Study & Evaluation Scheme

of

Master of Science (Physics)

[Applicable for Academic Session 2020-21]

[As per CBCS guidelines given by UGC]

TEERTHANKER MAHAVEER UNIVERSITY

N.H.-24, Delhi Road, Moradabad, Uttar Pradesh-244001

Website: www.tmu.ac.in

TEERTHANKER MAHAVEER UNIVERSITY
(Established under Govt. of U.P. Act No. 30, 2008)
Delhi Road, Bagarpur, Moradabad (U.P.)

Study & Evaluation Scheme	
SUMMARY	
Institute Name	*Faculty of Engineering*
Programme	*M.Sc. Physics*
Duration	*Two Years full time(Four Semesters)*
Medium	*English*
Minimum Required Attendance	*75%*
Credits	
Maximum Credits	*105*
Minimum Credits Required for Degree	*100*

Assessment:

Evaluation			**Internal**	**External**	**Total**
Theory			40	60	100
Practical/ Dissertations/ Project Reports/ Viva-Voce			50	50	100
Class Test-1	**Class Test-2**	**Class Test-3**	**Assignment(s)**	**Attendance& Participation**	**Total**
Best two out of three					
10	10	10	10	10	40
Duration of Examination			**External**	**Internal**	
			3 Hours	1.5 Hours	

To qualify the course a student is required to secure a minimum of 45% marks in aggregate including the semester end examination and teachers continuous evaluation.(i.e. both internal and external).A candidate who secures less than 45% of marks in a course shall be deemed to have failed in that course. The student should have at least 45% marks in aggregate to clear the semester.

 # Provision for delivery of 25% content through online mode.

Policy regarding promoting the students from semester to semester & year to year. No specific condition to earn the credit for promoting the students from one semester to next semester.

Maximum no of years required to complete the program: N+2 (N=No of years for program)

Question Paper Structure	
1	*The question paper shall consist of six questions. Out of which first question shall be of short answer type (not exceeding 50 words) and will be compulsory. Question no. 2 to 6 (from Unit-I to V) shall have explanatory answers (approximately 350 to 400 words) along with having an internal choice within each unit.*
2	*Question No. 1 shall contain 8 parts from all units of the syllabus with at least one question from each unit and students shall have to answer any five, each part will carry 2 marks.*
3	*The remaining five questions shall have internal choice within each unit; each question will carry 10 marks.*
IMPORTANT NOTES:	
1	*The purpose of examination should be to assess the Course Outcomes (CO) that will ultimately lead to attainment of Programme Specific Outcomes (PSOs). A question paper must assess the following aspects of learning: Remember, Understand, Apply, Analyze, Evaluate & Create (reference to Bloom's Taxonomy).*

2	*Case Study is essential in every question paper (wherever it is being taught as a part of pedagogy) for evaluating higher-order learning. Not all the courses might have case teaching method used as pedagogy.*
3	*There shall be continuous evaluation of the student and there will be a provision of fortnight progress report.*

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 includingour 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 physicsis 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, condense 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 aboard 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..

The programme structure and credits for M.Sc. are finalized based on the stakeholders' requirements and general structure of the programme. Minimum number of classroom contact teaching credits for the M.Sc program will be 96 credits (one credit equals 1.0 hour) and Project and internship will be of (06+03) 09 credits. However, the minimum number of the credits for award of M.Sc. degree will be 100 credits. Out of 96 credits of classroom contact teaching, 65 credits are to be allotted for core courses (CC), 07 credits are allotted to Ability-Enhancement Compulsory Course (AECC), 02credits are allotted to Skill-Enhancement Compulsory Course (SEC), 12 credits are allotted to Program/Discipline Specific Elective Course (DSEC), 10 credits are allotted to Laboratory Course (LC). Credits distribution is given below in tabular form:

M.Sc. Physics : Two-Year (4-Semester) CBCS Programme			
Basic Structure: Distribution of Courses			
S.No.	**Type of Course**	**Credit Hours**	**Total Credits**
1	Core Course (CC)	13 Courses of 5 Credits each (Total Credit Hrs. 13X5)	65
2	Ability-Enhancement Compulsory Course (AECC)	1 Course of 4Credit each (Total Credit Hrs. 1X4) 1 Course of 3 Credit each (Total Credit Hrs. 1X3)	07
3	Skill-Enhancement Compulsory Course (SEC)	1 Course of 2 Credit each (Total Credit Hrs. 1X2)	02
4	Program/Discipline Specific Elective Course (DSEC)	3Courses of 4Credits each (Total Credit Hrs. 3X4)	12
5	LC-Laboratory Courses	5 Courses of 2 Credits each (Total Credit Hrs. 5X2)	10
6	Value Added Course (VAC)	4 Courses of 0 Credits each (Total Credit Hrs. 6X0)	00
7	PROJ& Internship	1 Course of 6 Credit each (Total Credit Hrs. 1X6) 1 Course of 3 Credit each (Total Credit Hrs. 1X3)	09
8	MOOC-Optional (credits will consider only in case a student fails to secure minimum required credits for the award of degree)	2 Courses of 0 Credits each (Total Credit Hrs. 2X0)	00
Total Credits			**105**

Contact hours include work related to Lecture, Tutorial and Practical (LTP), where our institution will have flexibility to decide course wise requirements.

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.
PSO – 5	Creating a critical attitude and logical reasoning among students to make them able for applying knowledge of physics in diverse fields

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 programes:*** 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 programe 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 1st 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

Study & Evaluation Scheme

M.Sc. (Physics)-Semester I

S. No	*Category*	*Course Code*	Course	*Periods*			*Credit*	*Evaluation Scheme*		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	CC-1	MPH111	Mathematical Physics-I	4	1	-	5	40	60	100
2	CC-2	MPH112	Classical Mechanics	4	1	-	5	40	60	100
3	CC-3	MPH113	Quantum Mechanics –I	4	1	-	5	40	60	100
4	AECC-1	MAT115	Research Methodology	3	1	-	4	40	60	100
5	LC-1	MPH161	Physics Lab-I	-	-	4	2	50	50	100
6	LC-2	MPH162	Physics Lab-II	-	-	4	2	50	50	100
7	DGP-1	MGP111	Discipline & General Proficiency	**-**	**-**	**-**	**-**	100	-	100
			Total	**15**	**4**	**8**	**23**	**260**	**340**	**600**

Value Added Course:
It is an audit course. The performance of the student in this course will not be counted in the overall result however the student has to pass it compulsorily with 45% marks.

1	VAC-1	TMUPA-101	Elementary Arithmetic & Analytical Reasoning	2	1	-	-	40	60	100
2	VAC-2	TMUPS-101	Managing Self	2	1	-	-	50	50	100

M.Sc. (Physics)-Semester II

S. No	*Category*	*Course Code*	Course	*Periods*			*Credit*	*Evaluation Scheme*		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	CC-4	MPH211	Mathematical Physics-II	4	1	-	5	40	60	100
2	CC-5	MPH212	Solid State Physics	4	1	-	5	40	60	100
3	CC-6	MPH213	Atomic & Molecular Physics	4	1	-	5	40	60	100
4	CC-7	MPH214	Quantum Mechanics –II	4	1	-	5	40	60	100
5	LC-3	MPH261	Physics Lab-III	-	-	4	2	50	50	100
6	LC-4	MPH262	Physics Lab-IV	-	-	4	2	50	50	100
7	DGP-2	MGP211	Discipline & General Proficiency	**-**	**-**	**-**	**-**	100	-	100
			Total	**16**	**4**	**8**	**24**	**260**	**340**	**600**

***Value Added Course:**

1	VAC-3	TMUPA-201	Progressive Algebra & Data Management	2	1	-	-	40	60	100
2	VAC-4	TMUPS-201	Managing Work and Others	2	1	-	-	50	50	100

MOOC Course:

1	MOOC-1	MOOC12	MOOC Program –I (Optional)	-	-	-	2	-	100	100

M.Sc. (Physics)-Semester III

S. No	Category	Course Code	Course		Periods			Credit	Evaluation Scheme		
					L	T	P		Internal	External	Total
1	CC-8	MPH311	Electromagnetic Theory		4	1	-	5	40	60	100
2	CC-9	MPH312	Thermodynamics & Statistical Physics		4	1	-	5	40	60	100
3	CC-10	MPH317	Physics & Technology of Semiconductor Devices		4	1	-	5	40	60	100
4	AECC-2	MHM320	Human values & Professional Ethics		3	-	-	3	40	60	100
5	DSE-1		Discipline Specific Elective Courses	Discipline Specific Elective Course-I	4	-	-	4	40	60	100
6	DSE-2		Discipline Specific Elective Courses	Discipline Specific Elective Course-II	4	-	-	4	40	60	100
7	LC-5	MPH361	Physics lab-V		-	-	4	2	50	50	100
8	PROJ-1	MPH 392	Industrial Training & Presentation		-	-	6	3	50	50	100
9	DGP-3	MGP311	Discipline & General Proficiency		-	-	-	-	100	-	100
			Total		**23**	**3**	**10**	**31**	**340**	**460**	**800**

MOOC Course:

1	MOOC-2	MOOC13	MOOC Program –II (Optional)	-	-	-	2	-	100	100

M.Sc. (Physics)-Semester IV

S. No	*Category*	*Course Code*	**Course**	*Periods*			*Credit*	*Evaluation Scheme*		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	CC-11	MPH412	Electronic Communications	4	1	-	5	40	60	100
2	CC-12	MPH414	Nuclear & Particle Physics	4	1	-	5	40	60	100
3	CC-13	MPH431	Physics and our World	4	1	-	5	40	60	100
4	DSE-3		Discipline Specific Elective Courses: Discipline Specific Elective Course-III	4	-	-	4	40	60	100
5	SEC-1	MAT461	MATLAB Programming	-	1	2	2	50	50	100
6	PROJ-2	MPH492	Project	-		12	6	50	50	100
7	DGP-4	MGP411	Discipline & General Proficiency	-	-	-	-	100	-	100
			Total	**16**	**4**	**14**	**27**	**260**	**340**	**600**

ELECTIVE COURSES OFFERED

S.No	Code	Course	L	T	P	Credit
Semester III-Discipline Specific Elective Course-I -(Any one)						
1	MPH313	Material Sciences	4	-	-	4
2	MPH315	Nano-science &Technology	4	-	-	4
Semester III-Discipline Specific Elective Course-II -(Any one)						
3	MSC012	Elementary Biophysics	4	-	-	4
4	MPH319	Electronic Instrumentation	4	-	-	4
Semester IV-Discipline Specific Elective Course-III -(Any one)						
5	MPH411	Plasma Physics	4	-	-	4
6	MPH413	Astrophysics	4	-	-	4

Course Code: MPH111	M.Sc. Physics - Semester-I **Mathematical Physics-I**	L-4 T-1 P-0 C-5
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the structure of vector space.	
CO2.	**Applying** the methodologies & techniques of training to develop a training plan.	
CO3.	**Applying** the concepts of Calculus of variation like Euler Equation, Lagrange's Equation, and Hamilton's Principle.	
CO4.	**Applying** the special function, recurrence relations in solving integration problems.	
CO5.	**Analyzing** the dependency of vectors in linear equations.	
Course Content:		
Unit-1:	**Linear vector spaces and operators:** Vector spaces and subspaces, Linear dependence and independence, Orthogonality, Basis and Dimensions, linear operators, Matrix representation, Types of matrices, Similarity transformations, Characteristic polynomial of a matrix, Eigen values and eigenvectors, Self-adjoint and Unitary transformation. *One relevant Case Study/ Case let from the unit.*	**8 Hours**
Unit-2:	**Vector analysis and curvilinear co-ordinates-** Gradient, Divergence, their geometrical interpolation and Curl operations, rotational motion, vector potential function, Vector Integration, Gauss' and Stokes' theorems, Curvilinear co-ordinates, tangent and normal vectors, contravariant and covariant components, line element and the metric tensor, Gradient, Curl, divergence and Laplacian in spherical polar and cylindrical polar co-ordinates. *One relevant Case Study/ Case let from the unit.*	**8 Hours**
Unit-3:	**Calculus of variations and Non-linear methods:** Concept of variation, Euler's equation, Missing dependent variables, Applications of the Euler equation, Several independent variables, Hamilton's principle and Lagrange's equations, Lagrangian multipliers. *One relevant Case Study/ Case let from the unit.*	**8 Hours**
Unit-4:	**Ordinary differential equations and Special Functions-I:** Linear ordinary differentialequations, Separation of Poisson and Helmholtz equations in spherical polar and cylindrical polar coordinates, power Series methods, Series solutions – Frobenius'method, Series solutions*One relevant Case Study/ Case let from the unit.*	**8 Hours**
Unit-5:	**Ordinary differential equations and Special Functions-II:** Series solutions of the differential equations of Bessel, Legendre, Laguerre and Hermite polynomials, Generating functions, Some recurrence relations, orthogonality properties of these functions, Brief discussion of spherical Bessel functions and spherical harmonics. *One relevant Case Study/ Case let from the unit.*	**8 Hours**
Text Book:	**1.** Mathematical Methods for Physicists – G. B. Arfken and H. Weber, Seventh Edition, Academic Press.	

