**St. PETER’S INSTITUTE OF HIGHER EDUCATION AND RESEARCH**

(Deemed to be University U/S 3 of the UGC Act,1956)

Avadi, Chennai – 600 054.



**B.E. (COMPUTER SCIENCE AND ENGINEERING) PROGRAMME**

**(Approved by AICTE)**

(I and II SEMESTERS)

**REGULATIONS AND SYLLABI UNDER CHOICE BASED CREDIT SYSTEM**

**(REGULATIONS – 2018)**

**Effective from the Academic Year 2018 - 2019**

**St. PETER’S INSTITUTE OF HIGHER EDUCATION AND RESEARCH**

**B.E. (COMPUTER SCIENCE AND ENGINEERING)**

**REGULATIONS AND SYLLABI UNDER CHOICE BASED CREDIT SYSTEM**

**(Effective from the Academic Year 2018-2019)**

1. **Eligibility:**
2. Candidates who passed the following Examination or any other equivalent Examination thereto and who appeared for the entrance test conducted by the University or approved institutions wherever prescribed are eligible for admission to Four Year B.E. (Computer Science and Engineering) Programme.

Higher Secondary Examination with Mathematics, Physics and chemistry conducted by the Government of Tamil Nadu or its equivalent in the relevant subjects as recognized by the Institute with the percentage of marks prescribed by AICTE.

1. Candidates who passed Three Year Diploma in Technical Education in the concerned

subject conducted by the Government of Tamil Nadu are eligible for admission to

Second Year of Four Year B.E. (Computer Science and Engineering) Programme.

1. **Duration:** Four Years comprising 8 Semesters. Each semester has a minimum 90 working days with a minimum of 5 hours a day and a minimum of 450 hours per Semester. Candidates who have completed the duration of the programme of study are permitted to appear for the arrear subjects examinations, if any within two years after the duration of the programme.
2. **Medium:** English is the medium of instruction and examinations.
3. **Weight age for Continuous and End Assessment:** The weightage for Continuous Assessment (CA) and End Assessment (EA) is 25:75 unless the ratio is specifically mentioned in the scheme of Examinations. The Question Paper is to be set for a maximum of 100 Marks.

1. **Choice Based Credit System:** Choice BasedCredit System is followed with one credit equivalent to one hour for a theory paper and two hours for a practical per week in a cycle of 18 weeks (that is, one credit is equal to 18 hours for each theory paper and one credit is equal to 36 hours for a practical in a semester) in the Time Table.
2. **Induction Programme: (Vide Appendix - 1)**
3. **Scheme of Examinations**

**I Semester**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Code No.** | **Course Title** | | **L** | **T** | **P** | **Credit** | **Total Credits** | **Marks** | | | | | |
| **CA** | **EA** | | **Total** | | **Combined Total** |
| **Theory & Practical** | | | | | | | | | | | | | |
| 118CYT01 | Chemistry | Theory | 3 | 1 | 0 | 4 | 6 | 25 | | 75 | | 100 | 100 |
| 118CYP01 | Practical | 0 | 0 | 3 | 2 | 25 | 75 | | 100 | |
| 118CST02(CSE) /118MAT02(Others) | Mathematics –I | | 3 | 1 | 0 | 4 | 4 | 25 | 75 | | 100 | | 100 |
| 118BET03 | Basic Electrical Engineering | Theory | 3 | 1 | 0 | 4 | 5 | 25 | 75 | | 100 | | 100 |
| 118BEP02 | Practical | 0 | 0 | 2 | 1 | 25 | 75 | | 100 | |
| 118EGT04 | Engineering  Graphics & Design | Theory | 1 | 0 | 0 | 1 | 3 | 25 | 75 | | 100 | | 100 |
| 118EGP03 | Practical | 0 | 0 | 4 | 2 | 25 | 75 | | 100 | |
| 118EHT05 | English |  | 2 | 0 | 2 | 3 | 3 | 25 | 75 | | 100 | | 100 |
|  | **Total** | | **12** | **3** | **11** | **21** | **21** | **200** | **600** | | **800** | | **500** |

**II Semester**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Code No.** | **Course Title** | | **L** | **T** | **P** | **Credit** | **Total Credit** | **Marks** | | | |
| **CA** | **EA** | **Total** | **Combined Total** |
| **Theory & Practical** | | | | | | | | | | | |
| 218PHT01 | Physics | Theory | 3 | 1 | 0 | 4 | 6 | 25 | 75 | 100 | 100 |
| 218PHP01 | Practical | 0 | 0 | 3 | 2 | 25 | 75 | 100 |
| 218CST02(CSE) /  218MAT02(Others) | Mathematics –II | | 3 | 1 | 0 | 4 | 4 | 25 | 75 | 100 | 100 |
| 218PPT03 | Programming for Problem Solving Using C and Python | Theory | 3 | 0 | 0 | 3 | 5 | 25 | 75 | 100 | 100 |
| 218PPP02 | Practical | 0 | 0 | 4 | 2 | 25 | 75 | 100 |
| 218WMT04 | Manufacturing Practices | Theory | 1 | 0 | 0 | 1 | 3 | 25 | 75 | 100 | 100 |
| 218WMP03 | Practical | 0 | 0 | 4 | 2 | 25 | 75 | 100 |
|  | **Total** | | **10** | **2** | **11** | **18** | **18** | **175** | **525** | **700** | **400** |

