Study & Evaluation Scheme

of

Bachelor of Science (Hons.) (Physics)

[Applicable for Academic Session 2021-22]

[As per CBCS guidelines given by UGC]

TEERTHANKER MAHAVEER UNIVERSITY

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

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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	*B.Sc.(H) Physics*
Duration	*Three Years full time (Six Semesters)*
Medium	*English*
Minimum Required Attendance	*75%*
Credits	
Maximum Credits	*149*
Minimum Credits Required for Degree	*143*

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 of 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-B.Sc.(H) Physics

A. Introduction:

The main goal of physics is to explain how things move in space and time and understand how the universe behaves. It studies matter, forces and their effects. Physics is a science of nature which deals the various phenomena from our daily life as well as interaction at atomic scales. It satisfies not only our curiosity to understand about galaxy and universe but also the backbone of engineering and technology. B.Sc. (Honours) in Physics is intended to provide a broad framework to create an academic base that responds to the need of the students to understand the basics of Physics and its ever-evolving nature of applications in explaining the entire observed natural phenomenon as well as predicting the future applications to the new phenomenon.

The curriculum framework is designed and formulated in order to acquire and maintain standards of achievement in terms of knowledge, understanding and skills in Physics and their applications to the natural phenomenon as well as the development of scientific attitudes and values appropriate for rational reasoning, critical thinking and developing skills for problem solving and initiating research which are competitive globally.

The scope of physics is broadly divided into classical and modern physics. The key areas of classical physics comprise special relativity, classical mechanics, statistical mechanics, thermodynamics, electricity and magnetism, and optics. The modern physics deals quantum mechanics, atomic physics, nuclear particle physics, condense matter physics, laser physics. Development of new interdisciplinary subjects like nano-science, medical physics, and their applications from physics point of view added new dimension. Thus, the degree programme in physics also intended to cover overlapping areas of physics with chemistry, mathematics, environmental sciences. Further, a broad range of subjects such as Design and Installation of photo voltaic system, MATLAB, SPSS and Database management studies are introduced which can be helpful for students/faculty members to broaden the scope of their studies and hence applications from job perspective point of view. In addition, National Laboratory visits/industrial visits/ projects are encouraged and added to the curriculum in order to enhance better exposure to jobs/employment opportunities in National lab, scientific projects and allied sectors.

The aims and objectives of our three-year degree UG programs in sciences in general and Physics in particular should be structured to create the facilities and environment in our institution to upgrade the knowledge of students and to motivate and inspire them to create deep interest in Physics. Our objective to develop broad and balanced knowledge of students for their understanding of physical concepts, principles and theories of Physics, designing and performing of experiments in the labs to demonstrate the concepts, principles theories learned in the classrooms. The curriculum include almost every area of physics such as Modern Physics, Quantum Physics, Material science, Nuclear and Particle Physics, Condensed matter Physics, Atomic and Molecular Physics, Mathematical Physics, Nano Science and Nano Technology, Electronics, Classical Physics, Mechanics, electricity and magnetism, optics and other related fields of study, including broader interdisciplinary subfields like Chemistry, Mathematics, Environmental sciences, Atmospheric Physics, Computer science, Polymer Science. The students during the course of study will be capable for asking relevant/appropriate questions and problems in the field of Physics, and planning, to executing the theoretical or experimental investigation such as Team player/ Skilled project manager.

The aim of bachelor's degree programme in physics is intended to provide:

1. Read, understand and interpret physical information – verbal, mathematical and graphical.
2. Impart skills required to gather information from resources and use them.
3. To give need-based education in physics of the highest quality at the undergraduate level thus enabling them to undertake further studies in Physics in related areas or multidisciplinary areas that can be helpful for self-employment/entrepreneurship
4. Offer courses to the choice of the students.
5. Perform experiments and interpret the results of observation, including making an assessment of experimental errors. Activities outside the classroom, such as independent research or study, allow students to further develop their knowledge and understanding.
6. Provide an intellectually stimulating environment to develop skills and enthusiasms of students to the best of their potential.
7. Attract outstanding students from all backgrounds.
8. To enable the graduate, prepare for national as well as international competitive examinations, especially IIT-JAM and UPSC Civil Services Examination.

Course handouts for students will be provided in every course. A course handout is a thorough teaching plan of a faculty taking up a course. It is a blueprint which will guide the students about the pedagogical tools being used at different stages of the syllabus coverage and more specifically the topic-wise complete plan of discourse, that is, how the faculty members treat each and every topic from the syllabus and what they want the student to do, as an extra effort, for creating an effective learning. It may be a case study, a role-play, a classroom exercise, an assignment- home or field, or anything else which is relevant and which can enhance their learning about that particular concept or topic. Due to limited availability of time, most relevant topics will have this kind of method in course handout.

The program structure and credits for B.Sc. (H) are finalized based on the stakeholders' requirements and general structure of the programme. Minimum number of classroom contact teaching credits for the B.Sc. (H) program will be 149 credits (one credit equals 1.0 hour) and Project and internship will be of (05+03) 08 credits. However, the minimum number of the credits for award of B.Sc (H) degree will be 143 credits. Out of 149 credits of classroom contact teaching, 66 credits are to be allotted for core courses (CC), 12 credits are allotted to Ability-Enhancement Compulsory Course (AECC), 07 credits are allotted to Skill-Enhancement Compulsory Course (SEC), 03 credits are allotted to Mandatory Courses (MC), 30 credits are allotted to Open/Generic Elective Course (OEC/GEC), 08 credits are allotted to Program/Discipline Specific Elective Course (DSEC), 15 credits are allotted to Laboratory Courses (LC).05 credits are allotted to Project and 03 credits are allotted for internship. Credits distribution is given below in tabular form:

B.Sc. (H) Physics: Three-Year (6-Semester) CBCS Programme			
Basic Structure: Distribution of Courses			
S. No.	**Type of Course**	**Credit Hours**	**Total Credits**
1	Core Course (CC)	3 Courses of 6Credits each (Total Credit Hrs. 3X6) 12 Courses of 4Credits each (Total Credit Hrs. 12X4)	66
2	Ability-Enhancement Compulsory Course (AECC)	4 Courses of 3 Credits each (Total Credit Hrs. 4X3)	12
3	Skill-Enhancement Compulsory Course (SEC)	1 Course of 4Credits each (Total Credit Hrs. 1X4) 1 Course of 3Credits each (Total Credit Hrs. 1X3)	07
4	Open/Generic Elective Course (OEC/GEC)	4Courses of 4 Credits each (Total Credit Hrs. 4X4) 4 Courses of 2 Credits each (Total Credit Hrs. 4X2) 2 Courses of 3 Credits each (Total Credit Hrs. 2X3)	30
5	Program/Discipline Specific Elective Course (DSEC)	2 Courses of 4Credits each (Total Credit Hrs. 2X4)	08
6	Value Added Course (VAC)	6 Courses of 0 Credits each (Total Credit Hrs. 6X0)	00
8	MC-Mandatory Courses	1 Course of 3 Credits each (Total Credit Hrs. 1X3)	03
9	LC –Laboratory Courses	7 Courses of 2 Credits each (Total Credit Hrs. 7X2) 1 Course of 1 Credit each (Total Credit Hrs. 1X1)	15
10	PROJ& Internship	1 Course of 5 Credits each (Total Credit Hrs. 1X5) 1 Course of 3 Credits each (Total Credit Hrs. 1X3)	08
11	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			**149**

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 B.Sc. (H) program:

- ***Core competency:*** Core courses of B.Sc. (Hons.) 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 include 15 theory Papers and 8 laboratory courses which covers both Classical and Modern Physics, Electricity and Magnetism, Mechanics, Optics, Statistical Physics, Thermodynamics, Electromagnetic Theory, Quantum Physics, Atomic and Molecular Physics and Solid-State Physics etc.

- ***Generic Elective Course (GEC):*** Generic Elective is an interdisciplinary additional subject that is compulsory in the first, second, third and fourth semester of a program. The score of Generic Elective is counted in your overall aggregate marks under Choice Based Credit System (CBCS). Each Generic Elective paper will be of 4 Credits and students will have the choice of taking 4 GE's: One paper in Semester I, II, III& IV. Each student has to take Generic Electives from department other than the parent department. Core / Discipline Specific Electives will not be offered as Generic Electives.

- ***Program/Discipline Specific Elective Course (DSEC):*** A graduate student is expected to be capable of demonstrating comprehensive knowledge and understanding of both theoretical and experimental/applied physics knowledge in various fields of interest.

- ***Skilled communicator:*** The course curriculum incorporates basics and advanced training in order to make a 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 graduate students to develop critical thinking ability by way of solving problems/numerical 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 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 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 –(Optional) 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 four courses of Aptitude in Semester I, II, III&IV semesters and two courses of Soft Skills in III&IV Semesters and will carry no credit. 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 three SECs-during the whole program, One SEC will carry 3 credits each.

- ***Open Elective Course (OEC):*** Open Elective is an interdisciplinary additional subject that is compulsory in a program. The score of Open Elective is counted in the overall aggregate marks under Choice Based Credit System (CBCS). Each Open Elective paper will be of 3 Credits in Vth semesters. Each student has to take Open/Generic Electives from department other than the parent department. Core / Discipline Specific Electives will not be offered as Open Electives.

- ***Mandatory Course (MC):*** This is a compulsory course that does not have any choice and will be of 3 credits. Each student of B.Sc. (Hons.) Program has to compulsorily pass the Environmental Studies.

C. Programme Outcomes (POs)

The learning and abilities or skills that a student would have developed by the end of three-years B.Sc.(H) Programs**:**

PO – 1	**Critical thinking** - This is based on the assumption, thinking and actions. These assumptions are tested for accuracy & validity taking into consideration the ideas and decisions. These ideas may be collected from intellectual organization or personal from different prospectus.
PO – 2	**Effective communication-** Effective communication an important tool to enhance the effectiveness of learning among the students. The speaking, reading & writing must be followed correctly.
PO – 3	**Social interaction –**Social interaction also play important role to reads the conclusion in group settings.
PO – 4	**Effective citizenship**- This contributes in the national development and promptness to achieve the goals. It develops awareness through volunteering.
PO – 5	**Ethics-** It has direct impact to recognize the different value systems. It gives proper understanding in different dimension for making decisions.
PO – 6	**Environment and sustainability**- Essential to understand the environmental issues & sustainable development.
PO – 7	**Self-directed & lifelong learning –** Acquire the ability to engage in independent and life- long learning in broad spectrum including socio technological changes.
PO- 8	**Problem analysis & Solving:** Identify, formulate, research literature, and analyze complex basic sciences problems reaching substantiated conclusions using first principles of mathematics, natural sciences.
PO- 9	**Entrepreneurship:** An Entrepreneurship cut across every sector of human life including the field of engineering, engineering entrepreneurship is the process of harnessing the business opportunities in engineering and turning it into profitable commercially viable innovation.
PO- 10	**Interpersonal skills:** Interpersonal skills involve the ability to communicate and build relationships with others. Effective interpersonal skills can help the students during the job interview process and can have a positive impact on your career advancement.
PO- 11	**Technology savvy/usage:** Being technology savvy is essentially one's skill to be smart with technology. This skill reaches far beyond 'understanding' the concepts of how technology works and encompasses the 'utilization' of such modern technology for the purpose of enhancing productivity and efficiency.

D. Programme Specific Outcomes (PSOs)

The learning and abilities or skills that a student would have developed by the end of three-years B.Sc. (H) Physics**:**

PSO – 1	Remembering the basic with sufficient contents of topic from classical, modern and contemporary areas of exciting development of physical sciences
PSO – 2	Understanding the vast scope of physics as a theoretical and experimental science with application in solving most of the problem in nature spanning from 10^{-15} m to 10^{26} m in space and 10^{-10} eV to 10^{25}eV in energy dimension
PSO – 3	Applying the classroom learning to perform basic laboratory experiments and relating the corresponding observation to explain the real-life problems.
PSO – 4	Analysing the real-life problems and to seek their solutions using one's own knowle understanding related to Physics
PSO – 5	Demonstrating subject related and transferable skills that are relevant to some of the physics related jobs and employment opportunities.
PSO – 6	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 Honours 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 Counselling:** - Identifies the problem of student as early as possible and gives time to discuss their problems individually as well as with the parents. Counselling 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 counsellors 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. This 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 Counselling, Soft skill development, Remedial Coaching, Bridge Course, Language Lab, Yoga and Meditation, Personal Counselling

- **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

B.Sc. (H) (Physics)-Semester I

S. No	*Category*	*Course Code*	Course	*Periods*			*Credit*	*Evaluation Scheme*		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	CC-1	BAS119	Mathematical Physics-I	5	1	-	6	40	60	100
2	CC-2	BAS114	Mechanics	4	-	-	4	40	60	100
3	SEC-1	BCS112	Computer System &C++ Programming	3	1	-	4	40	60	100
4	AECC-1	TMUGE101	English Communication-I	2	-	2	3	40	60	100
5	GEC-1		Generic Elective Course: Generic Elective-I	4	-	-	4	40	60	100
6			Generic Elective Course (Lab): Generic Elective-I (lab)	-	-	4	2	50	50	100
7	*LC-1	BAS166	Mechanics (Lab)	-	-	4	2	50	50	100
8	LC-2	BCS162	Computer System &C++ Programming (Lab)	-	-	2	1	50	50	100
9	DGP-1	BGP111	Discipline & General Proficiency	**-**	**-**	**-**	**-**	100	-	100
			Total	**18**	**2**	**12**	**26**	**450**	**450**	**900**

Value Added Course (Optional):
It is an audit course. The performance of the student in this course will not be counted in the overall result.

1	VAC-1	TMUGA-101	Foundation in Quantitative Aptitude	2	1	-	-	40	60	100

*Some of the lab experiments may be conducted through virtually (https://www.vlab.co.in/)

B.Sc. (H) (Physics)-Semester II

S. No	Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	CC-3	BAS218	Electricity and Magnetism	4	-	-	4	40	60	100
2	CC-4	BAS220	Waves & optics	4	-	-	4	40	60	100
3	AECC-2	TMUGE201	English Communication-II	2	-	2	3	40	60	100
4	GEC-2		Generic Elective Course: Generic Elective-II	4	-	-	4	40	60	100
5			Generic Elective Course (Lab): Generic Elective-II (Lab)	-	-	4	2	50	50	100
6	MC-1	TMU201	Environmental Studies	2	1	-	3	40	60	100
7	*LC-3	BAS268	Electricity and Magnetism (Lab)	-	-	4	2	50	50	100
8	*LC-4	BAS266	Waves & optics (Lab)	-	-	4	2	50	50	100
9	DGP-2	BGP211	Discipline & General Proficiency	-	-	-	-	100	-	100
			Total	**16**	**1**	**14**	**24**	**450**	**450**	**900**

Value Added Course (Optional):

1	VAC-2	TMUGA-201	Analytical Reasoning	2	1	-	-	40	60	100

*Some of the lab experiments may be conducted through virtually (https://www.vlab.co.in/)

B.Sc. (H) (Physics)-Semester III

S. No	Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	CC-5	BAS314	Elements of Modern Physics	3	1	-	4	40	60	100
2	CC-6	BAS320	Thermal Physics	4	-	-	4	40	60	100
3	CC-7	BAS332	Semiconductor Physics	4	-	-	4	40	60	100
4	GEC-3		Generic Elective Course: Generic Elective-III	4	-	-	4	40	60	100
5			Generic Elective Course (Lab): Generic Elective-III (Lab)	-	-	4	2	50	50	100
6	*LC-5	BAS364	Elements of Modern Physics (Lab)	-	-	4	2	50	50	100
7	*LC-6	BAS365	Thermal Physics (Lab)	-	-	4	2	50	50	100
8	DGP-3	BGP311	Discipline & General Proficiency	-	-	-	-	100	-	100
			Total	**15**	**1**	**12**	**22**	**410**	**390**	**800**

***Value Added Course (Optional):**

1		TMUGE301	English Communication-III	2	-	2	3	40	60	100
2	VAC-3	TMUGA-302	Modern Algebra and Data Management	2	1	-	-	40	60	100
3	VAC-4	TMUGS-301	Managing Self	2	1	-	-	50	50	100

*Some of the lab experiments may be conducted through virtually (https://www.vlab.co.in/)

B.Sc. (H) (Physics)-Semester IV

S. No	*Category*	*Course Code*	Course	*Periods*			*Credit*	*Evaluation Scheme*		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	CC-8	BAS433	Mathematical Physics-II	5	1	-	6	40	60	100
2	CC-9	BAS434	Atomic & Laser Physics	4	-	-	4	40	60	100
3	CC-10	BAS438	Electromagnetic Theory	4	-	-	4	40	60	100
4	GEC-4		Generic Elective Course: Generic Elective-IV	4	-	-	4	40	60	100
5			Generic Elective Course (Lab): Generic Elective-IV (Lab)	-	-	4	2	50	50	100
6	*LC-7	BAS473	Atomic &Laser Physics (Lab)	-	-	4	2	50	50	100
7	DGP-4	BGP411	Discipline & General Proficiency	-	-	-	-	100	-	100
			Total	**17**	**1**	**8**	**22**	**360**	**340**	**700**

***Value Added Course (Optional):**

1	AECC-4	TMUGE401	English Communication-IV	2	-	2	3	40	60	100
2	VAC-5	TMUGA-402	Advance Algebra and Geometry	2	1	-	-	40	60	100
3	VAC-6	TMUGS-401	Managing Work and Others	2	1	-	-	50	50	100

MOOC Course:

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

*Some of the lab experiments may be conducted through virtually (https://www.vlab.co.in/)

B.Sc. (H) (Physics)-Semester V

S. No	Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	CC-11	BAS523	Quantum Mechanics	4	-	-	4	40	60	100
2	CC-12	BAS537	Mathematical Physics-III	5	1	-	6	40	60	100
3	CC-13	BAS524	Solid State Physics	4	-	-	4	40	60	100
4	AECC-5	BHM515	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	OEC-1		Open Elective Course: Open Elective-I	3	-	-	3	40/50	60/50	100
7	*LC-8	BAS567	Solid State Physics (Lab)	-	-	4	2	50	50	100
8	PROJ-1	BAS 598	Industrial Training & Presentation	-	-	6	3	50	50	100
9	DGP-5	BGP511	Discipline & General Proficiency	-	-	-	-	100	-	100
			Total	**23**	**1**	**10**	**29**	**440/450**	**460/450**	**900**

MOOC Course:

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

*Some of the lab experiments may be conducted through virtually (https://www.vlab.co.in/)

B.Sc. (H) (Physics)-Semester VI

S. No	*Category*	*Course Code*	**Course**	*Periods*			*Credit*	*Evaluation Scheme*		
				L	*T*	*P*		*Internal*	*External*	*Total*
1	CC-14	BAS635	Statistical& Classical Mechanics	4	-	-	4	40	60	100
2	CC-15	BAS621	Nuclear & Particle Physics	4	-	-	4	40	60	100
3	DSE-2		Discipline Specific Elective Courses: Discipline Specific Elective Course-II	4	-	-	4	40	60	100
4	OEC-2		Open Elective Course: Open Elective-II	3	-	-	3	40/50	60/50	100
5	AECC-6	BHM615	Entrepreneurship	3	-	-	3	40	60	100
6	SEC-2	BAS636	Design and Installation of Solar Photovoltaic System (Lab)	-	2	2	3	50	50	100
7	PROJ-2	BAS698	Project	**-**	**-**	10	5	50	50	100
8	DGP-6	BGP611	Discipline & General Proficiency	**-**	**-**	**-**	**-**	100	-	100
			Total	**18**	**2**	**12**	**26**	**400/410**	**400/390**	**800**

