



**SCHEME OF INSTRUCTION AND SYLLABI (R-20)  
OF  
B.E. I & II SEMESTERS  
IN  
ARTIFICIAL INTELLIGENCE  
& MACHINE LEARNING  
(For the batch admitted in 2021-22)**



**CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY**

*(An Autonomous Institution)*

*Affiliated to Osmania University*

**Kokapet Village, Gandipet Mandal, Hyderabad– 500 075. Telangana**

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**CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY**  
**(AUTONOMOUS)**  
**DEPARTMENT OF CSE**  
**PROGRAMME: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**

**INSTITUTE VISION AND MISSION:**

**Vision:** To be a Centre of Excellence in Technical Education and Research

**Mission:** To address the emerging needs through quality technical education and advanced research

**DEPARTMENT VISION AND MISSION:**

**Vision:** To be in the frontiers of Computer Science and Engineering with academic excellence and Research

**Mission:** The mission of Computer Science and Engineering Department is to:

1. Educate students with the best practices of Computer Science by integrating the latest research into the curriculum
2. Develop professionals with sound knowledge in theory and practice of Computer Science and Engineering
3. Facilitate the development of academia-industry collaboration and societal outreach programs
4. Prepare students for full and ethical participation in a diverse society and encourage lifelong learning

**PROGRAM EDUCATION OBJECTIVES (PEOS):**

1. Graduate will practice their career in the areas of application software development, AI&ML, Data Analytics and Internet of Things.
2. Graduate will exhibit professional ethics and moral value with capability of working as an individual and as a team contributing towards the needs of industry and society.
3. Graduate will become a successful entrepreneur with innovative ideas and research contribution or pursue higher studies.

**PROGRAM SPECIFIC OUTCOMES (PSOS):** At the end of the program,

1. Able to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, cyber security, machine learning and networking for efficient design and automation of computer-based systems of varying complexity.
2. Able to apply standard and modern practices, technologies, automation and strategies in software project development using open-ended programming environments to deliver a quality product for business success.
3. Able to become a successful entrepreneur or pursue higher studies in the field of AI and Machine Learning, Cloud Computing, Robotic Automation, Cyber Security.

## **ABOUT THE DEPARTMENT:**

Department of CSE was established in the year 1985 with an intake of 20 students in UG program, gradually increased to 30 in 1991, 40 in 1993, 60 in 1994, 120 in 2000, 180 in 2013. Currently the department offers three UG programs BE (CSE), BE CSE (AI& ML), BE CSE (Internet of Things & Cyber Security including Block Chain Technology) with an intake of 300. M.Tech. CSE was started in the year 2002 with an intake of 18 and increased to 36 in 2011. The intellectual ambiance in CSE Department is conducive to the holistic development of the students.

BE-CSE program was first accredited by the NBA (AICTE) during 1998 with 'A' grade for 3 years, and further accredited during 2004, 2008, 2013 and 2017 consecutively. CSE department is a recognized Research center under Osmania University. CSE Faculty and students as part of their scholarly activities have published patents. Further both faculty and students have research publications in journals of international and national repute. In addition to the normal duties, faculty and Students continuously involve themselves in research and development activities. AICTE, UGC have funded research projects. Skill and Personality Development Centre and PRERANA centres are established with funds received through AICTE.

Department of CSE has centers of excellence in Internet of Things, Artificial Intelligence/Machine Learning, Cyber Security, Association for Artificial Intelligence in HealthCare. Department is also having MoU's with MSME, Robotic Process Automation, Kernel Sphere Technologies, Telangana State Council of Science and Technology and Data Security Council of India.

Department has committed well qualified and professionally active staff. Most of them are pursuing Ph.D. in the emerging areas like AI, ML, Cyber Security, Data Science, Data Mining and Block Chain.

Department is professionally active in conducting workshops and certifications with Microsoft, IBM, Oracle, SAP, Pega. Various activities are also conducted in collaboration with professional bodies like CSI, ISTE along with student branches of IEEE and CSI.

Department encourages the use of open source software and has vibrant technical clubs: CBIT Open Source (COSC) Club and CBIT Information Security Club (CISC). Through these clubs students have participated in various international and national Hackathons and bagged several prizes. Consecutively for the past three years CSE students have won first prize in Smart India Hackathon (SIH).

Students have participated in large numbers and won many worthy prizes in national and international coding competitions. They also presented papers in conferences and attended seminars, bootcamps and workshops.