**III Semester**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Code No.** | Course Title | | **L** | **T** | **P** | **Credit** | **Marks** | | |
| **CA** | **EA** | **Total** |
| **Theory & Practical** | | | | | | | | | |
| 318CST01 | Mathematics-III | | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| 318CST02 | Object Oriented Programming | Theory | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| 318CSP01 | Practical | 0 | 0 | 2 | 1 | 25 | 75 |
| 318CST03 | Computer Networks | Theory | 4 | 0 | 0 | 4 | 25 | 75 | 100 |
| 318CSP02 | Practical | 0 | 0 | 2 | 1 | 25 | 75 |
| 318CST04 | Computer Organization & Architecture | Theory | 3 | 0 | 0 | 3 | 25 | 75 | 100 |
| 318CSP03 | Practical | 0 | 0 | 2 | 1 | 25 | 75 |
| 318CST05 | Digital Electronics | Theory | 3 | 0 | 0 | 3 | 25 | 75 | 100 |
| 318CSP04 | Practical | 0 | 0 | 2 | 1 | 25 | 75 |
| 318CST06 | Humanities I (Effective Technical Communication) | | 3 | 0 | 0 | 3 | 25 | 75 | 100 |
| 318CSP05 | Soft Skills and Personality Development - I | | 0 | 0 | 2 | 1 | 25 | 75 | 100 |
| **Total** | | | **21** | **0** | **10** | **26** | **175** | **825** | **700** |

**IV Semester**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Code No.** | Course Title | | **L** | **T** | **P** | **Credit** | **Marks** | | |
| **CA** | **EA** | **Total** |
| **Theory & Practical** | | | | | | | | | |
| 418CST01 | Discrete Mathematics | | 3 | 1 | 0 | 4 | 25 | 75 | 100 |
| 418CST02 | Data structure & Algorithms | Theory | 3 | 0 | 0 | 3 | 25 | 75 | 100 |
| 418CSP01 | Practical | 0 | 0 | 4 | 2 | 25 | 75 |
| 418CST03 | Operating Systems | Theory | 3 | 0 | 0 | 3 | 25 | 75 | 100 |
| 418CSP02 | Practical | 0 | 0 | 4 | 2 | 25 | 75 |
| 418CST04 | Advanced Python Programming and Sci Lab / Mat Lab | Theory | 3 | 0 | 0 | 3 | 25 | 75 | 100 |
| 418CSP03 | Practical | 0 | 0 | 2 | 1 | 25 | 75 |
| 418CST05 | Analog Electronic Circuits | Theory | 3 | 0 | 0 | 3 | 25 | 75 | 100 |
| 418CSP04 | Practical | 0 | 0 | 2 | 1 | 25 | 75 |
| 418CST06 | Organizational Behaviour | | 2 | 0 | 0 | 2 | 25 | 75 | 100 |
| 418CST07 | Environmental Sciences | | 2 | 0 | 0 | 2 | 25 | 75 | 100 |
| **Total** | | | **19** | **1** | **12** | **26** | **275** | **825** | **700** |

1. **Virtual Laboratories: (Vide Appendix - 2)**
2. **Passing Requirements:** The minimum pass mark (raw score) be 50% in End Assessment (EA) and 50% in Continuous Assessment (CA) and End Assessment (EA) put together in theory and practical courses. The minimum pass mark is 50% each in practical and theory. No minimum mark (raw score) in Continuous Assessment (CA) be prescribed unless it is specifically mentioned in the Scheme of Examination. In a course (subject) where theory and practical are involved, the combined scores are considered for a pass.
3. **Grading System:** Grading System on a 10 Point Scale be followed with 1 mark = 0.1 Grade point to successful candidates as given below.

**CONVERSION TABLE**

(1 mark = 0.1 Grade Point on a 10 Point Scale)

|  |  |  |  |
| --- | --- | --- | --- |
| **Range of Marks** | **Grade Point** | **Letter Grade** | **Classification** |
| 90 to 100 | 9.0 to 10.0 | O | First Class |
| 80 to 89 | 8.0 to 8.9 | A | First Class |
| 70 to 79 | 7.0 to 7.9 | B | First Class |
| 60 to 69 | 6.0 to 6.9 | C | First Class |
| 50 to 59 | 5.0 to 5.9 | D | Second Class |
| 0 to 49 | 0 to 4.9 | **F** | **Reappearance** |

**Procedure for Calculation**

|  |
| --- |
| Cumulative Grade Point Average (CGPA) = Sum of Weighted Grade Points  Total Credits    = ∑ (CA+EA) C  ∑C  Where Weighted Grade Points in each Course = Grade Points (CA+EA)  multiplied by Credits  = (CA+EA)C  Weighted Cumulative Percentage of Marks(WCPM) = CGPAx10 |
|  |

C- Credit, CA-Continuous Assessment, EA- End Assessment

1. **Pattern of the Question Paper:**  The question paper for End Assessment will be set for three hours and for the maximum of 100 marks with following divisions and details.

**Part A:** 10 questions (with equal distribution to all units in the syllabus).

Each question carries 2 marks.

**Part B:** 5 questions with either or type (with equal distribution to all

Units in the syllabus). Each question carries 16 marks.

The total marks scored by the candidates will be reduced to the maximum prescribed in the Regulations.