Reference Books:	**1.** J.W. Brown, R. V. Churchill, Complex Variables and Applications, Mc-GrawHillWarren, M.W. Training for Results, Massachusetts, Addison-Wesley. **2.** A. W. Joshi, Matrices and Tensors in Physics, New Age International. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=y3ARLfm-52w 2. https://www.youtube.com/watch?v=Q2D-UScFjQI 3. https://www.youtube.com/watch?v=5KLdiwaJFMg	

Course Code: MPH112	M.Sc. Physics - Semester-I **Classical Mechanics**	L-4 T-1 P-0 C-5
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concept of generalized coordinates, Lagrangian, and Hamiltonian formalism.	
CO2.	**Understanding** the concepts of central force, scattering under central force field & Euler angles.	
CO3.	**Understanding** concepts of frames of references and special theory of relativity	
CO4.	**Applying** the Lagrange-Hamilton formalism to study the motion of various mechanical systems.	
CO5.	**Applying** the Euler angle concept for solving the problems of symmetric top & vibrating string motions.	
Course Content:		
Unit-1:	**Preliminaries of classical mechanics:** Newtonian mechanics - one and many particle systems; Conservation laws; Work energy theorem; Open system (with variable system) constraints and their classification; D'Alembert principle; Generalized coordinates. *One relevant Case Study/ Case let from the unit.*	**8 Hours**
Unit-2:	**Central Forces:** Reduction to one body problem; equation of motion and first integral; one dimensional problem and classification of orbits; Kepler's laws and planetary motion; Scattering in central force field; Transformation to laboratory frames. *One relevant Case Study/ Case let from the unit.*	**8 Hours**
Unit-3:	**Rigid Body and Vibrating System:** Euler angles; Tensor of inertia; Kinetic energy of a rotating body; Symmetric top and Applications; Vibrating string; Solution wave equation; Normal vibrations; Dispersion; Coupled vibrating system. *One relevant Case Study/ Case let from the unit.*	**8 Hours**
Unit-4:	**Hamiltonian Formulation:** Legendre transformation; Hamiltonian equation of motion; cyclic coordinates; Phase space and Liouville's theorem; Poisson bracket. Solutions. *One relevant Case Study/ Case let from the unit.*	**8 Hours**
Unit-5:	**Special Theory of Relativity** Inertial and Non- Inertial Frames, Michelson-Morley Experiment, Postulates of Special Theory of Relativity, Galilean and Lorentz Transformation, Length Contraction and Time Dilation, Addition of Velocities, Mass Energy Equivalence and Variation of Mass with Velocity. *One relevant Case Study/ Case let from the unit.*	**8 Hours**
Text Book:	1. N. C Rana& P S Joag, Classical Mechanics by, TMH.	
Reference Books:	**1.** P.V. Panat, Classical Mechanics, Narosa Publishing Home. **2.** R. G. Takawale and P.S. Puranik, Introduction to Classical Mechanics, TMH. **3.** J. C. Upadhyaya, Classical Mechanics, Himalaya Publishing House. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=ohbmg53jDN0&list=PLq-Gm0yRYwTjpY9BlDxFGNXIaQJIOQRdo 2. https://www.youtube.com/watch?v=nZ40jnChzbs 3. https://www.youtube.com/watch?v=GOkZs2RZMQY 4. https://www.youtube.com/watch?v=SZbNx4VfMzg	

Course Code: MPH113	M.Sc. Physics- Semester-I **Quantum Mechanics-I**	L-4 T-1 P-0 C-5
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding basic concepts of wave function, operator algebra and Schrodinger equation in quantum physics.	
CO2.	Understanding the concepts of matrix formulation and generalized uncertainty principle in quantum mechanics.	
CO3.	Applying Schrodinger equation for solving harmonic oscillator, particle in a hard-potential box and tunneling problems.	
CO4.	Applying Schrodinger equation for mechanism hydrogen atom and calculating the dependence of energy on quantum numbers and shape of orbitals.	
CO5.	Applying operator algebra for understanding the coupling of angular momentum and calculating Clebsch-Gordan coefficients.	
Course Content:		
Unit-1:	**Introductory concepts:** Empirical basis, wave-particle duality, electron diffraction, Wave packets, Gaussian wave packet, Spreading of Gaussian wave packet, Heisenberg uncertainty principle for position and momentum, Schrodinger equation, conservation of probability, probability interpretation of wave function, expectation values, Ehrenfest theorem, measurement in quantum theory, time-independent Schrodinger equation, stationary states, momentum space representation.	**8 Hours**
Unit-2:	**One-dimensional problems:** Free-particle solution, momentum eigen functions, box normalization, particle in square well potential, transmission through a potential barrier, simple harmonic oscillator.	**8 Hours**
Unit-3:	**General formalism of quantum theory: operator methods**- Hilbert space and observables, linear operators and observables, Dirac notation, degeneracy and simultaneous observables, generalized uncertainty principle for two non-commuting observables, Unitary dynamics, projection operators and measurements, time-dependence of observables: Schrodinger, Heisenberg and interaction pictures, Simple harmonic oscillator by operator method.	**8 Hours**
Unit-4:	**Angular momentum-I**- Orbital angular momentum commutation relations, Eigen values and eigen functions, Central potential, separation of variables in the Schrodinger equation, the radial equation. The Hydrogen atom.	**8 Hours**
Unit-5:	**Angular momentum-II** General operator algebra of angular momentum operators J_x, J_y, J_z. Ladder operators, Eigen values and eigenkets of J^2 and J_z, Matrix representations of angular momentum operators, Pauli matrices, Addition of angular momentum, Clebsch-Gordan coefficients, computation of Clebsch-Gordan coefficients in simple cases ($j_1 = j_2=1/2$).	**8 Hours**
Text Book:	**1.** P. M. Mathews and K. Venkatesan, A Text-book of Quantum Mechanics, Tata McGraw-Hill.	
Reference Books:	**1.** Liboff, Introductory Quantum Mechanics, Pearson Education Ltd. **2.** R.P. Feynman, Feynman Lectures on Physics, Narosa. **3.** J.J. Sakurai, Modern Quantum Mechanics, Addison-Wesley. Introduction to Quantum Mechanics – David J. Griffiths, Second Edition, Pearson Prentice Hall. *** Latest editions of all the suggested books are recommended.**	

Additional electronic reference materials	1. https://www.youtube.com/watch?v=8mi0PoPvLvs&list=PLcC5RwLpGl6eyNvVfAixR18_nDmsX9rh- 2. https://www.youtube.com/watch?v=7O1NhGP07Xo&list=PLcC5RwLpGl6eyNvVfAixR18_nDmsX9rh-&index=2 3. https://www.youtube.com/watch?v=LUTWAcmglQk&list=PL3V8X5qWC1MRmSvEMZUjTU3BisDsi2KqV&index=23 4. https://www.youtube.com/watch?v=zy9aLwWtGDU&list=PL3V8X5qWC1MRmSvEMZUjTU3BisDsi2KqV&index=24	

Course Code: MAT115	**M.Sc. Physics- Semester-I** **Research Methodology**	**L-3 T-1 P-0 C-4**
Course Outcomes :	**On completion of the course, the students will be :**	
CO1.	**Understanding** basic concepts of research and its methodologies, sampling techniques, meaning of scaling, its classification, important scaling techniques, basic principles of graphical representation	
CO2.	**Identifying** appropriate research topics using better central tendency and dispersion procedures	
CO3.	**Analyzing** different research problem and their associated parameters, hypothesis with significance levels and different degree of freedoms, correlation and regression	
CO4.	**Evaluating** appropriate project proposal (to undertake a project), significance of report writing, layout and precautions for writing research report	
CO5.	**Creating,** organizing and conducting research (advanced project) in a more appropriate manner with the help of SPSS for data analysis	
Course Content:		
Unit-1:	**Research Methodology**: Introduction to Research methodology: Meaning, Objective, Types of research & research approaches, Criteria for Good research .Review of Literature. Research problem: Statement, Purpose, Objective, Necessity of defining the problems. Research design: Meaning, Need Features, Different research design.	**8 Hours**
Unit-2:	**Measurement of scaling techniques**: Measurement scales, sources of error in measurement, technique of developing measurement tools, Meaning of scaling, its classification, important scaling techniques. Methods of collection, Sampling Techniques.	**8 Hours**
Unit-3:	**Introduction to statistics:** Meaning, Definition, Characteristics, importance of the study of statistics, Tabulation of Data: Basic principles of graphical representation, Types of diagrams histograms, frequency polygons, smooth frequency polygons, cumulative frequency curve. Measures of central Tendency: Mean, Median, Mode, Measures of Dispersion: Range, Mean deviation and Standard deviation.	**8 Hours**
Unit-4:	Testing of Hypotheses, Level of significance, Degree of freedom, Student t-test, F- test, Chi Square-test, Anova-one way & two way; Correlation & Regression: Significance, Types of Correlation, Linear Regression	**8 Hours**
Unit-5:	**Interpretation and report writing**: Meaning, Techniques of interpretation, significance of report writing, steps in writing, layout of the research report, types of report and precautions for writing research report. Use of SPSS in Data Analysis.	**8 Hours**
Text Book:	**1.** Kapoor B.K & Gupta S.C, Fundamental of Statistics, S. Chand Publication, New Delhi.	
Reference Books:	**2.** Dr. J. A Khan: Biostatistics & Research Methodology, APH Publishing.	

	3. C. R Kothari: Research Methodology, Methods & techniques New age international Publishers. **4.** R. Paneerselvam Research Methodology, PHI Learning Second Edition. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=rz30rRfManE&list=PLdj5pVg1kHiOypKNUmO0NKOfvoIThAv4N 2. https://www.youtube.com/watch?v=jVAoBW-y8VE&list=PL_uaeekrhGzL9fDd1Mohm9Llzah1yFYem	

Course Code: MPH161	M.Sc. Physics- Semester-I **Physics Lab-I**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of Elliptical and Hyperbolic Fringes	
CO2.	**Applying** the Quinck's&Guoy's methods to observe the magnetic susceptibility of liquid & solid materials.	
CO3.	**Analysing** fibre attenuation & Stefan's constant.	
CO4.	**Analysing** the resistivity properties of semiconductor material.	
CO5.	**Analysing** the characteristic curve, band gap energy of a thermistor, elastic constants & Curie temperature using CRO.	
Experiments:	**Note: Minimum eight experiments should be performed:**	
Experiment-1:	Study of Non-Destructive Testing using Ultrasonics.	
Experiment-2:	Measurement of resistivity of sheets/films of polymer by Two Probe Method.	
Experiment-3:	Study of Op-Amp as Square and Ramp Generator.	
Experiment-4:	Find the Susceptibility of given paramagnetic substances ($FeCl_3$) by Quincke's Method.	
Experiment-5:	Study of Curie Temperature of Magnetic Materials (Iron).	
Experiment-6:	Study of the elastic constants of glass by Cornu's interference methods – Elliptical and Hyperbolic Fringes	
Experiment-7:	To trace I-V characteristic curves of diodes and transistors on a CRO, and learn their uses in electronic circuits	
Experiment-8:	Determination of solar constant of a solar cell.	
Experiment-9:	To study the Fibre attenuation of a given optical fiber.	
Experiment-10:	Study of Band gap energy of a Thermister.	
Experiment-11:	Determination of Stefan's constant	
Text Book:	**1.** Experimental Physics: Modern Methods, R.A. Dunlap, Oxford University Press.	
Reference Books:	**1.** B.K. Jones, Electronics for Experimentation and Research, Prentice-Hall. **2.** Basic Electronics: A Text-Lab Manual, P.B. Zbar and A.P. Malvino, Tata Mc-Graw Hill, New Delhi. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. http://vlab.amrita.edu/?sub=1&brch=282 2. https://www.youtube.com/watch?v=-_Ny8YjPY-U 3. https://www.youtube.com/watch?v=3PgAhleLqAI 4. https://www.youtube.com/watch?v=Wr2X7XmhRiw	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MPH162	M.Sc. Physics - Semester-I **Physics Lab-II**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of Electromagnetism & optics laws to find dielectric constant & Cauchy constant.	
CO2.	**Applying** the concepts of frequency variation in various oscillators.	
CO3.	**Applying** ESR method to find the spin of electron.	
CO4.	**Analysing** the BH curve on CRO & I-V characteristic of solar cell.	
CO5.	**Analysing** the parameters of semiconductors using Hall effect.	
Experiments:	**Note: Minimum eight experiments should be performed:**	
Experiment-1:	To study the B-H curve for a given sample using CRO.	
Experiment-2:	To measure the dielectric constant of unknown solid.	
Experiment-3:	To study Hall's effect and to determine Hall coefficient.	
Experiment-4:	To study electrical resistivity of Semiconductors by four probe method.	
Experiment-5:	Study of E.S.R. of DPPH.	
Experiment-6:	Study of Faraday's effect using He-Ne Laser.	
Experiment-7:	Determination of the Plank's Constant by Photo cell	
Experiment-8:	Measurement of wave length of He-Ne laser light using grating.	
Experiment-9:	To study the I-V characteristics and also calculate fill factor of used solar cell.	
Experiment-10:	To calibrate the prism/grating spectrometer with mercury vapour lamps and hence to find the Cauchy's constant.	
Experiment-11:	To study the frequency variation in R-C phase shift Oscillator or Colpitt's Oscillator or Hartley Oscillator.	
Experiment-12:	Determine the energy band gap of the given sample using the spectrometer.	
Text Books:	**2.** Experimental Physics: Modern Methods, R.A. Dunlap, Oxford University Press.	
Reference Books:	**3.** B.K. Jones, Electronics for Experimentation and Research, Prentice-Hall. **4.** Basic Electronics: A Text-Lab Manual, P.B. Zbar and A.P. Malvino, Tata Mc-Graw Hill, New Delhi. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. http://vlab.amrita.edu/?sub=1&brch=282 2. https://www.youtube.com/watch?v=Ic_yugMzkxY 3. https://www.youtube.com/watch?v=1vROHZqNsKI 4. https://www.youtube.com/watch?v=h4RiczDeLQY	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MGP111	M.Sc. Physics- Semester-I **Discipline & General Proficiency**	L-0 T-0 P-0 C-0

There shall be continuous evaluation of the student on the following broad parameters:

1. Observance of dress code.

2. Participation in Conferences /Workshops / Seminars.

3. Attendance in guest lectures, invited talks and special technical sessions organized from time to time.

4. Participation in community projects including NSS.

5. Exhibiting team spirit in different Culture & extra curriculum activities, Department Club activities of the University and College organized from time to time.

6. Observance of rule & regulations in the College/University, Behavior in Campus Premises, Bus, hostel mess and hostel.

7. Performance and awards received in different events (sports/ co-curricular activities) organized at College / University and other level.