CSE has maintained an excellent placement record by providing its students with ample opportunities to pursue their career goals. Leading companies that visited the campus for placements include Microsoft, JPMorgan, Accolite, NCR, Oracle, TCS, Infosys, Deloitte, D.E.Shaw, Sales Force, Service Now, Modak, etc., with CTC going well beyond 24 LPA. The number of students who are doing internship is gradually increasing year by year.

During 2017-18, 204 CSE students secured 287 job offers. In 2018-19, the offers increased to 291 for 214 students, further 311 job offers for 224 students during 2019-20. The salary trend in CSE has improved over the years with an average salary being 7.1 LPA. The highest salary offered in Placement 2020 is 41.6 LPA. Microsoft offered the highest CTC of 41.60 LPA. Six students have got their placement in Microsoft with the Super Dream Offer. From the batch of 211 students, 65 students secured multiple job offers out of which 23 students secured three offers.

## **ABOUT B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING PROGRAMME**

Every industry or human being is virtually impacted by Artificial Intelligence. It can be applied to every sector to enable new possibilities and efficiencies. AI is the main driver of emerging technologies like Big Data, robotic and IoT. AI technology is important because it enables human capabilities of understanding, reasoning, planning, communication and perception to be undertaken by software increasingly effective, efficient and at low cost. It can make the machines to do jobs that human does. Machine learning is an application of AI that enables the machines to learn and advance automatically from experience. The AI based applications can be found in various sectors. According to the Gartner prediction, the global AI software revenue is \$62.5 billion in 2022.

CBIT offers BE(AI & ML) programme covering the topics of Data Science, Machine Learning, Artificial Intelligence and Robotics, Data Engineering and Data Science apart from Computer and other core fundamentals of Engineering programs. As per Government of India Vision document, plan to deploy AI in retail, transport, utilities, education and Public Health etc.. Students shall look forward to a wide variety of careers after graduating from our BE programme in AI & ML.

### **Career Prospect :**

- Big Data Engineer
- Machine Learning Engineer
- Data Engineer / Architect
- Business Intelligence Developer
- Data Scientist
- Research Scientist
- AI Data Analyst
- Product Manager
- AI Engineer
- .....



# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

## Scheme of Instructions of I Semester of B.E.-Artificial Intelligence & Machine Learning as per AICTE Model Curriculum 2021-22

### SEMESTER – I

S. No	CourseCode	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
<b>THEORY</b>									
1	20MT C01	Linear Algebra & Calculus	3	-	-	3	40	60	3
2	20EG C01	English	2	-	-	3	40	60	2
3	20PY C01	Optics and Semiconductor Physics	3	-	-	3	40	60	3
4	20CS C01	Programming for Problem Solving	3	-	-	3	40	60	3
<b>PRACTICAL</b>									
5	20MT C02	Linear Algebra & Calculus Lab	-	-	2	3	50	50	1
6	20EG C02	English lab	-	-	2	3	50	50	1
7	20PY C03	Optics and Semiconductor Physics Lab	-	-	4	3	50	50	2
8	20CS C02	Programming for problem Solving Lab	-	-	4	3	50	50	2
9	20ME C01	CAD AND DRAFTING	-	1	3	3	50	50	2.5
10	20MB C02	Community Engagement	30 field + 2P/W			-	50	-	1.5
<b>TOTAL</b>			<b>11</b>	<b>1</b>	<b>15</b>	<b>-</b>	<b>460</b>	<b>490</b>	<b>21</b>

**L: Lecture**

**T: Tutorial**

**P: Practical**

**CIE - Continuous Internal Evaluation**

**SEE - Semester End Examination**

## 20MT C01

### LINEAR ALGEBRA & CALCULUS

(CSE, IT, AI&ML, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block Chain Technology))

Instruction	3 L Hours per week
Duration of SEE	3Hours
SEE	60Marks
CIE	40Marks
Credits	3

**Course Objectives:** The objectives of the course is to make the student

1. To explain the solutions of system of linear equations by Matrix Methods.
2. To discuss the convergence and divergence of the Series.
3. To explain the Partial Derivatives and the extreme values of functions of two variables
4. To discuss Physical interpretations on Scalars and vector functions
5. To discuss vector line, surface and volume integrals.