1. **(a) Effective Period of Operation for the Arrear Candidates :**

Two Year grace period is provided for the candidates to complete the arrear

examination, if any in the subsequent semester in which the courses (subjects)

are offered.

**(b) Failed Subjects:**

Candidates who have failed in a subject (course) are to repeat the course by

attending the classes or to choose another subject by attending the classes

wherever provision is given in the scheme of courses in the subsequent semester

in which the courses (subjects) are offered.

**Registrar**

**Appendix - 1**

**INDUCTION PROGRAMME**

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days.

We propose a 3-week long induction program for the UG students entering the insti- tution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty

and students, develop awarness, sensitivity and understanding of the self, people around them, society at large, and nature.2

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deﬁciency in it.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

**2.1 Physical Activity**

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the ﬁeld for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

**2.2 Creative Arts**

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program.

These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, ﬂow into engineering design later.

**2.3 Universal Human Values**

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staﬀ in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base.

Methodology of teaching this content is extremely important. It must not be through do’s and dont’s, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values.

The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT(BHU) are noteworthy and one can learn from them.3

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

**2.4 Literary**

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

**2.5. Proﬁciency Modules**

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

**2.6 Lectures by Eminent People**

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

**2.7 Visits to Local Area**

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

**2.8 Familiarization to Dept./Branch & Innovations**

The students should be told about diﬀerent method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilties.

##### **3. Schedule**

The activities during the Induction Program would have an Initial Phase, a Regular Phase and a Closing Phase. The Initial and Closing Phases would be two days each.

**3.1 Initial Phase**

|  |  |
| --- | --- |
| **Time** | **Activity** |
| **Day 0**  *Whole day* | *Students arrive - Hostel allotment. (Preferably do pre-allotment)* |
| **Day 1**  *09:00 am - 03:00 pm*  04:30 pm - 06:00 pm | *Academic registration*  Orientation |
| Day 2  09:00 am - 10:00 am  10:15 am - 12:25 pm | Diagnostic test (for English etc.)  Visit to depts. |
| *12:30 pm - 01:55 pm* | **Lunch** |
| 02:00 pm - 02:55 pm | Director’s address |
| 03:00 pm - 05:00 pm | Interaction with parents |
| 03:30 pm - 05:00 pm | Mentor-mentee groups - Introduction within group (Same as Universal Human Values groups) |

**3.2 Regular Phase**

After two days is the start of the Regular Phase of induction. With this phase there would be regular program to be followed every day.

##### **4. Summary**

Engineering institutions were set up to generate well trained manpower in engineering with a feeling of responsibility towards oneself, one’s family, and society. The incoming undergraduate students are driven by their parents and society to join engineering without understanding their own interests and talents. As a result, most students fail to link up with the goals of their own institution.

The graduating student must have values as a human being, and knowledge and meta- skills related to his/her profession as an engineer and as a citizen. Most students who get demotivated to study engineering or their branch, also lose interest in learning.

The *Induction Program* is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing compe- tition and making them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and building of character.

The *Universal Human Values* component, which acts as an anchor, develops awareness and sensitivity, feeling of equality, compassion and oneness, draw attention to society and nature, and character to follow through. It also makes them reﬂect on their relationship with their families and extended family in the college (with hostel staﬀ and others). It also connects students with each other and with teachers so that they can share any diﬃculty they might be facing and seek help.

**Appendix – 2**

**VIRTUAL LABORATORIES**

It is said that in a professional life span of any engineering graduate, minimum three technological advances take place. Most of these advances are not part of the curriculum. On this background, it becomes essential to master “Learning to Learn” skill. Many options are now available for theory courses but laboratory work lacks in this. The laboratory/hands-on sessions are the backbone of engineering education. But in current situation, physical distances, costly equipment, and limited expertise often put constraints on performing experiments. The recent technological advances have addressed this problem. Now, it is possible to overcome these constraints by using web enabled experiments for remote operation so as to enthuse the curiosity and innovation of students.

The basic aim of this main project on Virtual Labs is to design and develop Virtual Labs in various areas of Science and Engineering, in order to benefit maximum number of students. The Virtual Labs are essentially comprising of a user-friendly graphical front- end, working in synchronization with a backend, consisting of a simulation-engine running on a server or actual measurement data or a remotely-triggered experiment. The Virtual Labs would cater to students at the undergraduate level, post graduate level as well as to research scholars. These Virtual Labs are centrally maintained and upgraded as and when required. It is expected that the competence level of the engineering students will enhance through the use of these labs. The Virtual Labs are expected to enthuse students about performing ‘experiments’ and thereby getting them interested in their respective disciplines in a meaningful way.

Physical distances and the availability of resources limit doing experiments, especially when they involve sophisticated instruments. Also, good teachers are always a scare resource. Web-based and video-based courses address the issue of teaching to some extent. Conducting joint experiments by two participating institutions and also sharing costly resources have always been a challenge. With the present-day internet and computer technologies the above limitations need not limit students and researchers in enhancing their skills. Also, in a country such as ours, costly instruments and equipment need to be shared with fellow researchers to the extent possible. Web enabled experiments can be designed for remote operation and viewing so as to enthuse the curiosity and innovation of students. This would help in learning basic and advanced concepts through remote experimentation. Today most equipment has a computer interface for control and data storage. It is possible to design good experiments around some of these equipment, which would enhance the learning of a student. Internet- based experimentation further permits use of resources – knowledge, software, and data available on the web, apart from encouraging skilful experiments being simultaneously performed at points separated in space (and possibly, time). The basic idea is to design and develop Virtual Labs in suitable areas of science and engineering in order to benefit the maximum number of students. An implicit objective is to enthuse students about performing ‘experiments’ and thereby getting them interested in their respective disciplines in a meaningful way. These activities would also generate an interest in the students to pursue higher studies/research. The virtual labs are designed in such a manner that maximum number of students can use these labs simultaneously.

