**NOIDA INTERNATIONAL UNIVERSITY**



**School of Engineering & Technology**

**SCHEME OF EVALUATION & SYLLABUS**

**for**

**BACHELOR OF TECHNOLOGY in Mechatronics Engineering [B. Tech. (Mechatronics)]**

**w.e.f. Academic Session 2022-2023onwards**

**Program Curriculum**

**FOR B. Tech. (Mechatronics)**

**(Effective from Academic Session 2022-2023)**

***B. Tech. in Mechatronics is undoubtedly one of the most sought-after specializations of Engineering. B. Tech. Mechatronics is a Four-Year Undergraduate program with strong focus on students’ learning in the modern fields of mechatronics which are the harbinger of Digital Transformation worldwide. Mechatronics refers to the deployment of machines to enable them to perform tasks with intelligence like humans. The goal of mechatronics generally is to design intelligent machines that can assist people in their everyday life. It is an interdisciplinary branch that includes electronics, mechanical, information, and computer science engineering. It deals with the design and development of robots. The mechatronics graduates can find jobs in private manufacturing & design companies, public organizations, military & defence, education, agriculture, healthcare, etc. Some of the jobs available in the field of mechatronics are Robotics Engineer, Robotics Designer & Analyst, Robotics Sales Engineer, Research Scientist, Automation engineer etc. The mechatronics graduates will be demanded in sectors like mining industry, telecommunications, forest industry, food industry, industrial engineering, space exploration, healthcare, transportation, etc. So, they can find jobs in any of the above-mentioned sectors.***

**Program Educational Objectives (POs)**

The Department of Mechatronics has developed and maintained a well-defined set of Program Educational Objectives and desired Program Outcomes. Educational objectives of the program cater to the requirements of the stakeholders such as students, parents, employers, alumni, faculty etc. The Program Educational Objectives are as follows:

After few years of Graduation, the Graduates of **B. Tech. (Mechatronics)** will be able to:

|  |  |
| --- | --- |
| * **PEO1:** | Achieve professional growth in an engineering position in regional and national industries. Growth can be evidenced by promotions and appointment in the workplace (management positions, technical specialization), entrepreneurial activities, and consulting activities. |
| * **PEO2:** | Success in advanced engineering studies evidenced by enrolment in graduate courses, completion of graduate degree programs, presentations and publications at professional events, and awards or licenses associated with advanced studies. |
| * **PEO3:** | Realization of impactful achievements in societal roles demonstrated by attainment of community leadership roles, mentoring activities, civic outreach service, and active roles in professional societies. |

**Program Outcomes (POs)**

***On successful completion of B. Tech. (Mechatronics) Engineering Graduates will be able to:***

* **PO**1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
* **PO**2. **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
* **PO**3. **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
* **PO**4. **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
* **PO**5. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
* **PO**6. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.
* **PO**7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
* **PO**8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
* **PO**9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
* **PO**10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
* **PO**11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
* **PO**12**. Life-Long Learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**Program Specific Outcomes (PSOs)**

On successful completion of the program, the graduates of B. Tech (Mechatronics) program will be able to:

* **PSO1:** Provide the solutions to problems faced in the industrial area related to the field of Mechatronics Engineering.
* **PSO2:** Design and develop new application with help of Mechatronics using modern tools.

**Credit System:** Credit requirement for award of B. Tech (Mechatronics):

* Every semester shall offer a minimum of **21 credits** and a maximum of **29 credits**.
* Total Credits for the Project or Thesis in the program can vary from **12 to 18**.
* The total number of credits for the B. Tech Degree program could vary from a **minimum of 145** credits to a **maximum of 163** credits.
* All courses of study put together in the program would engage the students for a **minimum of 28 periods** or hours of study a week and a **maximum of 37 periods** or hours a week.

Under the CHOICE BASED CREDIT SYSTEM (CBCS), which is a student or learner centric system, the courses of study in the B. Tech Degree program shall be as under:

1. Basic Sciences and Engineering Science (BS and ES) Course: A course which informs the Professional core and should compulsorily be studied.
2. Professional Core (PC) Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
3. Elective Course: Generally, a course which can be chosen from a pool of courses and are of two types:
   1. Professional Elective (PE) which may be very specific or specialized or advanced or supportive to the discipline or subject of study or which provides an extended scope
   2. Open Elective (OE) which enables an exposure to some other discipline or subject or domain or nurtures the candidates’ proficiency or skill

The Weightage in terms of Credits for each of the above in the prescribed curriculum of the School is as follows:

|  |  |  |
| --- | --- | --- |
| **S.**  **No.** | **Credit Breakups** | **Credits** |
| 1 | Humanities and Social Sciences including Management Courses | 12 |
| 2 | Basic Science Courses | 21 |
| 3 | Mechatronics Engineering Core Courses | 101 |
| 4 | Professional Elective Core Courses | 6 |
| 5 | Open Elective Courses relevant to chosen Specialization/Branch | 6 |
| 6 | Project Work, Seminar, and Internship in Industry or elsewhere | 17 |
| 7 | Audit Course | Non-Credit |
|  | **Total Credits** | 163 |

While calculating credits the following guidelines is adopted, namely: -

* 1 Hr. Lecture (L) per week 1 credit
* 1 Hr. Tutorial (T) per week 1 credit
* 1 Hr. Practical (P) per week 0.5
* 2 Hours Practical (Lab)/week 1 credit **Credit distribution in each semester** (199 credits to 8 semesters)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Semester** | **Hrs. (Credits)** | | | |
| **Lecture** | **Tutorials** | **Practical** | **Total** |
| **1st** | 17 **(15)** | 2 **(2)** | 14 **(7)** | 33 **(24)** |
| **2nd** | 18 **(16)** | 2 **(2)** | 12 **(6)** | 32 **(24)** |
| **3rd** | 17 **(17)** | 5 **(5)** | 6 **(3)** | 28 **(25)** |
| **4th** | 17 **(17)** | 5 **(5)** | 6 **(3)** | 28 **(25)** |
| **5th** | 21 **(21)** | 4 **(4)** | 6 **(3)** | 31 **(28)** |
| **6th** | 23 **(21)** | 1 **(1)** | 8 **(4)** | 32 **(27)** |
| **7th** | 18 **(18)** | 0 **(0)** | 14 **(7)** | 32 **(25)** |
| **8th** | 11 **(11)** | 0 **(0)** | 18 **(9)** | 35 **(20)** |
| **Total Credits** | 142 **(136)** | 19 **(19)** | **84 (42)** | 245 **(198)** |

**Course Coding System**: Every Course coded as follows:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Type of Course** | **First 2 Alphabets** | **Next 2 Alphabets** | **X1** | **X2** | **X3** | **X4** | **Second Last Alphabet** | **(Last Alphabet)** | **Example** |
| Basic Science Courses (BSC) | BT | SC | Version | Semester | Course Number | | T: Theory  P: Practical  E: Professional Elective  O: Open Elective  S: Seminar/Industrial Training/Project/Thesis | Thread Identifier for Professional Elective  (Only where Professional Elective Threads are implemented.) | BTSC1101T |
| Engineering Science Course (ESC) | BT | ES | Version | Semester | Course Number | | BTES1101T |
| Humanities and Social Sciences including Management (HSMC) | BT | HM | Version | Semester | Course Number | | BTHM1101T |
| Program Core Courses (PCC) | BT | CS | Version | Semester | Course Number | | BTME1301T |
| Program Elective Courses (PEC) | BT | CS | Version | Semester | Course Number | | BTME1501E(A) |
| Open Elective Courses (OEC) | BT | CS | Version | Semester | Course Number | | BTME1701O |
| Mandatory Courses (MC) | BT | MC | Version | Semester | Course Number | | BTMC1101T |
| Any Course Common to Other Department | BT | <##> | Version | Semester | Course Number | | BTEC1403T |