ELECTIVE COURSES OFFERED

S. No	Code	Course	L	T	P	Credit
Semester I - Generic Elective I - (Any one)						
1	BAS120	Fundamentals of Inorganic Chemistry	4	-	-	4
2	BAS117	Trigonometry & Differential Calculus	4	-	-	4
Semester I- Generic Elective I (Lab) - (Select one Corresponding Lab)						
3	BAS168	Fundamentals of Inorganic Chemistry (Lab)	-	-	4	2
4	BAS173	Calculus Lab (Lab)	-	-	4	2
Semester II- Generic Elective II - (Any one)						
5	BAS219	Fundamentals of Physical Chemistry	4	-	-	4
6	BAS231	Discrete Mathematics	4	-	-	4
Semester II- Generic Elective II (Lab)-(Select one Corresponding Lab)						
7	BAS269	Fundamentals of Physical Chemistry (Lab)	-	-	4	2
8	BAS271	Introduction to MATLAB	-	-	4	2
Semester III- Generic Elective III-(Any one)						
9	BAS321	Fundamentals of Organic Chemistry	4	-	-	4
10	BAS331	Numerical Analysis	4	-	-	4
Semester III- Generic Elective III (Lab) -(Select one Corresponding Lab)						
11	BAS366	Fundamentals of Organic Chemistry (Lab)	-	-	4	2
12	BAS371	Numerical Analysis (Lab)	-	-	4	2
Semester IV- Generic Elective IV- (Any one)						
13	BAS436	Polymer Chemistry	4	-	-	4
14	BAS418	Introduction to Probability	4	-	-	4
Semester IV- Generic Elective IV (Lab) - (Select one Corresponding Lab)						
15	BAS471	Polymer Chemistry (Lab)	-	-	4	2
16	BAS472	Statistical Package for Social Sciences (Lab)	-	-	4	2
Semester V-Discipline Specific Elective Course-I - (Any one)						
17	BAS538	Material Science	4	-	-	4
18	BAS013	Introduction to Nano Science and Technology	4	-	-	4
Semester VI-Discipline Specific Elective Course-II - (Any one)						
19	BAS622	Medical Physics	4	-	-	4
20	BAS623	Atmospheric Physics	4	-	-	4

Course Code: BAS119	B.Sc. (H) Physics- Semester-I **Mathematical Physics-I**	L-5 T-1 P-0 C-6
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** the concepts of Limit, Continuity and Differentiability of functions.	
CO2.	**Understanding** the concepts of differential equation in one- & two-dimensions.	
CO3.	**Understanding** the concepts of eigenvalue &eigen vectors of matrices.	
CO4.	**Understanding** the concepts of curvilinear systems.	
CO5.	**Applying** differential equations in heat transformation equations, application of vector Integration in finding Area, Volume & Moment of Inertia.	
CO6.	**Applying** curvilinear systems for Cylindrical, Spherical and Cartesian coordinates.	
Course Content:		
Unit-1:	**Calculus and First Order Differential equations:** Recapitulation: Limits, continuity, differentiation. Plotting functions. First Order Differential Equations: Variable separable, Homogeneous, Integrating Factor, Exact differential forms and their reducible forms.	**8 Hours**
Unit-2:	**Differential equations of Second Order:** Second Order Linear Differential Equations with constant coefficients, Particular Integral, Second Order Homogeneous Differential Equations with constant coefficients, Wronskian and general solution, Variation of parameters.	**8 Hours**
Unit-3:	**Vector Calculus and Calculus of functions of more than one variable:** Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields. Partial derivatives. Integrating factor with simple illustration. Constrained Maximization using Lagrange Multipliers.	**8 Hours**
Unit-4:	**Vector Differentiation and Vector Integration:** Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Vector identities. Line, surface and volume integrals of Vector fields.	**8 Hours**
Unit-5:	**Orthogonal Curvilinear Coordinates:** Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, spherical and cylindrical coordinates. Green's Theorems and Stokes Theorems, Gauss' divergence theorem, and their applications (no rigorous proofs).	**8 Hours**
Text Book:	**1.** Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, Elsevier.	
Reference Books:	**1.** Mathematical Tools for Physics, James Nearing, Dover Publications. **2.** Mathematical methods for Scientists and Engineers, D.A. McQuarrie, Viva Book Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, Jones and Bartlett Learning. **3.** Essential Mathematical Methods, K. F. Riley & M. P. Hobson, Cambridge Univ. Press. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	1. https://www.youtube.com/watch?v=ES741wq3APA&list=PLo2fuKadGpUTmZX6ubb3dIB7zrhs8Eyj8 2. https://www.youtube.com/watch?v=NBcGLLU90fM&list=PLbMVogVj5nJSGlf9sluucwobyr_zz6glD 3. https://www.youtube.com/watch?v=Kk5SEzASkZU&list=PL9m2Lkh6odgKbfY03TFRhwjOqW79UdzK8	

Course Code: BAS114	B.Sc. (H) Physics- Semester-I Mechanics	L-4 T-0 P-0 C-4
Course Outcomes :	**On completion of the course, the students will be :**	
CO1.	**Remembering** the concepts of Newtonian Mechanics of general bodies.	
CO2.	**Understanding** the concepts of rotational dynamics of bodies, gravitation, central forces, Oscillatory motion, Elasticity and fluid motions.	
CO3.	**Understanding** the frames of references and fundamentals of Special Theory of Relativity.	
CO4.	**Applying** the concepts of gravitation for understanding the motion of Satellites and planets.	
CO5.	**Applying** the concept of relativity in understanding the phenomena of time dilation, mass energy equivalence, twin paradox and relativistic addition of velocities.	
Course Content:		
Unit-1:	**Rotational Dynamics**: Centre of Mass and Laboratory frames. Angular momentum of a particle and system of particles, Torque, Principle of conservation of angular momentum, Rotation about a fixed axis, Moment of Inertia, Calculation of moment of inertia for rectangular, cylindrical and spherical bodies, Kinetic energy of rotation, Motion involving both translation and rotation.	**8 Hours**
Unit-2:	**Fluid Motion:** Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube. **Gravitation and Central Force Motion:** Law of gravitation. Gravitational potential energy, Inertial and gravitational mass, Potential and field due to spherical shell and solid sphere, **Non-Inertial Systems:** Non-inertial frames and fictitious forces. Uniformly rotating frame, Centrifugal force, Coriolis force.	**8 Hours**
Unit-3:	**Elasticity:** Relation between Elastic constants, Twisting torque on a Cylinder or Wire. **Central Forces:** Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution, Kepler's Laws, Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness, Basic idea of global positioning system (GPS).	**8 Hours**
Unit-4:	**Oscillations:** SHM: Simple Harmonic Oscillations. Differential equation of SHM and its solution, Kinetic energy, potential energy, total energy and their time-average values, Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor.	**8 Hours**
Unit-5:	**Special Theory of Relativity:** Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity, Massless Particles. Lorentz Transformations: Simultaneity, Length contraction, Time dilation, Twin Paradox, Relativistic addition of velocities, Variation of mass with velocity. Mass energy Equivalence.	**8 Hours**
Text Book:	**1.** Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et.al. Tata McGraw-Hill. Physics, Resnick, Halliday and Walker, Wiley.	
Reference Books:	**1.** Analytical Mechanics, G.R. Fowles and G.L. Cassiday. Cengage Learning. **2.** Feynman Lectures, R. P. Feynman, R. B. Leighton, M. Sands, Pearson Education Introduction to Special Relativity, R. Resnick, John Wiley and Sons. University Physics, Ronald Lane Reese, Thomson Brooks/Cole. **3.** Mechanics, D.S. Mathur, S. Chand and Company Limited, University Physics. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference	1.https://www.youtube.com/watch?v=tNpuTx7UQbw&list=PLyQSN7X0ro203puVhQsmCj9qhlFQ-As8e&index=11 2.https://www.youtube.com/watch?v=fDJeVR0o__w&list=PLyQSN7X0ro203puVhQsmCj9qhlFQ-As8e&index=20	

material	3.https://www.youtube.com/watch?v=sNaaL19opxw&list=PLyQSN7X0ro203puVhQsmCj9qhlFQ-As8e&index=21 4. https://www.youtube.com/watch?v=313C1zo9pyE&list=PLyQSN7X0ro203puVhQsmCj9qhlFQ-As8e&index=24 5.https://www.youtube.com/watch?v=KOKnWaLiL8w&list=RDCMUC4EY_qnSeAP1xGsh61eOoJA&start_radio=1&t=7	

Course Code: BCS112	**B.Sc. (H) Physics- Semester-I** **Computer System & C++ Programming**	**L-3 T-1 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concept of various components of computer system	
CO2.	**Understanding** the Object-Oriented Programming Language concepts.	
CO3.	**Analyzing** basic mathematical problem and their solutions through programming	
CO4.	**Applying** the concepts of programming solutions for distinct problems	
CO5.	**Applying** the concepts of scalable solutions through function	
Course Content:		
Unit-1:	**Problem Solving**: Phases of problem solving, Algorithms, Structure Chart, Flow chart, Practice of solving Sequence Problems, Selection Problems, Repetition problem. **Statements for problem solving:** if, switch, while, for, do, break, continue, go to statements.	**8 Hours**
Unit-2:	**Concepts in Computer Application:** Generations, Characteristic and Application of Computers, Functional Component of Computer: CPU, I/O devices, Type of Memory. Translators: Assembler, Compiler, and Interpreter; Number System: Decimal, Octal, Binary and Hexadecimal &their Conversions; Various Codes: BCD, ASCII and EBCDIC and Gray Code.	**8 Hours**
Unit-3:	**Concepts in Operating System**: Purpose, Services, Types, Functions. **Data Communication & Networks:** Types, Topology, IP address classes. C++ Basics: Data types, Variables, Constants, Keywords, Identifiers, Types of Operators, Memory Allocation operators, Expressions, Pre-processor directives, Introduction to Array, Pointers, Structures and Strings.	**8 Hours**
Unit-4:	**Functions:** Scope of variables; Parameter passing; Default arguments; Inline functions; Recursive functions; Pointers to functions. **C++ Classes and Data Abstraction: Class** Structure, Objects; this pointer; Friend function; Static class members; Constructors and Destructors; Data abstraction. **Inheritance:** Types, Access to the base class members; Virtual base class.	**8 Hours**
Unit-5:	**Polymorphism:** Function overloading; Operator overloading; Static Binding and Dynamic bindings; Virtual function: Definition, Call mechanism, Pure virtual functions; Virtual destructors; Abstract Classes. **C++ I/O:** Stream classes hierarchy; Stream I/O; File streams; Overloading << and >> operators; File Modes, Reading and Writing to a file; Formatted I/O.	**8 Hours**
Text Book:	1. Object-Oriented Programming with C++, Balagurusamy, TMH	
Reference Books:	1. Beginning C++, The Complete Language, Horton, SPD/WROX 2. Programming with C++, Radhaganesan, Scitech 3. Projects using C++, Varalaxmi, Scitech ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	1. https://www.youtube.com/watch?v=LZFoktwiars&list=PL0gIV7t6l2iIsR55zsSgeiOw9Bd_IUTbY https://www.youtube.com/watch?v=tVXtDD7LvCo 2. https://www.youtube.com/watch?v=YraxnPsxZgc 3. https://www.youtube.com/watch?v=dLpoq_00DjU	

Course Code: TMUGE101	**B.Sc. (H) Physics- Semester-I** **English Communication – I**	**L-2** **T-0** **P-2** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering and understanding** of the basic of English grammar and vocabulary.	
CO2.	**Understanding** of the basic Communication process.	
CO3.	**Applying** correct vocabulary and tenses in sentences construction.	
CO4.	**Analyzing** communication needs and developing communication strategies using both verbal & non-verbal method.	
CO5.	**Drafting** applications in correct format for common issues.	
CO6.	**Developing** self-confidence.	
Course Content:		
Unit-1:	**Introductory Sessions** • Self-Introduction • Building Self Confidence: Identifying strengths and weakness, reasons Failure, strategies to overcome Fear of Failure • Importance of English Language in present scenario (Practice: Self-introduction session)	**6 Hours**
Unit-2:	**Basics of Grammar** • Parts of Speech • Tense • Subject and Predicate • Vocabulary: Synonym and Antonym (Practice: Conversation Practice)	**12 Hours**
Unit-3:	**Basics of Communication** • Communication: Process, Types, 7Cs of Communication, Importance & Barrier • Language as a tool of communication • Non-verbal communication: Body Language • Etiquette & Manners • Basic Problem Sounds (Practice: Pronunciation drill and building positive body language)	**10 Hours**
Unit-4:	**Application writing** • Format & Style of Application Writing • Practice of Application writing on common issues.	**8 Hours**
Unit-5:	**Value based text reading:** Short Story (Non- detailed study) • Gift of Magi - O. Henry	**4 Hours**
Text Book:	**1**. Singh R.P., An Anthology of Short stories, O.U.P. New Delhi.	
Reference Books:	**1.** Kumar, Sanjay. & Pushp Lata. "Communication Skills" New Delhi: Oxford University Press. **2.** Carnegie Dale. "How to win Friends and Influence People" New York: Simon & Schuster.	

	3. Goleman, Daniel. "Emotional Intelligence' Bantam Book. ***Latest editions of all the suggested books are recommended.**	
Additional electronics reference material:	**1.** https://www.youtube.com/watch?v=4XEa-8HD3lE **2.** https://www.youtube.com/watch?v=sb6ZZ2p3hEM&feature=youtu.be **3.** https://www.youtube.com/watch?v=Df3ysUkdB38 **4.** https://www.youtube.com/watch?v=0LdYaj3jcws **5.** https://www.youtube.com/watch?v=64XIkMqPm_8 **6.** https://www.youtube.com/watch?v=_vS6O8YlMq0	
Methodology:	**1.** Language Lab software. **2.** The content will be conveyed through Real life situations, Pair Conversation, Group Talk and Class Discussion. **3.** Conversational Practice will be effectively carried out by Face to Face & Via Media (Telephone, Audio-Video Clips) **4.** Modern Teaching tools (PPT Presentation, Tongue-Twisters & Motivational videos with sub-titles) will be utilized	

Evaluation Scheme

Internal Evaluation			**External Evaluation**		**Total Marks**
40 Marks			**60 Marks**		**100**
20 Marks (Best 2 out of Three CTs) ***(From Unit- II, IV & V)***	10 Marks (Oral Assignments) ***(From Unit I & III)***	10 Marks (Attendance)	40 Marks (External Written Examination) ***(From Unit II, IV & V)***	20 Marks (External Viva)* ***(From Unit -1 & III)***	

*Parameters of External Viva

Content	**Body Language**	**Confidence**	**Question Responsiveness**	**TOTAL**
05 Marks	05 Marks	05 Marks	05 Marks	20 Marks

Note: External Viva will be conducted by 2-member committee comprising

a) One Faculty teaching the class

b) One examiner nominated by University Examination cell.

Each member will evaluate on a scale of 20 marks and the average of two would be the 20 marks obtained by the students.

Course Code: BAS166	B.Sc.(H) Physics- Semester-I **Mechanics (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** of basic concepts of pendulums like Bar &Kater's pendulums and measuring the value of g.	
CO2.	**Understanding** of Kinematics of oscillating and bending bodies	
CO3.	**Understanding** and measuring the random errors in experiments.	
CO4.	**Applying** time period concepts to determine the acceleration due to gravity, moment of inertia & young modulus using bar, kater's pendulum, mass spring system, fly wheel & cantilever.	
CO5.	**Applying** Poiseuille's equation to determine coefficient of viscosity & sextant to determine the height of building.	
CO6.	**Analyzing** the mechanical processes in performing the experiments.	
Experiments:	**Note: Minimum 10 experiments should be performed:**	
Experiment-1:	Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.	
Experiment-2:	To study the random error in observations.	
Experiment-3:	To determine the height of a building using a Sextant.	
Experiment-4:	To study the Motion of Spring and calculate (a) Spring constant, (b) **g** and (c) Modulus of rigidity.	
Experiment-5:	To determine the Moment of Inertia of a Flywheel.	
Experiment-6:	To determine **g** and velocity for a freely falling body using Digital Timing Technique	
Experiment-7:	To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).	
Experiment-8:	To determine the Young's Modulus of a Wire by Optical Lever Method.	
Experiment-9:	To determine the Modulus of Rigidity of a Wire by Maxwell's needle.	
Experiment-10:	To determine the elastic Constants of a wire by Searle's method.	
Experiment-11:	To determine the value of g using Bar Pendulum.	
Experiment-12:	To determine the value of g using Kater's Pendulum.	
Experiment-13:	To determine Modulus of Rigidity by using Torsion pendulum.	
Experiment-14:	To determine Young's Modulus in case of Cantilever using Pin and Microscope.	
Experiment-15:	To determine the frequency of A.C. mains by means of a sonometer.	
Text Book:	1. **TEXT BOOK OF ENGINEERING MECHANICS**, KHURMI R S., S. Chand, 2008.	
Reference Books:	1. Mechanics, D.S. Mathur, S. Chand and Company Limited, University Physics.	

	2. **ENIGINEERING MECHANICS (WITH EXPERIMENTS)**, KUMAR DS, KASTON 2011. 3. B.Sc. Practical Physics, C.L. Arora, S. Chand, 2012.	
Additional electronic reference material	**1.** https://www.youtube.com/watch?v=DgMdre5q0tc **2.** https://www.youtube.com/watch?v=aw0_seEt4v0 **3.** https://www.youtube.com/watch?v=TxbDyv17Jfs **4.** https://www.youtube.com/watch?v=9MBE5t1Sv_w	

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: BCS162	**B.Sc. (H) Physics- Semester-I** **Computer System & C++ Programming (Lab)**	**L-0** **T-0** **P-2** **C-1**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of execution to programs written in C language.	
CO2.	**Applying** to prepare programming solutions for specific problems.	
CO3.	**Applying** to prepare scalable solutions through functions.	
CO4.	**Applying** basic elements of a C program including arithmetic and logical operators, functions, control structures, and arrays	
CO5.	**Analyzing** basic mathematical problem and their solutions through programming.	
Experiments:	**Note: Minimum 15 experiments should be performed:**	
Experiment-1:	Write a Program (WAP) to calculate Sum & average of N numbers.	
Experiment-2:	WAP to convert integer arithmetic to a given number of day and month.	
Experiment-3:	WAP to find maximum and minimum out of 3 numbers a, b & c.	
Experiment-4:	WAP to find factorial of positive integer.	
Experiment-5:	WAP to find sum of series up to n number, 2+5+8+……+n.	
Experiment-6:	WAP to print all the number between 1 to 100 which are dividing by 7.	
Experiment-7:	WAP to generate Fibonacci series up to n.	
Experiment-8:	WAP to calculate area of circle using Functions.	
Experiment-9:	WAP to calculate factorial of given number using Recursion function.	
Experiment-10:	WAP to find whether number is prime or not.	
Experiment-11:	WAP to find that the enter character is a letter or digit.	
Experiment-12:	WAP to find addition of two matrix of n*n order.	
Experiment-13:	WAP to find multiplication of two matrix of n*n order.	
Experiment-14:	WAP to find even or odd up to a given limit n.	
Experiment-15:	WAP to find whether a given no is palindrome or not.	
Experiment-16:	WAP to Swap two numbers using third Variable and without using third variable.	
Experiment-17:	WAP to Swap two numbers using call by value and call by reference.	
Experiment-18:	WAP illustrating overloading of various operators.	