**Course Outcomes:** Upon completing this course, students will be able to:

1. Apply the Matrix Methods to solve the system of linear equations
2. Test the convergence and divergence of the infinite Series.
3. Determine the extreme values of functions of two variables.
4. Apply the vector differential operator to scalar and vector functions
5. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.

#### UNIT-I

**Matrices:** Rank of a matrix, Echelon form, consistency of linear System of equations, Linear dependence of vectors, Eigen values, Eigenvectors, Properties of Eigen values, Cayley-Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

#### UNIT-II

**Infinite Series:** Definition of Convergence of sequence and series. Series of positive terms – Necessary condition for convergence, Comparison tests, limit form comparison test, D'Alembert's Ratio test, Raabe's test, Cauchy's root test, alternating series, Leibnitz's rule, absolutely and conditionally convergence.

#### UNIT-III

**Partial Differentiation and Its Applications :** Functions of two or more variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions, Jacobians, Taylor's expansion of functions of two variables, Maxima and minima of functions of two variables.

#### UNIT-IV

**Vector Differential Calculus:** Scalar and vector point functions, vector operator Del, Gradient, Directional derivative, Divergence, Curl, Del applied twice to point functions, Del applied to product of point functions (vector identities). Applications: Irrotational fields and Solenoidal fields.

#### UNIT-V

**Vector Integral Calculus:** Line integral, Surface integral and Volume integral. Green's theorem in the plane, verifications of Stroke's theorem (without proof) and Gauss's divergence theorem (without proof).

#### Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44<sup>th</sup> Edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010

**Suggested Reading:**

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw- Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

**20 EG C01**

**ENGLISH**  
**(Common to all branches)**

Instruction	2 Hours per week
Duration of SEE	3Hours
SEE	60Marks
CIE	40Marks
Credits	2

**Course Objectives:** This course will introduce the students:

1. To the role and importance of communication while developing their basic communicationskills in English.
2. To basics of writing coherent paragraphs and formal emails.
3. To techniques of writing a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. To description, definition and classification of processes while enabling them to draft formalreports following a proper structure.
5. To gaining adequate reading comprehension techniques.

**Course Outcomes:** After successful completion of the course the students will be able to:

1. Illustrate the nature, process and types of communication and communicate effectively withoutbarriers.
2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
3. Apply techniques of precision to write a précis and formal letters by using acceptable grammarand appropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by draftingformal reports.
5. Critique passages by applying effective reading techniques

**UNIT-I Understanding Communication in English:**

Introduction, nature and importance of communication; Process of communication; Types of communication - verbal and non-verbal; Barriers to communication; Intrapersonal and interpersonal communication; Understanding Johari Window.

Vocabulary & Grammar: The concept of Word Formation; Use of appropriate prepositions and articles.

**UNIT-II Developing Writing Skills I:**

Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.

Vocabulary & Grammar: Use of cohesive devices and correct punctuation.

**UNIT-III Developing Writing Skills II:**

Précis Writing; Techniques of writing precisely. Letter Writing – Structure, format of a formal letter;Letter of request and the response

Vocabulary and Grammar: Subject-verb agreement.

Use of prefixes and suffixes to form derivatives. Avoiding redundancies.

**UNIT-IV Developing Writing Skills III:**

Report writing – Importance, structure, elements of style of formal reports; Writing a formal report. Vocabulary and Grammar: Avoiding ambiguity - Misplaced modifiers. Use of synonyms andantonyms.



**UNIT-V Developing Reading Skills:**

The reading process, purpose, different kinds of texts; Reading comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.

Vocabulary and Grammar: Words often confused; Use of standard abbreviations.

**Text Books:**

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael, Practical English Usage.OUP. 1995.

**Suggested Readings:**

1. Wood F.T, Remedial English Grammar,Macmillan,2007
2. Zinsser William, On Writing Well, Harper Resource Book, 2001
3. Sanjay Kumar and PushpLata, Communication Skills. Oxford University Press, 2011.