**## Parent Department where this Course belongs to:**

AE: Automobile Engineering

BT: Bio Technology

CE: Civil Engineering

CS: Computer Science & Engineering

EC: Electronics & Communication Engineering

EE: Electrical Engineering

EN: Electrical & Electronics Engineering

IT: Information Technology

MR: Mechatronics Engineering

**Bachelor of Technology (Mechatronics)**

**First Semester (Common to All Branches)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S.**  **No.** | **University**  **Course Code** | **Course Name** | **Period Schedule** | | | **Evaluation Scheme** | | | | | | | | |
| **Internal Assessment** | | | | **External**  **Assessment** | **Total** | **Total Credits** | |
| **L** | **T** | **P** | **CT** | **TA** | **AT** | **Total** |
| 1 | BTSC1101T/1201T | Chemistry | 3 | 1 | 0 | 20 | 10 | 10 | 40 | 60 | 100 | 4 | |
| 2 | BTSC1103T | Mathematics I | 3 | 1 | 0 | 20 | 10 | 10 | 40 | 60 | 100 | 4 | |
| 3 | BTES1101T | Programming for Problem Solving Using C | 3 | 0 | 0 | 20 | 10 | 10 | 40 | 60 | 100 | 3 | |
| 4 | BTES1102T/1202T | Engineering Graphics and Design | 1 | 0 | 0 | 20 | 10 | 10 | 40 | 60 | 100 | 1 | |
| 5 | BTES1104T/1204T | Basic Electrical Engineering | 3 | 0 | 0 | 20 | 10 | 10 | 40 | 60 | 100 | 3 | |
| **PRACTICALS** | | | | | | | | | | | | | | | |
| 1 | BTSC1101P/1201P | Chemistry Lab | 0 | 0 | 3 | 20 | 10 | 10 | 40 | 60 | 100 | 1.5 | |
| 2 | BTES1101P | Programming for Problem Solving using C Lab | 0 | 0 | 3 | 20 | 10 | 10 | 40 | 60 | 100 | 1.5 | |
| 3 | BTES1102P/1202P | Engineering Graphics and Design Lab | 0 | 0 | 4 | 20 | 10 | 10 | 40 | 60 | 100 | 2 | |
| 4 | BTES1104P/1204P  BTES1105P/1205P | Basic Electrical Engineering Lab | 0 | 0 | 2 | 20 | 10 | 10 | 40 | 60 | 100 | 1 | |
| **Total [First Semester]** | | | **17** | **2** | **14** | **240** | **120** | **120** | **480** | **720** | **1200** | **24** |

**Bachelor of Technology (Mechatronics)**

**Second Semester (Common to All Branches)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S.**  **No.** | **University**  **Course Code** | **Course Name** | **Period Schedule** | | | **Evaluation Scheme** | | | | | | | |
| **Internal Assessment** | | | | **External**  **Assessment** | **Total** | **Total Credits** | |
| **L** | **T** | **P** | **CT** | **TA** | **AT** | **Total** |
| 1 | BTSC1202T | Physics | 3 | 1 | 0 | 20 | 10 | 10 | 40 | 60 | 100 | 4 | |
| 2 | BTSC1203T | Mathematics II | 3 | 1 | 0 | 20 | 10 | 10 | 40 | 60 | 100 | 4 | |
| 3 | BTES1201T | Introduction to Python | 3 | 0 | 0 | 20 | 10 | 10 | 40 | 60 | 100 | 3 | |
| 4 | BTES1202T | Workshop & Manufacturing Practices | 1 | 0 | 0 | 20 | 10 | 10 | 40 | 60 | 100 | 1 | |
| 5 | BTES1205T | Basic Electronics Engineering | 3 | 0 | 0 | 20 | 10 | 10 | 40 | 60 | 100 | 3 | |
| 6 | BTES 1206T | Engineering Mechanics | 3 | 0 | 0 | 20 | 10 | 10 | 40 | 60 | 100 | 3 | |
| 7 | BTMC1201T | Environment Study | 2 | 0 | 0 | 20 | 10 | 10 | 40 | 60 | 100 | 0 | |
| **PRACTICALS** | | | | | | | | | | | | | | |
| 1 | BTSC1202P | Physics Lab | 0 | 0 | 3 | 20 | 10 | 10 | 40 | 60 | 100 | 1.5 | |
| 2 | BTES1201P | Introduction to Python Lab | 0 | 0 | 3 | 20 | 10 | 10 | 40 | 60 | 100 | 1.5 | |
| 3 | BTES1103P/1203P  BTES1102P/1202P | Workshop & Manufacturing Practices Lab | 0 | 0 | 4 | 20 | 10 | 10 | 40 | 60 | 100 | 2 | |
| 4. | BTES1205P | Basic Electronics Engineering Lab | 0 | 0 | 2 | 20 | 10 | 10 | 40 | 60 | 100 | 1 | |
| **Total [Second Semester]** | | | **18** | **2** | **12** | **220** | **110** | **110** | **440** | **660** | **1100** | **24** |

**SEMESTER-I**

**DETAILED CURRICULUM CONTENTS**

**Course Code:** BSC103 **Course Name:** Mathematics-I

**Course Credit Hour:** 4hr **Total Contact Hour:** 40hrs

**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.

**Course Description:**

* In this course we apply to 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 and discuss the fallouts of Rolle’s Theorem that is fundamental to application of analysis to Engineering problems.
* We shall also learn the tool of power series and Fourier series for learning advanced Engineering Mathematics and deal with functions of several variables that are essential in most branches of engineering and the essential tool of matrices and linear algebra in a comprehensive manner

**Course Contents:**

**Unit 1**: Calculus: (6 lectures)

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.

**Unit 2**: Calculus: (6 lectures)

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

**Unit 3**: Sequences and series: (10 lectures)

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval’s theorem.

**Unit 4**: Multivariable Calculus (Differentiation): (8 lectures)

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

**Unit 5**: Matrices (10 lectures)

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

**Course Learning Outcomes (CLOs):**

* CLO-1: Apply to differential and integral calculus to notions of curvature and to improper integrals and its applications in engineering problems
* CLO-2: Fundamental to application of analysis to Engineering problems by mean value theorems.
* CLO-3: Apply the tool of power series and Fourier series for learning advanced Engineering Mathematics.
* CLO-4: Discuss problem and application of Multivariable Calculus.
* CLO-5: Apply tool of matrices and linear algebra in a comprehensive manner

**Text books:**

1. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Edition, Pearson,

**Reference books:**

(i) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,

(ii) D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

**Online links for study & reference materials:**

<https://www.classcentral.com/course/swayam-engineering-mathematics-i-13000>

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1 - 04%

Assignment -2 - 04%

Assessment-3(Mid-Exam) - 20%

Assignment-3 - 04%

Assignment-4 - 04%

Assignment-5 - 04%

**Total Internal Assessment - 40%**

**Course Code:** BSC102 **Course Name:** Chemistry-I

**Course Credit Hour:** 4hr **Total Contact Hour:** 45hr

**Course Objective:**

The objectives of the course are

1. To develop the interest among the students regarding chemistry and their applications in engineering. The student should understand the concepts of chemistry to lay the groundwork for subsequent studies in the fields such as chemical, mechanical, civil, environmental, electrical and electronics engineering etc.
2. To emphasize on learning microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
3. To understand principles of different spectroscopic techniques and its applications. Bulk properties and processes will be analyzed using thermodynamic considerations.
4. To outline periodic properties, stereochemistry, chemical reactions and synthesis.
5. To teach of experiments illustrating the principles of chemistry that have been learnt so far, as well as others relevant to the study of science and engineering.
6. To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
7. To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.

