenomena but also develop their decision-making ability and contribute to the other area of life. The core courses includes 12 theory Papers and 5 laboratory courses which covers both classical and modern Physics, classical mechanics, statistical physics, thermodynamics, electromagnetic theory and modern physics such as quantum physics, atomic & molecular physics solid state physics etc.
- **Program/Discipline Specific Elective Course (DSEC):** The discipline specific elective course is chosen to make students specialist or having specialized knowledge of a specific domain like nano-science, astrophysics, plasma physics, electronic instrumentation and biophysics etc. Three discipline specific elective courses offered in III and IV semester.
- **Ability Enhancement Compulsory Course (AECC):** As per the guidelines of Choice Based Credit System (CBCS) for all Universities, including the private Universities, the Ability Enhancement Compulsory Course (AECC) are suggested. To develop the ability of students for Research perspective one course of research methodology has been adopted.





- **Skilled communicator:** The course curriculum incorporates basics and advanced training in order to make a post graduate student capable of expressing the subject through technical writing as well as through oral presentation.
- **Critical thinker and problem solver:** The course curriculum also includes components that can be helpful to post graduate students to develop critical thinking ability by way of solving problems/numericals using basic & advance knowledge and concepts of Physics.
- **Sense of inquiry:** It is expected that the course curriculum will develop an inquisitive characteristic among the students through appropriate questions, planning and reporting experimental investigation.
- **Skilled project manager:** The course curriculum has been designed in such a manner as to enabling a post graduate student to become a skilled project manager by acquiring knowledge about mathematical project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.
- **Ethical awareness/reasoning:** A post graduate student requires understanding and developing ethical awareness/reasoning which the course curriculums adequately provide.
- **Lifelong learner:** The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.
- **Value Added Course (VAC):** A Value Added Course is a non-credit course which is basically meant to enhance general ability of students in areas like soft skills, quantitative aptitude and reasoning ability - required for the overall development of a student and at the same time crucial for industry/corporate demands and requirements. The student possessing these skills will definitely develop acumen to perform well during the recruitment process of any premier organization and will have the desired confidence to face the interview. Moreover, these skills are also essential in day-to-day life of the corporate world. The aim is to nurture every student for making effective communication, developing aptitude and a general reasoning ability for a better performance, as desired in corporate world. There shall be Two courses of Aptitude in Semester I, II semesters and two courses of Soft Skills in I&II Semesters and will carry no credit, however, it will be compulsory for every student to pass these courses with minimum 45% marks to be eligible for the certificate. These marks will not be included in the calculation of CGPI. Students have to specifically be registered in the specific course of the respective semesters.
- **Skill Enhancement Course:** This course may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge. We offer two SECs- one each in III Semester & IV Semester.

### C. Programme Specific Outcomes (PSOs)

The learning and abilities or skills that a student would have developed by the end of three-years M.Sc. Physics:

PSO – 1	Understanding and Learning the concepts in basic as well as certain advanced areas of Physics.
PSO – 2	Learning designing and performing experiments in the labs to demonstrate the concepts of principles learned in classrooms.
PSO – 3	Applying the knowledge acquired in the classrooms and laboratories to solve a wide range of problems in theoretical and experimental Physics.
PSO – 4	Analyzing the real life problems and to seek their solutions using one's own knowledge & understanding related to Physics.