Experiment-19:	WAP illustrating use of Friend	
Experiment-20:	WAP illustrating use of Inline Function.	
Experiment-21:	WAP illustrating use of destructor and various types of constructor.	
Experiment-22:	WAP illustrating various forms of Inheritance.	
Experiment-23:	WAP illustrating use of virtual functions, virtual Base Class.	
Text Book:	1. **COMPUTER CONCEPTS AND PROGRAMMING IN C**	
Reference Books:	1. **ANSI C PROGRAMMING**, KANETKAR YASHAWANT, PB 2010. 2. **PROGRAMMING IN ANSI C**, BALAGURUSAMY E, TMH 2008.	
Additional electronic reference material	1. https://www.youtube.com/watch?v=4l0BdjWBS_Q 2. https://www.youtube.com/watch?v=TGwl3tJYFRg 3. https://www.youtube.com/watch?v=uyy7mqkQd9U	

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: BGP111	B.Sc. (H) 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, Behaviour 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: **TMUGA-101**	**Value Added Course** **B.Sc. (H) Physics- Semester-I** **Foundation in Quantitative Aptitude**	**L-2** **T-1** **P-0** **C-0**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Solving complex problems using Criss cross method, base method and square techniques.	
CO2.	Applying the arithmetical concepts of Average, Mixture and Allegation.	
CO3.	Evaluating the different possibilities of various reasoning based problems in series, Blood relation and Direction.	
CO4.	Operationalizing the inter-related concept of Percentage in Profit Loss and Discount, Si/CI and Mixture/Allegation.	
Course Content:		
Unit-1:	**Speed calculations** Squares till 1000,square root, multiplications: base 100, 200 300 etc., 11-19, crisscross method for 2X2, 3X3, 4X4, 2X3, 2X4 etc., cubes, cube root	**3 Hours**
Unit-2:	**Percentages** Basic calculation, ratio equivalent, base, change of base, multiplying factor, percentage change, increment, decrement, successive percentages, word problems	**5 Hours**
Unit-3:	**Profit Loss Discount** Basic definition, formula, concept of mark up, discount, relation with successive change, faulty weights	**5 Hours**
Unit-4:	**SI and CI** Simple Interest, finding time and rate, Compound Interest, difference between SI and CI, Installments	**4 Hours**
Unit-5:	**Averages** Basic Averages, Concept of Distribution, Weighted Average, equations	**3 Hours**
Unit-6:	**Mixtures and allegations** Mixtures of 2 components, mixtures of 3 components, Replacements	**5 Hours**
Unit-7:	**Blood relations** Indicating type, operator type, family tree type	**3 Hours**
Unit-8:	**Direction sense** Simple statements, shadow type	**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: BAS120	Generic Elective Course-I B.Sc. (H) Physics- Semester-I **Fundamentals of Inorganic Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** the concept of modern atomic structure, Periodicity of elements and Redox reactions.	
CO2.	**Understanding** the Schrodinger's wave equation to explain the origin of quantum numbers &standard electrode potential.	
CO3.	**Understanding** the theories of chemical bonding & Born Haber's cycle.	
CO4.	**Applying** theories of chemical bonding to know the characteristics of molecules.	
CO5.	**Applying** the relationship between Ionization potential and reactivity of metals, electron gain enthalpy and reactivity of non-metals.	
Course Content:		
Unit-1:	**Atomic Structure:** Schrödinger's wave equation, significance of ψ and ψ^2.Quantum numbers and their significance, Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s*, *p*, *d* and *f* orbitals, Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations.	**8 hours**
Unit-2:	**Periodicity of Elements:** Effective nuclear charge, shielding or screening effect, Atomic & ionic radii, Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy, Electron gain enthalpy, Electronegativity, trends in periodic table and applications in predicting and explaining the chemical behavior.	**8 hours**
Unit-3:	**Chemical Bonding – I:** Z6Covalent bond: Valence Bond theory & its limitations. Hybridization & shapes of simple inorganic molecules & ions, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons. Resonance and resonance energy, Molecular orbital theory & MO diagrams of Homo &heteronuclear (CO, NO) diatomic molecules.	**8 hours**
Unit-4:	**Chemical Bonding – II:** Ionic Solids: Covalent character in ionic compounds, polarizing power and polarizability, Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice energy and Born-Haber cycle, salvation energy and solubility of ionic solid.	**8 hours**

Unit-5:	**Chemical bonding III:** Metallic bond-free electron, Semiconductors & insulators, valence bond and band theories. Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding, Effects of chemical force, melting and boiling points, solubility & energetics of dissolution process. **Oxidation-Reduction:** Redox equations, Standard Electrode Potential and its application to inorganic reactions.	**8 hours**
Text Book:	1. Lee, J.D. Concise Inorganic Chemistry ELBS.	
Reference Books:	**1.** Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press. **2.** Rodger, G.E. Inorganic and Solid-State Chemistry, Cengage Learning India Edition.	
Additional electronic reference material	https://www.khanacademy.org/science/biology/chemistry--of-life/elements-and-atoms/v/introduction-to-the-atom https://www.youtube.com/watch?v=-0xxEWd9utc https://www.youtube.com/watch?v=O90urimJyxk https://www.khanacademy.org/science/class-11-chemistry-india/xfbb6cb8fc2bd00c8:in-in-classification-of-elements/xfbb6cb8fc2bd00c8:in-in-periodic-trends-in-physical-properties-of-elements/v/metallic-nature-trends?modal=1 https://www.youtube.com/watch?v=H1-COuLbvzI https://byjus.com/jee/chemical-bonding/ https://www.youtube.com/watch?v=KjoQHqgzda8 https://byjus.com/jee/chemical-bonding/ https://www.youtube.com/watch?v=H1-COuLbvzI https://www.khanacademy.org/science/biology/chemistry--of-life/chemical-bonds-and-reactions/v/covalent-bonds	

Course Code: BAS117	Generic Elective Course-- I B.Sc. (H) Physics- Semester-I **Trigonometry & Differential Calculus**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concepts of trigonometric functions, hyperbolic functions, inverse circular and inverse hyperbolic functions of complex quantities.	
CO2.	**Understanding** the concept of Successive differentiation and partial differentiation.	
CO3.	**Understanding** the concepts of envelopes, evolutes, curvature and asymptotes of curves in Cartesian and polar coordinates.	
CO4.	**Applying** the concept of Leibnitz's theorem for successive derivatives.	
CO5.	**Applying** the concept of tangent, normal and asymptotes to tracing of curves in Cartesian, parametric and polar coordinates.	
Course Content:		
Unit-1:	Circular and Hyperbolic functions of Complex quantities, Separation of real and imaginary parts of Trigonometric, Logarithmic, and Exponential functions.	**8 Hours**
Unit-2:	Gregory's series, Summation of series, Expansion of functions (Maclaurin's and Taylor's expansion of functions).	**8 Hours**
Unit-3:	Successive differentiation, Leibnitz theorem (without proof), Partial differentiation, Euler's theorem, Jacobians, Maxima and Minima	**8 Hours**
Unit-4:	Tangents and Normals, Envelopes and Evolutes, Curvature and Asymptotes of curves in Cartesian and Polar coordinates.	**8 Hours**
Unit-5:	Tracing of curves in Cartesian, Parametric and Polar coordinates (Conics, Asteroid, Hypocycloid, Folium of Descartes, Cycloid, Circle, Cardioids, Lemniscates, Equiangular spiral), Limit and its properties, Indeterminate forms.	**8 Hours**
Text Book:	1. "Differential Calculas" by Gorakh Prasad, Pothishala Pvt Ltd..	
Reference Books:	1. "Trigonometry" by A.R. Vashistha and R. K. Gupta, Krishna Prakashan Mandir. 2. "Differential Calculus" by N. Pishkunor, Peace Publishers Moscow. 3. "Differential Calculus" by Khalil Ahmed, Anamya Publication, New Delhi. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	1. https://www.youtube.com/watch?v=4kd_56yXlYY 2. https://www.youtube.com/watch?v=rtbyyJ1UuVU 3. https://www.youtube.com/watch?v=67uJGwsZz-Q	

Course Code: BAS168	Generic Elective Course-- I (Lab) B.Sc. (H) Physics- Semester-I **Fundamentals of Inorganic Chemistry (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering&** understanding the concept of Normality & Molarity.	
CO2.	**Analyzing** of carbonates, bicarbonates, hydroxides and free alkalies in acids base titrations.	
CO3.	**Analyzing** the strength of Fe(II) in the given sample	
CO4.	**Analyzing** of oxalic acid and sodium oxalate in given mixture by Oxidation-Reduction Titrimetric	
CO5.	**Analyzing** the hardness of a given sample of water.	
Experiments:	**Note: All experiments should be performed:**	
Experiment-1:	Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.	
Experiment-2:	Estimation of oxalic acid by titrating it with KMnO4.	
Experiment-3:	Estimation of water of crystallization in Mohr's salt by titrating with KMnO4.	
Experiment-4:	Estimation of Fe (II) ions by titrating it with K2Cr2O7 using internal indicator.	
Experiment-5:	Estimation of Cu (II) ions iodometrically using Na2S2O3	
Experiment-6:	Estimate the amount of nickel present in a given solution as bis (dimethyl glyoximato) nickel (II) or aluminium as oximate in a given solution gravimetrically.	
Experiment-7:	Estimation of (i) Mg2+ or (ii) Zn2+ by complexometric titrations using EDTA.	
Experiment-8:	Estimation of total hardness of a given sample of water by complexometric titration.	
Text Book:	1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education.	
Reference Books:	1. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition. 2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman.	
Additional electronic reference material	1. https://www.youtube.com/watch?v=-u3QQPjllaA 2. https://www.youtube.com/watch?v=6IQfpNgVzyU 3. https://www.youtube.com/watch?v=JFkxHWJ6_hE	

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: BAS173	Generic Elective Course- I (Lab) B.Sc. (H) Physics- Semester-I **Calculus (LAB)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the different coordinate systems of reference by plotting curves in a plane using its mathematical properties.	
CO2.	**Understanding** the graphs of polynomial in Physical Sciences.	
CO3.	**Understanding** the Matrix operations for quantum applications.	
CO4.	**Analyzing** complex numbers and their representations.	
CO5.	**Analyzing** the area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas.	
Experiments:	**Note: All experiments should be performed:**	
Experiment-1:	Plotting the graphs of the following functions: ax, $[x]$ (greatest integer functio $\sqrt{ax+b}$, $\lvert ax+b\rvert$, $c\pm\lvert ax+b\rvert$, $x^{\pm n}$, $x^{1/n}$ $(n\in\mathbb{Z})$, $\lvert x\rvert/x$, $\sin(1/x)$, $x\sin(1/x)$, and , $e^{\pm 1/x}$,for $x\neq 0$. e^{ax+b}, $\log(ax+b)$, $1/(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $\lvert\sin(ax+b)\rvert$, $\lvert\cos(ax+b$ Observe and discuss the effect of changes in the real constants a, b and c on the gra	
Experiment-2:	Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.	
Experiment-3:	Sketching parametric curves.	
Experiment-4:	Tracing of conics in Cartesian coordinates.	
Experiment-5:	Obtaining surface of revolution of curves.	
Experiment-6:	Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic paraboloid, hyperbolic paraboloid using Cartesian co-ordinates.	
Experiment-7:	To find numbers between two real numbers and plotting of finite and infinite subset of R.	
Experiment-8:	Matrix operations (addition, multiplication, inverse, transpose, determinant, rank, eigenvectors, eigenvalues, Characteristic equation and verification of Cayley Hamilton equation, system of linear equations	
Experiment-9:	Graph of Hyperbolic functions.	
Experiment-10:	Computation of limit, differentiation and integration of vector functions.	
Experiment-11:	Complex numbers and their representations, operations like addition, multiplication, division, modulus. Graphical representation of polar form.	
Test Book:	1. M. J. Strauss, G. L. Bradley and K. J. Smith, Calculus (3rd Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.	
Reference Book:	**1.** H. Anton, I. Bivens and S. Davis, Calculus (7th Edition), John Wiley and sons (Asia), Pt Ltd., Singapore, 2002. **Latest editions of all the suggested books are recommended**	
Additional electronic reference material	1. https://www.youtube.com/watch?v=CioY8ElsjO4 2. https://www.youtube.com/watch?v=HO2zAU3Eppo 3. https://www.youtube.com/watch?v=_QmDr4-xUO0 4. https://www.youtube.com/watch?v=GlBnrFMHMSo	

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: BAS218	B.Sc.(H) Physics- Semester-II **Electricity and Magnetism**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** basic concept of electric fields, potentials and laws relating fields and potentials in different conditions.	
CO2.	**Understanding** the principles of Capacitors, field polarization, magnetic fields and the laws for magnetic field.	
CO3.	**Applying** the concept of fields and potential to study the properties of dielectric and magnetic materials like dielectric constant and susceptibilities.	
CO4.	**Applying** the concept of Ampere's law to find the field strength due to straight wire and circular loop solenoid, toroid and analyzing the network theorems.	
CO5.	**Applying** the concept of Faraday's law, Lenz's law to calibrate the self-inductance, mutual inductance, reciprocity theorem and ballistic Galvanometer.	
Course Content:		
Unit-1:	**Electric Field and Electric Potential:** **Electric field**: Electric field lines, Electric flux, Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry. Electrostatic Potential, Laplace's and Poisson equations (Only statement).The Uniqueness Theorem, Potential and Electric Field of a dipole. Force and Torque on a dipole.	**8 Hours**
Unit-2:	**Electrostatics**: Electrostatic energy of system of charges. Electrostatic energy of a charged sphere, Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors, Parallel-plate capacitor, Capacitance of an isolated conductor. **Series & Parallel LCR Circuit**: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width.	**8 Hours**
Unit-3:	**Dielectric Properties of Matter:** Electric Field in matter, Polarization, Polarization Charges, Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector **D**. Relations between **E**, **P** and **D**. Gauss' Law in dielectrics, **Network Theorems:** Thevenin theorem, Norton theorem, Superposition theorem.	**8 Hours**
Unit-4:	**Magnetic Field:** Magnetic force between current elements and definition of Magnetic Field **B**. Biot-Savart's Law and its simple applications: straight wire and circular loop. Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid (3) Infinite long wire. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements.	**8 Hours**
Unit-5:	**Magnetic Properties of Matter:** Magnetization vector (**M).** Magnetic Intensity (**H).** Magnetic Susceptibility and permeability, Relation between **B, H, M**. Ferromagnetism. B-H curve and hysteresis **Electromagnetic Induction:** Faraday's Law. Lenz's Law, Self-Inductance and Mutual Inductance, Reciprocity Theorem. Energy stored in a Magnetic Field. Ballistic Galvanometer: Current and Charge Sensitivity.	**8 Hours**
Text Book:	**1.** Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, Tata McGraw.	

Reference Books:	**1.** Introduction to Electrodynamics, D.J. Griffiths, Benjamin Cummings. **2.** Feynman Lectures, R. P. Feynman, R. B. Leighton, M. Sands, Pearson Education Elements of Electromagnetics, M.N.O. Sadiku, Oxford University Press. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	1.https://www.youtube.com/watch?v=NED2Cl8u9Q0&list=PLQNC9KhS56XwsAtI28BZGC9cEGWGhuEOk&index=1 2.https://www.youtube.com/watch?v=NK-BxowMIfg&list=RDCMUC4EY_qnSeAP1xGsh61eOoJA&index=3 3.https://www.youtube.com/watch?v=W25SVn2bA8I&list=PLQNC9KhS56XwsAtI28BZGC9cEGWGhuEOk&index=2 4.https://www.youtube.com/watch?v=JCfhChaJvCo&list=PLQNC9KhS56XwsAtI28BZGC9cEGWGhuEOk&index=7	

Course Code: BAS220	B.Sc.(H) Physics- Semester-II Waves & optics	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering t**he concepts of optical phenomena like reflection, refraction, interference, diffraction & waves.	
CO2.	**Understanding** the principles of divisions of waves.	
CO3.	**Applying** the Fermat's principle to understand the optical phenomena.	
CO4.	**Applying** the concept of superposition of waves to draw the Lissajous Figures.	
CO5.	**Applying** the concept of diffraction phenomenon or using to single and multi-slit to find out the dispersive and resolving power of different optical devices like telescope, microscope and gratings.	
CO6.	**Applying** the concept of interference and diffraction phenomenon to Construct and reconstruct the holograms using two plane waves as well as zone plates.	
Course Content:		
Unit-1:	**Geometrical optics:** Fermat's principle, reflection and refraction at plane interface, Application to thick lenses, Ramsden and Huygens eyepiece. **Wave Motion:** Plane and Spherical Waves. Longitudinal and Transverse Waves, Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities, Differential Equation, Pressure of a Longitudinal Wave, Energy Transport, Intensity of Wave.	**8 Hours**
Unit-2:	**Superposition of two perpendicular Harmonic Oscillations**: Graphical and Analytical methods, Lissajous Figures (1:1 and 1:2) and their uses, Superposition of N harmonic waves, **Interference:** Division of amplitude and wavefront, Young's double slit experiment, Fresnel's Biprism, Interference in Thin Films: parallel and wedge-shaped films. Newton's Rings: Measurement of wavelength and refractive index.	**8 Hours**
Unit-3:	**Wave Optics:** Electromagnetic nature of light, Definition and properties of wave front, Huygens's Principle, Temporal and Spatial Coherence. **Interferometer**: Michelson Interferometer-(1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry-Perot interferometer.	**8Hours**
Unit-4:	**Fraunhofer diffraction**: Single slit, double slit & nth slits, Diffraction grating. Resolving Power of a telescope Resolving power of grating. **Holography**: Principle of Holography. Recording and Reconstruction Method, Theory of Holography as Interference between two Plane Waves.	**8 Hours**

Unit-5:	**Fresnel Diffraction**: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave, Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge.	**8 Hours**
Text Book:	1. Waves: Berkeley Physics Course, Francis Crawford, Tata McGraw-Hill.	
Reference Books:	**1.** Principles of Optics, Max Born and Emil Wolf, Pergamon Press. Optics, Ajoy Ghatak, Tata McGraw Hill. **2.** Fundamentals of Optics, F.A. Jenkins and H.E. White, McGraw-Hill. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference materials	https://www.youtube.com/watch?v=vZjGa49xfI0 https://www.youtube.com/watch?v=0OHM4iJZTHU https://www.khanacademy.org/science/physics/light-waves/interference-of-light-waves/v/youngs-double-split-part-1 https://www.youtube.com/watch?v=-hExFo05pNc https://www.youtube.com/watch?v=cA8g_pjoTrg https://www.youtube.com/watch?v=LO0Rxxldm0c https://www.khanacademy.org/science/physics/light-waves/interference-of-light-waves/v/single-slit-interference	

Course Code: TMUGE201	**B.Sc.(H) Physics- Semester-II** **English Communication – II**	**L-2** **T-0** **P-2** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering & understanding** the basics of English Grammar and Vocabulary.	
CO2.	**Understanding** the basics of Listening, Speaking & Writing Skills.	
CO3.	**Understanding** principles of letter drafting and various types of formats.	
CO4.	**Applying** correct vocabulary and grammar in sentence construction while writing and delivering presentations.	
CO5.	**Analyzing** different types of listening, role of Audience & Locale in presentation.	
CO6.	**Drafting** Official Letters, E-Mail & Paragraphs in correct format.	
Course Content:		
Unit-1:	**Functional Grammar** • Prefix, suffix and One words substitution • Modals • Concord	**10 Hours**
Unit-2:	**Listening Skills** • Difference between listening & hearing, Process and Types of Listening • Importance and Barriers to listening	**04Hours**
Unit-3:	**Writing Skills** • Official letter and email writing • Essentials of a paragraph, • Developing a paragraph: Structure and methods Paragraph writing (100-120 words)	**12 Hours**
Unit-4:	**Strategies & Structure of Oral Presentation** • Purpose, Organizing content, Audience & Locale, Audio-visual aids, Body langauge • Voice dynamics: Five P's - Pace, Power, Pronunciation, Pause, and Pitch. • Modes of speech delivery and 5 W's of presentation	**8 Hours**
Unit-5:	**Value based text reading:** Short Essay (Non- detailed study) How should one Read a book? - Virginia Woolf	**6 Hours**
Text Book:	**1.** Singh R.P., An Anthology of English Essay, O.U.P. New Delhi	
Reference Books:	**1.** Nesfield J.C. "*English Grammar Composition & Usage*" Macmillan Publishers **2.** Sood Madan "*The Business letters"* Goodwill Publishing House, New Delhi **3.** Kumar Sanjay & Pushp lata "*Communication Skills"* Oxford University Press, New Delhi. ***Latest editions of all the suggested books are recommended.**	

Additional Electronics Reference Material	**1.** https://www.youtube.com/watch?v=A0uekze2GOU **2.** https://www.youtube.com/watch?v=JIKU_WT0Bls **3.** https://www.youtube.com/watch?v=3Tu1jN65slw **4.** https://youtu.be/sb6ZZ2p3hEM **5.** https://youtu.be/yY6-cgShhac **6.** https://youtu.be/cc4yXwOQsBk **7.** https://youtu.be/yY6-cgShhac **8.** https://youtu.be/84qoeCofXXQ **9.** https://www.youtube.com/watch?v=-9MXmxLisI8&t=28s	
Methodologies:	**1.** Words and exercises, usage in sentences. **2.** Language Lab software. **3.** Sentence construction on daily activities and conversations. **4.** Format and layout to be taught with the help of samples and preparing letters on different subjects. **5.** JAM sessions and Picture presentation. **6.** Tongue twisters, Newspaper reading and short movies. **7.** Modern Teaching tools (PPT Presentation, Tongue-Twisters & Motivational videos with sub-titles) will be utilized. **8.** Text reading: discussion in detail, critical appreciation by reading the text to develop students' reading habits with voice modulation.	

Evaluation Scheme

<table>
<tr><th colspan="3">Internal Evaluation</th><th colspan="2">External Evaluation</th><th>Total Marks</th></tr>
<tr><td colspan="3">40 Marks</td><td colspan="2">60 Marks</td><td rowspan="4">100</td></tr>
<tr><td>20 Marks (Best 2 out of Three</td><td>10 Marks (Oral</td><td rowspan="3">10 Marks (Attendance)</td><td>40 Marks (External Written</td><td>20 Marks</td></tr>
<tr><td>CTs)</td><td>Assignments)</td><td>Examination)</td><td>(External Viva)*</td></tr>
<tr><td>(From Unit-I, III & V)</td><td>(From Unit-II &IV)</td><td>(From Unit-1, III & V)</td><td>(From Unit- II & IV)</td></tr>
</table>

*Parameters of External Viva

Content	Body Language	Communication skills	Confidence	TOTAL
05 Marks	05 Marks	05 Marks	05 Marks	20 Marks

***Note**: External Viva will be conducted by 2-member committee comprising*

***a)** One Faculty teaching the class*

***b)** One examiner nominated by University Examination cell.*

Each member will evaluate on a scale of 20 marks and the average of two would be the 20 marks obtained by the students.