8. General behavior

9. Any extraordinary achievement.

The above is an indicative list of parameters on which the students shall be continuously evaluated. The college may evaluate the student on the specific parameters by informing them through a notice displayed on the notice board before evaluation. There shall be no external examination for this course; however, the marks shall be included for calculation of cumulative Performance Index (CPI).

Head of Department would be display GP marks on notice board in prescribed format after IInd&IIIrd CT in semester:

S No		Enroll No.	Student Name	Dress code	Participation in Conferences /Workshops / Seminars	Participation in guest lectures, invited talks and special technical sessions	Participation in community Services	Participation in Culture & extra curriculum activities, Department Club Activities	Participation in sports/ co-curricular activities	General Behavior	Any Extra Achievement
				(5)	**(15)**	**(20)**	**(10)**	**(20)**	**(20)**	**(5)**	**(5)**
	Responsible for marks			Mentor	Head	Head	Mentor	Cultural Events Coordinator & Department Club Coordinator	Sports Coordinator	Mentor	Director or Principal

Course Code: TMUPA-101	VAC (Value Added Course) M.Sc. Physics (Semester-I) **Elementary Arithmetic & Analytical reasoning**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Operationalizing the inter-related concept of Percentage in Profit Loss and Discount.	
CO2.	Applying the arithmetical concepts in Ratio and Proportion, Mixture and Allegation.	
CO3.	Employing the techniques of Percentage, Ratios and Average in inter related concepts of Time and Work, Time speed and Distance.	
CO4.	Evaluating the different possibilities of various reasoning based problems in series, Direction and Coding-Decoding.	
Course Content:		
Unit-1:	**Percentages** Basic calculation, ratio equivalent, base, change of base, multiplying factor, percentage change, increment, decrement, successive percentages, word problems	**4 Hours**
Unit-2:	**Profit Loss Discount** Basic definition, formula, concept of mark up, discount, relation with successive change, faulty weights	**3 Hours**
Unit-3:	**Ratio, proportions and variations** Concept of ratios, proportions, variations, properties and their applications	**3 Hours**
Unit-4:	**Mixtures and allegations** Mixtures of 2 components, mixtures of 3 components, Replacements	**4 Hours**
Unit-5:	**Time and Work** Same efficiency, different efficiency, alternate work, application in Pipes and Cisterns	**4 Hours**
Unit-6:	**Time Speed Distance** Average speed, proportionalities in Time, Distance, trains, boats, races, circular tracks	**6 Hours**
Unit-7:	**Number and Alphabet Series** Different kind of series and pattern	**2 Hours**
Unit-8:	**Direction sense** Simple statements, shadow type	**2 Hours**
Unit-9:	**Coding and decoding** Sequential coding, reverse coding, abstract coding	**2 Hours**
Reference Books:	• R1:-Arun Shrama:- How to Prepare for Quantitative Aptitude • R2:-Quantitative Aptitude by R.S. Agrawal • R3:-M Tyra: Quicker Maths • R4:-Nishith K Sinha:- Quantitative Aptitude for CAT • R5:-Reference website:- Lofoya.com, gmatclub.com, cracku.in, handakafunda.com, tathagat.mba, Indiabix.com • R6:-Logical Reasoning by Nishith K Sinha	

	• R7:-Verbal and Non Verbal Reasoning by R.S. Agrawal *** Latest editions of all the suggested books are recommended.**	

Course Code: TMUPS-101	Value Added Course M.Sc. Physics- Semester-I **Managing Self**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Utilizing effective verbal and non-verbal communication techniques in formal and informal settings	
CO2.	Understanding and analyzing self and devising a strategy for self growth and development.	
CO3.	Adapting a positive mindset conducive for growth through optimism and constructive thinking.	
CO4.	Utilizing time in the most effective manner and avoiding procrastination.	
CO5.	Making appropriate and responsible decisions through various techniques like SWOT, Simulation and Decision Tree.	
CO6.	Formulating strategies of avoiding time wasters and preparing to-do list to manage priorities and achieve SMART goals.	
Course Content:		
Unit-1:	**Personal Development:** Personal growth and improvement in personality Perception Positive attitude Values and Morals High self motivation and confidence Grooming	**10 Hours**
Unit-2:	**Professional Development:** Goal setting and action planning Effective and assertive communication Decision making Time management Presentation Skills Happiness, risk taking and facing unknown	**8 Hours**
Unit-3:	**Career Development:** Resume Building Occupational Research Group discussion (GD) and Personal Interviews	**12 Hours**
Reference Books:	1. Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education 2. Tracy, Brian, Time Management (2018), Manjul Publishing House 3. Hill, Napolean, Think and grow rich (2014), Amazing Reads 4. Scott, S.J., SMART goals made simple (2014), Createspace Independent Pub 5. https://www.hloom.com/resumes/creative-templates/ 6. https://www.mbauniverse.com/group-discussion/topic.php 7. Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan 8. Burne, Eric, Games People Play (2010), Penguin UK 9. https://www.indeed.com/career-advice/interviewing/job-interview-tips-how-to-make-a-great-impression *** Latest editions of all the suggested books are recommended.**	

Course Code: MPH211	**M.Sc. Physics- Semester-II** **Mathematical Physics-II**	**L-4 T-1 P-0 C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** concepts of the Fourier series, Fourier transform and Laplace transform.	
CO2.	**Understanding** aboutAnalytic functions, Cauchy-Riemannrelations and their physical significance.	
CO3.	**Understanding** about Taylor and Laurent expansions and singularities	
CO4.	**Understanding** Group, Field and Rings and their properties.	
CO5.	**Applying** Fourier transform and Laplace transform in the various fields of Physics.	
CO6.	**Analyzing** complex integrals in solving real problems of Physics.	
Course Content:		
Unit-1:	**Fourier Series**: Periodic functions. Orthogonality of sine and cosine functions, DirichletConditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Even and odd functions and their Fourier expansions, Parseval's theorem,	**8 Hours**
Unit-2:	**Integral transforms:** **Fourier transform**: Fourier Integral and Fourier transform, Fourier complex transformation, Fourier sine and cosine transformations and application to simple heat transfer equation, Fourier transform of Dirac Delta function. **Laplace transform**: Laplace transform and its properties, inverse Laplace transforms, solution of differential equations using Laplace transforms, Laplace transform of Dirac Delta function.	**8 Hours**
Unit-3:	**Complex analysis I:** Functions of a complex variable, Analytic functions, Cauchy-Riemannrelations, Conjugate and harmonic nature of the real and imaginary parts of an analytic function, Cauchy's theorem, Cauchy's integral formula,	**8 Hours**
Unit-4:	**Complex analysis II:** Taylor and Laurent expansions, analytic continuation, classification of singularities, residue theorem, Evaluation of definite integrals	**8 Hours**
Unit-5:	**Group theory** Basic definitions, Group, a Multiplication table, Subgroups, Field, Ring and its properties, Permutation Groups.	**8 Hours**
Text Books:	**1.** Mathematical methods of physics - J. Mathews and R. L. Walker, Second Edition, Addison-Wesley.	
Reference Books:	**2.** Mathematical methods for Physicists – G. B. Arfken and H. Weber, Seventh Edition, Academic Press. **3.** Complex functions – M. R. Spiegel, Schaum Series. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=lkAvgVUvYvY&t=20s 2. https://www.youtube.com/watch?v=c9NibpoQjDk&t=19s 3. https://www.youtube.com/watch?v=b5VUnapu-qs 4. https://www.youtube.com/watch?v=nzmJb7KITxc&list=PLOzRYVm0a65dGef0BEA_CWbVCO6BtMZhE	

Course Code: MPH212	M.Sc. Physics- Semester-II **Solid State Physics**	L-4 T-1 P-0 C-5
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the physics of crystal structure, defects and various type of atomic bonding in crystal.	
CO2.	**Understanding** the x ray diffraction and the theory of specific heat of solids.	
CO3.	**Understanding** the electrical and thermal properties of metals and semiconductor.	
CO4.	**Understanding** the magnetic and superconducting properties of solids.	
CO5.	**Applying** the Bragg's law to deduce the crystal structure of materials.	
CO6.	**Applying** the concept of Josephson junction to understand the working and principle of SQUIDs.	
Course Content:		
Unit-1:	**Crystal Structure:** Bravais lattices; Crystal systems; Point groups, space groups and typical structures; Reciprocal Lattice, Planes and directions; Point, line, surface and volume defects; Ionic crystals: Born Mayer potential; Thermo-chemical Born-Haber cycle; Van der Waals binding: Rare gas crystals and binding energies; Covalent and metallic binding: characteristic features and examples	**8 Hours**
Unit-2:	**Crystal Diffraction and Lattice Vibrations:** X-rays; Bragg's law in direct and reciprocal lattice; Structure factor; diffraction techniques; Lattice dynamics: mono-atomic and diatomic lattices; Quantization of lattice vibrations; Phonon momentum; Inelastic scattering by phonons; Debye's theory of lattice heat capacity; Einstein‟s model and Debye's model of specific heat; thermal expansion; Thermal conductivity.	**8 Hours**
Unit-3:	**Theory of Conductors and Semiconductors:** Free electron theory of metals; Electron Heat Capacity; Bloch functions; Formation of energy bands; Kronig -Penny Model; Brillouin zone; Effective mass; Concept of Holes; Fermi surface; Drude model of electrical and thermal conductivity. Semiconductors: Carrier statistics in intrinsic and extrinsic crystals; Electrical conductivity; Hall Effect Electronic specific heat.	**8 Hours**
Unit-4:	**Superconductivity:** Concept of superconductivity; Meissner effect; Type I and type II superconductors; London equations; Penetration depth; Coherence length; Super-conductivity ground state; BCS theory; Flux quantization in a ring; Electron tunneling; DC & AC Josephson Effect; Macroscopic quantum interference; SQUID; Introduction to high temperature superconductors	**8 Hours**
Unit-5:	**Magnetic Materials:** Magnetic materials: Types, Quantum theories of dia- and para- magnetism; Susceptibility measurement: Guoy Balance, Quincke's method; Hysteresis; Domain theory – Ferri, Ferro and anti-ferromagnetic order; Curie temperature and Neel Temperature.	**8 Hours**
Text Books:	**1.** Charles Kittel, Introduction to Solid State Physics, Wiley Eastern. **2.** A.J. Dekker, Solid State Physics, Prentice Hall of India.	
Reference Books:	**1.** Ali Omar, Elementary Solid-State Physics, Narosa Publishing House. **2.** J.S. Blakemore, Solid State Physics, Cambridge University Press. **3.** S.O. Pillai, Problems and Solutions in Solid State Physics, New Age International. *** Latest editions of all the suggested books are recommended.**	

Additional electronic reference materials	1. https://www.youtube.com/watch?v=KNgKAcyUOZc&list=PLFW6lRTa1g83HGEihgwcy7KeTLUuBu3WF&index=2 2. https://www.youtube.com/watch?v=W4XlGG2jRs&list=PLFW6lRTa1g83HGEihgwcy7KeTLUuBu3WF&index=20 3. https://www.youtube.com/watch?v=inUAGOzb9nA&list=PLFW6lRTa1g83HGEihgwcy7KeTLUuBu3WF&index=32	

Course Code: MPH213	M.Sc. Physics- Semester-II **Atomic & Molecular Physics**	L-4 T-1 P-0 C-5
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding t**he spectrum of atoms and their origin such as spin orbit interaction LS and JJ couplings.	
CO2.	**Understanding** the effects on the atoms when placed in an external field like electric and magnetic.	
CO3.	**Understanding** the concepts of motion of atoms & molecules in an environment.	
CO4.	**Applying** the principals of electronic vibrations to study of UV & Vis spectrum.	
CO5.	**Applying** the rigid/non-rigid rotator concepts to explain microwave and IR spectroscopy	
CO6.	**Applying** the Frank-Condon principle to measure dissociation energy in electronic spectrum.	
Course Content:		
Unit-1:	**Atomic Spectra:** Quantum states of Electron in atoms; Hydrogen atom spectrum; Electron spin; Spin Orbit interaction; Lande interval rule; Two electron systems; LS – JJ coupling Schemes; Fine structure; Spectroscopic terms and selection rules; Hyperfine structure; Isotopic shift; Width of spectral lines; Exchange symmetry of wave function; Pauli's exclusion principle; Spectrum of Helium and Alkali atom.	**8 Hours**
Unit-2:	**Atoms in External Fields and Resonance Spectroscopy:** Zeeman and Paschen Back Effect of one and two electron systems; Stark effect; X-ray – Auger transitions; Compton Effect; NMR – Basic principles; Classical and Quantum mechanical description; Magnetic dipole coupling; Chemical shift; Knight shift; ESR – Basic principles; Nuclear interaction and Hyperfine Structure; g-factor; Zero field splitting.	**8 Hours**
Unit-3:	**Microwave Spectroscopy and IR Spectroscopy:** Rotational spectra of diatomic molecules; Rigid rotator - Effect of isotropic substitution; Non-rigid rotator – Rotation spectra of polyatomic molecules; Linear, symmetric top and asymmetric top molecules; Experimental Techniques; Diatomic vibrating rotator; Linear, Symmetric top molecule; Analysis by infrared techniques.	**8 Hours**
Unit-4:	**Raman Spectroscopy:** Raman Effect; Quantum theory of Raman effect; Electronic, rotational, vibrational and Raman spectra of diatomic molecules; Raman spectra of polyatomic molecules; Raman Spectrometer; Hyper Raman effect; Experimental techniques.	**8 Hours**
Unit-5:	**Electronic Spectroscopy:** Electronic spectra of diatomic molecules; Frank-Condon principle; Dissociation energy and dissociation products; Rotational fine structure of electronic vibration transitions; Fortrat Diagram; Pre-dissociation	**8 Hours**