**Course Description:**

* The course introduces fundamental concepts chemistry including Atomic and molecular structure,Spectroscopic techniques and applications, Intermolecular forces and potential energy surfaces , Use of free energy in chemical equilibrium, Periodic properties, Stereochemistry and Stereochemistry . This subject also laid down the groundwork for subsequent studies in the fields such as chemical, mechanical, civil, environmental, electrical and electronics engineering etc.

**Course Contents:**

**Module 1: Atomic and molecular structure**

Schrodinger equation. Particle in a box solutions and their applications for onjugated molecules and nanoparticles. 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 multi-centre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. 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 2: Spectroscopic techniques and applications

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

## Module 3: 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 4: 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 5: 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 6: 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 7: 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.

**Course Learning Outcomes (CLOs):**

The course will enable the student to:

* **CLO-1**: Students will learn to apply concepts from physics and methods from mathematics to derive and understand the properties of chemical systems that arise from quantum mechanical models for the structure of atoms and molecules.
* **CLO-2**: Student will achieve advanced knowledge about the interactions of electromagnetic radiation and matter and their applications in spectroscopy.
* **CLO-3**: Student can explain how intermolecular forces determine physical properties of molecules; especially boiling point, melting point and viscosity.
* **CLO-4**: Student can answer why chemical reactions occur? the driving force(s) that are responsible for physical and chemical changes.
* **CLO-5**: Student can apply the knowledge of periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity while planning use of any material for industrial purpose.
* **CLO-6**: Distinguish between different kinds of isomers, cis/trans or E/Z, superimposable, chiral/achiral, define enantiomers, levorotatory or dextrorotatory, racemic mixture, Distinguish between enantiomers and diastereomers, Understand the relationship between biological properties of pairs of enantiomers or diastereomer.
* **CLO-7**: Student can list major chemical reactions that are used in the synthesis of molecules.
* The properties of a compound are not only determined by the functional groups that it contains,
* but also by the spatial arrangements of the atoms in the molecule. Stereochemistry is the
* branch of chemistry that is concerned with the three-dimensional structures of molecules.
* After studying this unit I should be able to:
  + Distinguish between different kinds of isomers

**Text books:**

* B. H. Mahan, “ University chemistry”, Addison-Wesley Publishing Company.
* M. J. Sienko and R. A. Plane, “Chemistry: Principles and Applications”, McGraw- -ill International.
* C. N. Banwell, “Fundamentals of Molecular Spectroscopy”, McGraw Hill Education.

**Reference books:**

* B. L. Tembe, Kamaluddin and M. S. Krishnan, “Engineering Chemistry” (NPTEL).
* K. P. C. Volhardt and N. E. Schore, “ Organic Chemistry: Structure and Function” Freeman.

**Online links for study & reference materials:**

<https://nptel.ac.in/courses/104/103/104103071/>

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment-1 - 05%

Assignment-2 - 05%

Assessment-3(Midexam) - 20%

Assignment-4 - 05%

Assignment-5/Quiz - 05%

**Total Internal Assessment - 40%**

**Course Code:** **HSMC101** **Course Name:** English

**Course Credit Hour:** 2 Hr **Total Contact Hours:** 20hr

**Course Objective:**

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

**Course Description:**

* This course introduces the fundamental of communication skills, writing skills presentation skills and interview skills. Topic includes introduction to Grammar, speaking skills, Writing Skills, Presentation skills, Interview skills.

**Course Contents:**

**Unit 1:** **Vocabulary Building (4 lectures)**

The concept of Word Formation, Root words from foreign languages and their use in English Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations.

**Unit 2: Basic Writing Skills (4lectures)**

Sentence Structures, use of phrases and clauses in sentences Importance of proper punctuation Creating coherence Organizing principles of paragraphs in documents Techniques for writing precisely

## Unit 3: Identifying Common Errors in Writing (4 lectures)

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions

Redundancies Clichés

**Unit 4: Nature and Style of sensible Writing (4 lectures)**

Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion Writing Practices Comprehension Précis Writing Essay Writing

**Unit 5:** Oral Communication **(4 lectures)**

(This unit involves interactive interaction)

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

**Course Learning Outcomes (CLOs):**

* + - CLO-1: Develop the vocabulary building and basic grammar concepts.
    - CLO-2: Inculcate speaking skills and listening skills.
    - CLO-3: Develop the writing skills.
    - CLO-4: Understand technical writing skills.
    - CLO-5: Demonstrate all skills in presentation and interviews.

**Text books:**

* Raman, Singh – Business communication – Oxford Press
* Spoken English for India, R.K. Bansal & J.B. Harrison, Orient Longman, Delhi.
* Objective English, Tata Mc. Graw Hill Publishing Company Ltd., New Delhi.
* Practical English Usage. Michael Swan. OUP. 1995.
* Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

**Reference books:**

* English Phonetics & Phonology, P. Roach, Cambridge University Press, London
* Common Errors in English, Abul Hashem, Ramesh Publishing House, new Delhi.
* Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
* Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

**Online links for study & reference materials:**

* <https://nptel.ac.in/courses/109/106/109106094/>

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1 - 05%

Assignment -2 - 05%

Assessment-3(Mid-Exam) - 20%

Assignment-3/Quiz-1 - 05%

Assignment-4 - 05%

**Total Internal Assessment - 4**

**Course Code:** ECS103 **Course Name:** Programming for Problem Solving

**Course Credit Hour:** 4hr **Total Contact Hour:** 42hr

**Course Objective:**

* The course aims to provide exposure to problem –solving through programming. It aims to train the student to the basic concept of the C –programming language. This course involves a lab component which is designed to give the student hands –on experience with the concept.

**Course Description:**

* This course introduces the fundamental concepts of computer and programming and provides comprehensive introduction to programming in C. Topic includes introduction to programming, Arrays, Basic Algorithms, Functions, Recursion, Structure and Pointers.

**Course Contents:**

**Unit 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.

**Unit 2:** Arithmetic expressions and precedence

Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops.

**Unit 3:** Arrays

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

**Unit 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)

**Unit 5:** Function

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

**Unit 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.

**Unit 7:** Structure

Structures, Defining structures and Array of Structures.

**Unit 8:** Pointers

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

**Unit 9:** File handling (only if time is available, otherwise should be done as part of the lab)

**Course Learning Outcomes (CLOs):**

On completion of the course students will be able to:

* **CLO-1**: Formulate simple algorithms for arithmetic and logical problems.
* **CLO-2:** Test and execute the programs and correct syntax and logical errors.
* **CLO-3:** Implement conditional branching, iteration and recursion.
* **CLO-4:** Use arrays, pointers and structures to formulate algorithms and programs.
* **CLO-5:** Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

**Text books:**

1. Byron Gottfried, Schaum’s Outline of Programming with C, Third Edition, McGraw-Hill.
2. E.Balaguruswamy, Programming in ANSI, Tata McGraw- Hill.
3. Yashavant Kanetkar, Let Us C, BPB Publications.