Course Code: TMU201	B.Sc.(H) Physics- Semester-II **Environmental Studies**	L-2 T-1 P-0 C-3
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** environmental problems arising due to constructional and developmental activities.	
CO2.	**Understanding** the natural resources and suitable methods for conservation of resources for sustainable development.	
CO3.	**Understanding** the importance of ecosystem and biodiversity and its conservation for maintaining ecological balance.	
CO4.	**Understanding** the types and adverse effects of various environmental pollutants and their abatement devices.	
CO5.	**Understanding** Greenhouse effect, various Environmental laws, impact of human population explosion, environment protection movements, different disasters and their management.	
Course Content:		
Unit-1:	Definition and Scope of environmental studies, multidisciplinary nature of environmental studies, Concept of sustainability & sustainable development. **Ecology and Environment**: Concept of an Ecosystem-its structure and functions, Energy Flow in an Ecosystem, Food Chain, Food Web, Ecological Pyramid& Ecological succession, Study of following ecosystems: Forest Ecosystem, Grass land Ecosystem & Aquatic Ecosystem & Desert Ecosystem.	**8 Hours**
Unit-2:	**Natural Resources:** Renewable & Non-Renewable resources; Landre sources and landuse change; Land degradation, Soil erosion & desertification. **Deforestation**: Causes & impacts due to mining, Dam building on forest biodiversity & tribal population. **Energy Resources**: Renewable & Non-Renewable resources, Energy scenario & use of alternate energy sources, Case studies. **Biodiversity:** Hot Spots of Bio diversity in India and World, Conservation, Importance and Factors Responsible for Loss of Biodiversity, Bio geographical Classification of India	**8 Hours**
Unit-3:	**Environmental Pollutions:** Types, Causes, Effects & control; Air, Water, soil & noise pollution, Nuclear hazards & human health risks, Solid waste Management; Control measures of urban & industrial wastes, pollution case studies	**8 Hours**
Unit-4:	**Environmental policies & practices: Climate change & Global** Warming (Green house Effect),Ozone Layer -Its Depletion and Control Measures, Photo chemical Smog, Acid Rain Environmental laws: Environment protection Act; air prevention & control of pollution act, Water Prevention & Control of Pollution Act, Wild Life Protection Act, Forest Conservation Acts, International Acts; Montreal & Kyoto Protocols & Convention on biological diversity, Nature reserves, tribal population & Rights & human wild life conflicts in Indian context	**8 Hours**

Unit-5:	Human population growth; impacts on environment, human health & welfare, Resettlement & rehabilitation of projects affected person: A case study, Disaster Management; Earthquake, Floods & Droughts, Cyclones & Landslides, Environmental Movements; Chipko, Silent Valley, Vishnoi's of Rajasthan, Environmental Ethics; Role of Indian & other regions & culture in environmental conservation, Environmental communication & public awareness; Case study	**8 Hours**
Field Work:	**1.** Visit to an area to document environmental assets; river/forest/flora-fauna etc. **2.** Visit to a local polluted site: urban/rural/industrial/agricultural. **3.** Study of common plants, insects, birds & basic principles of identification. **4.** Study of simple ecosystem; pond, river etc.	
Text Books:	**1.** "Environmental Chemistry", De, A. K., New Age Publishers Pvt. Ltd.	
Reference Books:	**1.** "Biodiversity and Conservation", Bryant, P. J., Hypertext Book **2.** "Textbook of Environment Studies", Tewa Khulbe&Tewari,I.K. Publication ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	https://www.youtube.com/watch?v=j1rjB_-DhI https://www.youtube.com/watch?v=4AuwG2G_ERU https://www.youtube.com/watch?v=VgV6abF5KPk	

Course Code: BAS268	B.Sc.(H) Physics- Semester-II Electricity and Magnetism (Lab)	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** the concepts of Network theorems.	
CO2.	**Understanding** the use of various electrical instruments for measuring the resistance, voltage, current and capacitance.	
CO3.	**Applying** the concepts of Thevenin theorem and Norton theorems to determine EMF & resistances for complex circuits.	
CO4.	**Applying** Rayleigh's method to determine self-inductance & low resistance of coils.	
CO5.	**Applying** the concepts of wheat stone's bridge to determine the resistance using potentiometer and Carey Foster's.	
CO6.	**Analyzing** the frequency response curve for series and parallel LCR circuits in determining the resonant frequency, impedance, and band width & quality factor.	
Experiments:	**Note: Minimum 10 experiments should be performed:**	
Experiment-1:	Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.	
Experiment-2:	To study the characteristics of a series RC Circuit.	
Experiment-3:	To determine an unknown Low Resistance using Potentiometer.	
Experiment-4:	To determine an unknown Low Resistance using Carey Foster's Bridge.	
Experiment-5:	To compare capacitances using De'Sauty's bridge.	
Experiment-6:	Measurement of field strength B and its variation in a solenoid (determine dB/dx).	
Experiment-7:	To verify the Thevenin theorem.	
Experiment-8:	To verify Norton theorem.	
Experiment-9:	To determine self-inductance of a coil by Anderson's bridge.	
Experiment-10:	To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, & Impedance at resonance,	
Experiment-11:	To study response curve of a Series LCR circuit and determine its (a) Quality factor Q& (b) Band width.	
Experiment-12:	To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.	
Experiment-13:	Determine a high resistance by leakage method using Ballistic Galvanometer.	
Experiment-14:	To determine self-inductance of a coil by Rayleigh's method.	
Experiment-15:	To study the magnetic field using Stewart and Gee's apparatus.	
Experiment-16:	To determine the internal resistance of a Laclanche cell by using potentiometer.	
Experiment-17:	Convert a galvanometer into voltmeter of a given range.	
Experiment-18:	To calibrate a voltmeter with a potentiometer	
Experiment-19:	To calibrate an ammeter with a potentiometer.	

Text Book:	**1.** Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House.	
Reference Books:	**1.** Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, Heinemann Educational Publishers. **2.** Engineering Practical Physics, S. Panigrahi and B. Mallick, Cengage Learning. **3.** B.Sc. Practical Physics, C.L. Arora, S. Chand, 2012. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	http://vlab.amrita.edu/?sub=1&brch=75&sim=312&cnt=3 http://emv-au.vlabs.ac.in/ http://www.insifindia.com/laboratory-manufacturer_4925_166_106.htm	

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: BAS266	B.Sc.(H) Physics- Semester-II Waves & Optics (Lab)	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering t**he concepts of optical properties and character of lights.	
CO2.	**Understanding** the concepts to measure the focal lengths of concave, convex lenses and mirrors.	
CO3.	**Applying** the concepts of Schuster's method for optical adjustment of spectrometer.	
CO4.	**Analyzing** the diffraction and interference patterns obtained from different optical instruments.	
CO5.	**Analyzing** the dispersive power to verify the prism materials.	
Experiments:	**Note: Minimum ten experiments should be performed:**	
Experiment-1:	To determine the frequency of an electric tuning fork by Melde's experiment and verify λ^2 –T law.	
Experiment-2:	To investigate the motion of coupled oscillators.	
Experiment-3:	To study Lissajous Figures.	
Experiment-4:	Familiarization with: Schuster`s focusing; determination of angle of prism.	
Experiment-5:	To determine refractive index of the Material of a prism using sodium source.	
Experiment-6:	To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.	
Experiment-7:	To determine the wavelength of sodium source using Michelson's interferometer.	
Experiment-8:	To determine wavelength of sodium light using Fresnel Bi-prism.	
Experiment-9:	To determine wavelength of sodium light using Newton's Rings	
Experiment-10:	To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.	
Experiment-11:	To determine wavelength of (1) Na source or (2) spectral lines of Hg source using plane diffraction grating	
Experiment-12:	To determine dispersive power and resolving power of a plane diffraction grating.	
Experiment-13:	To find the equivalent focal length of a lens system by nodal slide assembly.	
Experiment-14:	To determine ordinary and extra ordinary refractive indices for calcite or quartz crystal.	
Experiment-15:	To determine Resolving power of a telescope.	
Experiment-16:	To determine the focal length of a convex and concave lens.	
Experiment-17:	To determine the focal length of a convex and concave mirror.	

Test Book	**1.** B.Sc. Practical Physics, C.L. Arora, S. Chand, 2012.	
Reference Books	1.B.Sc. Practical Physics, H. Singh & P. S. Hemne, S. Chand Publishing. 2. B.Sc. Practical Physics, C. L. Arora, S. Chand Publishing. 3.A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, Vani Pub. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	http://vlab.amrita.edu/?sub=1&brch=281 http://vlab.amrita.edu/?sub=1&brch=189&sim=1106&cnt=2	

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: BGP211	B.Sc.(H) 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: TMUGA-201	Value Added Course B.Sc. (H) Physics- Semester-II **Analytical Reasoning**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying the arithmetical concepts in Ratio Proportion Variation.	
CO2.	Employing the techniques of Percentage; Ratios and Average in inter related concepts of Time and Work, Time Speed and Distance.	
CO3.	Identifying different possibilities of reasoning-based problems of Syllogisms and Venn diagram.	
CO4.	Examining the optimized approach to solve logs and Surds.	
Course Content:		
Unit-1:	**Ratio, proportions and variations** Concept of ratios, proportions, variations, properties and their applications	**5 Hours**
Unit-2:	**Time and Work** Same efficiency, different efficiency, alternate work, application in Pipes and Cisterns	**6 Hours**
Unit-3:	**Time Speed Distance** Average speed, proportionalities in Time, Distance, trains, boats, races, circular tracks	**6 Hours**
Unit-4:	**Logs and Surds** Concept and properties of logs, surds and indices	**4 Hours**
Unit-5:	**Coding and decoding** Sequential coding, reverse coding, abstract coding	**3 Hours**
Unit-6:	**Syllogisms** Two statements, three statements	**4 Hours**
Unit-7:	**Venn diagram** Basic concept and applications	**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: BAS219	Generic Elective Course-II B.Sc.(H) Physics- Semester-II **Fundamentals of Physical Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concept of kinetic theory of gases and behavior of real gases.	
CO2.	Understanding the effect of solute and temperature on the physical properties of liquids.	
CO3.	Understanding the elements of symmetry, crystal structure of ionic Compounds.	
CO4.	Understanding the Ionization of electrolytes, theory of acid- base indicators, salt hydrolysis and buffer action.	
CO5.	Applying the concepts of Ionic Equilibria to determine the degree of ionization, ionization constant, solubility product and preparation of buffer solution.	
Course Content:		
Unit-1:	**Gaseous state**: Postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path, including their temperature and pressure dependence, behavior of real gases: Deviations from ideal gas behavior, compressibility factor, *Z*, Causes of deviation from ideal behaviour, Vander Waals equation of state, its derivation and application in explaining real gas behavior, virial equation of state; van der Waals equation expressed in virial form and calculation of Boyle temperature.	**8 Hours**
Unit-2:	**Liquid state** Qualitative treatment of the structure of the liquid state; Radial distribution function; physical properties of liquids; vapor pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity, Explanation of cleansing action of detergents, Temperature variation of viscosity of liquids and comparison with that of gases.	**8 Hours**
Unit-3:	**Solid state** Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; Bragg's law, Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals.	**8 Hours**
Unit-4:	**Ionic equilibria I** Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di-and triprotic acids (exact treatment).	**8 Hours**

Unit-5:	**Ionic equilibria II** Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts, Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers, Solubility and solubility product of sparingly soluble salts – applications of solubility product principle, Theory of acid–base indicators; selection of indicators and their limitations.	**8 Hours**
Text Book:	**1.** Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 10th Ed., Oxford University Press.	
Reference Books:	**1.** Mortimer, R. G. Physical Chemistry Elsevier: NOIDA, UP. **2.** Engel, T. & Reid, P. Physical Chemistry Pearson. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	https://www.youtube.com/watch?v=uIzdazEEXjI https://www.youtube.com/watch?v=FonFs-C9FXE&list=PLgMDNELGJ1CYJka07lYfNgSgno3OES8Wt&index=3	

Course Code: BAS231	**Generic Elective-II** **B.Sc.(H) Physics- Semester-II** **Discrete Mathematics**	**L-4** **T-0** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** basic concept of sets, relation, algebraic structure, Logic gates like countable set, equivalence relation, group, k-maps.	
CO2.	**Understanding** the basic concept of truth table, recurrence relation like tautology contradiction.	
CO3.	**Applying** the concept of relation to find out the equivalence relation, one-one, onto & into.	
CO4.	**Applying** the concept of relation to find out the equivalence relation, one-one, onto & into.	
CO5.	**Applying** the concept of truth table to find out the tautology, contradiction & contingency.	
Course Content:		
Unit-1:	Definition of set, countable and uncountable sets, Venn diagrams, proof of some general identity of sets, relation, types of relation, composition of relation, pictorial representation of relation, equivalence relation, function, types of function, one to one, into and onto function, inverse function, composition of function, mathematical induction (simple and strong).	**8 Hours**
Unit-2:	Introduction to algebraic structure, properties, semi-grouped, monoid, groups, abelian groups, properties of groups, subgroups, cyclic groups.	**8 Hours**
Unit-3:	Posets, hass diagram of posets, isomorphism of ordered sets, well ordered sets, Boolean algebra, SOP and POS form, logic gates, K-maps.	**8 Hours**
Unit-4:	Propositional logic, basic logic operator, truth tables, tautology, contradiction, algebra of proposition, logical implications, logical equivalence, predicates.	**8 Hours**
Unit-5:	Recurrence relations, generating function, graph definition, types of graphs, representation of graphs, isomorphism and homomorphism of graphs.	**8 Hours**
Text Book:	**1.** Discrete mathematics by Vinaya Rawol and bhakti Raul, Techmax publications.	
Reference Books:	**1.** Piskunov N, Differential & Integral Calculus, Moscow Peace Publishers. **2.** Discrete mathematics and its applications by Kenneth H Rosen. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	1. https://www.youtube.com/watch?v=xlUFkMKSB3Y 2. https://www.youtube.com/watch?v=7UiOuA2kJu8 3. https://www.youtube.com/watch?v=xlUFkMKSB3Y	

Course Code: BAS269	Generic Elective Course-II (Lab) B.Sc.(H) Physics- Semester-II **Fundamentals of Physical Chemistry (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** concept of viscosity, surface tension and calorimeter.	
CO2.	**Understanding** the heat capacity of calorimeter, enthalpy of ionization and neutralization of acids.	
CO3.	**Analyzing** the surface tension and Viscosity of aqueous solutions.	
CO4.	**Analyzing** the integral enthalpy of salt solutions.	
CO5.	**Analyzing** the kinetics of first and second order reactions.	
Experiments:	**Note: All experiments should be performed:**	
Experiment-1:	Determination of heat capacity of calorimeter for different volumes.	
Experiment-2:	Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.	
Experiment-3:	Determination of enthalpy of ionization of acetic acid.	
Experiment-4:	Determination of integral enthalpy of solution of salts (KNO3, NH4Cl).	
Experiment-5:	Determination of enthalpy of hydration of copper sulphate.	
Experiment-6:	Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.	
Experiment-7:	Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.	
Experiment-8:	Chemical Kinetics Study the kinetics of the following reactions. a). Initial rate method: Iodide-persulphate reaction b). Integrated rate method:	
Experiment-9:	Acid hydrolysis of methyl acetate with hydrochloric acid	
Text Book:	**1.** Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition.	
Reference Books:	1.Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman. 2.Khosla, B. D.; Garg, V. C. &Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi.	
Additional electronic reference material	https://www.youtube.com/watch?v=EAgbknIDKNo https://www.youtube.com/watch?v=Khsvfjbop-k	

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: BAS271	Generic Elective Course-II (Lab) B.Sc.(H) Physics- Semester-II **Introduction to MATLAB**	L-0 T-0 P-4 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 Software Working Environment: MATLAB Initializing & Ending, Quick Access Tool Bar, Command Window, Command History, Workspace Browser, Current folder window, Editor Window, Help Browser, Figure Window, Simulink Window, Creating Command Shortcuts, MATLAB Path Options MATLAB Programming, Debugging MATLAB codes.	**8 Hours**
Unit-2:	MATLAB Input Entry & Executing Commands & Methods: Input and Output, Symbolic Mathematics, Arithmetic, Algebra, Symbolic Expressions, Variable Precision and Exact Arithmetic, Errors in Input, Variables and Assignments, Predefined Variables, Operators & Special Characters, Control Structures, Input & Output Commands. Matrices: Arrays, Matrix representation, Matrix & Inverse of Matrix, Entry Retrieving, Matrix Division, Eigen values and vectors, Special matrices.	**8 Hours**
Unit-3:	Polynomials: Polynomial Overview, Representing Polynomials, Arithmetic operations on polynomials, Polynomial Roots, Polynomial coefficients, Polynomial Evaluation, Convolution and De-convolution. Solving Equations: Solution to first order differential Equations, Solving Second Order Differential Equations, Partial Fraction Expansion.	**8 Hours**
Unit-4:	MATLAB Graphics: 2-D Plot, Plotting Process, Creating a Graph, Exploring Data, Editing the Graph Components, Annotating Graphs, Printing and Exporting Graphs, Accessing Properties with the Property Inspector, Plotting Two Variables with Plotting Tools, Changing the Appearance of Lines and Markers, Placing Markers at Every Tenth Data Point, Adding More Data to the Graph, To add data using the Plot Browser, Changing the Type of Graph, Modifying the Graph Data Source, Providing New Values for the Data Source, Figure Windows, Clearing the Figure for a New Plot, Controlling the Axes, Setting Axis Limits, Setting the Axis Aspect Ratio - Setting Axis Visibility, Setting Grid Lines.	**8 Hours**
Unit-5:	Application Tools: Partial Differential Equation (PDE), Curve fitting	**8 Hours**

Text Book:	**1.** Amos Gilat, "MATLAB: An Introduction with Applications", Wiley Publication	
Reference Books:	**2.** J. Chakrabarty "Introduction to Matlab" Universities Press. **3.** R. Pratap, "Getting Started with MATLAB A Quick Introduction for Scientists and Engineers" Oxford University Press ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	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: BAS314	B.Sc.(H) Physics- Semester-III **Elements of Modern Physics**	L-3 T-1 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** concepts of Black body radiation, Photoelectric effect and Compton scattering to learn the beginning of quantum mechanics.	
CO2.	**Understanding** Young's two slit interference of light into the two slit interference of particles (e.g. photon, electron, atom etc.)	
CO3.	**Understanding** the matter wave and deducing the Schrodinger wave equation.	
CO4.	**Understanding** the laws of radioactive decay including alpha-, beta- and gamma decay, fission and fusion nuclear process.	
CO5.	**Applying** the Heisenberg's uncertainty principle to deduce the Size and structure of atomic nucleus and itsrelation with atomic weigh.	
CO6.	**Applying** the Heisenberg's uncertainty principle to prove the impossibility of an electron being in the nucleus.	
Course Content:		
Unit-1:	**Planck's quantum-I:** Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo electric effect and Compton scattering. De Broglie wavelength and matter waves. Two-Slit experiment with electrons/photons	**8 Hours**
Unit-2:	**Quantum-II:** linear superposition principle; wave amplitude, Properties and physical significance of wave function, Expectation value, Schrodinger equations, Particle in a box problem.	**8 Hours**
Unit-3:	**Quantum-III:** Heisenberg uncertainty principle, Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle.	**8 Hours**
Unit-4:	**Fission and fusion:** Nature of nuclear force, Mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Fusion and thermonuclear reactions driving stellar energy.	**8 Hours**
Unit-5:	**Radioactivity:** Stability of the nucleus; Law of radioactive decay; Mean life and half-life; Alpha decay; Beta decay- energy released, spectrum and Pauli's prediction of neutrino; Gamma ray emission, energy-momentum conservation: electron-positron pair creation by gamma photons in the vicinity of a nucleus.	**8 Hours**
Text Book:	**1.** Concepts of Modern Physics, Arthur Beiser, McGraw-Hill.	
Reference Books:	**1.** Introduction to Quantum Mechanics, David J. Griffith, Pearson Education. **2.** Physics for scientists and Engineers with Modern Physics, Jewett and Serway, Cengage Learning. **3.** Modern Physics, G. Kaur and G.R. Pickrell, McGraw Hill. ***Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	https://www.youtube.com/watch?v=ymGdrb-pCaI https://www.youtube.com/watch?v=vPJidbP_oLM https://www.youtube.com/watch?v=iMhDYarsfII	