Text Books:	**1.** G M Barrow, Introduction to molecular spectroscopy, Tata McGraw Hill.	
Reference Books:	**1.** ManasChanda, Atomic Structure and Chemical Bond, Tata McGraw Hill. **2.** G. Aruldhas, Molecular Structure and Spectroscopy, Prentice Hall of India Ltd. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=satDvYr4Cz8&list=PLXHedI-xbyr9VGhbnhw3fN9YyiH14oJCD&index=6 2. https://www.youtube.com/watch?v=miWymMtoFJ4&list=PLXHedI-xbyr9VGhbnhw3fN9YyiH14oJCD&index=21 3. https://www.youtube.com/watch?v=JW3uvkJDYSY&list=PLXHedI-xbyr9VGhbnhw3fN9YyiH14oJCD&index=41	

Course Code: MPH214	M.Sc. Physics- Semester-II **Quantum Mechanics-II**	L-4 T-1 P-0 C-5
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	**Understanding** of approach of perturbation theory, WKB approximation, scattering theory.	
CO2.	**Understanding** the Variation& WKB methods to explain the ground state of Helium.	
CO3.	**Understanding** the concepts of Spinor.	
CO4.	**Applying** the perturbation methods to explain the fine structure in H-atom & Zeeman effect.	
CO5.	**Applying** Dirac theory to explain existence of positron.	
CO6.	**Analyzing** of electron systems which cannot solved by the Schrödinger equations.	
Course Content:		
Unit-1:	**Approximation methods for stationary problems-I** Time independent perturbation theory**:** Time independent perturbation theory for a non-degenerate energy level, time independent perturbation theory for a degenerate energy level, Applications: (1) one dimensional harmonic oscillator subjected to a perturbing potential in x, x^2 and x^3 (2) the fine structure of the hydrogen atom (3) Zeeman effect.	**8 Hours**
Unit-2:	**Approximation methods for stationary problems:** Variational Method: Bound states (Ritz Method), Expectation value of the energy. Applications: (1) ground state of Helium (2) van de Waals interaction.WKB approximation: the ―classical region, connection formulae, tunneling.	**8 Hours**
Unit-3:	**Time dependent perturbation theory-I:** Statement of the problem, approximate solution of the Schrodinger equation, constant perturbation, harmonic perturbation, transition to a continuum, the Fermi golden rule. Scattering theory: The scattering experiment, relationship of the scattering cross section to the wave function, scattering amplitude and scattering cross-section, born approximation, scattering by a spherically symmetric potential, cross-section for scattering in a screened coulomb potential, validity of Born's approximation.	**8 Hours**
Unit-4:	**Time dependent perturbation theory-II**: Method of partial waves: Expansion of a plane wave in terms of partial waves, scattering by a central potential, optical theorem. **Symmetry principles and conservation laws**: Continuous symmetries: Spatial translation symmetry and conservation of linear momentum, time translation symmetry and conservation in energy, Rotations in Space: Conservation of angular momentum. Discrete symmetries: Parity, Time reversal, Permutation symmetry, symmetric and antisymmetric wave functions, Slater determinant, scattering of identical particles, ortho and para helium.	**8 Hours**
Unit-5:	**Relativistic quantum mechanics**: Klein-Gordan equation for a free relativistic particle, Plane wave solutions, probability density and probability current density. Dirac Hamiltonian for a free relativistic particle, properties of alpha and beta matrices, probability density and probability current, positive and negative energy solutions, intrinsic spin of the Dirac particle, Negative energy sea, gamma matrices.	**8 Hours**
Text Book	**1.** Introduction to Quantum Mechanics – David J. Griffiths, Second Edition, Pearson Prentice Hall.	
Reference Books:	**2.** Quantum Mechanics – V.K. Thankappan, Second Edition, Wiley Eastern Limited. **3.** Quantum Mechanics- L.I. Schiff, Third Edition, McGraw Hill Book Company. *** Latest editions of all the suggested books are recommended**	

Additional electronic reference materials	1. https://www.youtube.com/watch?v=8mi0PoPvLvs&list=PLcC5RwLpGl6eyNvVfAixR18_nDmsX9rh- 2. https://www.youtube.com/watch?v=7O1NhGP07Xo&list=PLcC5RwLpGl6eyNvVfAixR18_nDmsX9rh-&index=2 3. https://www.youtube.com/watch?v=LUTWAcmglQk&list=PL3V8X5qWC1MRmSvEMZUjTU3BisDsi2KqV&index=23 4. https://www.youtube.com/watch?v=zy9aLwWtGDU&list=PL3V8X5qWC1MRmSvEMZUjTU3BisDsi2KqV&index=24	

Course Code: MPH261	M.Sc. Physics- Semester-II **Physics Lab-III**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of Michelson interferometer used in research and industry.	
CO2.	**Analyzing** the data and plot of GM Counter to understand the concept of radioactive decays.	
CO3.	**Analyzing** of Susceptibility using Quinck's&Guoy's apparatus.	
CO4.	**Analyzing** the quantization of electronic charge using Millikan's oil drop method.	
CO5.	**Analyzing** the existence of atomic energy levels using Franck – Hertz Experiment.	
CO6.	**Analyzing** the perturbation of energy levels applying weak magnetic field (Zeeman effect).	
Experiments:	**Minimum 10 experiments should be performed**	
Expeiment-1:	To determine the wavelength, separation of wavelengths of sodium light and to determine the thickness of thin mica sheet using Michelson interferometer.	
Experiment-2:	To determine the resistivity of Ge at various temperatures by four-Probe method.	
Experiment-3:	Study of Susceptibility of paramagnetic material by Gouy's method.	
Experiment-4:	Study of skin depth in Al using electromagnetic radiation.	
Experiment-5:	Study of- plateu characteristics using GM Counter.	
Experiment-6:	Calculate the wavelength of the lamp using Fabry - Perot Etalon.	
Experiment-7:	Study of Thermionic Emission.	
Experiment-8:	Study of the existence of atomic energy levels using Franck – Hertz Experiment.	
Experiment-9:	Study of Zeeman Effect.	
Experiment-10:	Determination of 'e' by Millikan oil drop's method.	
Experiment-11:	To determine the molecular field in a dielectric and verify Clausius – Mossotti equation.	
Experiment-12:	Study of absorption spectra of Iodine molecule and to determine its dissociation energy using spectrometer.	
Experiment-13:	To determine the lattice parameter "a" of the unit cell of a cubic crystal using given X- Ray diffraction spectra.	
Text Book	**1.** D.R. Behekar, Dr. S. T. Seman, V.M. Gokhale, P.G .Kale, Practical Physics, (KitabMahal Publication)	

Reference Books:	**2.** G.Aruldas, Molecular structure and Spectroscopy, Prentice-hall of India Pvt. Ltd. **3.** S.P. Pillai (3 rd Edition), Solid State Physics, New age International Publisher. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.vlab.co.in/broad-area-physical-sciences 2. https://www.youtube.com/watch?v=eujzeM_AZFk 3. https://www.youtube.com/watch?v=vzfHE1dgO7A 4. https://www.youtube.com/watch?v=9FuA0wyjMOY 5. https://www.youtube.com/watch?v=ijHKu6iXiRk	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MPH262	M.Sc. Physics- Semester-II Physics Lab-IV	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of Malus law & Beer –Lamber law.	
CO2.	**Understanding** the function of Linear and Preamplifier circuits.	
CO3.	**Applying** the concepts of thermal field to determine the conductivity and luminescence properties of materials.	
CO4.	**Applying** Beer-Lamberts law to measure the extinction coefficients of materials.	
CO5.	**Analyzing** psychometric chart to find relative humidity.	
Experiments:	**Minimum 07 experiments should be performed:**	
Expeiment-1:	Verification of Malus's law.	
Experiment-2:	Verification of Beer-Lambert law.	
Experiment-3:	Fabry-Perot interferometer experiments	
Experiment-4:	Thermal conductivity of a poor conductor	
Experiment-5:	Thermostimulated luminescence of F-centre in Alkali halide.	
Experiment-6:	Analysis of Schmitt-Trigger as a discriminator.	
Experiment-7:	Study of Linear Pulse amplifier.	
Experiment-8:	Study of Preamplifier circuit.	
Experiment-9:	Determination of extinction coefficient of materials using Beer's law.	
Experiment-10:	Measurement of temperature by wet and dry bulb thermometers and estimation of humidity of the atmosphere.	
Experiment-11:	Measurement and analysis of atmospheric pressure and isobars	
Experiment-12:	Determining solar rotation period from given data of sunspot motion.	
Text Book:	**1.** G.Aruldas, Molecular structure and Spectroscopy, Prentice-hall of India Pvt. Ltd.	
Reference Books:	**2.** S.P. Pillai (3 rd Edition), Solid State Physics, New age International Publisher. **3.** D.R. Behekar, Dr. S. T. Seman, V.M. Gokhale, P.G .Kale, Practical Physics, (KitabMahal Publication). *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.vlab.co.in/broad-area-physical-sciences 2. https://www.youtube.com/watch?v=5CGG2dfUwEk 3. https://www.youtube.com/watch?v=mQM-5o3pBaU 4. https://www.youtube.com/watch?v=5JHcknTpARU 5. https://www.youtube.com/watch?v=DDfZyjV1EX4	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)
The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MGP211	M.Sc. Physics- Semester-II **Discipline & General Proficiency**	L-0 T-0 P-0 C-0

There shall be continuous evaluation of the student on the following broad parameters:

1. Observance of dress code.

2. Participation in Conferences /Workshops / Seminars.

3. Attendance in guest lectures, invited talks and special technical sessions organized from time to time.

4. Participation in community projects including NSS.

5. Exhibiting team spirit in different Culture & extra curriculum activities, Department Club activities of the University and College organized from time to time.

6. Observance of rule & regulations in the College/University, Behavior in Campus Premises, Bus, hostel mess and hostel.

7. Performance and awards received in different events (sports/ co-curricular activities) organized at College / University and other level.

8. General behavior

9. Any extraordinary achievement.

The above is an indicative list of parameters on which the students shall be continuously evaluated. The college may evaluate the student on the specific parameters by informing them through a notice displayed on the notice board before evaluation. There shall be no external examination for this course; however, the marks shall be included for calculation of cumulative Performance Index (CPI).

Head of Department would be display GP marks on notice board in prescribed format after IInd&IIIrd CT in semester:

S No		Enroll No.	Student Name	Dress code	Participation in Conferences /Workshops / Seminars	Participation in guest lectures, invited talks and special technical sessions	Participation in community Services	Participation in Culture & extra curriculum activities, Department Club Activities	Participation in sports/ co-curricular activities	General Behavior	Any Extra Achievement
				(5)	**(15)**	**(20)**	**(10)**	**(20)**	**(20)**	**(5)**	**(5)**
	Responsible for marks			Mentor	Head	Head	Mentor	Cultural Events Coordinator & Department Club Coordinator	Sports Coordinator	Mentor	Director or Principal

Course Code: TMUPA-201	VAC (Value Added Course) M.Sc. Physics (Semester-II) **Progressive Algebra & Data Management**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying the concepts of modern mathematics Divisibility rule, Remainder Theorem, HCF /LCM in Number System.	
CO2.	Relating the rules of permutation and combination, Fundamental Principle of Counting to find the probability.	
CO3.	Applying calculative and arithmetical concepts of ratio, Average and Percentage to analyze and interpret data	
CO4.	Employing the concept of higher level reasoning in Clocks and Calendars, Set theory and Puzzle Problems.	
Course Content:		
Unit-1:	**Number theory** Classification of Numbers, Divisibility Rules, HCF and LCM, Factors, Cyclicity (Unit Digit and Last Two digit), Remainder Theorem,Highest Power of a Number in a Factorial, Number of trailing zeroes	**7 Hours**
Unit-2:	**Data interpretation** Data Interpretation Basics, Bar Chart, Line Chart, Tabular Chart, Pie Chart, DI tables with missing values	**4 Hours**
Unit-3:	**Permutations and combinations** Fundamental counting, and or, arrangements of digits, letters, people in row, identical objects, rank, geometrical arrangements, combination: - basic, handshakes, committee, selection of any number of objects, identical and distinct, grouping and distribution, de-arrangements	**4 Hours**
Unit-4:	**Probability** Introduction, Probability based on Dice and Coins, Conditional Probability, Bayes Theorem	**3 Hours**
Unit-5:	**Set theory** Introduction , Venn Diagrams basics, Venn Diagram – 3 sets, 4-Group Venn Diagrams	**3 Hours**
Unit-6:	**Problem Solving** Introduction, Puzzle based on 3 variable, Puzzle based on 4 variable	**5 Hours**
Unit-7:	**Clocks and calendars** Introduction , Angle between hands , Gain and loss of Clock, Interchange of hands, Introduction of Calendars, Leap Year , Ordinary Year, Company Specific Pattern	**4 Hours**
Reference Books:	• R1:-Arun Shrama:- How to Prepare for Quantitative Aptitude • R2:-Quantitative Aptitude by R.S. Agrawal • R3:-M Tyra: Quicker Maths • R4:-Nishith K Sinha:- Quantitative Aptitude for CAT • R5:-Reference website:- Lofoya.com, gmatclub.com, cracku.in, handakafunda.com, tathagat.mba, Indiabix.com	

	• R6:-Logical Reasoning by Nishith K Sinha • R7:-Verbal and Non Verbal Reasoning by R.S. Agrawal *** Latest editions of all the suggested books are recommended.**	

Course Code: TMUPS-201	Value Added Course M.Sc. Physics- Semester-II **Managing Work and Others**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Communicating effectively in a variety of public and interpersonal settings.	
CO2.	Applying concepts of change management for growth and development by understanding inertia of change and mastering the Laws of Change.	
CO3.	Analyzing scenarios, synthesizing alternatives and thinking critically to negotiate, resolve conflicts and develop cordial interpersonal relationships.	
CO4.	Functioning in a team and enabling other people to act while encouraging growth and creating mutual respect and trust.	
CO5.	Handling difficult situations with grace, style, and professionalism.	
Course Content:		
Unit-1:	**Intrapersonal Skills:** Creativity and Innovation Understanding self and others (Johari window) Stress Management Managing Change for competitive success Handling feedback and criticism	**8 Hours**
Unit-2:	**Interpersonal Skills:** Conflict management Development of cordial interpersonal relations at all levels Negotiation Importance of working in teams in modern organisations Manners, etiquette and net etiquette	**12 Hours**
Unit-3:	**Interview Techniques:** Job Seeking Group discussion (GD) Personal Interview	**10 Hours**
Reference Books:	1. Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education 2. Burne, Eric, Games People Play (2010), Penguin UK 3. Carnegie, Dale, How to win friends and influence people (2004), RHUK *** Latest editions of all the suggested books are recommended.**	