20PY C01

**OPTICS AND SEMICONDUCTOR PHYSICS**

(CSE, IT, AI&ML, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block Chain Technology))

Instruction	3L/week
Duration of SEE	3Hours
SEE	60Marks
CIE	40Marks
Credits	3

**Course Objectives:** The objectives of the course is to make the student

1. Understand the fundamentals of wave nature of light
2. Acquire knowledge of lasers, holography and fiber optics
3. Familiarize with quantum mechanics
4. Learn the fundamental concepts of solids

**Course Outcomes:** At the end of the course, the student will be able to

1. Demonstrate the physical properties of light.
2. Explain characteristic properties of lasers and fiber optics
3. Find the applications of quantum mechanics
4. Classify the solids depending upon electrical conductivity
5. Identify different types of semiconductors

**UNIT-I**

**Wave Optics:** Huygens' principle –Superposition of waves –Interference of light by wave front splitting and amplitude splitting–Fresnel's biprism – Interference in thin films in reflected light–Newton's rings–Fraunhofer diffraction from a single slit –Double slit diffraction – Rayleigh criterion for limit of resolution– Concept of N-slits–Diffraction grating and its resolving power.

**UNIT-II**

**Lasers & Holography:** Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion –Different types of lasers: solid-state lasers: Ruby & Nd:YAG; gas lasers: He-Ne & CO<sub>2</sub>; semiconductor laser –Applications of lasers in engineering and medicine. Holography: Principle – Recording and reconstruction–Applications. Fiber Optics: Introduction –Construction –Principle –Propagation of light through an optical fiber – Numerical aperture and acceptance angle –Step-index and graded-index fibers –Pulse dispersion –Fiber losses–Fiber optic communication system –Applications.

**UNIT-III**

**Principles of Quantum Mechanics:** Introduction –Wave nature of particles – de-Broglie hypothesis – Physical significance of  $\psi$  –Time-dependent and time-independent Schrodinger equations – Born interpretation – Probability current –Wave packets –Uncertainty principle – Particle in infinite square well potential –Scattering from potential step – Potential barrier and tunneling.

**UNIT-IV**

**Band Theory of Solids:** Salient features of free electron theory of metals (Classical and Quantum) – Fermi level –Density of states – Bloch's theorem for particles in a periodic potential – Kronig-Penney model – Classification of solids: metals, semiconductors and insulators.

**UNIT-V**

**Semiconductors:** Intrinsic and extrinsic semiconductors –Charge carrier concentration in intrinsic semiconductors –Dependence of Fermi level on carrier concentration and temperature in extrinsic semiconductors (qualitative) –Carrier generation and recombination –Carrier

transport: diffusion and drift – P-N junction – Thermistor – Hall effect – LED –Solar cell.

**Text Books:**

1. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, A Text Book of Engineering Physics, S. Chand Publications, 2014.
3. M. Arumugam, Materials Science, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, Modern Engineering Physics, Dhanpat Rai Publications, 2011.

**Suggested Reading:**

1. R. Murugesan and Kiruthiga Sivaprasath, Modern Physics, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, Engineering Physics, McGraw-Hill Education Publications, 2013.
3. P.K. Palanisamy, Engineering Physics, Scitech Publications, 2012.
4. V. Raghavan, Materials Science and Engineering, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

## 20CS C01

### PROGRAMMING FOR PROBLEM SOLVING (Common to all Programs)

Instruction	3 Periods per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

**Course Objectives:** The objectives of this course are

1. Identification of computer components, Operating environments, IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
4. Develop intuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

**Course Outcomes:** On Successful completion of the course, students will be able to

1. Identify and understand the computing environments for scientific and mathematical problems.
2. Formulate solutions to problems with alternate approaches and represent them using algorithms /Flowcharts.
3. Choose data types and control structures to solve mathematical and scientific problem.
4. Decompose a problem into modules and use functions to implement the modules.
5. Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems.
6. Develop applications using file I/O.

#### UNIT -I

**Introduction to computers and Problem Solving:** Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.

**Introduction to programming:** Programming languages and generations, categorization of high-level languages.

**Introduction to C:** Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence, and associativity.

#### UNIT – II

**Introduction to decision control statements:** Selective, looping, and nested statements.

**Functions:** Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes, Case study using functions and control statements.

#### UNIT – III

**Arrays:** Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting (Selection and Bubble) algorithms, 2-D arrays, matrix operations.

**Strings:** Introduction, strings representation, string operations with examples. Case study using arrays.

#### UNIT – IV

**Pointers:** Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, dynamic memory allocation, advantages, and drawbacks of pointers.

**Structures:** Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self-referential structures, unions, and enumerated data types.

## **UNIT-V**

**Files:** Introduction to files, file operations, reading data from files, writing data to files, error handling during file operations.