Course Code: BAS320	B.Sc.(H) Physics- Semester-III **Thermal Physics**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** and understanding the laws of thermodynamics, entropy, and Maxwell's thermodynamic relations.	
CO2.	**Understanding** the Kinetic theory of gases-distribution of velocities, and molecular collisions in Physics.	
CO3.	**Understanding** the basics of real gases.	
CO4.	**Applying** the T-S diagram to understand phase transition processes	
CO5.	**Applying** Maxwell's thermodynamic relations to understand ideal and Van der Waal Gases, Energy equations, Change of Temperature during Adiabatic Process	
Course Content:		
Unit-1:	**Introduction to Thermodynamics:** Zeroth, First & Second Law of Thermodynamics: Thermodynamic Variables & Equilibrium, Concept of Temperature, Work & Heat, Internal Energy, Applications of First Law: General Relation between C_P and C_V, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient. Reversible and Irreversible process with examples, Conversion of Work into Heat and Heat into Work, Carnot's Cycle, Carnot engine & efficiency, Applications of Second Law of Thermodynamics.	**8 Hours**
Unit-2:	**Entropy & Thermodynamic Potentials:** Concept of Entropy, Clausius Theorem, Clausius Inequality, Second Law of Thermodynamics in terms of Entropy, Entropy of a perfect gas, Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe, Principle of Increase of Entropy. Temperature–Entropy diagrams. Third Law of Thermodynamics.	**8 Hours**
Unit-3:	**Maxwell's Thermodynamic Relations:** Thermodynamic Potentials, First and second order Phase Transitions with examples, Clausius Clapeyron Equation and Ehrenfest equations, Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of C_p-$C_{v,}$(3) TdS Equations, (4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations, (6) Change of Temperature during Adiabatic Process.	**8Hours**
Unit-4:	**Kinetic Theory of Gases-Distribution of Velocities, Molecular Collisions:** Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification, Degrees of Freedom. Law of equipartition of Energy (No proof required). Specific heats of Gases, Mean Free Path, Collision Probability, Estimates of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian motion and its Significance.	**8 Hours**

Unit-5:	**Real Gases:** Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation, Critical Constants, Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. P-V Diagrams, Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas. Joule-Thomson Porous Plug Experiment. Joule-Thomson Effect for Real and Van der Waal Gases. Temperature of Inversion, Joule-Thomson Cooling.	**8 Hours**
Text Book:	**1.** Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, McGraw-Hill. A Treatise on Heat, Meghnad Saha, and B. N. Srivastava, Indian Press	
Reference Books:	**1.** Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. Narosa. **2.** Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, Oxford University Press **3.** Thermal Physics, A. Kumar and S.P. Taneja, R. Chand Publications. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	https://www.youtube.com/watch?v=mb8LqNlHeLY https://www.youtube.com/watch?v=DeNBWsZHXTE https://www.youtube.com/watch?v=ER8d_ElMJu0	

Course Code: BAS332	**B.Sc.(H) Physics- Semester-IV** **Semiconductor Physics**	**L-4** **T-0** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** basic concepts of crystal structure and semiconductors.	
CO2.	**Understanding** the semiconductors on the basis of density of states.	
CO3.	**Understanding** the electron - hole pair generation and recombination on the basis of direct and indirect band gap transitions	
CO4.	**Understanding** the concept of scattering mechanism for the transport properties of semiconductor materials.	
CO5.	**Applying** the concepts of 1D, 2D & 3D photonic crystals in fabricating of semiconductor devices.	
CO6.	**Analyzing** the types of semiconductor using the concepts of Fermi level	
Course Content:		
Unit-1:	**Introduction to solid state materials:** Crystal structure - Reciprocal lattice - Brillouin zone and rules for band (k - space) representation. Dynamics of electrons in periodic potential: Kronig - penny and nearly free electron models - Real methods for band structure calculations; Bandgaps in semiconductors - Holes and effective mass concept - Properties of conduction and valance bands.	**8 Hours**
Unit-2:	**Fermi distribution and energy:** Density of states (DOS) - Valance and conduction band density of states - intrinsic carrier concentration – intrinsic Fermi level. Extrinsic semiconductors: n and p type doping - Densities of carriers in extrinsic semiconductors and their temperature dependence - extrinsic semiconductor Fermi energy level - Degenerate and non - degenerate semiconductors - Bandgap engineering.	**8 Hours**
Unit-3:	**Scattering Mechanism**: electron - electron and electron - phonon scattering. Macroscopic transport: Carrier transport by Diffusion - Carrier transport by Drift: Low field, High field and very high field (Impact ionization) - Einstein relation.	**8 Hours**
Unit-4:	**Electron - hole pair generation and recombination:** band to band (direct and indirect band gap transitions) and intra band (impurity related) transitions, free - carrier & phonon transitions. Excitons: Origin, electronic levels and properties Radiative and non-radiative recombination (Shockley - Read - Hall and Auger) processes. Carrier transport - continuity equations.	**8 Hours**
Unit-5:	**Processing of Semiconductor devices** (Brief), p – n, Semiconductor junctions - Homo and hetero Junctions. Semiconductors Quantum structures, Density of states and excitons, Semiconductor photonic structures: 1D, 2D and 3D photonic crystals. Active and passive optoelectronic devices: performance and response enhancement (photo processes).	**8 Hours**
Text Book:	**1.** "Introduction to Solid State Physics" by Charles Kittel, Willey.	
Reference Books:	**1.** "The Physics of Semiconductors" by Kevin F Brennan, Cambridge University Press. **2.** "Fundamentals of Semiconductors" by Peter Y Yu and Manuel Cardona,	

	Spriger. 3. "Semiconductor Physics and Devices" by D.A. Neamen, Tata McGraw-Hill. *** Latest editions of all the suggested books are recommended**	
Electronic reference materials	1. https://www.youtube.com/watch?v=Nb3vGsitzQs 2. https://www.youtube.com/watch?v=4MiBBubORsIttps://www.youtube.com/watch?v=4MiBBubORsI 3. https://www.youtube.com/watch?v=4MiBBubORsI 4. https://www.youtube.com/watch?v=Xpw_V49U_vU 5. https://www.youtube.com/watch?v=7Ax2Aan7paM	

Course Code: TMUGE301	B.Sc.(H) Chemistry- Semester-III **English Communication- III**	L-2 T-0 P-2 C-3
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** knowledge of grammar to face competitive exams.	
CO2.	**Understanding** advance English language by using variety of words i.e. idioms and phrase in variety of sentences in functional context.	
CO3.	**Understanding** listening for effective communication.	
CO4.	**Applying** their English grammar knowledge in day to day context.	
CO5.	**Applying** writing and comprehensive skills in English.	
CO6.	**Analyzing** Comprehending & enriching their vocabulary through prescribed text.	
Course Content:		
Unit-1:	English Grammar & Vocabulary **(a)** Correction of Common Errors (with recap of English Grammar with its usage in practical context.) **(b)** Synthesis: Simple, complex and compound sentence **(c)** Commonly used Idioms & phrases (Progressive learning whole semester)	**14 Hours**
Unit-2:	Speaking Skills **(a)** Art of public speaking **(b)** Common conversation **(c)** Extempore **(d)** Power Point Presentation (PPt) Skills: Nuances of presenting PPTs	**10 Hours**
Unit-3:	Comprehension Skills **(a)** Strategies of Reading comprehension: Four S's **(b)** How to solve a Comprehension (Short unseen passage: 150-200 words)	**6 Hours**
Unit-4:	Professional Writing **(a)** Preparing Notice, Agenda & Minutes of the Meeting	**7 Hours**
Unit-5:	Value based text reading: Short story **(a)** The Barber's Trade Union - Mulk Raj Anand	**3 Hours**
Text Book:	Singh R.P., An Anthology of English Essay, O.U.P. New Delhi	
Reference Books:	**1.** Wren & Martin *"High School English Grammar and Composition*" S. Chand & Co. Ltd., New Delhi. **2.** Kumar Sanjay & Pushplata *"Communication Skills*" Oxford University Press, New Delhi. **3.** Agrawal, Malti *"Professional Communication*" Krishana Prakashan Media (P) Ltd. Meerut. ***Latest editions of all the suggested books are recommended.**	
Additional Electronics Reference Material	1-https://www.youtube.com/watch?v=dpYltVtsS_Q 2- https://www.youtube.com/watch?v=Z8HttKW8jVE 3-https://www.youtube.com/watch?v=srn5jgr9TZo 4-https://www.youtube.com/watch?v=En9-8xWYWqk 5-https://www.youtube.com/watch?v=aUEpmAo0OvM	

Methodology :	**1.** Idiom & Phrases and exercises, usage in sentences. **2.** Language Lab software. **3.** Power Point presentation. **4.** Newspaper reading, short articles from newspaper to comprehend and short movies. **5.** Modern Teaching tools (PPT Presentation & Motivational videos with sub-titles) will be utilized. **6.** Text reading: discussion in detail, Critical appreciation by reading the text to develop students' reading habits with voice modulation.	

Evaluation Scheme

Internal Evaluation			External Evaluation		Total Marks
40 Marks			60 Marks		
20 Marks (Best 2 out of Three CTs) (From Unit-I, III, IV & V)	10 Marks (Oral Assignments) (Unit -II)	10 Marks (Attendance)	40 Marks (External Written Examination) (From Unit-1, III, IV & V)	20 Marks (External Viva)* (Unit -II)	100

*Parameters of External Viva

Content	Body Language	Communication skills	Confidence	TOTAL
05 Marks	05 Marks	05 Marks	05 Marks	20 Marks

Note: External Viva will be conducted by 2-member committee comprising

a) One Faculty teaching the class

b) One examiner nominated by University Examination cell.

Each member will evaluate on a scale of 20 marks and the average of two would be the 20 marks obtained by the students.

Course Code: BAS364	B.Sc.(H) Physics- Semester-III **Elements of Modern Physics (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** the concepts of photo-electric effect, tunnelling effect and black body radiation.	
CO2.	**Understanding** & measuring the H-alpha emission line of Hydrogen atom and absorption lines in the rotational spectrum of Iodine vapour.	
CO3.	**Understanding** the concepts to measure the e/m by bar magnet and Millikan oil drop methods.	
CO4.	**Understanding** the concepts to measure wavelength & angular spread of laser sources	
CO5.	**Analyzing** the diffraction patterns from single, double slits.	
CO6.	**Analyzing** black body radiation, photo-detector and colour LED's in measuring the Planck's constant	
Experiments:	**Note: Minimum 10 experiments should be performed:**	
Experiment-1:	Measurement of Planck's constant using black body radiation and photo-detector	
Experiment-2:	Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light.	
Experiment-3:	To determine work function of material of filament of directly heated vacuum diode.	
Experiment-4:	To determine the Planck's constant using LEDs of at least 4 different colours.	
Experiment-5:	To determine the wavelength of H-alpha emission line of Hydrogen atom.	
Experiment-6:	To determine the ionization potential of mercury.	
Experiment-7:	To determine the absorption lines in the rotational spectrum of Iodine vapour.	
Experiment-8:	To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.	
Experiment-9:	To setup the Millikan oil drop apparatus and determine the charge of an electron.	
Experiment-10:	To show the tunneling effect in tunnel diode using I-V characteristics.	
Experiment-11:	To determine the wavelength of laser source using diffraction of single and double slits.	
Experiment-12:	To determine (1) wavelength and (2) angular spread of He-Ne laser using plane diffraction grating	
Text Book	**1.** B.Sc. Practical Physics, C.L. Arora, S. Chand, 2012.	
Reference Books:	1.Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, Heinemann Educational Publishers. *** Latest editions of all the suggested books are recommended**	
Additional electronic	1.https://mpv-au.vlabs.ac.in/ **2.**https://physics.iyte.edu.tr/wp-	

reference materials	content/uploads/sites/51/2019/05/modernfizik.pdf 3. http://vlab.amrita.edu/?sub=1&brch=281 4. http://vlab.amrita.edu/?sub=1&brch=189&sim=1106&cnt=2	

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: BAS365	B.Sc.(H) Physics- Semester-III **Thermal Physics (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** the basic thermodynamical concepts involved in various experiments of thermal Physics	
CO2.	**Applying** the concepts of thermodynamics to measure the mechanical equivalent of heat and coefficient of thermal conductivity.	
CO3.	**Applying** Seeback effect in determining the thermo EMF of a thermocouple.	
CO4.	**Applying** the concepts of temperature dependence of resistance to find the temperature coefficient of resistances.	
CO5.	**Analyzing** the characteristics curve of the thermocouple and RTD.	
Experiments:	**Note: All experiments should be performed:**	
Experiment-1:	To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.	
Experiment-2:	To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.	
Experiment-3:	To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.	
Experiment-4:	To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.	
Experiment-5:	To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).	
Experiment-6:	To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.	
Experiment-7:	To calibrate a thermocouple to measure temperature in a specified Range using (1) Null Method, (2) Direct measurement using Op-Amp difference amplifier and to determine Neutral Temperature.	
Experiment-8:	To study the operation & characteristics of RTD	
Experiment-9:	To study the operation & characteristics of thermocouple.	
Text Book	1. B.Sc. Practical Physics, C.L. Arora, S. Chand, 2012.	
Reference Book:	**1.** A Text Book of Practical Physics, I. Prakash & Ramakrishna, Kitab Mahal Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, Heinemann Educational Publishers. **2.** Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, Asia Publishing House *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1.http://vlab.amrita.edu/?sub=1&brch=194 2.http://htv-au.vlabs.ac.in/	

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: BGP311	B.Sc.(H) 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: TMUGA-302	**Value Added Course** **B.Sc. (H) Physics- Semester-III** **Modern Algebra and 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.	Correlating the various arithmetic concepts to check sufficiency of data	
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	**8 Hours**
Unit-2:	**Data interpretation** Data Interpretation Basics, Bar Chart, Line Chart, Tabular Chart, Pie Chart, DI tables with missing values	**7 Hours**
Unit-3:	**Data Sufficiency** Introduction of Data Sufficiency, different topics based DS	**5 Hours**
Unit-4:	**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	**6 Hours**
Unit-5:	**Probability** Introduction, Probability based on Dice and Coins, Conditional Probability, Bayes Theorem	**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: TMUGS-301	Value Added Course B.Sc.(H) Physics- Semester-III **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: BAS321	Generic Elective -III B.Sc.(H) Physics- Semester-III **Fundamentals of Organic Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** the basic concepts and classification of hybridization, electronic displacement, haemolytic & hetrolytic fission in organic molecules and aromatic hydrocarbons.	
CO2.	**Understanding** the addition-elimination reactions & their mechanisms of alkenes and alkynes.	
CO3.	**Understanding** the nomenclature, structure and mechanisms of stereochemistry.	
CO4.	**Understanding** the electrophilic aromatic substitution reactions and mechanisms of aromatic hydrocarbons.	
CO5.	**Applying** the Fischer Projection, Newmann and Sawhorse Projection to calculate the stereochemistry of organic molecule and Hückel's rule to calculate the aromaticity.	
Course Content:		
Unit-1:	**Basics of Organic Chemistry I:** Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electrometric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength.	**8 Hours**
Unit-2:	**Basics of Organic Chemistry II:** Homolytic and Heterolytic fission. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes. Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions. Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.	**8 Hours**
Unit-3:	**Chemistry of Carbon-Carbon pi bonds:** Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. Reactions of alkenes: Electrophilic additions their mechanisms (Markownik off/ Anti Markownik off addition), hydroboration-oxidation, ozonolysis, reduction (catalytic and chemical). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylicbromination and mechanism, e.g. propene, 1-butene. Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of	**8 Hours**

	terminal alkynes.	
Unit-4:	**Stereochemistry:** Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.	**8 Hours**
Unit-5:	**Aromatic Hydrocarbons:** Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups.	**8 Hours**
Text Book:	**1.** Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).	
Reference Books:	1.Finar, I. L. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). **2.** Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	https://www.youtube.com/watch?v=4NhdsNG4ReA https://www.youtube.com/watch?v=FFqfM1cN89w https://www.youtube.com/watch?v=rzc6tGAUMas	

Course Code: BAS331	Generic Elective –III B.Sc.(H) Physics- Semester-III Numerical Analysis	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** finite differences and interpolation with equal intervals and Unequal Intervals.	
CO2.	**Understanding** introduction of operators and its properties.	
CO3.	**Applying** numerical solution of first order differential equation using Eulers, Picards and Runge Kutta methods and derivative using forward and backward difference interpolation.	
CO4.	**Analyzing** Lagrange's interpolation formula for unequal intervals.	
CO5.	**Evaluating** Numerical differentiation and Integration, Trapezoidal Formulae, Simpson's Rule, Weddle rule and Cote's formula.	
Course Content:		
Unit-1:	Introduction of finite differences; Forward and backward differences, Forward and backward differences table, Missing term problems, General Introduction of operators and its properties.	8 Hours
Unit-2:	Interpolation with equal intervals and Unequal Intervals; Newton Gregory Forward and Backward Formula, Divided difference table, Newton's divide difference Formula, Lagrange's Interpolation Formula, Hermit Interpolation formulas using differences.	8 Hours
Unit-3:	Central difference formulae, Bessel's and Strling formula, Gauss Forward and Backward, Evertt formula.	8 Hours
Unit-4:	Numerical differentiation and Integration, Derivative using forward and backward difference interpolation formula, Trapezoidal Rule, Simposon's one-third and three-eight rules, Weddle rule and Cotes formula.	8 Hours
Unit-5:	Numerical solution of first order differential equation using Eulers, Picards and Runge Kutta methods.	8 Hours
Text Book:	**1.** "Numerical Analysis" by Pradeep Niyosi, Tata Mcgraw Hell.	
Reference Books:	**1.** "Numerical Analysis" by P.P. Gupta and Sanjay Gupta, Krishana Prakashan Mandir. **2.** "Numerical Analysis" by S.S. Sastry, Prentice Hall of India. **3.** "Introduction to Numerical Analysis" by C. E. Froberg, Addition Welly Publishing Co. ***Latest editions of all the suggested books are recommended.**	
Additional electronic reference material	https://www.youtube.com/watch?v=6x_5R9zggIw https://www.youtube.com/watch?v=PBjGdQOghJE https://www.youtube.com/watch?v=G7p0nvtUFn0	

Course Code: **BAS366**	**Generic Elective -III (Lab)** **B.Sc.(H) Physics- Semester-III** **Fundamentals of Organic Chemistry (Lab)**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the producer and mechanism for the synthesis of organic compounds.	
CO2.	**Understanding** the qualitative analysis of functional groups in organic compounds.	
CO3.	**Applying** chemical techniques for the detection of extra elements in the organic compounds.	
CO4.	**Analyzing** organic compounds containing functional groups.	
CO5.	**Applying** confirmation test to identify the compounds.	
Experiments:	**Note: All experiments should be performed:**	
Experiment-1:	Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)	
Experiment-2:	Systematic Qualitative Organic Analysis of Organic Compounds possessing mono functional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.	
Experiment-3:	Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done. **1.** Bromination of Phenol/Aniline **2.** Benzoylation of amines/phenols Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone	
Text Book;	**1.** Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education.	
Reference Books:	**2.** Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson. **3.** Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall. **4.** Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman. ***Latest editions of all the suggested books are recommended**	
Additional electronic reference material	1. https://www.youtube.com/watch?v=wyeJ7emivsI 2. https://www.youtube.com/watch?v=niQUmj8b4CI 3. https://www.youtube.com/watch?v=DCcXOcD6KPg	

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: BAS371	Generic Elective -III (Lab) B.Sc.(H) Physics- Semester-III **Numerical Analysis (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** the finite differences, operators and its properties.	
CO2.	**Understanding** the concepts of methods of Numerical Analysis.	
CO3.	**Applying** numerical solution of first order differential equation using Eulers, Picards and Runge Kutta methods.	
CO4.	**Applying** Simpson's rule in logical operators and expressions using Matlab / Mathematica / Maple.	
CO5.	**Analyzing** Lagrange's interpolation formula for unequal intervals.	
Experiments:	**Note: All experiments should be performed:**	
Experiment-1:	Calculate the sum 1/1 + 1/2 + 1/3 + 1/4 + ----------+ 1/ N.	
Experiment-2:	To find the absolute value of an integer.	
Experiment-3:	Enter 100 integers into an array and sort them in an ascending order.	
Experiment-4:	Any two of the following (a) Bisection Method (b) Newton Raphson Method (c) Secant Method (d) Regulai Falsi Method	
Experiment-5:	LU decomposition Method (vi) Gauss-Jacobi Method (vii) SOR Method or Gauss-Siedel Method	
Experiment-6:	Lagrange Interpolation or Newton Interpolation	
Experiment-7:	Simpson's rule. Note: For any of the CAS Matlab / Mathematica / Maple / Maxima etc., Data types-simple data types, floating data types, character data types, arithmetic operators and operator precedence, variables and constant declarations, expressions, input/output, relational operators, logical operators and logical expressions, control statements and loop statements, Arrays should be introduced to the students.	
Text Book:	**1.** B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India.	
Reference Books:	**1.** M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New age International Publisher, India, 5th edition. **2.** C. F. Gerald and P. O. Wheatley, Applied Numerical Analysis, Pearson Education, India,7th edition. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference material	https://www.youtube.com/watch?v=6x_5R9zggIw https://www.youtube.com/watch?v=PBjGdQOghJE https://www.youtube.com/watch?v=G7p0nvtUFn0	

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: BAS433	B.Sc.(H) Physics- Semester-IV **Mathematical Physics- II**	L-5 T-1 P-0 C-6
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** expansion of periodic functions in a series of sine and cosine functions and the determination of Fourier coefficients, power series method classification of partial- differential equation	
CO2.	**Understanding** special functions, Beta and Gamma functions and relation between them.	
CO3.	**Understanding** the theory of errors.	
CO4.	**Applying** Frobenius method and its applications to differential equations and solutions to partial differential equations using separation of variables.	
CO5.	**Applying** partial differential equation in solving the problems of rectangular, cylindrical and spherical symmetry for Wave and diffusion equations.	
Course Content:		
Unit-1:	**Fourier Series:** Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (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.	**8 Hours**
Unit-2:	**Power series and Frobenius Method:** Ordinary points, Power series method, Singular Points of Second Order Linear Differential Equations and their importance, Frobenius method and its applications to differential equations.	**8 Hours**
Unit-3:	**Special Functions:** Legendre, Bessel and Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Bessel Generating Function, simple recurrence relations. Zeros of Bessel Functions $J_o(x)$ and J1(x)) and Orthogonality, Hermite Polynomials (without proof).	**8Hours**
Unit-4:	**Some Special Integral & Theory of Errors:** Beta and Gamma Functions and Relation between them, Expression of Integrals in terms of Gamma Functions, Error Function, Random Errors, Propagation of Errors, Standard and Probable Error. Least-squares fit (straight line).	**8 Hours**
Unit-5:	**Partial Differential Equations:** Classification of partial differential equation. Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular, Diffusion Equation.	**8 Hours**
Text Book:	**1.** Mathematical Methods for Physicists: Arfken, Weber, Harris, Elsevier. Fourier analysis by M.R. Spiegel, Tata McGraw-Hill.	