Course Code: MPH311	M.Sc. Physics- Semester-III **Electromagnetic Theory**	L-4 T-1 P-0 C-5
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the electrostatics, magnetostatics& EM concepts of fields.	
CO2.	**Understanding** the boundary conditions at interface of two media.	
CO3.	**Understanding** concept of propagation of EM wave through bounded and unbounded media	
CO5.	**Applying** Gauss's law, Poisson and Laplace equations method of image to find the electric fields and potentials.	
CO6.	**Applying** Ampere's law to find the magnetic field solenoid etc.	
CO7.	**Applying** radiation theory to understand the concept of antenna.	
Course Content:		
Unit-1:	**Electrostatics:** Differential equation for electric field; Gauss's law; Poisson and Laplace equations; examples of image method; Solutions of Laplace equation in cylindrical and spherical coordinates by orthogonal functions; Dielectrics, polarization of a medium, electrostatic energy; Boundary value problems.	**8 Hours**
Unit-2:	**Magneto-statics**: Magnetic Induction, Biot-Savart law, Ampere's law and applications; Magnetic flux; Magnetization; Magnetic intensity, energy density; Linear and nonlinear media.	**8 Hours**
Unit-3:	**Maxwell's Equations:** Displacement current; Maxwell's equations; Boundary conditions on the fields at interfaces; Vector and scalar potentials; Electromagnetic energy and momentum; Conservation laws; Inhomogeneous wave equation and Green's function solution.	**8 Hours**
Unit-4:	**Electromagnetic Waves:** Electromagnetic wave equation; Solution and propagation of monochromatic waves in non-conducting media; Polarization and energy density; Reflection and transmission at oblique incidence; Waves in conducting media; Wave guides, TE, TM and TEM waves in rectangular wave guide.	**8 Hours**
Unit-5:	**Radiation:** Field and radiation in dipole; Radiation by moving charges; Lienard-Wiechert potentials; Total power radiated by an accelerated charge; Lorentz formula; Basics of antennas and their applications.	**8 Hours**
Text Book:	**1.** J.D. Jackson, Classical Electrodynamics, John Wiley & Sons.	
Reference Books:	**1.** F.J. Milford and R.W. Christy, Foundations of Electromagnetic Theory, Narosa publishing house. **2.** E.C. Jordon and K.G. Balmain, Electromagnetic Waves and Radiating Systems, Prentice-Hall of India. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=W25SVn2bA8I&list=PLQNC9KhS56XwsAtI28BZGC9cEGWGhuEOk&index=2 2. https://www.youtube.com/watch?v=JCfhChaJvCo&list=PLQNC9KhS56XwsAtI28BZGC9cEGWGhuEOk&index=7 3. https://www.youtube.com/watch?v=yINtzw63Knc&list=RDCMUC4EY_qnSeAP1xGsh61eOoJA&index=4 4. https://www.youtube.com/watch?v=Rje75XimTMM&list=PLQNC9KhS56XwsAtI28BZGC9cEGWGhuEOk&index=17 5. https://www.youtube.com/watch?v=v9K6ICt8RJc	

Course Code: MPH312	M.Sc. Physics- Semester-III **Thermodynamics & Statistical Physics**	L-4 T-1 P-0 C-5
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** and understanding importance and applications of thermodynamic laws.	
CO2.	**Understanding** the concepts of probability and their relations with Statistical Mechanics.	
CO3.	**Understanding**the concepts of macroscopic and microscopic phenomenon.	
CO4.	**Applying** the Maxwell distribution to explain equation of state for a non-ideal gas; Van der Waals' equation of state; Meyer cluster expansion.	
CO5.	**Applying** the Fermi-Dirac distribution to explain the pauliparamagnetism and White dwarf.	
CO6.	**Applying** the B-E Statistics to explain black body radiation.	
Course Content:		
Unit-1:	**Elementary Probability Theory:** Binomial; Poisson and Gaussian distributions; Central limit theorem.	**8 Hours**
Unit-2:	**Ensembles: Review of Thermodynamics-** Extensive and intensive variables; Laws of thermodynamics; Legendre transformations and thermodynamic potentials; Maxwell relations; Applications of thermodynamics to (a) ideal gas; (b) magnetic material and (c) dielectric material.	**8 Hours**
Unit-3:	**Formalism of Equilibrium: Statistical Mechanics:** Concept of phase space; Liouville's theorem; Basic postulates of statistical mechanics; Ensembles: microcanonical, canonical, grand canonical and isobaric; Connection to thermodynamics; Fluctuations; Applications of various ensembles; equation of state for a non-ideal gas; Van der Waals' equation of state; Meyer cluster expansion; virial coefficients.	**8 Hours**
Unit-4:	**Fermi-Dirac Statistics:** Fermi-Dirac, Ideal Fermi gas, properties of simple metals, Pauli paramagnetism, electronic specific heat, and white dwarf stars.	**8 Hours**
Unit-5:	**Bose-Einstein Statistics** Ideal Bose gas; Debye theory of specific heat, properties of black-body radiation, Bose-Einstein condensation, experiments on atomic BEC, BEC in a harmonic potential.	**8 Hours**
Text Book:	1. F. Reif, Fundamentals of Statistical and Thermal Physics, Tata McGraw-Hill.	
Reference Books:	**1.** B. B. Laud, Fundamentals of Statistical Mechanics, New Age International Publication. **2.** Lokanathan and Gambhir, Statistical and Thermal Physics, Prentice Hall of India Ltd. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=mrCrjeqJv6U&list=PLbMVogVj5nJQWowhOG0-K-yI-bwRRmm3C 2. https://www.youtube.com/watch?v=jkdMtmXo664&list=PL3zvA_WajfGAwLuULH-L0AG9fKDgplYne 3. https://www.youtube.com/watch?v=CefOcjpUP-A&list=PLyqSpQzTE6M9iXvWVCopr67kKt61ntzIl&index=27	

Course Code: MPH317	**M.Sc. Physics- Semester-III** **Physics & Technology of Semiconductor Devices**	**L-4 T-1 P-0 C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of semiconductor materials and its properties.	
CO2.	**Understanding**the carrier transport mechanism in semiconductors.	
CO3.	**Understanding** functioning of junction devices such as p-n diodes, MOSFET, BJT.	
CO4.	**Applying** IC fabrication process.	
CO5.	**Applying** the concepts of deposition methods for preparation of Crystals.	
Course Content:		
Unit-1:	**Semiconductor Materials:** Energy Bands; Intrinsic carrier concentration; Donors and Acceptors; Direct and Indirect band semiconductors; Elemental (Si) and Compound semiconductors (GaAs); Alloy semiconductor and their important properties; Doping of Si (Group III(n) and Group V (p) compounds) and GaAs (group II(p), IV (n-p) and VI (n compounds).	**8 Hours**
Unit-2:	**Carrier Transport in Semiconductors:** Drift velocity; Carrier Diffusion; Carrier Injection; Generation; Recombination Processes; Direct and Indirect Bandgap Semiconductors; Minority Carrier Life Time; drift and diffusion; Determination of conductivity (a) four-probe and (b) Van der Paw techniques; Hall coefficient; minority carrier lifetime	**8 Hours**
Unit-3:	**Junction Devices:** Junction Devices: (i) p-n junction – energy Band diagrams for homo and hetero junctions; Current flow mechanism in p-n junction, (ii) Metal semiconductor (Schottky Junction): Energy band diagram, current flow mechanisms in forward and reverse bias. (iii) Metal-Oxide-Semiconductor (MOS) diodes; Energy band diagram, depletion and inversion layer; High and low frequency Capacitance Voltage (C-V) characteristics.	**8 Hours**
Unit-4:	**Bipolar Junction Transistor (BJT):** Charge transport and current in a BJT; Current transfer ratio; Terminal currents; Generalized biasing; Charge control analysis; BJT switching; Turn-on and Turnoff transients; Base narrowing; Frequency limitations of a transistor; FET, MOSFET: Principle of Operation and I-V Characteristics of FET; MESFET; MOSFET; MOS Capacitor; Threshold voltage in MOSFET.	**8 Hours**
Unit-5:	**Polysilicon Preparation of Crystal:** Single crystal growth; Defects in epitaxial; Lithography; Etching and Micro-machining of Silicon; Fabrication of Integrated Circuits; Film Deposition Methods: Chemical vapour deposition (CVD), MOCVD.	**8 Hours**
Text Book:	**1.** Sze S.M., Semiconductor Devices Physics and Technology, Wiley.	
Reference Books:	**1.** Sayer M. and Mansingh A., Measurement, Instrumentation and Experimental Design in Physics and Engineering, Prentice Hall of India Pvt. Ltd. **2.** Streetman Ben G., Solid State electronics, Prentice Hall of India Pvt. Ltd. *** Latest editions of all the suggested books are recommended**	

Additional electronic reference materials	1. https://www.youtube.com/watch?v=JA3sCmrv11M&list=PLgMDNELGJ1CaNcuuQv9xN07ZWkXE-wCGP&index=2 2. https://www.youtube.com/watch?v=mGdWAspBQXw&list=PLgMDNELGJ1CaNcuuQv9xN07ZWkXE-wCGP&index=22 3. https://www.youtube.com/watch?v=mwITd4JkUjw&list=PLgMDNELGJ1CaNcuuQv9xN07ZWkXE-wCGP&index=26 4. https://www.youtube.com/watch?v=6sAszNbCVok&list=PLgMDNELGJ1CaNcuuQv9xN07ZWkXE-wCGP&index=35	

Course Code: MHM320	M.Sc. Physics- Semester-V **Human Values & Professional Ethics**	L-3 T-0 P-0 C-3
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the importance of value education in life and method of self-exploration.	
CO2.	**Understanding** 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration.	
CO3.	**Applying** right understanding about relationship and physical facilities.	
CO4.	**Analysing** harmony in myself, harmony in the family and society, harmony in the nature and existence.	
CO5.	**Evaluating** human conduct on ethical basis.	
Course Content:		
Unit-1:	Understanding of Morals, Values and Ethics; Introduction to Value Education- need for Value Education. Self- Exploration– content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration. Continuous Happiness and Prosperity- basic Human Aspirations. Gender Issues: Gender Discrimination and Gender Bias (home & office), Gender issues in human values, morality and ethics.	**8 Hours**
Unit-2:	Conflicts of Interest: Conflicts between Business Demands and Professional Ethics. Social and Ethical Responsibilities of Technologists. Ethical Issues at Workplace: Discrimination, Cybercrime, Plagiarism, Sexual Misconduct, Fraudulent Use of Institutional Resources. Intellectual Property Rights and its uses. Whistle blowing and beyond, Case study.	**8 Hours**
Unit-3:	Harmony in the Family and Society- Harmony in Human-Human Relationship, Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationship; meaning of Nyaya; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship. Understanding the meaning of Vishwas; Difference between intention and competence. Understanding the meaning of Samman and other salient values in relationship.	**8 Hours**
Unit-4:	Understanding Harmony in the Nature and Existence – Whole existence as Co-existence. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Coexistence (Sah-astitva) of mutually interacting units in all pervasive space. Holistic perception of harmony at all levels of existence.	**8 Hours**
Unit-5:	Implications of the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Competence in professional ethics:	**8 Hours**

	a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people friendly and eco-friendly production systems c) Ability to identify and develop appropriate technologies and management patterns for above production systems.	
Text Book:	**1.** R R Gaur, R Sangal, G P Bagaria, A Foundation Course in Value Education.	
Reference Books:	**1.** Ivan Illich, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA 2. E.F. Schumacher, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain. **2.** A Nagraj, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak. **3.** Sussan George, How the Other Half Dies, Penguin Press. Reprinted. **4.** PL Dhar, RR Gaur, Science and Humanism, Commonwealth Purblishers. **5.** A.N. Tripathy, Human Values, New Age International Publishers. **6.** E G Seebauer & Robert L. Berry, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press. ***Latest editions of all the suggested books are recommended.**	
Additional electronics reference material	https://www.youtube.com/watch?v=Cnw1nK3K5qk https://www.youtube.com/watch?v=hTTCMrQyF8E	

Course Code: MPH361	M.Sc. Physics- Semester-III **Physics Lab-V**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the working of various electronic circuits like differentiator, integrator, logic gates etc.	
CO2.	**Understanding** the OP-AMP, Adder, Substractor and various IC's to understand their working.	
CO3.	**Applying** logics gates to verify the Boolean algebra.	
CO4.	**Applying** the IC's as a stable multivitorator and voltage controlled oscillator, multiplication and division etc.	
CO5.	**Analyzing** the I-V characteristic of FET and MOSFET.	
Experiments:	**Note: All experiments should be performed:**	
Experiment-1:	To design and analyze the Combinational Logic Circuit.	
Experiment-2:	To verify Thevenin Theorem and find out Thevenin's Equivalent circuit using DC Sources.	
Experiment-3:	Experiments on FET and MOSFET characterization and application as an amplifier.	
Experiment-4:	Experiment on uni-junction Transistor and its application	
Experiment-5:	Study of OP AMP as summing and inverting amplifier.	
Experiment-6:	Study of OP AMP as Emitter Follower.	
Experiment-7:	Study of OP AMP as Difference Amplifier.	
Experiment-8:	Study of OP AMP as differentiator and integrator.	
Experiment-9:	Study of Voltage to Frequency / Frequency to voltage converter using OP-AMP.	
Experiment-10:	Study of errors in electrical measurement and results due to loading.	
Experiment-11:	Study of noise performance of an amplifier	
Experiment-12:	Study of IC 7400 as Half adder, Half subtractor, Full adder, Full subtractor.	
Experiment-13:	Study of IC 555 as A stable multivitorator and Voltage Controlled Oscillator.	
Experiment-14:	To measure temperature co-efficient using 555 timer.	
Experiment-15:	Instrumentation Amplifier - using four IC 741.	
Experiment-16:	Study of Addition and subtraction using 8086.	
Experiment-17:	Multiplication and division using 8086.	
Experiment-18:	Sum of a simple series using 8086.	