**Preprocessor Directives:** Types of preprocessor directives, examples.

### **Text Books:**

1. M.T. Somashekar “Problem Solving with C”, 2nd Edition, Prentice Hall India Learning Private Limited 2018
2. AK Sharma, “Computer Fundamentals and Programming”, 2nd Edition, University Press, 2018
3. Pradeep Dey and Manas Ghosh, “Programming in C”, Oxford Press, 2nd Edition, 2017

### **Suggested Reading:**

1. Byron Gottfried, Schaum’s Outline of Programming with C”, Mc Graw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Reema Tharaja “Introduction to C Programming”, Second Edition, OXFORD Press, 2015.

### **Online Resources:**

1. <https://www.tutorialspoint.com/cprogramming/index.htm>.
2. <https://onlinecourses.nptel.ac.in/noc18-cs10/preview>

**20MT C02**

**LINEAR ALGEBRA & CALCULUS LAB**

**(CSE, IT, AI&ML, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block Chain Technology))**

Instruction	2 P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

**Course Objectives:** The objectives of this course are

1. To explain basic operations of matrix algebra.
2. To discuss the behaviour of the infinite Series.
3. To discuss the maxima and minima of the functions of two variables
4. To discuss Physical interpretations on Scalars and vector functions.
5. To explain vector line, surface and volume integrals.

**Course Outcomes:** Upon completing this course, students will be able to:

1. Apply the Matrix operations in executing various programmes.
2. Test the convergence and divergence of the infinite Series.
3. Explore the extreme values of functions of two variables.
4. Determine the gradient, divergent and curl of scalar and vector point functions.
5. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems

**LIST OF EXPERIMENTS:**

1. Addition and multiplication of higher order matrices.
2. Determinant and Inverse of the matrices
3. Eigen values and Eigenvectors of Matrix.
4. Nature of quadratic form of Matrix.
5. Solution of system of linear equations.
6. Data plotting (2D,3D)
7. Test the convergence of infinite series
8. Examine the extreme values of given function
9. Examine the rotational, irrotational and divergence of the flows
10. Verify inter connection between vector theorems (Green's, Gauss and Stoke's Theorems)

**Text Books / Suggested Reading / Online Resources:**

1. [https://www.scilab.org/sites/default/files/Scilab\\_beginners\\_0.pdf](https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf)
2. <https://www.scilab.org/tutorials>
3. <https://nptel.ac.in/courses/106102064/>
4. <https://www.udemy.com/algorithms-and-data-structures-in-python/>

**20EG C02**

**ENGLISH LAB  
(Common to all branches)**

Instruction	2 Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	1

**Course Objectives:** This course will introduce the students:

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To IELTS and TOEFL material for honing their listening skills.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behaviour while developing their ability to discuss in groups and making oral presentations.

**Course Outcomes:** After successful completion of the course the students will be able to:

1. Define the speech sounds in English and understand the nuances of pronunciation in English
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
4. Determine the context and speak appropriately in various situations.
5. Design and present effective posters while working in teams, and discuss and participate in Group discussions.

**Exercises**

1. **Introduction to English Phonetics:** Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English:** Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs. The syllable: types of syllables, consonant clusters.
3. **Word stress:** Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm & Intonation:** Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – Practice with IELTS and TOEFL material
6. **Public speaking** – Speaking with confidence and clarity in different contexts on various issues.
7. **Group Discussions** - Dynamics of a group discussion, group discussion techniques, body language.
8. **Pictionary** – weaving an imaginative story around a given picture.
9. **Information Gap Activity** – Writing a brief report on a newspaper headline by building on the hints given
10. **Poster presentation** – Theme, poster preparation, team work and presentation.

**Suggested Reading**

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt. Ltd., 2011
4. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016

**20PY C03**

**OPTICS AND SEMICONDUCTOR PHYSICS LAB**

**(CSE, IT, AI&ML, CSE (AI&ML), AI&DS, CSE (IoT & Cyber Security including Block chain Technology))**

Instruction	4 Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	2

**Course Objectives:** The objectives of the course is to make the student

1. Apply theoretical physics knowledge in doing experiments
2. Understand the behaviour of the light experimentally
3. Analyze the conduction behaviour of semiconductor materials and optoelectronic devices

**Course Outcomes:** At the end of the course, the student will be able to

1. Interpret the errors in the results of an experiment.
2. Demonstrate physical properties of light experimentally
3. Make use of lasers and optical fibers for engineering applications
4. Explain the V-I characteristics of some optoelectronic and semiconductor devices
5. Find the applications thermistor