Reference Book:	**1.** Mathematics for Physicists, Susan M. Lea, Thomson Brooks/Cole. Differential Equations, George F. Simmons, Tata McGraw-Hill. **2.** Mathematical Tools for Physics, James Nearing, Dover Publications. **3.** Mathematical methods for Scientists and Engineers, D.A. McQuarrie, Viva Book Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, Jones and Bartlett Learning. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=GMP1re80KHA 2. https://www.youtube.com/watch?v=zgX6S7tEScI 3. https://www.youtube.com/watch?v=NBcGLLU90fM	

Course Code: BAS434	**B.Sc.(H) Physics- Semester-IV** **Atomic & Laser Physics**	**L-4 T-0 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** the some of the early models of the atom.	
CO2.	**Understanding** Bohr's model of the hydrogen atom and its relation to de Broglie waves.	
CO3.	**Understanding** the basic mechanisms for production of X-rays & laser light.	
CO4.	**Understanding** the constructions and workings of various types of lasers.	
CO5.	**Applying** the L-S and J-J couplings to explain fine structures in Hydrogen and Alkali Atoms.	
Course Content:		
Unit-1:	Determination of e/m of the Electron, Thermionic Emission, Isotopes and Isobars, X-rays: Ionizing Power, X-ray Diffraction, Bragg's Law. Bohr Atomic Model, Critical Potentials, X-rays-Spectra: Continuous and Characteristic X-rays, Moseley Law.	**8 Hours**
Unit-2:	Atoms in Electric and Magnetic Fields: Electron Angular Momentum, Space Quantization, Electron Spin and Spin Angular Momentum, Larmor's Theorem. Spin Magnetic Moment, Stern-Gerlach Experiment, Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton, Zeeman Effect, Paschen Back and Stark Effect.	**8 Hours**
Unit-3:	Many electron atoms: Pauli's Exclusion Principle, Symmetric and Antisymmetric Wave Functions, Periodic table. Fine structure, Spin orbit coupling, Spectral Notations for Atomic States, Total Angular Momentum, Vector Model, L-S and J-J couplings, Hund's Rule, Term symbols, Spectra of Hydrogen and Alkali Atoms (Na etc.).	**8 Hours**
Unit-4:	Basic Principle of Laser, Einstein Coefficients, condition for Light Amplification- Population Inversion, threshold condition, Laser Rate Equations-two, three and four level systems.	**8 Hours**
Unit-5:	Types of Lasers: Solid State lasers - Ruby and Nd-YAG Laser; Gas lasers - He-Ne and CO_2 lasers; semiconductor lasers - Liquid Dye lasers, Application of laser in industry, Medical applications, Holography - Theory of recording and reconstruction - application of Holography.	**8 Hours**
Text Book:	1. Concepts of Modern Physics by Arthur Beiser (McGraw-Hill Book Company.	
Reference Books:	1. Physics of Atoms and Molecules, Bransden and Joachein. 2. Molecular Spectroscopy, Banwell. 3. Optoelectronics by Ghatak and Thyagarajan. *** Latest editions of all the suggested books are recommended**	

Additional electronic reference materials	1. https://www.youtube.com/watch?v=UheTlVwukWg 2. https://www.youtube.com/watch?v=illnJUD7JI4 3. https://www.youtube.com/watch?v=FNp81kkxj5c 4. https://www.youtube.com/watch?v=BevG0bRlgUU	

Course Code: BAS438	B.Sc.(H) Physics- Semester-V Electromagnetic Theory	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the Maxwell's Equations, Poynting Theorem and Poynting Vector.	
CO2.	**Understanding** the boundary condition of EM wave at plane interface of two media and propagation of E.M waves in vacuum, isotropic media and Anisotropic Media.	
CO3.	**Understanding** production & detection of different polarized waves.	
CO4.	**Applying** the Maxwell equations, boundary conditions at plane interface of two media to derive the laws of reflection, refraction, Brewster law and Fresnel's formula.	
CO5.	**Applying** the boundary conditions, total internal reflections and Maxwell equations to understand the propagation of TE & TM modes in optical waveguide.	
CO6.	**Analyzing** the polarization of light from a given light using retarder and polarizer.	
Course Content:		
Unit-1	**Maxwell Equations:** Review of Maxwell's equations. Displacement Current. Vector and Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge, Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density.	**8Hours**
Unit-2	**EM Wave Propagation in Unbounded Media:** Wave Equations, Transverse nature of plane EM waves, Plane EM waves through vacuum and isotropic dielectric medium, refractive index and dielectric constant, wave impedance. Propagation through conducting media, skin depth.	**8Hours**
Unit-3	**EM Wave in Bounded Media:** Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction. Fresnel's Formulae for perpendicular & parallel polarization cases, Brewster's law. Reflection& Transmission coefficients. Total internal reflection.	**8Hours**
Unit-4	**Polarization of Electromagnetic Waves:** Propagation of E.M. Waves in Anisotropic Media. Symmetric Nature of Dielectric Tensor. Fresnel's Formula. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Polarization by Double Refraction. Nicol Prism. Ordinary& extraordinary refractive indices. Production & detection of Plane, Circularly and Elliptically Polarized Light. Phase Retardation Plates: Quarter-Wave and Half-Wave Plates. Analysis of Polarized Light.	**8Hours**
Unit-5	**Optical Wave Guides:** Planar optical wave guides. Condition of continuity at interface. Propagation of TE & TM modes in symmetrical wave guides. Eigen value equation, Phase shift on total reflection.	**8Hours**

Text Book:	1. Introduction to Electrodynamics, D.J. Griffiths, Benjamin Cummings. Elements of Electromagnetics, M.N.O. Sadiku, Oxford University Press.	
Reference Books:	**1.** Introduction to Electromagnetic Theory, T.L. Chow, Jones & Bartlett Learning Fundamentals of Electromagnetics, M.A.W. Miah, Tata McGraw Hill. **2.** Electromagnetic field Theory, R.S. Kshetrimayun, Cengage Learning. **3.** Engineering Electromagnetic, Willian H. Hayt, McGraw Hill. **4.** Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, Springer. *** 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 6.https://www.youtube.com/watch?v=Y6ngDf_f-O4 7.https://www.youtube.com/watch?v=5Uqt3Igj_Uc	

Course Code TMUGE401	B.Sc.(H) Physics- Semester-IV **English Communication – IV**	L-2 T-0 P-2 C-3
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** adequate knowledge of grammar and vocabulary through prescribed text to address competitive exams.	
CO2.	**Understanding** the value of listening to understand the basic content.	
CO3.	**Understanding** the usage of English grammar in day to day context.	
CO4.	**Understating** about the skills required in corporate world.	
CO5.	**Applying** writing and comprehensive skills in English.	
CO6.	**Creating** a simple proposal and report.	
Course Content:		
Unit-1:	**Vocabulary & Grammar** • Homophones and Homonyms • Correction of Common Errors (with recap of English Grammar with its usage in practical context.) • Transformation of sentences	**12 Hours**
Unit-2:	**Essence of Effective listening & speaking** • Listening short conversation/ recording (TED talks / Speeches by eminent personalities) *Critical Review of these abovementioned* • Impromptu	**5 Hours**
Unit-3:	**Professional Writing** • Proposal: Significance, Types, Structure & AIDA • Report Writing: Significance, Types, Structure& Steps towards Report writing	**8 Hours**
Unit-4:	**Job Oriented Skills** • Cover Letter • Preparing Resume and Curriculum-Vitae • Interview: Types of Interview, Tips for preparing for Interview and Mock Interview • Corporate Expectation & Professional ethics: Skills expected in corporate world.	**10 Hours**
Unit-5:	**Value based text reading:** Short story • A Bookish Topic - R.K. Narayan	**5 Hours**
Text Book:	**1.** Singh R.P., An Anthology of English Essay, O.U.P. New Delhi	
Reference Books:	**1.** Joseph, Dr C.J. & Myall E.G. "A *Comprehensive Grammar of Current English*" Inter University Press, Delhi **2.** Chaudhary Sarla "Basic Concept of Professional Communication" Dhanpat Rai Publication, New Delhi. **3.** Kumar Sanjay &Pushplata "Communication Skills" Oxford University Press, New Delhi. ***Latest editions of all the suggested books are recommended.**	
Additional Electronics Reference Material	1-https://www.youtube.com/watch?v=dpYltVtsS_Q 2 - https://www.youtube.com/watch?v=QthdqIB0WS8 3 -https://www.youtube.com/watch?v=MrgHfK8Pcfk 4 -https://www.youtube.com/watch?v=860LtRxP3rw	

	5 - https://www.youtube.com/watch?v=0nN7Q7DrI6Q	
Methodology:	**1.** The content will be conveyed through Real life situations, Pair Conversation, Group Talk and Class Discussion. **2.** Language Lab software. **3.** Sentence transformation on daily activities and conversations. **4.** Conversational Practice will be effectively carried out by Face to Face & Via Media (Audio-Video Clips) **5.** Modern Teaching tools (PPT Presentation & Motivational videos with sub-titles) will be utilized.	

Evaluation Scheme

Internal Evaluation			**External Evaluation**		**Total Marks**
40 Marks			**60 Marks**		
20 Marks (Best 2 out of Three CTs) ***(From Unit - I, III, IV & V)***	10 Marks (Oral Assignments) ***(From Unit - II & IV)***	10 Marks (Attendance)	40 Marks (External Written Examination) ***(From Unit -I, III, IV & V)***	20 Marks (External Viva)* ***(From Unit -II & IV)***	**100**

*Parameters of External Viva

Content	**Body Language**	**Communication skills**	**Confidence**	**TOTAL**
05 Marks	05 Marks	05 Marks	05 Marks	20 Marks

***Note**: External Viva will be conducted by 2-member committee comprising*

a) *One Faculty teaching the class*

b) *One examiner nominated by University Examination cell.*

Each member will evaluate on a scale of 20 marks and the average of two would be the 20 marks obtained by the students.

Course Code: BAS473	B.Sc.(H) Physics- Semester-IV **Atomic & Laser Physics (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Remembering the physical phenomenon of polarization and diffraction.	
CO2.	Applying the concepts of optical phenomena for understanding the mechanisms of various monochromatic sources.	
CO3.	Applying the spectrophotometer for verification of Beer's law.	
CO4.	Analyzing the V-I characteristics of LEDs, IR and P-N junction diode.	
CO5.	Analyzing the groove spacing of CD and DVD using reflection method.	
Experiments:	**Note: Minimum 10 experiments should be performed:**	
Experiment-1:	To verify the law of Malus for plane polarized light.	
Experiment-2:	To determine the specific rotation of sugar solution using Polarimeter.	
Experiment-3:	To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil or Xylene) by studying the diffraction through ultrasonic grating.	
Experiment-4:	To verify the Stefan`s law of radiation and to determine Stefan's constant	
Experiment-5:	To determine the Boltzmann constant using V-I characteristics of PN junction diode.	
Experiment-6:	To study Faraday's effect.	
Experiment-7:	To study Optical absorption – spectrophotometer.	
Experiment-8:	Laser coherence and divergence measurement.	
Experiment-9:	Determine of Cauchy's constant by using spectrometer.	
Experiment-10:	Determine of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid state laser.	
Experiment-11:	V-I Characteristics of IR sensor.	
Experiment-12:	To find the polarization angle of laser light using polarizer and analyzer.	
Experiment-13:	V-I Characteristics of LED.	
Text Book:	**1.** LASERS- Theory and Applications, by- Thyagarajan and A. K. Ghatak.	
Reference Books:	**1.** Lasers and Non-linear optics. By- B. B. Laud. **2.** Optics and LASER, by- V. K. Sewane **3.** Introduction to Lasers, by- Dr. Avadhanulu, Dr. P. S. Hemne, Publisher: S. Chand & Company Ltd. New Delhi. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1.http://vlab.amrita.edu/?sub=1&brch=189 2.http://www.indosawedu.com/polarization-of-light-and-verification-of-malus-law.php	

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: BGP411	B.Sc.(H) 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: TMUGA-402	Value Added Course B.Sc. (H) Physics- Semester-IV **Advance Algebra and Geometry**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	Recognizing the rules of Crypt-arithmetic and relate them to find out the solutions.	
CO2.	Illustrating the different concepts of Height and Distance and Functions.	
CO3.	Employing the concept of higher level reasoning in Clocks, Calendars and Puzzle Problems.	
CO4.	Correlating the various arithmetic and reasoning concepts in checking sufficiency of data.	
Course Content:		
Unit-1:	**Clocks and calendars** Introduction , Angle based , faulty Clock, Interchange of hands, Introduction of Calendars, Leap Year , Ordinary Year	**5 Hours**
Unit-2:	**Set theory** Introduction , Venn Diagrams basics, Venn Diagram – 3 sets, 4-Group Venn Diagrams	**4 Hours**
Unit-3:	**Heights and Distance** Basic concept, Word problems	**3 Hours**
Unit-4:	**Functions** Introduction to Functions, Even and Odd Functions, Recursive	**3 Hours**
Unit-5:	**Problem Solving** Introduction, Puzzle based on 3 variable, Puzzle based on 4 variable	**6 Hours**
Unit-6:	**Data Sufficiency** Introduction, Blood relation based, direction based, ranking based	**5 Hours**
Unit-7:	**Crypt Arithmetic** Introduction of Crypt Arithmetic, Mathematical operations using Crypt Arithmetic, 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: TMUGS-401	Value Added Course B.Sc.(H) Physics- Semester-IV **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 4. Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan 5. Steinburg, Scott, Nettiquette Essentials (2013), Lulu.com 6. https://www.hloom.com/resumes/creative-templates/	

	7. https://www.mbauniverse.com/group-discussion/topic.php 8. 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: BAS436	Generic Elective- IV B.Sc.(H) Physics- Semester-IV **Polymer Chemistry**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** the introduction & basic concepts of polymers.	
CO2.	**Understanding** the classification & properties of polymers.	
CO3.	**Understanding** the kinetics & mechanism of polymerization reaction.	
CO4.	**Understanding** the preparation & application of industrial & natural polymers.	
CO5.	**Analyzing** the molecular weight determination of polymers.	
Course Content:		
Unit-1:	**Basic Concepts:** Classification – Nomenclature and isomerism – functionality – Molecular forces and chemical bonding in polymers – Molecular weight – Linear, branched and cross-linked polymers. Thermoplastic and thermosetting polymers – Elastomers, Fibers and resins. Techniques of polymerization–emulsion, bulk, solution and suspension.	**8 Hours**
Unit-2:	**Kinetics and Mechanism:** Kinetics and Mechanism of polymerization – free radical, cationic, anionic and co-ordination polymerization (Ziegler - Natta Catalyst). Copolymerization – Kinetics (Detailed Study).General characterization–Kinetic chain length–degree of polymerization, chain transfer - initiators – inhibitors – retarders.	**8 Hours**
Unit-3:	**Structure and Properties** Structure - property relationship – Mechanical properties, Thermal properties – Glass transition temperature – Factors affecting Glass transition temperature – crystallinity and melting point – related to structure. **Polymer characterization and analysis** Crystalline nature – X-Ray diffraction – Differential Scanning Calorimetry (DSC) – Thermo Gravimetric Analysis – molecular weight determination – Osmometry (membrane), Viscosity, Ultra centrifuge and Gel Permeation Chromatography.	**8Hours**
Unit-4:	**Industrial Natural Polymers:** Important industrial polymers – preparation and application of polyethylene, poly vinyl chloride, poly urethanes, polytetrafluro ethylene (TEFLON), Nafion and ion – exchange resins. Importance of natural polymers – application and structures of starch, cellulose and chitosin derivatives.	**8 Hours**
Unit-5:	**Specialty Polymers:** Bio polymers – biodegradable polymers – biomedical polymers – poly electrolytes - conducting polymers – high temperature and fire-retardant polymers - polymer blend – polymer composites – polymer nanocomposites – IPN inter penetrating network polymers – Electroluminescent polymers.	**8Hours**
Text Book	**1.** F.W. Bill Meyer. Text book of polymer science, John Wiley and sons, New York. P. J. Flory. Principles of Polymer Chemistry, Cornell Press.	