TextBook	**1.** P.B. Zbar and A.P. Malvino, Basic Electronics: A Text-Lab Manual, Tata Mc-Graw Hill.	
Reference Books:	**2.** B.K. Jones, Electronics for Experimentation and Research, Prentice-Hall. **3.** P.B. Zbar and A.P. Malvino, Basic Electronics: A Text-Lab Manual, Tata Mc-Graw Hill. **4.** B.K. Jones, Electronics for Experimentation and Research, Prentice-Hall. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=tf0t7molCts 2. https://www.youtube.com/watch?v=IBjdVAK4QxM 3. https://www.youtube.com/watch?v=ltVspUteuuI 4. https://www.youtube.com/watch?v=TbYamLEozG4	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)
Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MPH392	M.Sc. Physics- Semester-III **Industrial Training & Presentation**	L-0 T-0 P-6 C-3
Course Procedure:		
	Students will have to undergo industrial training of six weeks in any industry or reputed organization after the II semester examination in summer. The evaluation of this training shall be included in the III semester evaluation. The student will be assigned a faculty guide who would be the supervisor of the student. The faculty would be identified before the end of the II semester and shall be the nodal officer for coordination of the training. Students will prepare an exhaustive technical report of the training during the III semester which will be duly signed by the officer under whom training was undertaken in the industry/ organization. The covering format shall be signed by the concerned office in-charge of the training in the industry. The officer-in-charge of the trainee would also give his rating of the student in the standard University format in a sealed envelope to the Director/Principal of the college. The student at the end of the III semester will present his report about the training before a committee constituted by the Director/Principal of the College which would comprise of at least three members comprising of the Department Coordinator, Class Coordinator and a nominee of the Director/Principal. The students guide would be a special invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each member of the committee separately in a sealed envelope to the Director/Principal. The marks by the external examiner would be based on the report submitted by the student which shall be evaluated by the external examiner and cross examination done of the student concerned. Not more than three students would form a group for such industrial training/ project submission.	
	The marking shall be as follows.	
Internal: **50 marks**	By the Faculty Guide – 25 marks. By Committee appointed by the Director/Principal – 25 marks.	
External: **50 marks**	By Officer-in-charge trainee in industry – 25 marks. By External examiner appointed by the University – 25 marks	
	Technical report will consist five chapter as per given format:	
Chapter 1:	Brief about organization	
Chapter 2:	Detail of business carried out by organization	
Chapter 3:	Specific contribution during the industrial training (not more than 500 words)	
Chapter 4:	Learning during the industrial training (not more than 200 words)	
Chapter 5:	Conclusion	

Course Code: MGP311	M.Sc. Physics- Semester-III **Discipline & General Proficiency**	L-0 T-0 P-0 C-0

There shall be continuous evaluation of the student on the following broad parameters:

1. Observance of dress code.

2. Participation in Conferences /Workshops / Seminars.

3. Attendance in guest lectures, invited talks and special technical sessions organized from time to time.

4. Participation in community projects including NSS.

5. Exhibiting team spirit in different Culture & extra curriculum activities, Department Club activities of the University and College organized from time to time.

6. Observance of rule & regulations in the College/University, Behavior in Campus Premises, Bus, hostel mess and hostel.

7. Performance and awards received in different events (sports/ co-curricular activities) organized at College / University and other level.

8. General behavior

9. Any extraordinary achievement.

The above is an indicative list of parameters on which the students shall be continuously evaluated. The college may evaluate the student on the specific parameters by informing them through a notice displayed on the notice board before evaluation. There shall be no external examination for this course; however, the marks shall be included for calculation of cumulative Performance Index (CPI).

Head of Department would be display GP marks on notice board in prescribed format after IInd&IIIrd CT in semester:

S No		Enroll No.	Student Name	Dress code	Participation in Conferences /Workshops / Seminars	Participation in guest lectures, invited talks and special technical sessions	Participation in community Services	Participation in Culture & extra curriculum activities, Department Club Activities	Participation in sports/ co-curricular activities	General Behavior	Any Extra Achievement
				(5)	**(15)**	**(20)**	**(10)**	**(20)**	**(20)**	**(5)**	**(5)**
	Responsible for marks			Mentor	Head	Head	Mentor	Cultural Events Coordinator & Department Club Coordinator	Sports Coordinator	Mentor	Director or Principal

Course Code: MPH313	**Discipline Specific Elective Course-I** **M.Sc. Physics- Semester-III** . **Material Sciences**	**L-4 T-0 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the basics concepts of dielectric and ferroelectric properties of materials.	
CO2.	**Understanding** the concepts of corrosion in superconductors.	
CO3.	**Understanding** the concepts of Phase diagram growth of transformations in alloy.	
CO4.	**Applying** the key concepts of elastic behaviour to understand the mechanical properties of materials.	
CO5.	**Analyzing** the phase diagrams to understand the Austenite, Pearlite, Bainite and Martensite phases of Iron-Carbon alloys	
Course Content:		
Unit-1:	Mechanical properties of materials, Stress and strain behaviour, Elastic properties of materials, Plastic deformation, tensile properties, compressive and shear deformation, hardness, creep, fracture, fatigue.	**8 Hours**
Unit-2:	Phase diagrams, Solubility limit, phase equilibrium, binary eutectic systems, ceramic phase diagram, Phase rule, microstructures, Iron-Carbon system, influence of alloying, Isothermal Transformation Diagrams, Continuous Cooling Transformation Diagrams, Austenite, Pearlite, Bainite and Martensite phases of Iron-Carbon alloys	**8 Hours**
Unit-3:	Corrosion mechanism, electrochemical considerations, corrosion rates, environmental effects, corrosion resistant materials, Materials superconducting at liquid Helium temperatures, High-Tc metal oxides, Organic materials, Fullerenes, Preparation and characterization of superconducting materials, Crystal Structure,	**8 Hours**
Unit-4:	Dielectric properties of solids, Ferroelectricity, Optical constants, Optical absorption. Optoelectronic effects. Optical materials for UV, visible and IR regions, Photosensitive materials for photography, and photo fabrication	**8 Hours**
Unit-5:	Magneto crystalline anisotropy, Magneto static energy, Domain walls and their properties, Domain structure, Magnetostriction, applications of magnetostriction, Wiedemann effect, Inverse Wiedemann effect, Barkhausen effect, Magnetization process, Soft and Hard Magnetic materials, Ferrites: structure and use.	**8 Hours**
Text Book:	1. Superconductivity Today, T. V. Ramakrishnan and C. N. R. Rao, Wiley Eastern Limited.	
Reference Book:	1. Materials Science and Engineering, W. D. Callister, Jr. Wiley Eastern Limited. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=5nBBUahtz- 2. https://www.youtube.com/watch?v=6vyYRnLvnqI&list=PLyAZSyX8Qy5C8ciqBBlypbx91j4nowUbL&index=3&list=PLyAZSyX8Qy5C8ciqBBlypbx91j4nowUbL 3. https://www.youtube.com/watch?v=EhIKEBCVryw&list=PLyAZSyX8Qy5C8ciqBBlypbx91j4nowUbL&index=13 4. https://www.youtube.com/watch?v=-YN7nP6KwTs&list=PLyAZSyX8Qy5C8ciqBBlypbx91j4nowUbL&index=21	

Course Code: MPH315	**Discipline Specific Elective Course-I** **M.Sc. Physics- Semester-III** **Nano-Science & Technology**	**L-4 T-0 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the basics of nano-particle, its classification and synthesis.	
CO2.	**Understanding** the concept of nano-magnetism, nano-electronics and integrated system	
CO3.	**Applying** the various microscopy techniques to characterize nano-materials.	
CO4.	**Applying** the concepts of nano-materials in developing, LEDs, SET and DNA Chips.	
CO5.	**Applying** the concepts of Hall effect in working of Hall effect sensors.	
Course Content:		
Unit-1:	**Introduction to Nanoparticles:** Introduction; Historical perspective of nanoparticle; Classification of nanomaterials - Nanorods, Nanoparticle; Nanomaterial preparation - Plasma Arching, Chemical Vapor Deposition, Sol Gel electrode position, Ball Milling technique	**8 Hours**
Unit-2:	**Characterization Tools:** Electron Microscopy Techniques – SEM, TEM; X ray methods; Optical Methods Fluorescence Microscopy; Atomic Force Microscopy; STM.	**8 Hours**
Unit-3:	**Nano magnetism:** Mesoscopic magnetism; Magnetic measurements: Miniature Hall Detectors; Integrated DC SQUID Microsusceptometry; Magnetic recording technology; Biological Magnets.	**8 Hours**
Unit-4:	**Nanoelectronics and Integrated Systems:** Basics of nanoelectronics; Single Electron Transistor; Quantum Computation; Tools of micro-nanofabrication; Nanolithography; Quantum electronic devices; MEMS and NEMS; Dynamics of NEMS; Limits of integrated electronics.	**8 Hours**
Unit-5:	**Applications:** Micromechanical systems; Robots; Ageless materials; Nano mechanics; Nano electronics; Optoelectronic devices; LED; Colorants and pigments; Nano biotechnology - DNA chips, DNA array devices, Drug delivery systems.	**8 Hours**
Text Book:	**1.** Jan Korvink& Andreas Greiner, Semiconductors for Micro and Nanotechnology – an Introduction for Engineers, Weinheim Cambridge: Wiley.	
Reference Books:	**1.** N John Dinardo, NanoscaleCharacterisation of Surfaces & Interfaces, Weinheim Cambridge, Wiley-VCH. **2.** G Timp (ed), Nanotechnology, AIP press, Springer. **3.** M. Wilson, K. Kannangara, G. Smith, M. Simmons and B. Raguse, Nanotechnology: Basic Sciences and Energy Technologies, Overseas Press. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	**1.** http://www.emm-nano.org/what-is-nanoscience-nanotechnology/ **2.** https://www.youtube.com/watch?v=VDcINv5JKDg **3.** https://www.youtube.com/watch?v=VdNhREmkrmE **4.** https://www.youtube.com/watch?v=BcgG3Cp8QQY 5. https://study.com/academy/lesson/magnetic-storage-definition-devices-examples.html 6. https://searchdatabackup.techtarget.com/definition/magnetic-tape	

Course Code: MSC012	**Discipline Specific Elective Course-II** **M.Sc. Physics- Semester-III** **Elementary Biophysics**	**L-4 T-0 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** basics of biology in Physics.	
CO2.	**Understanding** the physical methods of investigation of macromolecules for the analysis of biological systems.	
CO3.	**Understanding** the concepts of isotopes for labelling and detection of biomolecules in non-curable diseases.	
CO4.	**Applying** the instrumental methods to characterize the macromolecules.	
CO5.	**Applying** the radiation sources to explain the effect of radiation on living systems.	
Course Content:		
Unit-1:	**Foundations of Biophysics-I**: Biophysics as an interdisciplinary science, aim and scope of biophysics. Chemical and physical forces between atoms and molecules: Atomic and molecular forces. Inter-atomic molecular bonds: Ionic, covalent and Vander Waals bonds, Coordinate bonds and hydrophobic interaction. Mechanism of bond formation based on electronic orbitals. Formation of molecular orbitals, Sigma and Pi bonds, Hybridization. Examples of bond formation between C-C, C-N and carbon and other atoms.	**8 Hours**
Unit-2:	**Physical methods of investigation of macromolecules:** Biological macromolecules, General classification, Physical methods of determining size and shape of molecules. Separation methods: Diffusion, Sedimentation and osmosis. Viscosity and surface tension measurements.	**8 Hours**
Unit-3:	**Instrumental methods of analysis of biological systems:** Light scattering by macromolecules. Optical activity, Absorption spectroscopy and spectrophotometry, Calorimetry, IR and Raman spectroscopy for study of biomolecules. NMR spectroscopy for studying interactions and identification of biomolecules. X-ray diffraction and microscopy for studying living matter (basics).	**8 Hours**
Unit-4:	**Isotopes and radioactivity:** Radioactive decay laws, production of radioisotopes (radionuclides), allocation of radioactive traces, isotopic tracer method. Assay using radioactive substances, Labelling and detection methods using fluorescent molecules (a few examples).	**8 Hours**
Unit-5:	**Radiation biophysics:** Radiation sources, Interaction of radiation with matter (general discussion), energy transfer process, measurement of radiation, Dosimetry, Biological effects of radiation, effect of radiation on living systems, radiation protection and radiation therapy.	**8 Hours**
Text Book:	**1.** Biophysics- VasanthaPattabi and N. Goutham, Narosa Publishing House, New Delhi.	
Reference Books:	**1.** Aspects of Biophysics- William Hughes, John Wiley and Sons. **2.** Biochemistry of Nucleic acids- Adams et al. Chapmann and Hall. **3.** Biophysics- Cotterill. *** Latest editions of all the suggested books are recommended**	

Additional electronic reference materials	1. https://www.youtube.com/watch?v=jFZHIPhmNTs&list=PLFn7fvIP7CbMun4daH24AZzX3r7ETT6aD 2. https://www.youtube.com/watch?v=HcYjL0uwerA 3. https://www.youtube.com/watch?v=Mm50pmfwxsQ 4. https://www.youtube.com/watch?v=4Q1fzX9zwFA	