**Following is the list of discipline-wise Laboratories:**

1. **Electronics & Communication Engineering**

|  |  |
| --- | --- |
| **S. No.** | **Name of the lab** |
| 1 | Electronic design using DSP, FPGA, CPLD and Microcontrollers  through simulation and direct access of the hardware |
| 2 | Digital Electronic Circuits Laboratory |
| 3 | Digital Signal Processing Laboratory |
| 4 | Speech Signal Processing Laboratory |
| 5 | Digital VLSI Design Virtual lab |
| 6 | Virtual Electric Circuits Laboratory |
| 7 | Fading Channels and Mobile Communications |
| 8 | Electromagnetic Theory |
| 9 | Signals and Systems Laboratory |
| 10 | Transducers and Instrumentation Virtual Laboratory |
| 11 | RF and Microwave Characterization Laboratory |
| 12 | Hybrid Electronics Lab |
| 13 | Queuing Networks Modeling Lab |
| 14 | Engineering Electro-magnets Laboratory |
| 15 | Virtual Microwave Lab |
| 16 | Basic Electronics |
| 17 | Single Board Heater System |
| 18 | Systems, communication and control laboratory for remote users |

1. **Civil Engineering**

|  |  |
| --- | --- |
| **S. No.** | **Name of the lab** |
| 1 | Soft Computing Tools in Engineering |
| 2 | Strength of Material Lab |
| 3 | Soil Mechanics & Foundation Engineering Lab |
| 4 | Fluid Mechanics Lab |
| 5 | Geotechnical Engineering Lab |
| 6 | Strength of Materials and Fluid Mechanics |
| 7 | Urban Transportation Systems Planning Lab |
| 8 | Surveying Lab |
| 9 | Basic Structural Analysis Lab |
| 10 | Virtual Smart Structures and Dynamics Lab |

1. **Electrical Engineering**

|  |  |
| --- | --- |
| **S. No.** | **Name of the lab** |
| 1 | Electrical Machines Lab |
| 2 | Electrical Machines Laboratory |
| 3 | Sensors Modeling & Simulation |
| 4 | Virtual Power Laboratory |
| 5 | Industrial Electric Drives And Substation Automation Lab |
| 6 | Industrial Automation Laboratory |
| 7 | Electrical Machines |
| 8 | Electronic instrumentation |
| 9 | PLC |
| 10 | Creative Design, Prototyping & Experiential Simulation Lab |
| 11 | Ergonomics Lab for Assessing Physical Aspects of Design |
| 12 | Real Time Embedded Systems Laboratory |
| 13 | Virtual Anthropology Lab |
| 14 | Electromechanical Energy Conversion Laboratory |
| 15 | Analog Signals, Network and Measurement Laboratory |

1. **Biotechnology Engineering**

|  |  |
| --- | --- |
| **S. No** | **Name of the lab** |
| 1 | Virtual Proteomics Laboratory |
| 2 | System Biology Virtual Lab |
| 3 | Molecular Biology Virtual Lab I |
| 4 | Molecular Biology Virtual Lab II |
| 5 | Computer-Aided Drug Design Virtual Lab |
| 6 | Cell Biology Virtual Lab I |
| 7 | Cell Biology Virtual Lab I |
| 8 | Biological Image processing Virtual Lab |
| 9 | Virtual Immunology Lab I |
| 10 | Virtual Immunology Lab II |
| 11 | Virtual Population Ecology Lab I |
| 12 | Virtual Population Ecology Lab II |
| 13 | Bioinformatics Virtual Labs I |
| 14 | Bioinformatics Virtual Labs II |
| 15 | Bioinformatics Virtual Labs III |
| 16 | Biochemistry Lab I |
| 17 | Biochemistry Lab II |
| 18 | Microbiology Lab I |
| 19 | Microbiology Lab II |
| 20 | Neurophysiology Lab |
| 21 | Neuron Simulation Virtual Lab |
| 22 | Ecology Virtual Lab |
| 23 | Biomedical Instrumentation |
| 24 | Medical Signal & Image Processing Lab |
| 25 | Bioreactor Modeling & Simulation lab |
| 26 | Biomedical and Signal processing Laboratory |

1. **Computer Science & Engineering**

|  |  |
| --- | --- |
| **S. No.** | **Name of the lab** |
| 1 | Data Structures Lab |
| 2 | Computer Programming Lab |
| 3 | Problem Solving |
| 4 | Principles of Programming Languages |
| 5 | Data Mining |
| 6 | Databases |
| 7 | Computer Organization |
| 8 | Software Engineering |
| 9 | VLSI |
| 10 | Digital Logic Design |
| 11 | Linux Lab |
| 12 | Speech Signal Processing |
| 13 | Mobile Robotics |
| 14 | Computer Graphics |
| 15 | Image Processing |
| 16 | Pattern Recognition |
| 17 | Artificial Neural Networks |
| 18 | Optical remote Sensing Lab |
| 19 | Computational Linguistics |
| 20 | Computer Architecture & Organization |
| 21 | Virtual Advanced VLSI Lab |
| 22 | Cryptography Lab |
| 23 | Analog CMOS VLSI Circuit Design Lab |
| 24 | Natural Language Processing Lab |
| 25 | Programming & Data Structure Lab |
| 26 | Advanced Network Technologies Lab |
| 27 | FPGA and Embedded System Lab |