Reference Books:	1.V. R. Gowarikar, B. Viswanathan, J. Sridhar, Polymer Science – Wiley eastern. 2.G. S. Misra – Introduction to Polymer Chemistry, Wiley Eastern Ltd., 3.P. Bahadur, N. V. Sastry, Principles of Polymer Science, Narosa Publishing House. 4.G. Odian, Principles of Polymerization, McGraw Hill Book Company, New York. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference materials	1.https://www.youtube.com/watch?v=ACPDEy3evqE 2.https://www.youtube.com/watch?v=rvm4xMMrnaI 3.https://www.youtube.com/watch?v=D2juqlqtXGw 4.https://www.youtube.com/watch?v=_38Mr4vASDU	

Course Code: **BAS418**	**Generic Elective Course-IV** **B.Sc.(H) Physics- Semester-IV** **Introduction to Probability**	**L-4** **T-0** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the concept of the probability, addition law of probability and multiplication law of probability with its applications.	
CO2.	**Applying** the concept of discrete and continuous random variable to calculate the moment and generating functions.	
CO3.	**Analyzing** the concept of mathematical expectation, addition and multiplication theorem of Expectation.	
CO4.	**Analyzing** the M.G.F,C.F and P.D.F of the discrete and continuous distributions.	
CO5.	**Evaluating** the concept of Probability distributions and its recurrence relation of the distribution.	
Course Content:		
Unit-1:	Probability: Introduction, sample space, events and algebra of events, Kinds of Probability: classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events.	**8 Hours**
Unit-2:	Random Variables: Discrete and continuous random variables, p.m.f, p.d.f, c.d.f. Illustrations of random variables and its properties, variance, moments and moment generating function.	**8 Hours**
Unit-3:	Mathematical Expectation- Expectation of a Random Variable, Addition & Multiplication Theorem of Expectation, Moments-Moment Generating Function, Limitations of m.g.f, cumulants - additive property.	**8 Hours**
Unit-4:	Discrete probability distributions: Bernoulli distribution : M.G.F, C.F , mean and variance, Binomial distribution : M.G.F, C.F , P,D.F, mean and variance, Poisson distribution: M.G.F, C.F , P,D.F, mean and variance.	**8 Hours**
Unit-5:	Continuous Probability Distributions: Gamma Distribution : M.G.F, C.F , P,D.F, mean and variance, Beta distribution: M.G.F, C.F , P,D.F, mean and variance, and Uniform distribution: M.G.F, C.F , P,D.F, mean and variance,	**8 Hours**
Text Books:	**1.** Mathematical Statistics" by S.C. Gupta, S. Chand & co.	
Reference Books:	**1.** Miller, Irwin and Miller, Marylees : John E. Freund's Mathematical Statistics with Applications, Pearson Education, Asia. **2.** Myer, P.L.: Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi. ***Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=WNurLRYXJfI 2. https://www.youtube.com/watch?v=J0Yzmb_PY3Y 3. https://www.youtube.com/watch?v=lmGiViDWlJI	

Course Code: BAS471	**Generic Elective Course-IV (Lab)** **B.Sc.(H) Physics- Semester-IV** **Polymer Chemistry (Lab)**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the mechanical properties of Polymers.	
CO2.	**Determination** of molecular weight & hydroxyl number of polymers.	
CO3.	**Estimation** of the amount of HCHO in the given solution.	
CO4.	**Synthesizing** different types of industrial polymers.	
CO5.	**Determination** of hydroxyl number of a polymer using colorimetric method.	
Experiments:	**Note: All experiments should be performed:**	
Experiment-1:	**Polymer synthesis:** Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) / Methyl Acrylate (MA) / Acrylic acid (AA). Purification of monomer Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bis-isobutylonitrile (AIBN)	
Experiment-2:	Preparation of nylon 66/6	
Experiment-3:	Precipitation polymerization of acrylonitrile	
Experiment-4:	Preparation of urea-formaldehyde resin	
Experiment-5:	Preparations of novalac resin/ resold resin.	
Experiment-6:	Microscale Emulsion Polymerization of Poly(methylacrylate).	
Experiment-7:	**Polymer characterization:** Determination of molecular weight by viscometry: Polyacrylamide-aq.NaNO2 solution (Poly vinyl proplylidine (PVP) in water	
Experiment-8:	Determination of the viscosity-average molecular weight of poly(vinyl alcohol) (PVOH) and the fraction of "head-to-head" monomer linkages in the polymer.	
Experiment-9:	Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group).	
Experiment-10:	Testing of mechanical properties of polymers.	
Experiment-11:	Determination of hydroxyl number of a polymer using colorimetric method.	
Experiment-12:	**Polymer analysis:** Estimation of the amount of HCHO in the given solution by sodium sulphite method	
Text Book	M.P. Stevens, Polymer Chemistry: An Introduction, Oxford University Press	
Reference Books:	**1.** M.P. Stevens, Polymer Chemistry: An Introduction, Oxford University Press. **2.** H.R. Allcock, F.W. Lampe & J.E. Mark, Contemporary Polymer Chemistry, Prentice-Hall. **3.** F.W. Billmeyer, Textbook of Polymer Science, Wiley-Inter-science. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=rtSlMPxk_X0 2. https://www.youtube.com/watch?v=bu-_32O0QNs 3. https://www.youtube.com/watch?v=WQASBwMuoBw	

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: BAS472	Generic Elective -IV (Lab) B.Sc.(H) Physics- Semester-IV **Statistical Package for Social Sciences (Lab)**	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	**Understanding** the concept of data analysis, general description, functions, menus and commands.	
CO2.	**Understanding** the different type of variables as well as computing new variables.	
CO3.	**Understanding** the concept of Descriptive analysis of data, creating & editing graphs.	
CO4.	**Applying** the Statistical test (Paramatric & non parametric) for independent samples, paired samples.	
CO5.	**Evaluating** the correlation and regression analysis and cluster sampling.	
Course Content:		
Unit-1:	**Introduction to SPSS: Definition of SPSS, Uses and its application in mathematics & Statistics,** Data analysis with SPSS: General aspects, discrete and continuous data, Primary and secondary data, variable, output, and syntax view; General description, data editing factor: completeness of data, consistency of data, homogeneity of data, functions, menus.	**8 Hours**
Unit-2:	**Input and data management:** Defining variables; Entering and modifying data: manual and automated input of data, and file import; Data Arrangement: Listing cases, replacing missing values, computing new variables, exploring data, selecting cases.	**8 Hours**
Unit-3:	**Descriptive analysis of data:** Frequencies; Descriptive Statistics: measures of central tendency, variability, deviation from normality; chi-square analyses; Charts: creating &editing graphs (Bar; histograms; scatter diagram; percentiles etc.).	**8 Hours**
Unit-4:	**Correlation and regression**: Correlation: Bivariate and Multiplication correlation; correlation matrix; Regression: Simple linear regression; Multiple regression analysis; Factor analysis, Cluster analysis.	**8 Hours**
Unit-5:	**Statistical tests:** Parametric Tests: Means; t-test (Independent samples, paired samples, and one sample tests); One-way ANOVA, two – way ANOVA, Non parametric tests: Mann-Whitney U, Wilcoxon signed-rank.	**8 Hours**
Text Book:	1. Pallant, Julie. "SPSS Survival Manual." 4th Ed., McGraw-Hill.	
Reference Books:	**1.** Cronk, Brian. "How to Use SPSS: A Step-By-Step Guide to Analysis and Interpretation." 5thEd. **2.** Kiran Pandya, Smruti Bulsari, Sanjay Sinha, "SPSS in simple steps" Wiley/Dream tech Press. *** Latest editions of all the suggested books are recommended.**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=uJJP1BB0Y24 2. https://www.youtube.com/watch?v=PrNslXgJNP8 3. https://www.youtube.com/watch?v=sjRg6W2awZs	

Experiments:

Experiments:	Note: Minimum 5 experiments should be performed:
Experiment-1:	Open the SPSS data file MEMORY.SAV.
Experiment-2:	Describe the shape of the distribution of the sample
Experiment-3:	Compare box plots for the groups. In particular, do the box plots indicate that there is a difference between the memorization methods?
Experiment-4:	Open the SPSS data file RESPONSE.SAV. Compute the difference between the visual and auditory response of each subject and store the values in an unused column. Remember that you can use Transform > Compute to do this easily
Experiment-5:	Describe the shape of the distribution of these differences.
Experiment-6:	Do these differences indicate that the type of stimulus matters? Explain your reasoning.

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: BAS523	**B.Sc.(H) Physics- Semester-V** **Quantum Mechanics**	**L-4** **T-0** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the measurement process in quantum mechanics using uncertainty principle.	
CO2.	**Understanding** square and delta potential and using them to explain contact potential and electron sharing in metals.	
CO3.	**Understanding** linear harmonic oscillator and its applications.	
CO4.	**Applying** Schrödinger equation to one and three dimensional problems.	
CO5.	**Applying** Schrodinger equation for understanding tunnelling and explaining in nuclear processes.	
Course Content:		
Unit-1	**Origin of quantum theory:** Davisson-Germer experiments, wave-particle duality for photons and material particles, wave function and its Born interpretation, relation with measurement of dynamical variables, delta-function as definite position and plane wave as definite momentum wave function, wave packet as superposition of delta-functions and of plane waves.	**8Hours**
Unit-2	**Uncertainty principle & Operators:** Position-momentum uncertainty principle, time energy uncertainty; Gaussian wave packets, applicability of classical physics on the basis of uncertainty product, operator formulation, commuting operators, simultaneous Eigen-functions, degenerate eigenfunctions, Schrödinger equation for time evolution.	**8Hours**
Unit-3	**Application of Schrödinger equation-I:** Square well potentials, bound states in deep potential well and finite potential well, double, well potentials, delta function potentials and examples like electron sharing in covalent bonds.	**8Hours**
Unit-4	**Application of Schrödinger equation-II:** Linear harmonic oscillator, outline of getting stationary states, molecular vibrations and spectroscopy, barrier tunneling, examples of alpha-decay, nuclear fission, fusion in the sun.	**8Hours**
Unit-5	**Application of Schrödinger Equation-III:** Angular momentum operators, its eigenvalues and eigenfunctions, spin angular momentum, hydrogen atom using coulomb interaction. Identical particles, indistinguishability in quantum mechanics, bosons and fermions.	**8Hours**
Text Book:	**1.** Quantum Physics: S. Gasiorowicz.	
References Books:	**1.** Quantum Mechanics: B. H. Bransden and C. J. Joachain. **2.** Quantum Physics of Atoms, Molecules, Nuclei and Solids: R. M. Eisberg and R. Resnick. **3.** Quantum Mechanics: V. Devanathan. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1.https://www.youtube.com/watch?v=R-x9KdNjQmo&list=PL1955A15B7F282A7F 2.https://www.youtube.com/watch?v=Olq-	

	meHLjus&list=PL1955A15B7F282A7F&index=19 3. https://www.youtube.com/watch?v=9lX2FENOe4o 4. https://www.youtube.com/watch?v=bsu6lVtfPvM	

Course Code: BAS537	**B.Sc.(H) Physics- Semester-V** **Mathematical Physics-III**	**L-5** **T-1** **P-0** **C-6**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** and learning of Complex analysis and integration of a function.	
CO2.	**Understanding** the Integral transform and its use to solve various physical problems, etc	
CO3.	**Applying** residues theorems to solve various integrals used in real physical phenomena.	
CO4.	**Applying** the Laplace transform in solving the different problems in Physics.	
CO5.	**Applying** Fourier transforms in solving various physical problems.	
Course Content:		
Unit-1:	**Complex Analysis**: Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Milnes-Thomson method	**8 Hours**
Unit-2:	**Singular functions:** Poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral Theorem, Cauchy's Integral formula. Simply and multiply connected region. Laurent and Taylor's expansion. Residues and Residue Theorem. Application in solving Definite Integrals.	**8 Hours**
Unit-3:	**Fourier Transforms:** Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a Fourier Integral. Fourier transform of derivatives, Inverse Fourier transform.	**8 Hours**
Unit-4:	**Laplace Transforms:** Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting Theorem. LTs of 1^{st} and 2^{nd} order Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions.	**8 Hours**
Unit-5:	**Convolution Theorem:** Inverse LT. Application of Laplace Transforms to 2^{nd} order Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits, Coupled differential equations of 1^{st} order. Solution of heat flow along infinite bar using Laplace transform.	**8 Hours**
Text Books:	1. Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, Cambridge University Press.	
Reference Books:	**1.** Mathematics for Physicists, P. Dennery and A. Krzywicki, Dover Publications Complex Variables, A. S. Fokas& M. J. Ablowitz, Cambridge Univ. Press Complex Variables, A.K.	

	Kapoor, Cambridge Univ. Press. **2.** Complex Variables and Applications, J.W. Brown & R.V. Churchill, Tata McGraw-Hill. **3.** First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, Jones & Bartlett. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=VBAeogiKH2A 2. https://www.youtube.com/watch?v=lkAvgVUvYvY 3. https://www.youtube.com/watch?v=c9NibpoQjDk 4. https://www.youtube.com/watch?v=h_kht-5D6NM	

Course Code: BAS524	**B.Sc.(H) Physics- Semester-V** **Solid State Physics**	**L-4** **T-0** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** the Lorentz force to understand the Hall effect.	
CO2.	**Understanding** the physical significance in elementary of lattice dynamics, magnetic, dielectric and ferroelectric properties of matter, etc.	
CO3.	**Understanding** the physical properties of crystal structure like, lattice translation vectors, lattice with a basis unit cell.	
CO4.	**Understanding** the magnetic, dielectric and superconducting properties materials.	
CO5.	**Applying** the Bragg law to deduce the crystal structure of a material.	
Course Content:		
Unit-1	**Crystal Structure:** Solids: Amorphous and Crystalline Materials. Lattice: Translation Vectors, Lattice with a Basis Unit Cell, Miller Indices, Reciprocal Lattice, Types of Lattices, Brillouin Zones. Diffraction of X-rays by Crystals, Bragg's Law.	**8Hours**
Unit-2	**Elementary Lattice Dynamics:** Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains; Acoustical and Optical Phonons, Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids; T^3 law.	**8Hours**
Unit-3	**Magnetic Properties of Matter:** Dia-, Para-, Ferri- and Ferromagnetic Materials, Classical Langevin Theory of dia and Paramagnetic Domains, Quantum Mechanical Treatment of Para magnetism (Qualitative) , Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains, Discussion of B-H Curve, Hysteresis and Energy Loss.	**8Hours**
Unit-4	**Dielectric and Ferroelectric Properties of Materials:** Electric Susceptibility. Polarizability, Clausius-Mosotti Equation, Classical Theory of Electric Polarizability, Langevin-Debye equation. Plasma Oscillations, Plasma Frequency, Plasmons, Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop.	**8Hours**
Unit-5	**Superconductivity and Elementary band theory:** Critical Temperature. Critical magnetic field, Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (theoretically) Kronig Penny model. Band Gap, Conductor, Semiconductor (P and N type) and insulator, Hall Effect, Measurement of conductivity (four probe method) & Hall coefficient.	**8Hours**
Text Book:	**1.** Introduction to Solid State Physics, Charles Kittel, Wiley India Pvt. Ltd.	
References Books:	**1.** Elements of Solid State Physics, J.P. Srivastava, Prentice-Hall of India.	

	2. Introduction to Solids, Leonid V. Azaroff, Tata Mc-Graw Hill. **3.** Solid State Physics, N.W. Ashcroft and N.D. Mermin, Cengage Learning Solid-state Physics, H. Ibach and H. Luth, Springer. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1.https://www.youtube.com/watch?v=TbLJqifPXKM 2.https://www.youtube.com/watch?v=kygXzJa7tX4 3.https://www.youtube.com/watch?v=yWa_2P6CDpw 4.https://www.youtube.com/watch?v=etjZmdmrjSU 5.https://www.youtube.com/watch?v=D-9M3GWoBrw	

Course Code: BHM515	B.Sc.(H) 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: a) Ability to utilize the professional competence for augmenting	**8 Hours**

	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: BAS567	B.Sc.(H) Physics- Semester-V Solid State Physics (Lab)	L-0 T-0 P-4 C-2
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the physical properties of solid/liquid materials.	
CO2.	**Understanding** working modes of transistors, Zener diode as a voltage regulator.	
CO3.	**Applying** the concepts of resonance in LC circuits in determining the dielectric constant of mica sheets	
CO4.	**Applying** in the measurements of Hall effect to use to distinguish types of charges, their mobilites and concentrations.	
CO5.	**Applying** Gouy's and Qunick's method in the determination of magnetic susceptibility of solid /liquids materials.	
Experiments:	**Note: Minimum 10 experiments should be performed:**	
Experiment-1:	Measurement of resistivity by using 4-probe technique.	
Experiment-2:	Study of Hall effect.	
Experiment-3:	Measurement of magnetoresistance.	
Experiment-4:	Measurement of magnetic susceptibility using Quinck's method.	
Experiment-5:	Study of thermo luminescence of color center	
Experiment-6:	Study of magnetic hysteresis.	
Experiment-7:	Measurement of dielectric constant.	
Experiment-8:	Study of Raman effect.	
Experiment-9:	Characteristics of Transistor.	
Experiment-10:	Characteristics of Zener or Tunnel diode.	
Experiment-11:	Measurement of magnetic susceptibility using Guoy's method.	
Text Book:	1. Introduction to Solid State Physics, Charles Kittel, Wiley India Pvt. Ltd.	
References Books:	1.Elements of Solid State Physics, J.P. Srivastava, Prentice-Hall of India. 2.Introduction to Solids, Leonid V. Azaroff, Tata Mc-Graw Hill. **st 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=3PgAhleLqAI 3. https://www.youtube.com/watch?v=uy0NU_UEc8Y 4. https://www.youtube.com/watch?v=1W7dou4kAU8	

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: BAS598	B.Sc. (H)-Physics- Semester-V **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 V 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 IV semester and shall be the nodal officer for coordination of the training. Students will prepare an exhaustive technical report of the training during the V 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 V 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: BGP511	B.Sc.(H) Physics- Semester-V **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: BAS538	Discipline Specific Elective Course-I B.Sc.(H) Physics- Semester-V **Material Science**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the basics of material science on the basis of atomic structure.	
CO2.	**Understanding** various defects in crystals.	
CO3.	**Understanding** the concepts of nucleation kinetics, growth of transformations in steel, and glass transition.	
CO4.	**Applying** the key concepts of elastic behaviour to understand the mechanical properties of materials.	
CO5.	**Analyzing** the various phase diagrams to understand its thermodynamical properties.	
Course Content:		
Unit-1	**Internal Structure of Materials:** Atomic basis of structure–ionic bonding, Covalent bonding, Metallic bonding, Secondary bonding. Crystalline and non-crystalline states, Crystal symmetry, Metal Structures, Ionic and Covalent Structures, Silica and silicates, Polymers, Fullerenes, Experimental methods for structural determination: x-ray and neutron diffraction.	**8Hours**
Unit-2	**Crystal Imperfections:** Point, line, surface and volume imperfections, dislocations and their geometry, Disorder in polymers and non-crystalline materials.	**8Hours**
Unit-3	**Phase Diagrams:** Phase rule, Single component systems, Binary phase diagrams, Lever rule, phases in polymers, non-crystalline and crystalline phases. Non-equilibrium in phase diagrams, Cu-Zn system, Fe- C alloys, Ceramic Systems, Other applications of phase diagrams.	**8Hours**
Unit-4	**Phase Transformations:** Time scale for phase changes, Nucleation kinetics, Growth of nuclei and solidification of alloys, Transformations in steel, Precipitation processes, Glass Transition; Recovery, re-crystallization and grain growth. .	**8Hours**
Unit-5	**Elastic Properties:** Elastic behavior and its atomic model, Rubber like elasticity, inelastic behavior, Relaxation processes, Visco-elastic behavior, and spring dash pot model, Plastic deformation.	**8Hours**
Text Books:	**1.** Introduction to Solid State Physics: C. Kittel, wiley.	
Reference Books:	**1.** Essentials of Materials Science: A.G. Guy, McGraw Hill. **2.** Materials Science and Engineering: V. Raghvan, Prentice Hall. **3.** Elements of Materials Science and Engineering: L.H. Van Vlack, Wesley. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1.https://www.youtube.com/watch?v=v1qw-ttBOdA 2.https://www.youtube.com/watch?v=5vaYfd0fekI 3.https://www.youtube.com/watch?v=2mvLvFDU3w0	

Course Code: BAS013	Discipline Specific Elective Course-I B.Sc.(H) Physics- Semester-V **Introduction to Nano Science and Technology**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** basics of nanoparticles, its classifications and synthesis.	
CO2	**Understanding** the concept of nano magnetism, nanoelectronics and integrated systems.	
CO3.	**Understanding** the DOS in nanomaterials.	
CO4.	**Applying** the various techniques to characterize nanomaterials.	
CO5.	**Applying** the concepts of nanomaterials in developing CNTs, LEDs and Q-LEDs, SET.	
Course Content:		
Unit-1	**Nanoscale Systems:** Length, energy, and time scales - Quantum confinement of electrons in semiconductor nanostructures: Quantum confinement in 3D, 2D, 1D and zero dimensional structures-Size effect and properties of nanostructures- Landauer-Buttiker formalism for conduction in confined geometries - Top down and Bottom up approach.	**8Hours**
Unit-2	**Quantum Dots:** Excitons and excitonic Bohr radius – difference between nanoparticles and quantum dots - Preparation through colloidal methods - Epitaxial methods- Chemical vapour deposition (CVD. PECVD, MOCVD) and MBE growth of quantum dots spectroscopy of Quantum Dots: Absorption and emission spectra - photo luminescence spectrum -optical spectroscopy- linear and nonlinear optical spectroscopy	**8Hours**
Unit-3		**8Hours**
Unit-4	**Synthesis of Nanostructure Materials:** Gas phase condensation – Vacuum deposition -Physical vapor deposition (PVD), Vacuum evaporation, e-beam evaporation, sputtering (DC, RF, Magnetron Sputtering) -– laser ablation- Sol-Gel- Ball milling –Electrodeposition-electroless deposition – spray pyrolysis – hydrothermal synthesis.	**8Hours**
Unit-5	**Nanotechnology Applications:** Applications of nanoparticles, quantum dots, nanotubes and nanowires for nanodevice fabrication – Single electron transistors, coulomb blockade effects in ultra-small metallic tunnel junctions - nanoparticles based solar cells and quantum dots based white LEDs – CNT based transistors – principle of dip pen lithography.	**8Hours**
Text Book:	**1.** Hand book of Nanoscience, Engineering and Technology (The Electrical Engineering handbook series), Kluwer Publishers.	
References Books:	**2.** "Sol-Gel Science", C.J. Brinker and G.W. Scherrer, Academic Press, Boston. **3.** Nanoscale characterization of surfaces & interfaces, N John Dinardo, Weinheim Cambridge: Wiley-VCH. *** Latest editions of all the suggested books are recommended**	