Course Code: MPH319	**Discipline Specific Elective Course-II** **M.Sc. Physics- Semester-III** **Electronic Instrumentation**	**L-4 T-0 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** observation and estimation of errors in experimental data.	
CO2.	**Understanding** production and measurement various vacuum systems.	
CO3.	**Understanding** the techniques of production and measurement of low and high temperature.	
CO4.	**Understanding** the concept of monochromatrors, photomultipier, used in various radiation detectors.	
CO5.	**Applying** the concept of error measurement to best fit the experimental data using least square method.	
CO6.	**Applying** the concept of Magnetic resonance to understand the principle and working of NMR, ESR, NQR and ENDOR.	
Course Content:		
Unit-1:	**Errors in Measurement Systems:** Errors in observations and treatment of experimental data; Estimation of errors; Theory of errors and distribution laws; Least squares method: Curve fitting, Statistical assessment of goodness of fit.	**8 Hours**
Unit-2:	**Vacuum Systems:** Production and measurement of high vacuum; Principles and operation of various pumps and gauges; Design of high vacuum systems; High pressure cells and measurements at high pressures.	**8 Hours**
Unit-3:	**Temperature Measurement:** Production and measurement of low temperatures; Design of cryostats; High temperature furnaces: resistance, induction and arc furnaces; Measurement of high temperatures.	**8 Hours**
Unit-4:	**Radiation Detectors:** Optical monochromators; Filters and spectrophotometers for UV, Visible and Infrared; Measurement of reflectivity; Absorption and fluorescence; Radiation detectors; Pyroelectric; Ferroelectric; Thermoelectric; Photo conducting; Photoelectric and Photomultiplier; Scintillation types of detectors; Circuits; Sensitivity and Spectral response; photon counters.	**8 Hours**
Unit-5:	**Magnetic Resonances:** NQR, ESR, NMR, ENDOR; Principles and schematic working systems; Measurement of resistivity; four probe techniques; Box car integrator.	**8 Hours**
Text Book:	**1.** J.F. Rabek, Experimental Methods in Photochemistry and Photo physics, John Wiley.	
Reference Books:	**1.** C.S. Rangan, G.R. Sharma and V.S.V. Mani, Instrumentation Devices and Systems, Tata McGraw-Hill. **2.** H.H. Willard, L.L. Merrit and John A. Dean, Instrumental Methods of Analysis, CBS Publishers & Distributors. **3.** Barry E. Jones, Instrumentation Measurement and Feedback, Tata McGraw-Hill. *** Latest editions of all the suggested books are recommended**	

Additional electronic reference materials	1. https://www.youtube.com/watch?v=3eYmFjHnQjY&list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio&index=2 2. https://www.youtube.com/watch?v=ZpYGQQAix0E&list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio&index=25 3. https://www.youtube.com/watch?v=Vuqk-Ag7xV4	

Course Code: MPH412	**M.Sc. Physics- Semester-IV** **Electronic Communications**	**L-4 T-1 P-0 C-5**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** various analog modulation techniques like AM, FM, PM.	
CO2.	**Understanding** the fundamental concepts of Digital communication.	
CO3.	**Understanding** the classification of the elementary particles and their interactions.	
CO4.	**Applying** the Fourier series and transform for signal transmission.	
CO5.	**Applying** the basics of Optical communication.	
Course Content:		
Unit-1:	**Signal Analysis:** Sinusoidal signals (Frequency and time Domain); Fourier series expansion of periodic sequence of impulses; Sampling function; Normalized power; Power Spectral density (of Digital data, sequence of random pulses); Effect of Transfer function on power spectral density; Fourier transform (example v(t) = coswt); Convolution; Power and Energy Transfer through a network.	**8 Hours**
Unit-2:	**Amplitude Modulation:** Amplitude Modulation; Spectrum of the modulated signal; Square law Modulator; Balanced Modulator; DSBSC; SSB and vestigial sideband modulation; Limitations of Amplitude Modulation.	**8 Hours**
Unit-3:	**Frequency Modulation:** Analysis and frequency Spectrum; Generation and Detection of FM; Comparison of AM and FM. Pre-emphasis and De-emphasis; Reactance Modulator; Capture Effect; Varactor Modulator; Amplitude Limiter; FM Receiver; Foster Seeley Discriminator; Ratio Detector.	**8 Hours**
Unit-4:	**Digital Communication:** Digital Line Waveforms: Symbols, Bits and Bauds; Functional Notation for Pulses; Line Codes and Waveforms; Pulse Modulation: Pulse Amplitude, Pulse Code, Pulse Frequency, Pulse Time, Pulse Position and Pulse Width Modulation; Differential PCM; Delta Modulation. Digital Communication Systems; Digital Carrier System; Frequency Shift Keying; Phase Shift Keying; Differential Phase Shift Keying; Digital Multiplexing.	**8 Hours**
Unit-5:	**Fiber Optic Communication:** Principle of light transmission in a fiber; effect of index profile on propagation; modes of propagation; Number of modes in a fiber; Losses in fibers; Dispersion in fiber; Source and detectors for fiber optic; Connectors and splices; Fiber optic communication systems.	**8 Hours**
Text Books:	**1.** G. Kennedy and B. Davis, Electronic Communication Systems, Tata McGraw Hill.	
Reference Books:	**1.** Analog & Digital by R.P. Sing and S.D. Sapre, Communication Systems, Tata McGraw Hill. *** Latest editions of all the suggested books are recommended**	

Additional electronic reference materials	1. https://www.youtube.com/watch?v=6dFnpz_AEyA&list=PL9567DFCA3A66F299 2. https://www.youtube.com/watch?v=UznnkHMisIk 3. https://www.youtube.com/watch?v=YbB8u_EvcdY&list=PLq-Gm0yRYwTgr7v3HhdrI_Kcc38369fw-	

Course Code: MPH414	M.Sc. Physics- Semester-IV **Nuclear & Particle Physics**	L-4 T-1 P-0 C-5
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the basic nuclear properties, force and nuclear models.	
CO2.	**Understanding** the concepts and properties of nuclear decays processes.	
CO3.	**Understanding** the basic concept of nuclear reactions.	
CO4.	**Understanding** the symmetry and conservations laws elementary particles.	
CO5.	**Applying** the selection rule to explain the decay process.	
CO6	**Analyzing** binding energy curves to explain the stability of nuclei.	
Course Content:		
Unit-1:	**Basic Nuclear Properties and Force:** Basic nuclear properties: Size, Shape and charge distribution, Spin and parity; Binding energy, semi-empirical mass formula, liquid drop model; Nature of the nuclear force; form of nucleon-nucleon potential; Charge independence and charge-symmetry of nuclear forces; Deuteron problem.	**8 Hours**
Unit-2:	**Nuclear Models:** The Semi empirical mass formula; Evidence of shell structure; Single-particle shell model, its validity and limitations; Rotational spectra; Magnetic moments and Schmidt lines; Iso-spins.	**8 Hours**
Unit-3:	**Nuclear Decay:** Decay-range; Particle spectra; Gamow theory; Beta decay; Fermi decay of beta decay; Shape of the beta spectrum; Total decay rate; Angular momentum and parity selection rules; Parity violation; Detection and properties of neutrino; Application of radiation theory to multirole transitions in nuclei; Angular momentum and parity selection rules; Internal conversion; Nuclear isomerism.	**8 Hours**
Unit-4:	**Nuclear Reactions:** Reaction dynamics; The Q equation; Theory of Nuclear reaction; Partial wave analysis; Compound nucleus formations and break up; Resonance scattering and reactions; The Optical Model Theory of stripping reactions; The Fission process; Neutron released in the fission process.	**8 Hours**
Unit-5:	**Elementary Particle Physics:** Types of interaction between elementary particles; Hadrons and leptons; Symmetry and conservation laws; Elementary ideas of CP and CPT invariance; Classification of hadrons quark model SU(2) SU(3) multiplets; Gell-Mann-Okubo mass formula for octet decuplet hadrons.	**8 Hours**
Text Book:	**1.** R.R. Roy and B.P. Nigam, Nuclear Physics, New Age International	
Reference Books:	**1.** Kaplan, Nuclear Physics, Narosa. **2.** B.L. Cohen, Concepts of Nuclear Physics, Tata McGraw Hill. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=josqjcH79PE&list=PLbMVogVj5nJRvq-w3zway7k3GzmUDte3a 2. https://www.youtube.com/watch?v=iMhDYarsfII&list=PLbMVogVj5nJRvq-w3zway7k3GzmUDte3a&index=24 3. https://www.youtube.com/watch?v=0tMs9EkktIY&list=PLbMVogVj5nJRvq-w3zway7k3GzmUDte3a&index=33 4. https://www.youtube.com/watch?v=eDCDrRzHGuE&list=PLAMHSEssaOJvCFoRdbbmFMi7tQhpV902s&index=18	

Course Code: MPH 431	M.Sc. Physics- Semester-IV **Physics and our World**	L-4 T-1 P-0 C-5
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the world we inhabit	
CO2.	**Understanding** the hierarchical structuring of the universe in categories of space, time, matter and energy, from the very small to the gigantic.	
CO3.	**Understanding** the bonding from chemical compound to large molecule and living matter.	
CO4.	**Applying** the physical concept in weather forecast.	
CO5.	**Analyzing** physical realities of quantum world	
Course Content:		
Unit-1:	Space and Time A discussion on length scales and dimensions, Galaxies, The solar system and Planet Earth, Rotation and revolution of the Earth, Seasons, Calendars in history and the recording of time. Laws of nature – a discussion of principles, theories and models, Gravitation, Planetary motion and Kepler's laws, The laws of motion in the eyes of Galileo and Newton.	**8 Hours**
Unit-2:	The relationship between space and time: A basic account of the theory of relativity, Does nature differentiate between Left and Right?- The notion of Parity Is there an —arrow of time? Entropy and the laws of thermodynamics The size of the universe - Is the universe expanding?	**8 Hours**
Unit-3:	Matter and Energy Discrete and continuous matter- a brief historical survey, Atoms and molecules: Structure of atoms, the nucleus, Elementary particles, Unification of forces Equivalence of matter and energy, Nuclear energy and thermonuclear power. The Periodic table of elements, Chemical bonds and molecules, Large molecules and living matter.	**8 Hours**
Unit-4:	Waves and oscillations, Electromagnetic radiation and spectrum, Propagation of waves Energy in the atmosphere- Wind and solar energy, Weather predictability and chaos,	**8 Hours**
Unit-5:	Indeterminacy, The quantum world -- an introduction, Debates on the conceptualization of physical realities – is nature unreasonably mathematical?	**8 Hours**
Text Book:	The Evolution of Physics- Einstein and L. Infeld, Toughstone 1967.	
Reference Books:	1. The Ascent of Man- J. Bronowski, Liffle and Brown Company, 1976. 2.Cosmos- Carl Sagan, McDonald and Company, 2003. 3. In search of Schrodinger's Cat- John Gribbin, Random House, 2012 4. Chaos- James Gleick, Viking Penguin, 1987 5. Doubt And Certainty – Tony Rothman and George Sudarshan (Helix books, Cambridge, 1998) *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=0nHovWsWZTw&list=PLRuWd0sgheSZLMfA9yl_-cYEW_QyRlssD 2. https://www.youtube.com/watch?v=PEXSH8dB-Uk 3. https://www.youtube.com/watch?v=R-x9KdNjQmo&list=PL1955A15B7F282A7F	

Course Code: MAT461	**M.Sc. Physics- Semester-IV** **MATLAB Programming**	**L-0** **T-1** **P-2** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** simple program modules to implement single numerical methods and algorithms.	
CO2.	**Applying** to use basic flow controls (if-else, for, while).	
CO3.	**Applying** Test program output for accuracy using hand calculations and debugging techniques	
CO4.	**Applying** multiple program modules into larger program packages	
CO5.	**Analyzing** the generate plots and export this for use in reports and presentations.	
Course Content:		
Unit-1:	**MATLAB Basics:** MATLAB environment, Menus and the toolbar, Basic computer programming, variables and constants, operators and simple calculations, formulas and functions, MATLAB toolboxes, use of MATLAB help, Debugging MATLAB codes**.**	**8 Hours**
Unit-2:	**Matrices & Vectors**: Matrix representation, Resizing and Reshaping Matrices, General Operating on Matrices, Multidimensional Arrays and sorting of arrays, Matrices in the MATLAB Environment, Matrix Operations and Function in MATLAB, MatrixDivision, Eigen values and vectors, Special matrices.	**8 Hours**
Unit-3:	**Loop and Selection Statements:** Functions and Scripts, break statement, continue statement, end statement, for statement, for nested loop statement, if/else if/else statement, while statement - nested while statement.	**8 Hours**
Unit-4:	**Plotting And I/O:** Plot functions, X-Y Plotting,plotyy, surf, mesh, contour, pie chart, bar diagram, 3D plots, handle graphics and plot properties, saving and printing plots, File input/output, writing and reading spreadsheet files, Using MAT files for variables, Simple programs.	**8 Hours**
Unit-5:	**Toolboxes:** Curve fitting toolbox: Curve Fitting Objects and Methods. Signal Processing toolbox: Filter Design Process Overview, Basic Filter Design Process. Symbolic math toolbox: Symbolic Objects, Creating and Performing Symbolic Computations.	**8 Hours**
Text Book:	**1.** Ross L. Spencer and Michael Ware, Introduction to MATLAB, Brigham Young University.	
Reference Books:	**1.** Suresh Chandra, Applications of Numerical Techniques with C, Narosa. **2.** Vinay K. Lngle and John G. Proakis, Digital Signal Processing Using Matlab, PWS Publishing Company. **3.** P.B. Zbar and A.P. Malvino, Basic Electronics: A Text-Lab Manual, Tata Mc-Graw Hill. ***Latest editions of all the suggested books are recommended.**	