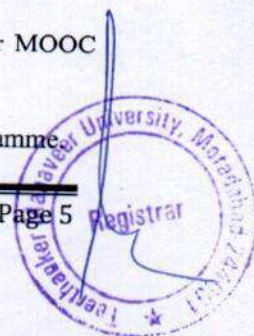


**D. Pedagogy & Unique practices adopted:**

“Pedagogy is the method and practice of teaching, especially for teaching an academic subject or theoretical concept”. In addition to conventional time-tested lecture method, the institute will **emphasize on experiential learning**:

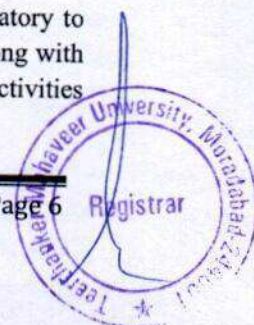
- **Role Play & Simulation:** Role-play and simulation are forms of experiential learning. Learners take on different roles, assuming a profile of a character or personality, and interact and participate in diverse and complex learning settings. Role-play and simulation function as learning tools for teams and groups or individuals as they “play” online or face-to-face. They alter the power ratios in teaching and learning relationships between students and educators, as students learn through their explorations and the viewpoints of the character or personality they are articulating in the environment. This student-centered space can enable learner-oriented assessment, where the design of the task is created for active student learning. Therefore, role-play & simulation exercises such as virtual share trading, marketing simulation etc. are being promoted for the practical-based experiential learning of our students.
- **Video Based Learning (VBL) & Learning through Movies (LTM):** These days technology has taken a front seat and classrooms are well equipped with equipment and gadgets. Video-based learning has become an indispensable part of learning. Similarly, students can learn various concepts through movies. In fact, many teachers give examples from movies during their discourses. Making students learn few important theoretical concepts through VBL & LTM is a good idea and method. The learning becomes really interesting and easy as videos add life to concepts and make the learning engaging and effective. Therefore, our institute is promoting VBL & LTM, wherever possible.
- **Field/Live Projects:** The students, who take up experiential projects in companies, where senior executives with a stake in teaching guide them, drive the learning. All students are encouraged to do some live project other their regular classes.
- **National Lab /Industrial Visits:** National Lab/industry visit are essential to give students hand-on exposure and experience of Research related area. Our institute organizes such visits to enhance students’ exposure to practical learning and work out for a report of such a visit relating to their specific topic, course or even domain.
- **MOOCs:** Students may earn credits by passing MOOCs as decided by the college. Graduate level programs may award Honors degree provided students earn pre-requisite credits through MOOCs. University allows students to undertake additional subjects/course(s) (In-house offered by the university through collaborative efforts or courses in the open domain by various internationally recognized universities) and to earn additional credits on successful completion of the same. Each course will be approved in advance by the University following the standard procedure of approval and will be granted credits as per the approval. Keeping this in mind, University proposed and allowed a maximum of two credits to be allocated for each MOOC courses. In the pilot phase it is proposed that a student undertaking and successfully completing a MOOC course through only NPTEL could be given 2 credits for each MOOC course. For smooth functioning and monitoring of the scheme the following shall be the guidelines for MOOC courses, Add-on courses carried out by the College from time to time.

- a) This is recommended for every student to take at least one MOOC Course throughout the programme.