1. **Mechanical Engineering**

|  |  |
| --- | --- |
| **S. No.** | **Name of the lab** |
| 1 | Metal Forming and Solid Mechanics Lab |
| 2 | Vibration and Acoustics Lab |
| 3 | General Purpose Production Shop Simulation Lab |
| 4 | Laser Based Flow Diagnostics Laboratory |
| 5 | Micromachining laboratory |
| 6 | Fab laboratory |
| 7 | Mine Automation and Virtual Reality |
| 8 | Nanocomposite, fabrication and biomaterials laboratory & Signal Processing Laboratory |
| 9 | Material Response to Microstructural, Mechanical, Thermal and Biological Stimuli |
| 10 | Virtual Labs for Mechanical Vibrations |
| 11 | Mechanics of machine Lab |
| 12 | Machine dynamics & vibration lab |
| 13 | Virtual combustion and atomization laboratory |

1. **Physical Sciences**

|  |  |
| --- | --- |
| **S. No.** | **Name of the lab** |
| 1 | Virtual Astrophysics Lab |
| 2 | Virtual Heat & Thermodynamics Lab |
| 3 | Virtual Advanced Mechanics Lab |
| 4 | Virtual Laser Optics Lab |
| 5 | Virtual Solid-State Physics Lab |
| 6 | Virtual Harmonic Motion & Waves Lab |
| 7 | Virtual Electricity and Magnetism Lab |
| 8 | Virtual Optics Lab |
| 9 | Virtual Modern Physics Lab |
| 10 | Virtual Lab on oscillations |
| 11 | Virtual Physical Sciences Lab |
| 12 | Virtual English and Communication |

1. **Chemical Engineering**

|  |  |
| --- | --- |
| **S. No.** | **Name of the lab** |
| 1 | Virtual Lab for Mass Transfer |
| 2 | Simulation of Control of Magnetic Levitation System |
| 3 | Process control, reaction engineering and unit operations lab Engineering |
| 4 | Chemical Engineering Lab |

1. **Chemical Sciences**

|  |  |
| --- | --- |
| **S. No** | **Name of the lab** |
| 1 | Virtual Physical Chemistry Lab |
| 2 | Virtual Organic Chemistry Lab |
| 3 | Virtual Inorganic Chemistry Lab |
| 4 | Ultrafast Laser Spectroscopy |
| 5 | Molecular Florescence Spectroscopy |
| 6 | Molecular Absorption Spectroscopy |
| 7 | Quantum Chemistry |
| 8 | Colloidal and Surface Chemistry |
| 9 | Circular Dichroism Spectroscopy |
| 10 | Molecular Interactions Lab |
| 11 | Physical Chemistry Lab |
| 12 | Analytical Lab |

**How to use the virtual laboratories:**

The virtual labs are easy to use. All the laboratories developed under “Virtual Laboratory” project is running from a central location. A student can visit the portal https://vlabs.ac.in and register for the laboratory he/she is interested in. These laboratories will have all the required information like aim, pre-test, theory, procedure, simulator, review questions, reference links, additional material to read, post-test, and feedback. This is one stop solution, and a student can run the simulator by following the procedure. The simulators are similar to experimental set-up or a brief presentation about the working of the model. In certain cases, a student need to load some software as pre-requisite. In case of any doubt or clarification a student can write to the lab developer through the portal only. It is expected that the engineering students to carry out these experiments prior to their actual experiment in certain cases. In case of non- availability of the sophisticated instruments/systems these experiments will fulfil the requirement of understanding the technology.

It would be a far enriching experience to use virtual labs and learn at one’s own pace and time. A student can even learn the skills which are not part of the curriculum but required as professionals to take up new challenges.

**SYLLABUS**

**I Semester**

**118CYT01 - CHEMISTRY**

**OBJECTIVES:**

* To make the students conversant with Atomic and Molecular structure, Spectroscopic techniques and applications. .
* To develop an understanding of the concepts of Intermolecular forces and potential energy surfaces
* To understand the use of free energy in chemical equilibria.
* To have thorough knowledge on periodic properties.
* To understand the basic concepts of Stereochemistry, Organic reactions and synthesis of a drug molecule

***Module* I ATOMIC AND MOLECULAR STRUCTURE**

Schrodinger equation. Particle in a box. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

***Module* II SPECTROSCOPIC TECHNIQUES AND APPLICATIONS**

Principles of spectroscopy and selection rules. Electronic spectroscopy and their applications for conjugated molecules and nanoparticles. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

***Module* III INTERMOLECULAR FORCES AND POTENTIAL ENERGY SURFACES**

Ionic, dipolar and Van der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

***Module* IV USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA**

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

***Module* V PERIODIC PROPERTIES**

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

***Module* VI STEREOCHEMISTRY**

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

***Module* VII ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE**

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Text Books

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and

M. S. Krishnan

1. Physical Chemistry, by P. W. Atkins
2. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition <http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

* + Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
  + Rationalise bulk properties and processes using thermodynamic considerations.
  + Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
  + Rationalise periodic properties such as ionization potential, oxidation states and electronegativity.
  + List major chemical reactions that are used in the synthesis of molecules.