Additional electronic reference materials	1. https://www.youtube.com/playlist?list=PLRWKj4sFG7-6_Xr9yqg6SMr_F80KdFVhN 2. https://www.youtube.com/playlist?list=PLp6ek2hDcoNAyvh2A1y628-9fzXq6pXuf 3. https://www.youtube.com/playlist?list=PLYdXvSx87cgRJfv6gZl7GjAs0GNvyg-uS	

Experiments:

Experiments:	Note: Minimum 15 experiments should be performed:	
Experiment-1:	To find the Local Environment for MATLAB programming.	
Experiment-2:	Enter the m*n order matrix.	
Experiment-3:	Find the matrix transpose.	
Experiment-4:	Find the inverse of matrix.	
Experiment-5:	Find the addition, subtraction & multiplication of matrix.	
Experiment-6:	If $V_1 = 5v$, $V_2 = 6v$, $Z_{11}=2$, $Z_{12}=1$, $Z_{21}=3$ $Z_{22}=4$, get the value of I_1 and I_2?	
Experiment-7:	If A1 = [2 7 6 8 9 10] and B1 = [6 4 3 2 3 4], Find a) C1 = A1.*B1 b) D1 = A1./B1	
Experiment-8:	If r1 = [7 3 5] and s1 = [2 4 3], get a) q1 = r1.^s1 b) q2 = r1.^2	
Experiment-9:	State if the following statements are true or false, a) If a MATLAB statement ends with a semicolon (;) MATLAB evaluates the statement but suppresses the display of the results. b) The end of each row in entering a matrix, is indicated by a semicolon (;) c) MATLAB is case sensitive in naming variables only.	
Experiment-10:	Enter the following matrix, **A = 1 3 4 2** **2 0 1 6** **4 1 2 7** **0 3 6 4** a. Get the diagonal of the matrix A b. Get the sum of each column in the matrix A c. Get the sum of each row in the matrix A d. Get the sum of all elements in the matrix A e. Add 2 to the element in the 2nd row and 3rd column	
Experiment-11:	Enter the following complex number, z = 2-j3 then a. Get the real and the imaginary parts of z b. Get the magnitude and the phase angle of z c. If y = 3+j5, calculate the following: y+z, y-z, y×z	
Experiment-12:	If w = [1+j 5-2*j; 3+2*j 4+3*j] a. Get the conjugate transpose b. Get the point transpose c. Type the elements of 2nd row only	
Experiment-13:	Reshape matrix.	

Experiment-14:	Eliminate Rows of matrix.	
Experiment-15:	Sorting a matrix	
Experiment-16:	Plot, xlabel, ylabel, title, and axis commands;	
Experiment-17:	Find difference between plot, semilogy, semilogx, logogcommands	
Experiment-18:	Bar plot, Pie chart, 3D plots command	
Experiment-19:	Creating and performing symbolic computations.	

Evaluation Scheme of Practical Examination:

Internal Evaluation (50 marks)

Each experiment would be evaluated by the faculty concerned on the date of the experiment on a 4-point scale which would include the practical conducted by the students and a Viva taken by the faculty concerned. The marks shall be entered on the index sheet of the practical file.

Evaluation scheme:

PRACTICAL PERFORMANCE & VIVA DURING THE SEMESTER (35 MARKS)				ON THE DAY OF EXAM (15 MARKS)		TOTAL INTERNAL (50 MARKS)
EXPERIMENT (5 MARKS)	FILE WORK (10 MARKS)	VIVA (10 MARKS)	ATTENDANCE (10 MARKS)	EXPERIMENT (5 MARKS)	VIVA (10 MARKS)	

External Evaluation (50 marks)

The external evaluation would also be done by the external Examiner based on the experiment conducted during the examination.

EXPERIMENT (20 MARKS)	FILE WORK (10 MARKS)	VIVA (20 MARKS)	TOTAL EXTERNAL (50 MARKS)

Course Code: MPH492	M.Sc. Physics- Semester-IV **Project**	L-0 T-0 P-12 C-6

For students to enter into preliminary research field both in theory and experiment the concept of Project has been introduced in the final Semester. In the Project, the student will explore new developments from the books and journals, collecting literature / data and write a Dissertation based on his / her work and studies. The Project Work can also be based on experimental work in industries / research laboratories.

Selection of Topic:

1. Students will make project which should be preferably a working of third thoughts based on their subject.
2. The student will be assigned a faculty guide who will be the supervisor of the students. The faculty would be identified at the end of the III semester.
3. The assessment of performance of the students should be made at least twice in the semester. Internal assessment shall be for 50 marks. The students shall present the final project live using overhead projector PowerPoint presentation on LCD to the internal committee and the external examiner.
4. The evaluation committee shall consist of faculty members constituted by the college which would be comprised of at least three members comprising of the department Coordinator's Class Coordinator and a nominee of the Director/Principal. The students guide would be special in invitee to the presentation. The seminar session shall be an open house session. The internal marks would be the average of the marks given by each members of the committee.

The Marking shall be as follows.

Internal: 50 marks

By the Faculty Guide – 25 marks

By Committee appointed by the Director/Principal – 25 marks

External: 50 marks

By External examiner by the University – 50

Note: Project will be prepared as per approved project template which included the entire guidelines & format related project.

EVALUATION SHEET

(To be filled by the GUIDE & Internal Examiners only)

Name of Candidate:
Roll No:

Class and Section:

Please evaluate out of five marks each.

S. No.	Details	Marks (5) Guide	Marks (5) Int. Exam. 1	Marks (5) Int. Exam. 2
1.	Objective Identified &Understood			
2.	Literature Review / Background Work (Coverage, Organization, Critical Review)			
3.	Discussion/Conclusions (Clarity, Exhaustive)			
4.	Slides/Presentation Submitted (Readable, Adequate)			
5.	Frequency Of Interaction (Timely Submission, Interest Shown, Depth, Attitude)			
	Total (Out of 25)			
	Average out of 50			

Signature: Signature: Signature:
Date: Date: Date:

EVALUATION SHEET FOR EXTERNAL EXAMINER

(To be filled by the External Examiner only)

Name of Candidate:

Roll No:

I. For use by **External Examiner ONLY**

S. No.	Details	Marks (10) each
1.	Objective Identified & Understood	
2.	Literature Review / Background Work (Coverage, Organization, Critical Review)	
3.	Discussion/Conclusions (Clarity, Exhaustive)	
4.	Power Point Presentation (Clear, Structured)	
5.	Slides (Readable, Adequate)	
	Total (Out of 50)	

Signature:

Date:

Course Code: MGP411	M.Sc. Physics- Semester-IV **Discipline & General Proficiency**	L-0 T-0 P-0 C-0

There shall be continuous evaluation of the student on the following broad parameters:

1. Observance of dress code.

2. Participation in Conferences /Workshops / Seminars.

3. Attendance in guest lectures, invited talks and special technical sessions organized from time to time.

4. Participation in community projects including NSS.

5. Exhibiting team spirit in different Culture & extra curriculum activities, Department Club activities of the University and College organized from time to time.

6. Observance of rule & regulations in the College/University, Behavior in Campus Premises, Bus, hostel mess and hostel.

7. Performance and awards received in different events (sports/ co-curricular activities) organized at College / University and other level.

8. General behavior

9. Any extraordinary achievement.

The above is an indicative list of parameters on which the students shall be continuously evaluated. The college may evaluate the student on the specific parameters by informing them through a notice displayed on the notice board before evaluation. There shall be no external examination for this course; however, the marks shall be included for calculation of cumulative Performance Index (CPI).

Head of Department would be display GP marks on notice board in prescribed format after IInd&IIIrd CT in semester:

S No		Enroll No.	Student Name	Dress code	Participation in Conferences /Workshops / Seminars	Participation in guest lectures, invited talks and special technical sessions	Participation in community Services	Participation in Culture & extra curriculum activities, Department Club Activities	Participation in sports/ co-curricular activities	General Behavior	Any Extra Achievement
				(5)	**(15)**	**(20)**	**(10)**	**(20)**	**(20)**	**(5)**	**(5)**
	Responsible for marks			Mentor	Head	Head	Mentor	Cultural Events Coordinator & Department Club Coordinator	Sports Coordinator	Mentor	Director or Principal

Course Code: MPH411	**Discipline Specific Elective Course-III** **M.Sc. Physics- Semester-IV** **Plasma Physics**	**L-4 T-0 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** basic concept of Plasma state and various gas discharge principle and method.	
CO2.	**Understanding** the concept of fluid and kinetic description of plasma.	
CO3.	**Understanding** the concept of thermonuclear fusion.	
CO4.	**Applying** single particle dynamics to understand the particle confinement.	
CO5.	**Applying** the fluid description of plasma explaining the generation of ion acoustic, Alfven and magnetosonic wave.	
CO6.	**Applying** the kinetic description of plasma to explain the phenomena of Landau damping.	
Course Content:		
Unit-1:	Introduction to the Plasma State, elementary concepts and definitions of temperature and other plasma parameters, occurrence and importance of plasma for various applications. Physics of glow discharge, electron emission, ionization breakdown of gases, Paschen's laws and different regimes of E/p in a discharge, Townsend discharge and the evolution of a discharge.	**8 Hours**
Unit-2:	Single particle orbit theory: Drifts of charged particles under the effect of different combinations of electric and magnetic fields. Crossed electric and magnetic fields. Homogenous electric and magnetic fields, spatially varying electric and magnetic fields, time varying electric and magnetic fields, particle motion in large amplitude waves	**8 Hours**
Unit-3:	Fluid description of plasmas: distribution functions and Liouville's equation, macroscopic parameters of plasma, two and one fluid equations for plasma. Waves in fluid plasmas: dielectric constant of field free plasma, plasma oscillations, space charge waves of warm plasma, dielectric constant of a cold magnetized plasma, ion-acoustic waves, Alfven waves, Magnetosonic waves	**8 Hours**
Unit-4:	Kinetic description of plasma: microscopic equations for many body systems: Statistical equations for a many body system, Vlasov equation and its properties, drift kinetic equation andits properties.	**8 Hours**
Unit-5:	Waves in Vlasov Plasma: Vlasov equation and its Linearization, solutions of linearisedVlasov equation, theories of Langumuir waves, Landau damping, Ion Acoustic waves, Drift waves inmagnetized plasmas. Thermonuclear fusion: Status, problems and technological requirements. Applications of cold low pressure and thermal plasmas.	**8 Hours**
Test Book:	**1.** Introduction to Plasma Physics, FF Chen.	
Reference Books:	1.Principles of Plasma Physics, Krall and Trievelpiece. 2.Introduction to Plasma Theory, DR Nicholson. *** Latest editions of all the suggested books are recommended**.	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=wO2HS7hcSb8&list=PLbMVogVj5nJS4KY5UFWBLSu7kMzPbL35T 2. https://www.youtube.com/watch?v=CiBmD0Zr07s&list=PlbMVogVj5nJS4KY5UFWBLSu7kMzPbL35T&index=2 3. https://www.youtube.com/watch?v=_V-CnFzzoUw&list=PlbMVogVj5nJS4KY5UFWBLSu7kMzPbL35T&index=8	

Course Code: MPH413	**Discipline Specific Elective Course-III** **M.Sc. Physics- Semester-IV** **Astrophysics**	**L-4 T-0 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the basic concepts of Astronomy, various co-ordinates and time systems and various astronomical instruments.	
CO2.	**Understanding** the properties and classification of stars.	
CO3.	**Understanding** the physics of the sun and its interior structure, properties of planets and satellites and theory of formation of the solar system.	
CO4.	**Applying** Chandrasekhar's Limit for the formation of White Dwarfs, Neutron Stars, and Black Holes.	
CO5.	**Applying** the concepts of hydrostatic equilibrium, mass conservation, luminosity and temperature gradient equations for the formation of stellar structure.	
CO6.	**Applying** the Schwarzschild criterion for the stability of the stellar medium.	
Course Content:		
Unit-1:	Basic concepts of Astronomy: Co-ordinate system, Time System-Solar and Sidereal times, Apparent and Absolute magnitudes, Trigonometric Parallax, Atmospheric extinction, Optical telescopes and their characteristics, Modern Optical telescopes, Astronomical Instruments – Photometer, Photographic plates, Spectrographs, Charge Coupled Detector	**8 Hours**
Unit-2:	Stellar properties: Observational properties of stars – spectral and luminosity classification of stars- H-R Diagram, Saha Equation, , Star Formation – Jeans mass, Jeans Length and Free fall timescale, Main Sequence Evolution, Mass- luminosity relation, White Dwarfs –Chandrasekhar's Limit, Neutron Stars, Pulsars, Supernovae, Stellar Black holes	**8 Hours**
Unit-3:	Solar system: Overview of Sun, Solar Interior structure- Core, Radiative zone and Convective Zone, solar atmosphere-photosphere, Chromospheres, Properties of Interior planets and exterior planets satellites of planets, Kuiper Belt objects, Oort Cloud, Theories of formation of the solar system.	**8 Hours**
Unit-4:	Stellar structure: Hydrostatic Equilibrium, Mass conservation, Luminosity gradient equation, Temperature gradient Equations, Lane – Emden equation for polytrophic stars and its physical solution, estimates of central pressure and temperature	**8 Hours**
Unit-5:	Radiation pressure, equation for generation and luminosity, equation of temperature gradient for radiative and convective equilibrium, Schwarzschild criterion, gas pressure and radiation pressure, Linear Model and its properties, Volt – Russell theorem, Zero age main sequence, Mass – Luminosity relation.	**8 Hours**
Text Book:	**1.** Kristian Rohlf: Tools of Radio Astronomy, Springer.	
Reference Books:	1.Ostlie and Carroll: Introduction to Modern Astrophysics, Addison Wesley (II Edition). **2.** John D. Krauss: Radio Astronomy, Signet. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=Co5_y6Ie5rg 2. https://www.youtube.com/watch?v=dpRqK_awV9Y&list=PLy5Ast_vPItFNkraErbQ8AmWEaQMt34Rx 3. https://www.youtube.com/watch?v=jMPyTG6UqlY&list=PLy5Ast_vPItFNkraErbQ8AmWEaQMt34Rx&index=5	