**Reference books:**

* Brian W. Kernighhan and Dennis Ritchie, The C Programming Language, Prentice Hall of India

**Online links for study & reference materials:**

<https://nptel.ac.in/courses/106/104/106104128/>

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1 - 05%

Assignment -2 - 05%

Assessment-3(Mid-Exam) - 20%

Assignment-3/Quiz-1 - 05%

Assignment-4 - 05%

**Total Internal Assessment - 40%**

LAB EXPERIMENTS

FIRST SEMESTER

**Lab Code:** ESC103P **Lab Name:** Programming for Problem Solving

**Course Credit Hour:** 2hr **Total Contact Hour:** 04

**List of Experiments:**

**Problems based on if-then-else structure:**

1. If the three sides of the triangle are entered through the keyboard, write a program to check whether the triangle is isosceles or equilateral.
2. In a company an employee is paid under: If his basic salary is less then Rs.1500, then HRA=10% of basic salary and DA=90% of basic salary .If his salary is either equal to or above Rs 1500, then HRA=Rs 500 and DA= 98% of basic salary. If the employee’s salary is input through the keyboard write a program to find his gross salary.
3. The current year and year in which the employee joined the organization are entered through the keyboard. If the no of years for which the employee has served the organization is greater than 3 then a bonus of Rs.2500/- is given to the employee. If the years of service are not greater than three, then the program should do nothing. Write a program to perform the said task.
4. Write a program to check whether a triangle is valid or not when the three angles of the triangle are entered through the keyboard. A triangle is valid if the sum of all the three angles is equal to 180 degree.
5. If cost price and selling price of item is input through the keyboard, write a program to determine whether the seller gas made profit or incurred loss. Also determine how much profit he made or loss he incurred.
6. In a company worker efficiency is determined on the basis of the time required for a worker to complete a particular job. If the time taken by the worker is between 2-3 hours, then the worker is said to be highly efficient. If the time required by the worker is between 3-4 hours, then the worker is ordered to improve speed. If the time taken is between 4-5 hours, the worker is given training to improve his speed, and if the time taken by the worker is more than 5 hours, then the worker has to leave the company. If time taken by the worker is input through the keyboard, write a program to find the efficiency of the worker.

**Problems based on while loop and for loop:**

1. Write a program to print the cube of any number provided by the user.
2. Make a program to calculate the simple interest for 3 sets of p, n, r using while and for loop.
3. Write a program to print the sum of all the digits from 1 to 10 using while loop.
4. Write a program to print the digit from 1 to100 using while and for loop.
5. Using for loop print the following pattern

R=1 c=1 sum=2

R=1 c=2 sum=3

R=2 c=1 sum =3

R=2 c=2 sum=4

1. Write a program to print the following pattern

|  |  |  |  |
| --- | --- | --- | --- |
| \*\*\*\*\*  \*\*\*\*\*  \*\*\*\*\*  \*\*\*\*\* | \*  \*\*  \*\*\*  \*\*\*\*  \*\*\*\*\* | 1  12  123  1234  12345 |  |

1. Write a program to print the square and cube of any given number**.**

**Problems based on 1-D Array, Array Manipulation, 2-D Array and String Operations:**

1. Write a program to perform following operations on String(s) using a well-defined library function:

* Find the length of the string.
* Concatenate two strings
* Compare two given strings
* Copy the content of string to another string

1. Write a program to find average marks obtained by a class of 30 students in a test.
2. Write a program to find the maximum marks obtained by a student in 5 subjects.
3. Write a program to pick up the largest number from any 5 row by 5 column matrix.
4. Twenty five numbers are entered from the keyboard into an array. Write a program to find out how many of them are positive, how many of them are negative and how many of them are zeros.
5. Write a program to store n elements in an array and print all elements.
6. Write a program to compute the sum of all elements in an array.
7. Write a program to print the elements of an array in reverse order.

**Problems based on Structures:**

1. Write a program to enter name, price and page number of three books using structure.
2. Write a program to enter roll number and average marks of 3 students using structure.
3. Create a structure to specify data of customer in a bank. The data to be stored is: Account number, Name, Balance in Account. Assume maximum of 200 customers in the bank. Write a program to print name and account number of each customer with balance below Rs. 100.
4. A record contains name of cricketer, his age, number of test matches that he has played and the average runs that he has scored. Create an array of structures to hold records of 20 such cricketers.
5. There is a structure called employee that holds information like employee code, name, and year of joining. Write a program to create an array of structures and enter some data into it. Then ask the user to enter current year. Display the names of those employees whose tenure is more than 3 years according to given year.

**Problems based on Function, Pointer, Call by Value and Call by Reference**

1. Write function which receives a float and an integer from main (), find the product of these two and returns the product which is printed through main ().
2. Write a function that receives marks received by a student in 3 subjects and returns the average and percentage of these marks. Call this function from main and print the result in main.
3. Find the smallest number in an array.
4. Any year is entered through the keyboard. Write a function to determine whether the year is a leap year or not.
5. Write a function that receives 5 integers and returns the sum, average of these numbers. Call this function from main () and print the result in main ().
6. Write a program to add two numbers using pointers**.**
7. Write a program to store n elements in an array and print all elements using pointer.
8. Write a program to read array elements and print array addresses using pointer.
9. Write a program to compute the sum of all elements in an array using pointer.
10. Write a program to print the elements of an array in reverse order using pointer.

**Problems based on Recursion, recursive functions, file handling operations and numerical method problems:**

1. Write a program to writes records to a file using structure.
2. Write a program for reading a string from the file and display them on screen.
3. Write a program to copy the content of one file to another file.
4. Write a program to display contents of a file on screen.
5. Write a program to count Chars, space, tabs and new lines in a file.
6. Write a program to calculate factorial of any inputted number with recursion and without recursion.
7. Write a program to calculate Fibonacci Series using recursive call.
8. Write a program to calculate Ackerman Function for any two non-negative integers using recursion.

**Lab Code:** BSC102P **Lab Name:** Chemistry Lab

**Course Credit Hour:** 1.5 **Total Contact Hours:** 03

**List of Experiments:**

* Determination of Alkalinity in given water sample.
* Determination of Total hardness, Permanent hardness and Temporary Hardness of given Water Sample by using EDTA as standard solution.
* Determination of available chlorine in Bleaching powder.
* Determination of chloride Contents in given Water sample by using Mohr’s Method.
* Determination of Iron Content in the given Ore by using external Indicator.
* pH metric titration.
* Viscosity of an addition polymer like Polyester by Viscometer.
* Determination of heat of neutralization of Hydrochloric acid and Sodium hydroxide.
* Determination of amount of dissolve Oxygen in water.
* Separation of metal ions by paper chromatography.

**SEMESTER-II**

**DETAILED CURRICULUM CONTENTS**

**Course Code:** BSC102  **Course Name:** Physics

**Course Credit Hour: 4hr Total Contact Hour:** 42hr

**Course Objective:** At the completion of this course, a student will be able to

1. Know about the development of modern Physics and the theoretical formulation of quantum mechanics.
2. Know the applications of quantum mechanics in solving physical problems.

**Course Description:** This course willanalyze the applications of mathematics to the problems in physics & develop suitable mathematical method for such application & for formulation of physical theories.

**Course Contents:**

**Unit I: Wave nature of particles and the Schrodinger equation** **(8 Lectures)**

Introduction to Quantum mechanics, Wave nature of particles, Time independent and time dependent Schrodinger equation for wave function, Born interpretation, Probability current, Expectation values, Free particle wavefunction and wave packets, Uncertainty principle

**Unit II: Mathematical Preliminaries for Quantum Mechanics (4 Lectures)**

Complex numbers Linear vector spaces Inner product Operators Eigen value problems Hermitian operators Hermite polynomials Legendre`s equation Spherical harmonics

**Unit III: Applying the Schrodinger equation** (**15 Lectures)**

Solution of stationary state Schrodinger equation for one dimensional problem Particle in a box Particle in attractive delta function potential Square well potential Linear harmonic oscillator

Numerical solution of stationary state Schrodinger equation for one dimensional problem for different potentials Scattering from a potential barrier and tunneling Examples like alpha decay, field ionisation and scanning tunnelling microscope Three dimensional problems: particle in three-dimensional box and related examples Angular momentum operator Rigid rotor Hydrogen atom ground state, orbitals, interaction with magnetic field spin Numerical solution stationary state Schrodinger equation for spherically symmetric potentials

**Unit IV: Introduction to Molecular Bonding (4 Lectures)**

Particle in double delta function potential Molecules (Hydrogen molecule, valence bond and molecular orbitals picture) Singlet/triplet states Chemical bonding Hybridization