**118CYP01 - CHEMISTRY LABORATORY**

**Any** 10-12 experiments from the following:

* + Determination of surface tension and viscosity
  + Thin layer chromatography
  + Ion exchange column for removal of hardness of water
  + Determination of chloride content of water
  + Colligative properties using freezing point depression
  + Determination of the rate constant of a reaction
  + Determination of cell constant and conductance of solutions
  + Potentiometry - determination of redox potentials and emfs
  + Synthesis of a polymer/Determination of molecular weight of polymer
  + Saponification/acid value of an oil
  + Chemical analysis of a salt
  + Lattice structures and packing of spheres
  + Models of potential energy surfaces
  + Chemical oscillations- Iodine clock reaction
  + Determination of the partition coefficient of a substance between two immiscible liquids
  + Adsorption of acetic acid by charcoal
  + Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg .
  + Conductometric titration of strong acid and strong base
  + Determination of strength of acids in a mixture using conductivity meter.
  + Determination of Total, Permanent and Temporary hardness of water by EDTA method

Laboratory Outcomes

* The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:
* Estimate rate constants of reactions from concentration of reactants/products as a function of time
* Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
* Synthesize a small drug molecule and analyse a salt sample

**TEXT BOOKS:**

* Vogel’s text book of quantitative and qualitative chemical analysis

**118CST02 / 118ITT02 – MATHEMATICS – I**

**(Computer Science and Engineering and Information Technology)**

###### **Calculus and Linear Algebra**

**Course Objective:**

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

|  |  |
| --- | --- |
|  |  |
| ***Module 1: Calculus:*** |  |

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

***Module 2: Calculus:***

Rolle’s theorem, Mean value theorems, Taylor’s and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

***Module 3: Matrices (in case vector spaces is to be taught)***

Matrices, vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer’s Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

***Module 4: Vector spaces***

Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.

***Module 5: Vector spaces***

Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

***Textbooks/References:***

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
8. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated
9. East–West press, Reprint 2005.
10. Dr.G.Balaji ,Engineering Mathematics Volume-I & II ,Bharathi Publishers, 4 th edition,2017

Course Outcomes

The students will learn:

* + To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
  + The fallouts of Rolle’s Theorem that is fundamental to application of analysis to Engineering problems.
  + The tool of Vector space for learning advanced Engineering Mathematics.
  + To deal with functions of several variables that are essential in most branches of engineering.
  + The essential tool of matrices and linear algebra in a comprehensive manner.

**118BET03 - BASIC ELECTRICAL ENGINEERING**

***Module 1 : DC Circuits (8 hours)***

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

***Module 2: AC Circuits (8 hours)***

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections.

***Module 3: Transformers (6 hours)***

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

***Module 4: Electrical Machines (8 hours)***

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

***Module 5: Power Converters (6 hours)***

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

***Module 6: Electrical Installations (6 hours)***

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Text / Reference Books

* 1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering” , Tata McGraw Hill, 2010.
  2. D. C. Kulshreshtha, “ Basic Electrical Engineering”, McGraw Hill, 2009.

(iii)L. S. Bobrow, “ Fundamentals of Electrical Engineering”, Oxford University Press, 2011.

(iv)E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.

1. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Course Outcomes

* + To understand and analyze basic electric and magnetic circuits
  + To study the working principles of electrical machines and power converters.
  + To introduce the components of low voltage electrical installations

**118BEP02- Basic Electrical Engineering (Laboratory)**

1. Study of AC and DC measuring Instruments and their ranges
2. (a)Wattmeter and their connections and application in power measurement.

(b)Standard Values of Resistors and Capacitors.

1. The steady state and Transient Response of R-L, R-C, and R-L- C circuits for step inputvoltage – response curves to be traced from oscilloscope.
2. (a) The sinusoidal input the steady state response opf R- L and R-C Circuits

using oscilloscope.

(b) Measure the phase difference between voltage and current using

oscilloscope.

1. To study the no load current waveform of a transformer using oscilloscope.
2. To carry out No load &amp; Load Test on a transformer , Measurements of

Voltages, Currents and Power on No Load and under load conditions.

1. 3 Phase Transformer connections using 3 single phase transformers.
2. Load test on 3 Phase connected transformers and measurement of phase and line voltages, Measurement of Input and Output power and Efficiency Calculations.
3. To determine the Torque- Speed Characterstics of Seperately Excited DC motor.
4. (a) To Conduct a load test of 3 Phase Induction motor and to draw the Torque-

Slip characteristics.

(b) Reversal of motor terminals to change the direction of rotation.

1. (a) No load test and to draw I f vs E g characteristics of an alternator.

(b) Load test on a 3 Phase alternator.

1. To control the phase angle of DC- DC converter and draw its firing angle vs DC output voltage Characteristics.
2. To study the operation of

(a) DC –DC Converter.

(b) DC – AC Inverter with PWM output.

1. Speed Control of Squirrel cage Induction motor using PWM Inverter.

Laboratory Outcomes

* + Get an exposure to common electrical components and their ratings.
  + Make electrical connections by wires of appropriate ratings.
  + Understand the usage of common electrical measuring instruments.
  + Understand the basic characteristics of transformers and electrical machines.
  + Get an exposure to the working of power electronic converters.