- b) There shall be a MOOC co-ordination committee in the College with a faculty at the level of Professor heading the committee and all Heads of the Department being members of the Committee.
  - c) The Committee will list out courses to be offered during the semester, which could be requested by the department or the students and after deliberating on all courses finalize a list of courses to be offered with 2 credits defined for each course and the mode of credit consideration of the student. The complete process shall be obtained by the College before end of June and end of December for Odd and Even semester respectively of the year in which the course is being offered. In case of MOOC course, the approval will be valid only for the semester on offer.
  - d) Students will register for the course and the details of the students enrolling under the course along with the approval of the Vice Chancellor will be forwarded to the Examination department within fifteen days of start of the semester by the Coordinator MOOC through the Principal of the College.
  - e) After completion of MOOC course, Student will submit the photo copy of Completion certificate of MOOC Course to the Examination cell as proof.
  - f) Marks will be considered which is mentioned on Completion certificate of MOOC Course.
  - g) College will consider the credits only in case a student fails to secure minimum required credits then the additional subject(s) shall be counted for calculating the minimum credits required for the award of degree.
- **Special Guest Lectures (SGL) & Extra Mural Lectures (EML):** Some topics/concepts need extra attention and efforts as they either may be high in difficulty level or requires experts from specific industry/domain to make things/concepts clear for a better understanding from the perspective of the industry. Hence, to cater to the present needs of industry we organize such lectures, as part of lecture-series and invite prominent personalities from academia and industry from time to time to deliver their vital inputs and insights.
  - **Student Development Programs (SDP):** Harnessing and developing the right talent for the right industry an overall development of a student is required. Apart from the curriculum teaching various student development programs (training programs) relating to soft skills, interview skills, SAP, Advanced excel training etc. that may be required as per the need of the student and industry trends, are conducted across the whole program. Participation in such programs is solicited through volunteering and consensus.
  - **Industry Focused programmes:** Establishing collaborations with various industry partners to deliver the programme on sharing basis. The specific courses are to be delivered by industry experts to provide practice based insight to the students.
  - **Special assistance programme for slow learners & fast learners:** write the note how would you identify slow learners, develop the mechanism to correcting knowledge gap. Terms of advance topics what learning challenging it will be provided to the fast learners.
  - **Induction program:** Every year 3 weeks induction program is organized for 1<sup>st</sup> year students to make them familiarize with the entire academic environment of university including Curriculum, Classrooms, Labs, Faculty/ Staff members, Academic calendar and various activities.
  - **Mentoring scheme:** There is Mentor-Mentee system. One mentor lecture is provided per week in a class. Students can discuss their problems with mentor who is necessarily a teaching faculty. In this way, student's problems or issues can be identified and resolved.
  - **Extra-curricular Activities:** organizing & participation in extracurricular activities will be mandatory to help students develop confidence & face audience boldly. It brings out their leadership qualities along with planning & organizing skills. Students undertake various cultural, sports and other competitive activities within and outside then campus. This helps them build their wholesome personality.





- **Career & Personal Counseling:** - Identifies the problem of student as early as possible and gives time to discuss their problems individually as well as with the parents. Counseling enables the students to focus on behavior and feelings with a goal to facilitate positive change.

Its major role lies in giving: Advice, Help, Support, Tips, Assistance, and Guidance.

Strategies: a) Once in a week the counselors meet the students in order to inquire about problems. b) Available 24x7 on SOS basis.

- **Participation in Workshops, Seminars & writing & Presenting Papers:** Departments plan to organize the workshops, Seminars & Guest lecturers time to time on their respective topics as per academic calendar. Students must have to attend these programs. These participation would be count in the marks of general Discipline & General Proficiency which is the part of course scheme as non credit course.
- **Formation of Student Clubs, Membership & Organizing & Participating events:** Every department has the departmental clubs with the specific club name. The entire student's activity would be performed by the club. One faculty would be the coordinator of the student clubs & students would be the members with different responsibility.
- **Capability Enhancement & Development Schemes:** The Institute has these schemes to enhance the capability and holistic development of the students. Following measures/ initiatives are taken up from time to time for the same: Career Counseling, Soft skill development, Remedial Coaching, Bridge Course, Language Lab, Yoga and Meditation, Personal Counseling
- **Library Visit & Utilization of E-Learning Resources:** Student can visit the library from morning 10 AM to evening 8 PM. Library created its resources Database and provided Online Public Access Catalogue (OPAC) through which users can be accessed from any of the computer connected in the LAN can know the status of the book. Now we are in process to move from OPAC to KOHA.
  - a) Institute Library & Information is subscribing online e-books and e-journals databases (DELNET and EBSCO host E-databases) as per the requirement of the institute and fulfilling AICTE norms. IP based access is given to all computers connected on campus LAN to access e-journals.
  - b) For the effective utilization of resources, Information Literacy training programs are conducted to the staff and students.
  - c) Wi-Fi enabled campus
  - d) Regular addition of latest books and journals
  - e) Well maintained e-library to access e-resources