**Unit V: Introduction to Solids (7 Lectures)**

Free electron theory of metals Fermi level, density of states Application of white dwarfs and neutron stars Bloch theorem for particles in a periodic potential Kronig-Penney model and origin of energy bands Numerical solution for energy in one dimensional periodic lattice by mixing plane waves

**Course Learning Outcomes (CLOs):**

After successful completion of this paper, the student will be well-versed in

* **CLO1.** Concepts of basis and operators
* **CLO2.** Both Schrodinger and Heisenberg formulations of time development and their applications
* **CLO3.** Solution of stationary state Schrodinger equation for one dimensional problem
* **CLO4.** Concepts of Molecules (Hydrogen molecule, valence bond and molecular orbitals picture)
* **CLO5.** Kronig-Penney model and origin of energy bands

**Text Books**

* Eisberg and Resnik, Introduction to Quantum Physics

**Reference Books**

* D. J. Grriffiths, Quantum Mechanics
* Richard Robinett, Quantum Mechanics
* Daniel McQuarrie, Quantum Chemistry

**Online links for study &amp; reference materials:**

<https://nptel.ac.in/courses/122/106/122106034/>

**Assessment method: (**Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1 - 05%

Assignment -2 - 05%

Assessment-3(Mid-Exam) - 20%

Assignment-3/Quiz-1 - 05%

Assignment-4 - 05%

Total Internal Assessment - 40%

**Course Code:** BSC103 **Course Name:** Mathematics II

**Course Credit Hour:** 4hr **Total Contact Hour:** 40hrs

**Course Objective:**

* The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

**Course Description:**

* Applying the mathematical tools for need in evaluating multiple integrals and their usage, solutions of differential equations that model physical processes and the tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

**Course Contents:**

**Unit 1**: Multivariable Calculus (Integration): (10 lectures)

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

**Unit 2**: First order ordinary differential equations: (6 lectures)

Exact, linear and Bernoulli’s equations, Euler’s equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for *x* and Clairaut’s type.

**Unit 3:** Ordinary differential equations of higher orders: (8 lectures)

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

**Unit 4**: Complex Variable – Differentiation: (8 lectures)

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm)

**Unit 5**: Complex Variable – Integration: (8 lectures)

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville’s theorem and Maximum-Modulus theorem (without proof); Taylor’s series, zeros of analytic functions, singularities, Laurent’s series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

**Course Learning Outcomes (CLOs):**

* + - CLO-1: Evaluation of areas and volumes, Center of mass and Gravity.
    - CLO-2: Solution of first order ordinary differential equations by various methods.
    - CLO-3: Solution of ordinary differential equations of higher orders.
    - CLO-4: Differentiation of Vector calculus.
    - CLO-5: Integration of Vector Calculus.

**Text books:**

* Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
* B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
* G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Edition, Pearson,

**Reference books:**

* Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,
* D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
* W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, Wiley India

**Online links for study & reference materials:**

<https://nptel.ac.in/courses/122/107/122107036/>

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1 - 04%

Assignment -2 - 04%

Assessment-3(Mid-Exam) - 20%

Assignment-3 - 04%

Assignment-4 - 04%

Assignment-5 - 04%

**Total Internal Assessment - 40%**

**Course Code:** ESC104 **Course Name:** Workshop/Manufacturing Practices

**Course Credit:** 5.5 **Total Contact Hours:** 40hr

**Course Objective:**

* To familiarize with the basic manufacturing processes and to study the various tools and equipment.
* They will get hands-on training is given in different sections. Essentially student should know the labour involved, machinery or equipment necessary.
* To analyze time required to fabricate and also should be able to estimate the cost of the product or job work.

**Course Description:**

* Ability to prepare simple objects using machines and machine tools to make students aware of fundamental operations of manufacturing an engineering component, enhance visualization and motivate them to innovate.

**Course Contents:**

**Module 1**

**Machine Shop:** To make a machined-component using lathe with mild steel round bar or hexagonal bar comprising of common turning operations with reference to drawing given in the manual. Any one of the following jobs Jobs: Hex Bolt, Axle for cycle wheel, Jig Bush, a typical turning specimen.

**Module II**

**Sheet metal Shop:**To make a sheet metal component with galvanized iron sheet as per the drawing provided in the manual having spot welding joint. Any one of the following jobs Jobs: Square tray, Scoop, Funnel.

Fitting Shop To make a joint using fitting tools with mild steel flats, round bars or square bars as per the drawing provided in the manual.

**Module III**

**Carpentry Shop:** To make a wooden joint with soft wood as per the drawing provided in the manual. Any one of the following jobs Jobs: T-Lap joint, Dove tail joint, Mortise & Tendon joint, Bridle joint.

**Module IV**

**Welding Shop- Arc Welding** To prepare a welding joint with mild steel flat using Manual Metal Arc welding machine according to the drawing provided in the manual. Any one of the following jobs Jobs: Lap joint, Butt joint, Fillet/Corner joint.

**Gas & Spot Welding** To observe the demonstration of making a Lap joint/Butt joint with mild steel sheet using oxyacetylene flame as per the drawing provided in the manual. To perform the spot welding operation on G.I. Sheet.

**Module V**

**Foundry Shop** Introduction to foundry process like melting of metals, mould making, casting process and use of patterns to prepare of a component and significance of foundry. Demo of mould preparation.

**Course Learning Outcomes (CLOs):**

Upon completion of this course, students will be able to achieve the following:

* Have Capability to identify hand tools and instruments for machining and other workshop practices.
* The students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

**Text books:**

* A course in Workshop Technology Vol I and Vol II by Prof. B.S. Raghuwanshi Dhanpat Rai & Co.(P) Ltd.
* Elements of Workshop Technology Vol I and Vol II by S.K. Hajara Choudhury, A.K. Hajara Choudhury & Nirjhar Roy; Media Promoters & Publishers Pvt. Ltd, Mumbai.

**Reference books:**

* Workshop Technology Part 1, Part2 & Part3 by W.A.J. Chapman; CBS Publishers & Distributors, New Delhi
* Kalpak Jian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
* Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I” Pearson Education, 2008.
* Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
* Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

**Online links for study & reference materials:**

<http://ecoursesonline.iasri.res.in/course/view.php?id=86>

**Assessment method:** (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1 - 05%

Assessment-2 - 05%

Assessment-3(Midexam) - 20%

Assessment-3 - 05%

Assessment-4 - 05%

**Total Internal Assessment - 40**

**Course Code:** ESC101 **Course Name:** Basic Electrical Engineering

**Course Credit:** 5hr **Total Contact Hour:** 42hr

**Course Objective:**

* To introduce concept of D.C. circuits and A.C. circuits.
* To make the students understand and working of machines, transformer and components used for low voltage installation.

**Course Description:**

* This course introduces the fundamental concepts of circuits, machines and low voltage installation.

**Course Contents:**

Unit 1: DC Circuits

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.

Unit 2: AC Circuits

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.

Unit 3: Transformers

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

Unit 4: Electrical Machines

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.

Unit 5: Power Converters

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

Unit 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.

**Course Learning Outcomes (CLOs):**

At the end of this course, students will demonstrate the ability

* CLO-1: Analyze basic electric and magnetic circuits.
* CLO- 2: working principles of electrical machines and power converters.
* CLO-3 :Understand the basic concept of components of low-voltage electrical

Installations.

**Text books:**

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

**Reference books:**

* L. S. Bobrow, “ Fundamentals of Electrical Engineering”, Oxford University Press.
* E. Hughes, “Electrical and Electronics Technology”, Pearson.
* V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India.