**118EGT04 /118EGP03 - ENGINEERING GRAPHICS & DESIGN**

**(Theory & Lab)**

***Traditional Engineering Graphics***:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

***Computer Graphics***:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

***(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)***

***Module 1: Introduction to Engineering Drawing***covering,

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

***Module 2: Orthographic Projections*** covering,

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

***Module 3: Projections of Regular Solids*** covering,

those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

***Module 4:Sections and Sectional Views of Right Angular Solids*** covering,

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

***Module 5: Isometric Projections* covering,**

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

***Module 6: Overview of Computer Graphics*** covering,

listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

***Module 7: Customisation& CAD Drawing***

consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

***Module 8: Annotations, layering & other functions* covering**

applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

***Module 9: Demonstration of a simple team design project that illustrates***

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Suggested Text/Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. (Corresponding set of) CAD Software Theory and User Manuals

Course Outcomes

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

* + to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
  + to prepare you to communicate effectively
  + to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

The student will learn :

* + Introduction to engineering design and its place in society
  + Exposure to the visual aspects of engineering design
  + Exposure to engineering graphics standards
  + Exposure to solid modeling
  + Exposure to computer-aided geometric design
  + Exposure to creating working drawings
  + Exposure to engineering communication

**118EHT05 – ENGLISH**

1. **Vocabulary Building**
   1. The concept of Word Formation
   2. Root words from foreign languages and their use in English
   3. Acquaintance with prefixes and suffixes from foreign languages in English to

form derivatives.

* 1. Synonyms, antonyms, and standard abbreviations.

1. Basic Writing Skills
   1. Sentence Structures
   2. Use of phrases and clauses in sentences
   3. Importance of proper punctuation
   4. Creating coherence
   5. Organizing principles of paragraphs in documents
   6. Techniques for writing precisely
2. Identifying Common Errors in Writing
   1. Subject-verb agreement
   2. Noun-pronoun agreement
   3. Misplaced modifiers
   4. Articles
   5. Prepositions
   6. Redundancies
   7. Clichés
3. Nature and Style of sensible Writing
   1. Describing
   2. Defining
   3. Classifying
   4. Providing examples or evidence
   5. Writing introduction and conclusion
4. Writing Practices
   1. Comprehension
   2. Précis Writing
   3. Essay Writing
5. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

* Listening Comprehension
* Pronunciation, Intonation, Stress and Rhythm
* Common Everyday Situations: Conversations and Dialogues
* Communication at Workplace
* Interviews
* Formal Presentations

Suggested Readings:

1. *Practical English Usage.* Michael Swan. OUP. 1995.
2. *Remedial English Grammar.* F.T. Wood. Macmillan.2007 (iii)*On Writing Well.* William Zinsser. Harper Resource Book. 2001
3. *Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
4. *Communication Skills*. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
5. *Exercises in Spoken English.* Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

**II SEMESTER**

**218PHT01 – Physics**

**Circuit Branches**

(B.E. Electronics and Communication Engineering / B.E. Electrical and Electronics Engineering / B.E. Computer Science Engineering / B.E. Bio Medical Engineering / B. Tech. Information Technology)

**Module 1: Wave nature of particles and the Schrodinger equation:** Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time- independent Schrodinger equation for wavefunction, Born interpretation, probability current, Expectation values, Free-particle wavefunction and wave-packets, Uncertainty principle.

**Module 2: Introduction to solids:** Free electron theory of metals, Fermi level, density of states, Application to white dwarfs and neutron stars, Bloch’s theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bandsNumerical solution for energy in one-dimensional periodic lattice by mixing planewaves.

**Module 3: Magnetostatics:** Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes’ theorem; the equation for the vector potential and its solution for given current densities.

**Module 4: Electrostatics in a linear dielectric medium:** Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.

**Module 5: Wave optics:** Huygens’ principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young’s double slit experiment, Newton’s rings, Michelson interferometer, Mach-Zehnder interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

**Module 6: Lasers :** Einstein’s theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers ( He-Ne, CO2), solid-state lasers(ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicines.

Suggested Text Books

1. David Griffiths, Introduction to Electrodynamics
2. D. J. Griffiths, Quantum mechanics
3. Eisberg and Resnick, Introduction to Quantum Physics

Suggested Reference Books

1. Ian G. Main, Oscillations and waves in physics
2. H.J. Pain, The physics of vibrations and waves (iii)E. Hecht, Optics

(iii) A. Ghatak, Optics

(iv) O. Svelto, Principles of Lasers

(v) Halliday and Resnick, Physics

(vi) W. Saslow, Electricity, magnetism and light

(vii) D. J. Griffiths, Quantum mechanics

**218PHP01 - PHYSICS PRACTICALS**

**OBJECTIVES:**

To introduce different experiments to test basic understanding of physics concepts applied in optics, waves and electromagnetic.

**LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any five)**

1. (a) Determination of wavelength, and particle size using Laser

(b) Determination of acceptance angle in an optical fiber.