Additional electronic reference materials	1. https://www.youtube.com/watch?v=3379xUMQwdQ 2. http://www.emm-nano.org/what-is-nanoscience-nanotechnology/ 3. https://www.youtube.com/watch?v=9Mv1MEKLAhQ 4. https://www.youtube.com/watch?v=YcHprvkD_lY 5. https://www.youtube.com/watch?v=eWu6yWhMYeE 6. https://www.youtube.com/watch?v=UykHXisFq3w	

Course Code: BAS635	**B.Sc.(H) Physics- Semester-VI** **Statistical & Classical Mechanics**	**L-4** **T-0** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** the probability concepts to understand classical & quantum statistics.	
CO2	**Understanding** of different distribution laws such as, Maxwell-Boltzmann (MB), Bose-Einstein (BE) & Fermi-Dirac (FD) Statistics.	
CO3.	**Understanding** the concepts of constraints the generalized coordinators & calculation of variations and action principle.	
CO4.	**Applying** the concepts of Calculus of Variation to find the Lagrange's equation for non-holonomic/ holonomic systems.	
CO5.	**Applying** the Lagrange's equation to find velocity dependent potential of electro-magnetic field.	
CO6.	**Applying** Lagrangian and Hamiltonian equations for Linear Harmonic oscillator, Simple pendulum & Atwood's machine.	
Course Content:		
Unit-1	Classical Statistics: Entropy and Thermodynamic Probability, Maxwell-Boltzmann Distribution Law, Ensemble Concept, Partition Function, Thermodynamic Functions of Finite Number of Energy Levels, Negative Temperature, Thermodynamic Functions of an Ideal Gas, Classical Entropy Expression, Gibbs Paradox, Law of Equipartition of Energy – Applications to Specific Heat and its Limitations	**8Hours**
Unit-2	Quantum Statistics: B-E distribution law. Bose's derivation of Planck's law, Fermi-Dirac Distribution Law, Electron gas in a Metal, Specific Heat of Metals, Richardson Dushman equation	**8Hours**
Unit 3	System of particles, Constraints, Generalized coordinates, Velocity, acceleration and momentum and force, D'Alemberts principle and Lagrange's equation, Velocity dependent potential of electro-magnetic field.	**8Hours**
Unit-4	Calculus of Variation, Hamilton's principle, Lagrange's equation, Lagrangian for simple systems, Linear Harmonic oscillator, Simple pendulum, Atwood's machine. Cyclic coordinates symmetries and conservation laws.	**8Hours**
Unit-5	Basic concepts of Classical mechanics: Lagrange's undetermined multipliers, Lagrange's equation for non-holonomic systems, Virial theorem, Principle of mechanical similarity, Legendre transformations and Hamilton's equations of motion, Hamiltonian for a charge particle in Electro-magnetic field, Hamilton equation for simple system	**8Hours**
Text Book:	1. Statistical Physics: Berkeley Physics Course by F Reif (Tata McGraw-Hill Company Ltd	
Reference Books:	1. Statistical Mechanics by R. K. Patharia, Oxford: Butterworth. 2. Statistical Mechanics by K. Huang, Wiley. 3. Statistical Mechanics by eyring. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1.https://www.youtube.com/watch?v=XIXQ38JnF0k 2.https://www.youtube.com/watch?v=CefOcjpUP-A 3.https://www.youtube.com/watch?v=SZbNx4VfMzg 4.https://www.youtube.com/watch?v=nZ40jnChzbs	

Course Code: BAS621	B.Sc.(H) Physics- Semester-VI **Nuclear & Particle Physics**	L-4 T-0 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the basic properties of nuclei, and the models to describe them.	
CO2.	**Understanding** the properties of nucleon-nucleon interactions, low energy neutron-proton scattering to show spin dependence of nuclear force.	
CO3.	**Understanding** the concepts and properties of nuclear decays processes.	
CO4.	**Understanding** the basics of elementary particles.	
CO5.	**Analyzing** the energy spectrum of nuclear decays.	
CO6.	**Analyzing** binding energy curves to explain the stability of nuclei.	
Course Content:		
Unit-1	**Properties of Nuclei and Models**: Introduction to the nucleus, Fermi gas model, Binding energy, Bethe-Weizsaecker mass formula and its application to explain most stable isobars and nuclear fission, Inferences of nuclear size from elastic electron-nucleus experiments (no derivation).	**8Hours**
Unit-2	**Nuclear Force and Two-nucleon System**: Properties of nucleon-nucleon interaction, General forms of N-N potential, Description of low energy neutron-proton scattering to show the spin dependence of nuclear force, Ground state properties of deuteron, Simple consideration of deuteron using central potential (square well).	**8 Hours**
Unit-3	**Nuclear Stability**: Nucleon emission, separation energy, Alpha decay and its energy spectrum, Q-value, Gamow's theory of alpha decay (no derivation), Beta decay and its energy spectrum (for example, 137Cs), Need for neutrinos, Q-value for beta decay, Gamma decay, Selection rules for gamma transitions (no derivation).	**8 Hours**
Unit-4	**Accelerators and Detectors**: Van de Graaff and Linear accelerators, Synchrotrons, Geiger Muller detector, Scintillation detector.	**8 Hours**
Unit-5	**Elementary Particles**: Classification of particles and their interactions, Quantum numbers, Quarks as the building blocks of hadrons colour degree of freedom.	**8 Hours**
Text Book:	**1.** Introductory Nuclear Physics: S. S. M. Wong.	
References Books:	**2.** Concepts of Nuclear Physics: B. L. Cohen. **3.** Fundamentals of Nuclear Physics: B. B. Srivastava. **4.** Introduction to Nuclear Physics: H. A. Enge. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1.https://www.youtube.com/watch?v=q279l40Uo5g 2.https://www.youtube.com/watch?v=iMhDYarsfII&t=1281s 3.https://www.youtube.com/watch?v=C79838wtRZo 4.https://www.youtube.com/watch?v=eDCDrRzHGuE	

Course Code: BHM615	B.Sc.(H) Physics- Semester-VI **Entrepreneurship**	L-3 T-0 P-0 C-3
Course Outcomes:	**On completion of the course, the students will be:**	
CO1.	**Understanding** the concepts and skills needed to run a business successfully.	
CO2.	**Applying** the steps of project formulation and market research.	
CO3.	**Analyzing** the techno economic feasibility of a project.	
CO4.	**Analyzing** various growth strategies in small scale industry.	
CO5.	**Evaluating** breakeven point, working capital requirements, and taxes.	
Course Content:		
Unit-1:	**Entrepreneurship:** Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.	**8 Hours**
Unit-2:	**Motivation:** Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self-Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.	**8 Hours**
Unit-3:	**Business:** Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.	**8 Hours**
Unit-4:	**Financing and Accounting:** Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.	**8 Hours**
Unit-5:	**Support to Entrepreneurs:** Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures – Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.	**8 Hours**
Text Book:	1. Khanka. S.S., "Entrepreneurial Development" S. Chand & Co. Ltd., Ram Nagar, New Delhi.	
Reference Books:	1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill. 2. Mathew J Manimala, "Entrepreneurship theory at cross roads:	

	paradigms and praxis" 2nd Edition Dream tech. 3. Rajeev Roy, 'Entrepreneurship', Oxford University Press. 4. Donald F Kuratko, "Entrepreneurship – Theory, Process and Practice", Cengage Learning. ***Latest editions of all the suggested books are recommended.**	

Course Code: BAS636	B.Sc.(H) Physics- Semester-VI **Design and Installation of Solar Photovoltaic System (Lab)**	L-0 T-2 P-2 C-3
Course Outcomes :	**On completion of the course, students will be:**	
CO1.	**Understanding** basics of solar energy.	
CO2.	**Applying** methods Risk Management and to ensure safety and performance.	
CO3.	**Analysing** everything on Solar Modules, Optimizers (DC/DC converters), Junction Boxes, Inverters, Solar Meters, Learn all the fundamentals of Solar PV energy, Applications of Solar PV Systems, Advantages and Disadvantages of Solar photovoltaic energy.	
CO4.	**Analysing** Grid-Tie PV System, Calculating Solar Array size, Installing, Maintaining and Servicing of solar power plant.	
CO5.	**Analysing** the Power concepts & Units.	
Course Content:		
Unit-1:	**Basics of PV Technology:** What is Solar Energy, Solar Collectors, Photovoltaic Systems, History of Photovoltaics, Photovoltaic Effect, Photovoltaic Cells, PV Modules and Arrays. **Solar PV technology overview:** How does PV technology work, Other Types of Photovoltaic Technology, Costs of Solar Photovoltaics, Modern Photovoltaics. **Fundamentals of Solar Components Solar PV System**: Solar Radiation, Solar Cell Parameters and Equivalent Circuit, Losses and Efficiency Limits, Crystalline Silicon Solar Cells, Thin-film solar cells, PV System Design. **Site survey, assessment & feasibility study:** PV Site Location, Assumptions and Input Data for Analysis, Potential Rate Increases, Conclusions and Recommendations.	**T Hrs-4.5, P Hrs - 3.5**
Unit-2:	**Assess the customer's Solar PV requirement:** pv cost considerations, permits and covenants, stand-alone small solar electric systems, grid-connected small solar electric systems, estimating energy cost savings for net-metered pv system. **Capacity or system sizing approach:** Solar PV system sizing, determine power consumption demands, Inverter sizing, Battery sizing, available area for installation of SPV. **Design of SPV Plant**s: Load estimation, Estimation of number of PV panels, Estimation of battery bank, Cost estimation of the system.	**T Hrs-4, P Hrs -5**
Unit-3:	**Preparation of Bill of Materials (BoM)**: Mechanical or electrical components used to assemble or integrate major components, Size of the Plant, Type of Roof, Module Make and Specs, Inverter Make and Specs, Whether Remote Monitoring is separately required. **Installation, Maintenance and Service of SPV Plants**: Modularity & scalability, Flexible location. **Civil and Mechanical parts of Solar PV System**: Get Equipment Foundation constructed, Install Mounting System, Install Photovoltaic modules, Install Battery Bank Stand and Inverter Stand.	**T Hrs-4, P Hrs -5**
Unit-4	**Electrical components of Solar PV System**: Install Array JB, cost effective wiring, Using MCCBs and other essential components. **Advanced Solar Power plant Engineering**: Photovoltaic Inverter Topologies for Grid Integration Applications, Advanced Control Techniques for PV Maximum Power Point Tracking, Maximum Power Point Tracking Methods for PV Systems, Photovoltaic Multiple Peaks Power Tracking Using Particle, Swarm Optimization with Artificial Neural Network Algorithm **Intro – Google Sketchup, PV Syst, AutoCAD**: Creation of a grid-connected	**T Hrs-6, P Hrs -5**

	project, Construction and use of 3D shadings scenes, Meteorological data in PV-syst.	
Unit-5	**Solar project development phases and issues**: Initiation phase, Definition phase, Design phase, Development phase, Implementation phase, Follow-up phase. **Project planning and schedule of activities:** Management activities**,** Project planning, Project scheduling, Risk management, Risk identification, Risk analysis, Risk planning, Risk monitoring **Best practices in design & installation to ensure safety and performance**: Work History, Financial Transparency, Health and Safety, Insurance.	**T Hrs-7, P Hrs -1**
Text Books	1. SOLAR SYSTEM, BENNETT J., PEARSON 2002.	
Reference Books	1. SOLAR CELLS: MATERIALS, MANUFACTURE AND OPERATION, MARKVART TOM, ELSEVIER 2010. 2. SOLAR PHGOTOVOLTAIC TECHNOLOGY AND SYSTEMS (AMANUAL FOR TECHNICIANS, TRAINERS AND ENGINEERS), SOLANKI CHETAN SINGH, NEW DELHI PHI AUG-2017	
Additional electronic reference materials	**1.** https://www.youtube.com/watch?v=5zAQot4pKgU&list=PLLy_2iUCG87Dxsmc322YcSuNl_KCEbqPl **2.** https://www.youtube.com/watch?v=khzMZ8VL8Q4&list=PLuv3GM6-gsE2KyXoBTQ6lbrwn22Z3SiVm **3.** https://www.youtube.com/watch?v=Fuyq6WrM1EA **4.** https://www.youtube.com/watch?v=5zAQot4pKgU	

Evaluation of Practical Examination:

Internal Evaluation (50 marks)

Each experiment (Min. 06 experiment) would be evaluated by external trainer or by 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 external trainer or the faculty concerned. The marks shall be entered on the index sheet of the practical file. Each experiment will be evaluated in 5 marks as per given distribution.

Evaluation scheme:

S. No.	Experiment (10 marks)	Attendance (10 marks)	Test result (20 marks)	Viva (10 MARKS)	Average in 5 Marks
Experiment 1					
Experiment 2					
:					
Experiment 10					

External Evaluation (50 marks)

The external evaluation would also be done by the external trainer or industrial expert or by faculty based on the experiment conducted during the examination.

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

Course Code: BAS698	B.Sc.(H) Physics- Semester-VI **Project**	L-0 T-0 P-10 C-5

For students to enter into preliminary research field both in theory and experiment the concept of Seminar, Presentation & Viva has been introduced in the final Semester. In this report, student will explore new developments from the books and journals, collecting literature / data and prepare the report in form of power point presentation based on his / her work and studies, and submit in concern department.

General guidelines are as follows-

1. Students will make seminar report 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 Vth semester.
3. Internal assessment of the students should be done at least twice in the semester.
4. The students shall present the final presentation live using overhead projector PowerPoint presentation on LCD to the internal committee and the external examiner.
5. The internal 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 appointed 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: BGP611	B.Sc.(H) Physics- Semester-VI **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: BAS622	**Discipline Specific Elective Course-II** **B.Sc.(H) Physics- Semester-VI** **Medical Physics**	**L-4** **T-0** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering** physical properties of X-rays, radiation units, exposure, absorbed dose.	
CO2.	**Understanding** the radiation physics and its related instrumentation.	
CO3.	**Understanding** the medical imaging techniques to characterize the biological materials.	
CO4.	**Understanding** the concepts of radiation therapy & protection physics.	
CO5.	**Applying** the concepts of radiation therapy for the treatment of Cancer.	
Course Content:		
Unit-1	**X-Rays:** Electromagnetic spectrum - production of x-rays - x-ray spectra - Brehmsstrahlung - Characteristic x-ray - X-ray tubes - Coolidge tube - x-ray tube design - tube cooling - stationary mode - Rotating anode x-ray tubes - Tube rating - quality and intensity of x-ray. X-ray generator circuits - half wave and full wave rectification - filament circuit - kilo voltage circuit - high frequency generator - exposure timers - HT cables.	**8Hours**
Unit-2	**Radiation Physics:** Radiation units - exposure - absorbed dose - rad gray - kera relative biological effectiveness - effective dose - sievert - inverse square law - interaction of radiation with matter - linear attenuation coefficient. Radiation Detectors - Thisble chamber - condenser chambers - Geiger counter - Scintillation counter - ionization chamber - Dosimeters - survey methods - area monitors - TLD and semiconductor detectors.	**8 Hours**
Unit-3	**Medical Imaging Physics:** Radiological imaging - Radiography - Filters - grids - cassette - X-ray film - film processing - fluoroscopy - computed tomography scanner - principle function - display - generations - mammography. Ultrasound imaging - magnetic resonance imaging (MRI) - thyroid uptake system - Gamma camera (Only Principle, function and display).	**8Hours**
Unit-4	**Radiation Therapy Physics:** Radiotherapy - kilo voltage machines - deep therapy machines - tele-cobalt machines - Medical linear accelerator. Basics of Teletherapy units - deep x-ray, telecobalt units, medical linear accelerator - Radiation protection - external beam characteristics - phantom - dose maximum and build up - bolus - percentage depth dose - tissue - air ratio - back scatter factor.	**8Hours**
Unit-5	**Radiation Protection:** Principles of radiation protection - protective materials - radiation effects - somatic, genetic stochastic and deterministic effect, Personal monitoring devices - TLD film badge - pocket dosimeter.	**8Hours**
Text Book	**1.** Basic Radiological Physics Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi.	
	1.Christensen's Physics of Diagnostic Radiology: Curry, Dowdeyand Murry - Lippincot Williams and Wilkins. **2.** Physics of Radiation Therapy: FM Khan - Williamd and Wilkins.	

Reference Books:	**3.** The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins. **4.** HE Johns and Cunningham - The Physics of Radiology. **5.** Nuclear medicine physics: Chandra - Lippincot Williams and Wilkins. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=Nos_SQ2DpRw **2.** https://www.youtube.com/watch?v=KQbaMXBTM1U **3.** https://www.youtube.com/watch?v=N0Dwh3avx9A **4.** https://www.youtube.com/watch?v=qNy3MikOkc4 **5.** https://www.youtube.com/watch?v=DsqTsCJKEZI	

Course Code: BAS623	**Discipline Specific Elective Course-II** **B.Sc.(H) Physics- Semester-VI** **Atmospheric Physics**	**L-4** **T-0** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** the thermodynamic principles of atmospheric processes and composition and thermal structure of the atmosphere.	
CO2.	**Applying** the principles of the remote sensing and atmospheric dynamics to the space physics.	
CO3.	**Applying** thermodynamic diagrams to assess stability and cloud conditions and explain weather phenomena.	
CO4.	**Applying** the Remote sensing techniques for earth's resource management.	
CO5.	**Analyzing** the observational parameters of the Atmospheric Physics.	
CO6.	**Analyzing** absorption and emission of short and long wave radiation cause heating or cooling in different vertical layers of atmosphere.	
Course Content:		
Unit-1	**Elements of earth's atmosphere -**Vertical variations in compositions of the atmosphere – homosphere, heteorosphere, ionosphere; auroras; thermal structure of the atmosphere – troposphere, stratosphere, mesosphere, thermosphere; horizontal distribution of temperature, pressure and density, distribution of winds, horizontal and vertical winds, land breeze and sea breeze.	**8Hours**
Unit-2	**Atmospheric observations:** Importance of meteorological observations, measurement of temperature and humidity, measurement of wind and pressure, measurement of precipitation, upper air observations - radiosonde, rawinsonde, rocket sonde, pyrgeometer, pyrheliometer, Radar, Doppler weather radar & applications.	**8Hours**
Unit-3	**Space physics**: Basics of ionosphere formation, D-, E- and F-layers, composition of theionosphere, effect of terrestrial and solar radiation on earth's atmosphere, photochemical processes, currents in ionosphere, electrical conductivity, techniques of ionosphere measurements	**8Hours**
Unit-4	Remote sensing: Concepts of remote sensing, Energy interaction with earth's surface features, Signatures of vegetation, soil and water bodies of the earth's surface, Classification of remote sensors, Spectral, spatial and temporal resolution, IR and microwave sensors, Data reception and products, Application of Remote sensing for earth's resource management.	**8Hours**
Unit-5	**Atmospheric dynamics:** Large scale motions, vorticity and divergence, streamline and trajectories, dynamics of horizontal flow – apparent and real forces, equation of motion, geostrophic wind, effect of friction, gradient wind, thermal wind, suppression of vertical motions, conservation law for Vorticity, potential vorticity; primitive equations – pressure as a vertical coordinate, hydrostatic balance, thermodynamic energy equation.	**8Hours**
Text Book	1.Basics of Atmospheric Science, A. Chandrasekar, PHI Publications	
Reference Books:	1.Atmospheric Science-An Introductory Survey, John M Wallace and Peter V Hobbs, Academic Press, Elsevier. **2.** A course in Dynamic meteorology, Naval Pandari nath, BS Publications. **3.** The Physics of Monsoons, RN Keshva murthy and M Shankar Rao, Allied Publishers.	

	4. Basic Space Plasma Physics: W Baumjohann and RA Treumann, Imperial College Press. **5.** Fundamentals of Remote Sensing, George Joseph, University Press Pvt. Ltd. Hyderabad. *** Latest editions of all the suggested books are recommended**	
Additional electronic reference materials	1. https://www.youtube.com/watch?v=9YOhWw5at6A&list=PLLy_2iUCG87C37ThJ4x4VgwDkMLupSBFy 2. https://www.youtube.com/watch?v=uivuzDeEe1Q 3. https://www.youtube.com/watch?v=9YOhWw5at6A&list=PLLy_2iUCG87C37ThJ4x4VgwDkMLupSBFy 4. https://www.youtube.com/watch?v=4Rn0M39HOPU&list=PLLy_2iUCG87CDlroZBlwwBllYwz7KxVtA 5. https://www.youtube.com/watch?v=umI3VZa7ChU	