**Online links for study & reference materials:**

<https://nptel.ac.in/courses/108/108/108108076/>

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1 - 05%

Assignment -2 - 05%

Assessment-3(Mid-Exam) - 20%

Assignment-3/Quiz-1 - 05%

Assignment-4 - 05%

**Total Internal Assessment - 40%**

**Course Code:** AECCI **Course Name:** Environmental Science

**Course Credit Hour:** 2hr **Total Contact Hour:** 25

**Course Objective:**

* The Compulsory course on Environmental Science at Undergraduate level (AECCI) aims to train students to cater to the need for ecological citizenship through developing a strong foundation on the critical linkages between ecology-society-economy.

**Course Description:**

* Graduates will evolve into ecologically informed and socially responsible citizens who are empowered to protect the natural resources while ensuring sustainable lifestyle and developmental model.

**Course Contents:**

**Unit 1: Introduction to Environmental Studies**

* Multidisciplinary nature of environmental studies
* Scope and importance; Concept of sustainability and sustainable development

**Unit 2:** **Ecosystem**

* Definition and concept of Ecosystem

Structure of ecosystem (biotic and abiotic components); Functions of Ecosystem

Physical (energy flow), Biological (food chains, food web, ecological succession) and

Biogeochemical (nutrient cycling) processes. Concepts of productivity, ecological

pyramids and homeostasis

* Types of Ecosystem – Tundra, Forest, Grassland, Desert, Aquatic (ponds, streams, lakes, rivers, oceans, estuaries) – their importance and threats on them with relevant examples from India Ecosystem services (Provisioning, Regulating, Cultural and Supporting). Basics of Ecosystem restoration

**Unit 3:** **Natural Resources**

* Land resources and landuse change Land degradation, soil erosion and desertification
* Forest resources and causes of deforestation; impacts of mining and dam building on environment, forests, biodiversity and tribal populations
* Water resource: Use and over exploitation of surface and ground water, floods, drought conflicts over water (international & inter-state)
* Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs
* Case studies: National Solar Mission, Cauvery river water conflict etc

**Unit 4:** **Biodiversity and Conservation**

* Definition of Biodiversity; Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India
* India as a mega-biodiversity nation; Endemic and endangered species of India; IUCN Red list; biodiversity hotspots
* Value of biodiversity: Ecological, economic, social, ethical, aesthetic and informational value of biodiversity with examples; sacred groves and their importance with example
* Current mass extinction crisis; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasion with emphasis to Indian biodiversity
* Biodiversity conservation strategies: in-situ and ex-situ methods of conservation; Biosphere reserves; Keystone and Flagship species; Species reintroduction and translocation

**Unit 5:** **Environmental pollution**

* Environmental pollution (Air, water, soil, thermal and noise): causes, effects and controls; Air and water quality standards
* Nuclear hazards and human health risks
* Solid waste management: Control measures of urban and industrial waste
* Pollution case studies: Ganga Action plan (GAP), Delhi air pollution and public health issues etc

**Unit 6:** **Global Environmental Issues and Policies**

* Climate change, Global warming, Ozone layer depletion, Acid rain and impacts on human communities and agriculture
* International agreements: Earth Summit, UNFCCC, Montreal and Kyoto protocols and Convention on Biological Diversity (CBD)
* Sustainable Development Goals and India’s National Action Plan on ClimateChange Environment legislation in India: Wildlife Protection Act, 1972; Water (Prevention and Control of Pollution) Act, 1974; Forest (Conservation) Act 1980, Air (Prevention & Control of Pollution) Act, 1981; Environment Protection Act, 1986; Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006

**Unit 7:** **Human Communities and the Environment**

* Human population growth: Impacts on environment, human health and welfare
* Resettlement and rehabilitation of project affected persons; case studies
* Disaster management: floods, earthquake, cyclones and landslides
* Environmental movements: Chipko movement, Silent valley movement, Bishnois of Rajasthan, Narmada BachaoAndolan etc
* Environment justice: National Green Tribunal and its importance
* Environmental ethics: Role of Indian and other religions and cultures in environmental conservation
* Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi, Swachh Bharat Abhiyan)

**Field work/ Practicals**

* Field visit to any of the ecosystems found in Delhi like Delhi Ridge/ Sanjay lake/ Yamuna river and its floodplains etc. or any nearby lake or pond, explaining the theoretical aspects taught in the classroom
* Visit to any biodiversity park/ reserve forests/ protected area/ zoo/ nursery/ natural history museum in and around Delhi, explaining the theoretical aspects taught in the classroom
* Visit to a local polluted site (Urban/Rural/Industrial/Agricultural), Wastewater treatment plants
* Study of common plants, insects, birds and basic principles of identification
* Organize a seminar/ conference/ workshop/ panel discussion on relevant topics for enhancing awareness, capacity building and critical reasoning among students

**Course Learning Outcomes (CLOs):**

The course will empower the undergraduate students by helping them to:

* CLO-1 Gain in-depth knowledge on natural processes that sustain life, and govern economy.
* CLO-2: Predict the consequences of human actions on the web of life, global economyand quality of human life.
* CLO-3: Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.
* CLO-4: Acquire values and attitudes towards understanding complex environmental-economic social challenges, and participating actively in solving current environmental problems and preventing the future ones..
* CLO-5: Adopt sustainability as a practice in life, society and industry.

**Text books:**

* William P. Cunningham, Mary Ann Cunningham, Barbara Woodworth Saigo, Environmental Science: A global concern, McGrawHill 2003 ¬
* William Cunningham, Mary Cunningham, Principles of Environmental Science: Seventh Edition, Mc Graw Hill 2014 UGC DOCUMENT ON LOCF ENVIRONMENTAL SCIENCE 24
* Rogers PP, Jalal, KF, Boyd JA, An introduction to sustainable development, Earthscan

**Reference books:**

* Roosa SA, Sustainable Development Handbook, CRC Press 2008 ¬
* Atkinson G., Dietz S., Neumayer E., Agarwala M, Handbook of Sustainable Development, Edward Elger, 2014 ¬
* Robbins P., Hintz J., Moore S.A., Environment and Society: A critical introduction, Wiley Blackwel 2014

**Online links for study & reference materials:**

<https://www.hzu.edu.in/bed/E%20V%20S.pdf>

**Assessment method:** (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1 - 05%

Assignment -2 - 05%

Assessment-3(Mid-Exam) - 20%

Assignment-3/Quiz-1 - 05%

Assignment-4 - 05%

**Total Internal Assessment - 40%**

LAB EXPERIMENTS

SECOND SEMESTER

**Lab Code:** BSC101P **Lab Name:** Physics Lab

**Course Credit Hour:** 1.5hr **Total Contact Hour:** 03

**List of Experiments:**

* Four Probe Setup
* Stefan`s Law
* Diode Valve Characteristics
* Frequency of A.C Mains
* Band Gap in a Semi-Conductor Diode
* P-N Junction Diode Characteristics
* Zener Diode Characteristics
* Transistor Common-Base Configuration
* Transistor Common-Emitter Configuration

**Lab Code:** ESC102P **Lab Name:** Workshop/Manufacturing Practice

**Course Credit Hour:** 2hr **Total Contact Hour:** 04

**List of Experiments:**

* Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing Methods
* CNC machining, Additive manufacturing
* Fitting operations & power tools
* Electrical &Electronics
* Carpentry
* Plastic molding, glass cutting
* Metal casting
* Welding (arc welding & gas welding), brazing

**Lab Code:** ESC104P **Lab Name:** Electrical Engineering Lab

**Course Credit Hour:** 1hr **Total Contact Hour:** 02

**List of Experiments:**

* Basic safety precautions. Introduction and use of measuring instruments – poltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
* To verify KCL and KVL in D.C.circuit
* To verify Superposition theorem
* To Verify The venin’s Theorem
* To find resonance in series R-L-C circuit.
* Transformers: Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
* Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement).
* Torque Speed Characteristic of separately excited dc motor.
* Three-phase induction motors. Direction reversal by change of phase-sequence of connections.
* Demonstration of Components of LT switchgear.

|  |  |  |
| --- | --- | --- |
| Course Code | : | BTMR1701T |
| Course Title | : | Robotics |
| Number of Credits | : | 3 (L: 3; T: 0; P: 0) |
| Course Category | : | MT |

##### Course Objective:

* To acquire the knowledge on advanced algebraic tools for the description of motion.
* To develop the ability to analyze and design the motion for articulated systems.
* To develop an ability to use software tools for analysis and design of robotic systems.