1. Determination of angle of the prism and angle of minimum deviation
2. Photoelectric effect Experiment
3. Determination of band gap of a semiconductor
4. LC circuit and LCR circuit
5. Measurement of speed of light on a table top using modulation
6. Experiments on electromagnetic induction and electromagnetic breaking

**OUTCOMES:**

Upon completion of the course, the students will be able to

apply principles of optics, waves and quantum mechanics for engineering applications

**218CST02/218ITT02 – MATHEMATICS – II**

**(Computer Science and Engineering and Information Technology)**

**Probability and Statistics**

**Objectives:**

* To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering.
* To provide an overview of probability and statistics to engineers

|  |  |
| --- | --- |
| ***Module 1:* Basic Probability:** |  |

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

***Module 2:* Continuous Probability Distributions:**

Continuous random varibales and their properties, distribution functions and densities, normal, exponential and gamma densities.

***Module 3:* Bivariate Distributions:**

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

***Module 4: Basic Statistics:***

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation

***Module 5: Applied Statistics:***

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

***Module 6: Small samples:***

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

***Textbooks/References:***

* Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
* P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
* S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
* W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
* N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
* B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

* Dr.G.Balaji,Probability &Statistics,17 th edition,G.Balaji Publishers,2017.

**Course Outcomes:**

* Upon completion of this course, students will be able to solve field problems in engineering involving PDEs. They can also formulate and solve problems involving random variables and apply statistical methods for analysing experimental data

**218PPT03 - PROGRAMMING FOR PROBLEM SOLVING**

**Course Objectives:**

* To provide basic introduction to computer
* To introduce the concepts of structured Programming language.
* To introduce the concepts of pointers and files

***Details content:***

***Module 1:* Introduction to Programming**

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **.**

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code-

***Module 2:* Arithmetic expressions and precedence**

Conditional Branching and Loops

Writing and evaluation of conditionals and consequent branching

Iteration and loops

***Module 3:* Arrays**

Arrays (1-D, 2-D), Character arrays and Strings

***Module 4:* Basic Algorithms**

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

***Module 5:* Function**

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

***Module 6:* Recursion**

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

***Module 7:* Structure**

Structures, Defining structures and Array of Structures

***Module 8:* Pointers**

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

***Module 9:* File handling**

Suggested Text Books

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Outcomes

* The student will learn
* To formulate simple algorithms for arithmetic and logical problems.
* To translate the algorithms to programs (in C language).
* To test and execute the programs and correct syntax and logical errors.
* To implement conditional branching, iteration and recursion.
* To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
* To use arrays, pointers and structures to formulate algorithms and programs.
* To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
* To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

**218PPP02 - Laboratory - Programming for Problem Solving**

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

**Tutorial 1:** Problem solving using computers:

**Lab1:** Familiarization with programming environment

**Tutorial 2:** Variable types and type conversions:

**Lab 2:** Simple computational problems using arithmetic expressions

**Tutorial 3:** Branching and logical expressions:

**Lab 3**: Problems involving if-then-else structures

**Tutorial 4:** Loops, while and for loops:

**Lab 4:** Iterative problems e.g., sum of series

**Tutorial 5:** 1D Arrays: searching, sorting:

**Lab 5:** 1D Array manipulation

**Tutorial 6:** 2D arrays and Strings

**Lab 6:** Matrix problems, String operations

**Tutorial 7:** Functions, call by value:

**Lab 7:** Simple functions

**Tutorial 8 &9:** Numerical methods (Root finding, numerical differentiation, numerical integration):

**Lab 8 and 9:** Programming for solving Numerical methods problems

**Tutorial 10:** Recursion, structure of recursive calls

**Lab 10:** Recursive functions

**Tutorial 11:** Pointers, structures and dynamic memory allocation

**Lab 11:** Pointers and structures

**Tutorial 12:** File handling:

**Lab 12:** File operations

Laboratory Outcomes

* + To formulate the algorithms for simple problems
  + To translate given algorithms to a working and correct program
  + To be able to correct syntax errors as reported by the compilers
  + To be able to identify and correct logical errors encountered at run time
  + To be able to write iterative as well as recursive programs
  + To be able to represent data in arrays, strings and structures and manipulate them through a program
  + To be able to declare pointers of different types and use them in defining self- referential structures.
  + To be able to create, read and write to and from simple text files.

**218WMT04 –MANUFACTURING PRACTICES**

Lectures & videos: (10 hours)

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lectures)**
2. CNC machining, Additive manufacturing **(1 lecture)**
3. Fitting operations & power tools **(1 lecture)**
4. Electrical &Electronics **(1 lecture)**
5. Carpentry **(1 lecture)**
6. Plastic moulding, glass cutting **(1 lecture)**
7. Metal casting **(1 lecture)**
8. Welding (arc welding & gas welding), brazing **(1 lecture)**

Suggested Text/Reference Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “ Elements of Workshop Technology” , Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, “ Manufacturing Engineering and Technology” , 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu,” Manufacturing Technology – I” Pearson Education, 2008.
4. Roy A. Lindberg, “ Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
5. Rao P.N., “ Manufacturing Technology” , Vol. I and Vol. II, Tata McGrawHill House, 2017.

Course Outcomes

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

**218WMP03 – MANUFACTURING PRACTICES**

1. Machine shop **(10 hours)**
2. Fitting shop **(8 hours)**
3. Carpentry **(6 hours)**
4. Electrical & Electronics**(8 hours)**
5. Welding shop **( 8 hours (Arc welding 4 hrs + gas welding 4 hrs)**
6. Casting **(8 hours)**
7. Smithy **(6 hours)**
8. Plastic moulding& Glass Cutting (6 hours)

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

* Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
* They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
* By assembling different components, they will be able to produce small devices of their interest.

**Registrar**