##### Course Contents:

**Module I: Introduction:**

Definition, Classification of Robot – Industrial Robot & Service Robot, Anatomy, Spatial coordinates, Geometric configurations and work envelope, Machine intelligence, Criteria for robot selection, Safety standards for Industrial Robot, Economic justification, Robot Applications-Material handling, Machine loading and unloading, Assembly, Inspection, Welding, Spray painting, Medical Industry, Future of Robotics.

##### Module II: Robot Programming:

Introduction, On-line programming: Manual input, Lead through -programming, Teach pendant programming, Off-line programming language, Simulation, Introduction to ROS Concept

##### Module-III: Kinematics of Robotic Manipulators:

Introduction to manipulator kinematics, Homogeneous transformations and robot kinematics, Denavit- Hartenberg (D-H) representation, Concept of forward and inverse kinematics.

##### Module-IV: Control of Robot Manipulator:

Open and closed loop control system, Control system concepts, Linear control schemes, PID control system, Types of motion control, drives and control, Planning of trajectories, Human Robot Collaboration

##### Module V: Control Components and Sensors:

Mechanical control by stops and cams, Solenoids, Relays; Internal Sensors, potentiometers, resolvers and encoders; External sensing: Simple touch sensing, strain sensing, tactile sensing, acoustic sensing, magnetic sensing, capacitive sensing, laser sensing & machine vision

##### Text Books/References:

1. K.S Fu, R.C. Gonzalez, C.S.G. Lee, Robotics, McGraw Hill, 1987.
2. Y. Koren, Robotics for Engineers, McGraw Hill, 1985.
3. J.J. Craig, Robotics, Addison-Wesley, 1986.
4. Saeed B. Niku, “Introduction to Robotics – Analysis, Systems and Application” : PHI 2006.
5. Richard D, Klafter, Thomason A ChmielOwski, Michel Nagin “Robotics Engg-an Integrated Approach” PHI 2005.
6. R.K. Mittal & I.J. Nagrath, “Robotics & Control” TMH-2007.
7. Saha, S.K., “Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
8. Ghosal, A., “Robotics”, Oxford, New Delhi, 2006**.**

##### Alternative NPTEL/SWAYAM Course:

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No.** | **NPTEL Course Name** | **Instructor** | **Host Institute** |
| 1. | Robotics | Prof. Dilip Kumar Pratihar | IIT Kharagpur |
| 2. | Robotics | PROF. D.K. PRATIHAR | IIT Kharagpur |

**Course Outcomes:**

1. To Understand the basic knowledge on robotics.
2. To demonstrate the different type of robot programing & distinguish between them
3. To Design various types of linkage mechanism for obtaining specific motion and analyze them for optimal functioning.
4. To inspect the knowledge related to control techniques related to robot systems.
5. To Understand the knowledge of different types of sensor used in robot systems.

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| --- | --- | --- |
| Course Code | : | BTMR1702T |
| Course Title | : | Mechatronics System |
| Number of Credits | : | 3 (L: 2; T: 1; P: 0) |
| Course Category | : | MT |

**Course Objective:** This course aims at providing fundamental understanding about the elements of a mechatronics system, interfacing, and its practical applications.

##### Course Contents:

**Module I: Introduction:** Definition of Mechanical Systems, Philosophy and approach; Systems and Design: Mechatronic approach, Integrated Product Design, Modelling, Analysis and Simulation, Man-Machine Interface;

**Module II: Sensors and transducers:** classification, Development in Transducer technology, Opto-Electronics-Shaft encoders, CD Sensors, Vision System, etc.;

**Module III: Drives and Actuators:** Hydraulic and Pneumatic drives, Electrical Actuators such as servo motor and Stepper motor, Drive circuits, open and closed loop control; Embedded Systems: Hardware Structure, Software Design and Communication, Programmable Logic Devices, Automatic Control and Real Time Control Systems;

**Module IV: Replacement Programmable Logic Controllers:** Basic Structure, Types and Working Principle, Concept of Scan Cycle and Scan Time, IO’s and its Types, Selection Criteria and Applications

**Programming Techniques:** Ladder diagram –Concept of Contacts and Coil, Latching/ Holding Circuit, Memory Bits, Timers and Counter.

**Module V: Micro mechatronic systems:** Microsensors, Microactuators; Micro- fabrication techniques LIGA Process: Lithography, etching, Micro-joining etc. Application examples; Case studies Examples of Mechatronic Systems from Robotics Manufacturing, Machine Diagnostics, Road vehicles and Medical Technology.

##### Text Books/References:

1. Mechatronics System Design, Devdas Shetty & Richard A. Kolk, PWS Publishing Company (Thomson Learning Inc.).
2. Mechatronics: A Multidisciplinary Approach, William Bolton, Pearson Education.
3. A Textbook of Mechatronics, R.K.Rajput, S. Chand & Company Private Limited.
4. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Prentice Hall.

##### Alternative NPTEL/SWAYAM Course:

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| --- | --- | --- | --- |
| **S. No.** | **NPTEL Course Name** | **Instructor** | **Host Institute** |
| 1. | Mechatronics & Manufacturing Automation | Dr. Shrikrishna N. Joshi | IIT Guwahati |

**Course Outcomes:** Upon completion of this course, students will get an overview of mechatronics applications and the use of micro-sensors and microprocessors.

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| --- | --- | --- |
| Course Code | : | BTMR1703T |
| Course Title | : | Computer Aided Manufacturing |
| Number of Credits | : | 3 (L: 3; T: 0; P: 0) |
| Course Category | : | MT |

##### Course Objective:

1. To educate students by covering different aspects of computer Aided Manufacturing.
2. To create strong skills of writing CNC programs, PLC programs.
3. To educate students to understand different advances in manufacturing systems like: GT, CAPP and FMS.
4. To educate students by covering different integrated production management systems.

##### Course Content:

**Module I:** Fundamentals of Numerical Control, elements of NC machine tools, classification of NC machine tools, Advantages, suitability and limitations of NC machine tools, Application of NC system.

Definition and designation of control axes, Constructional details of Numerical Control Machine Tools, MCU structure and functions, Methods of improving accuracy and productivity using NC.

**Module II:** Computer Numerical Control (CNC): Features of CNC, Elements of CNC machines, the machine control Module for CNC, Direct Numerical Control(DNC) and Adaptive Controls.

System Devices: Drives, Feedback devices, counting devices, DAC and ADCs, Interpolator systems, Control loop circuit elements in PTP system, Contouring system, Incremental and absolute systems.

**Module III:** NC Part Programming- (a) Manual (word address format) programming Examples Drilling, Turning and Milling; canned cycles, Subroutine, and Macro.

Computer Assisted Part programming (APT) Geometry, Motion and Additional statements, Macro- statement.

**Module IV:** Computer Integrated manufacturing system, Group Technology, Flexible Manufacturing System, Computer aided process Planning-Retrieval and Generative System. Manufacturing Execution System; Overview, Components and Functionality, Relationship between MES and ERP, Benefits of MES.

**Module V:** Smart Manufacturing; Introduction to additive manufacturing, IoT, Smart Sensing, Smart Machines, Data Visualization and Analysis, Augmented Reality, Automated material handling & Cobots. Overview of 3D printing Technology, Materials used in 3D printing, Cyber-security for manufacturing.

##### Text Books/References:

1. Automation, Production System and Computer Integrated Manufacturing, by Mikell P. Grover, Prentice Hall of India Pvt Ltd.
2. CAD/CAM – Theory and Practice, by Ibrahim Zeid, McGraw Hill.
3. Computer Aided Manufacturing, by Cheng, Pearson India.
4. CAD/CAM: Principles and Operations, by P. N. Rao, McGraw Hill.
5. CAD/CAM: Computer Aided Design and Manufacturing, by M. Groover, Pearson India. CAD/CAM: Concepts and Applications by Alavala, PHI India.
6. Computer Aided Manufacturing, by Srinivas, Oxford University Press.

**Course Outcomes:** After learning the course:

1. To describe basic concepts of CAM application and understand CAM wheel.
2. To design CNC programs for manufacturing of different geometries on milling and lathe machines.
3. To illustrate logic diagrams for different applications of automation.
4. To classify different components using different techniques of group technology.
5. To develop process planning for different components.

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| --- | --- | --- |
| Course Code | : | MT-70X |
| Course Title | : | Professional Elective II |
| Number of Credits | : | 3 (L: 3; T: 0; P: 0) |
| Course Category | : | MT |

Any one course from following options can be opted under ‘Professional Elective II’:

* 1. Product Development (BTMR1702E(A))
  2. Rapid Prototyping (BTMR1801E(A))
  3. Machine Learning (BTMR1802E(A))

##### Refer Appendix I on Professional Electives.

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| --- | --- | --- |
| Course Code | : | BTMR1071S |
| Course Title | : | Robotics Lab |
| Number of Credits | : | 2 (L: 0; T: 0; P: 4) |
| Course Category | : | MT |

##### Course Objective:

1. To introduce different types of robotics and demonstrate them to identify different parts and components.
2. To write programming for simple operations.

##### List of Experiments:

1. Study the major equipment/Software/Components in Robotics Lab, e.g. Robotic Arm components, Arena etc.
2. Study components of a real robot and its DH parameters.
3. Integration of assorted sensors (IR, Potentiometer, strain gages etc.), micro controllers and ROS (Robot Operating System) in a robotic system

##### Exercise on any Robotic Simulation Software

1. Determination of maximum and minimum position of links.
2. Study Forward kinematics and validation.
3. Study Inverse kinematics o and validation.
4. Measure the knowledge of Robotic arm, material handling, Scorbase Software and Homing and Moving Robot
5. Recoding Robot positions (Absolute positions, Delete Positions, Save and load positions and Move the Robot to recorded positions.)
6. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system.
7. Robot Programming and Simulation using linear and nonlinear paths.
8. Writing and running Robot programs – Activity material handling operation.
9. Estimation of accuracy, repeatability and resolution.
10. Make a model using software to simulate the processing in small manufacturing cell.
11. Study and Simulate path planning and navigation in ROS.
12. Study the implementation of PID Control in ROS.

##### Text Books/References:

1. Saha, S.K., “Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
2. Richard D, Klafter, Thomason A ChmielOwski, Michel Nagin “Robotics Engg-an Integrated Approach” PHI 2005.
3. R.K. Mittal & I.J. Nagrath, “Robotics & Control” TMH-2007.

##### EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

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| --- | --- | --- |
| **S. No.** | **Experiment Name** | **Experiment Link(s)** |
| 1 | Study components of a real robot and its DH parameters. | [http://vlabs.iitkgp.ernet.in/mr/exp2](http://vlabs.iitkgp.ernet.in/mr/exp2/index.html)  [/index.html](http://vlabs.iitkgp.ernet.in/mr/exp2/index.html) |

**Course Outcomes:** Upon Completion of the course, the students will be able;

1. To assess kinematics & dynamic analysis of robot manipulators.
2. To understand the functionality and limitations of robot actuators.
3. To program a robot to perform a specified task in a target environment and solve problems in areas such as robot control and navigation.
4. To Understand how simulations of robots, where they can be useful and where they can break down.

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| --- | --- | --- |
| Course Code | : | BTMR1072S |
| Course Title | : | Computer Aided Manufacturing Lab |
| Number of Credits | : | 1 (L: 0; T: 0; P: 2) |
| Course Category | : | MT |

##### Course Objective:

1. Acquire fundamental understanding of the principles of CAD/CAM, including engineering drawing, geometric and surface and feature-based design.
2. Math behind geometry to understand CAD.
3. Applying CAD/CAM concept to product design and manufacturing.
4. Exposure to CAD/CAM software’s.
5. Exposure to machines at Imagineering lab.

##### List of Experiments:

1. Study of CNC VMC part programming fundamentals and writing part program.
2. Study and demonstration of CNC VMC.
3. Part Programming (in word address format) experiment for turning operation (including operations such as grooving and threading) and running on CNC machine.
4. Part Programming (in word address format or ATP) experiment for drilling operation (point to point) and running on CNC machine.
5. Part Programming (in word address format or ATP) experiment for milling operation (contouring) and running on CNC machine.
6. Experiment on difference between ordinary machine and NC machine, study or retrofitting.

##### Text Books/References:

1. Chang, T. C., Wysk, R. A., Wang, H. P, “Computer aided Manufacturing,” Prentice Hall, Third Ed.,
2. Nanua Singh, “Systems Approach to Computer Integrated Design and Manufacturing, “John Wiley and Sons Ltd, First Ed.

**Course Outcomes:** The student will be able:

* 1. To Understand engineering design concepts.
  2. To illustrate Product specification methods.
  3. To Construct 3D part models.
  4. To examine Geometric tolerance.
  5. To Understand process planning.
  6. To design Rapid Manufacturing.

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| Course Code | : | BTMR1073S |
| Course Title | : | Project Work I |
| Number of Credits | : | 2 (L: 0; T: 0; P: 4) |
| Course Category | : | MT |

The objective of Project Work-I is to enable the student to take up investigative study in the broad field of Mechatronics Engineering, either fully theoretical/practical or involving both. Theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment normally includes:

* Survey and study of published literature on the assigned topic;
* Working out a preliminary Approach to the Problem relating to the assigned topic;
* Conducting preliminary Analysis / Modeling / Simulation / Experiment / Design / Feasibility;
* Preparing a Written Report on the Study conducted for presentation to the Department;
* Final Seminar, as oral Presentation before a Departmental Committee.

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| --- | --- | --- |
| Course Code | : | BTMR1074S |
| Course Title | : | Mini Project or Internship. |
| Number of Credits | : | 1 |
| Course Category | : | MT |

##### Mini Project or Internship of 3 to 4 Weeks shall be performed during summer break after semester VI and this will be assessed as part of Semester VII.

During the summer vacations, after the 6th Semester, students are required to be involved in Inter/ Intra Institution Activities viz.; Training with higher Institutions; Soft skill training organized by Training and Placement Cell of the respective institution; contribution at incubation/ innovation /entrepreneurship cell of the Institution; participation in conferences/ workshops/ competitions etc.; Learning at Departmental Lab/ Tinkering Lab/ Institutional workshop; Working for consultancy/ research project within the institutes and Participation in all the activities of Institute’s Innovations Council for e.g.: IPR workshop/ Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

After completion of Mini-project or Internship the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period or while working on mini-project. The student may contact Industrial Supervisor/ Faculty Mentor/TPO for assigning special topics and problems and should prepare the final report on the assigned topics.

Student’s Diary and Internship Report should be submitted by the students along with an attendance record and an evolution sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. It will be evaluated on the basis of the following criteria:

* Regularity in maintenance of the diary.
* Adequacy & quality of information recorded.
* Drawing, sketches and data recorded.
* Thought process and recording techniques used.
* Organization of the information.