**Experiments**

- |                            |   |
|----------------------------|---|
|                            | Estimation of errors in the determination of time period of a   |
| 1. Error Analysis          | : torsional pendulum  |
| 2. Fresnel's Biprism       | : Determination of wavelength of given monochromatic source   |
| 3. Newton's Rings          | : Determination of wavelength of given monochromatic source   |
| 4. Single Slit Diffraction | : Determination of wavelength of given monochromatic source<br>Determination of wavelengths of two yellow lines of light of |
| 5. Diffraction Grating     | : mercury lamp  |
| 6. Laser                   | : Determination of wavelength of given semiconductor laser  |
| 7. Holography              | : Recording and reconstruction of a hologram  |
| 8. Optical Fiber           | : Determination of numerical aperture and power losses of given optical fiber   |
| 9. Energy Gap              | : Determination of energy gap of given semiconductor<br>Study of V-I characteristics and calculation of resistance of given |
| 10. P-N Junction Diode     | : diode in forward bias and reverse bias  |
| 11. Thermistor             | : Determination of temperature coefficient of resistance of given thermistor  |
| 12. Hall Effect            | : Determination of Hall coefficient, carrier concentration and mobility of charge carriers of given semiconductor specimen  |
| 13. LED                    | : Study of I-V characteristics of given LED<br>Study of I-V characteristics of given solar cell and calculation of          |
| 14. Solar Cell             | : fill factor, efficiency and series resistance   |
| 15. Planck's Constant      | : Determination of Planck's constant using photo cell   |

**NOTE: A minimum of TWELVE experiments should be conducted**



## 20CS C02

### PROGRAMMING FOR PROBLEM SOLVING LAB (Common to All Programs)

Instruction	4 Periods per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2

**Course Objectives:** The objectives of this course are

1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

**Course Outcomes:** On Successful completion of the course, students will be able to

1. Identify and setup program development environment.
2. Design and test programs to solve mathematical and scientific problems.
3. Identify and rectify the syntax errors and debug program for semantic errors
4. Implement modular programs using functions.
5. Represent data in arrays, pointers, structures and manipulate them through a program.
6. Create, read, and write to and from simple text files.

#### Lab experiments

1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling:

#### Text Books:

1. Pradeep Dey and Manas Ghosh, "Programming in C", Oxford Press, 2<sup>nd</sup> Edition, 2017.
2. Reema Tharaja "Introduction to C Programming", Second Edition, OXFORD Press, 2015.

#### Online Resources:

1. <https://www.tutorialspoint.com/cprogramming/index.htm>
2. <https://www.w3resource.com/c-programming/programming-in-c.php>
3. <https://www.w3schools.in/c-tutorial/>

## 20ME C01

### CAD AND DRAFTING

Instruction	1 T + 3 D Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

**Course Objectives:** The objectives of this course are

1. To get exposure to a cad package and its utility.
2. Understanding orthographic projections.
3. To visualize different solids and their sections in orthographic projection
4. To prepare the student to communicate effectively by using isometric projection.
5. To prepare the student to use the techniques, skills, and modern tools necessary for practice.

**Course Outcomes:** At the end of the course, the Students are able to

1. Become conversant with appropriate use of CAD software for drafting.
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting.
3. Construct the projections of points, lines, planes, solids
4. Analyse the internal details of solids through sectional views
5. Create an isometric projections and views

#### List of Exercises:

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
2. Construction of Conic Sections by General method
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. Conversion of isometric views to orthographic projections and vice versa.

#### Text Books:

1. N.D. Bhatt, "Elementary Engineering Drawing", Charotar Publishers, 2012.
2. K.Venugopal, "Engineering Drawing and Graphics + AutoCAD", New Age International Pvt. Ltd, 2011.
3. Basanth Agrawal and C M Agrawal, "Engineering Drawing", 2/e, Mc Graw-Hill Education (India) Pvt. Ltd.

#### Suggested Reading:

1. Shaw M.B and Rana B.C., "Engineering Drawing", 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kanniah, "Text Book of Engineering Drawing", Scitech Publications, 2011.

**20MBC02**

**COMMUNITY ENGAGEMENT**

Instruction	3 Hours per week (30 hours field work & 2 hours per week)
SEE	Nil
CIE	50 Marks
Credits	1.5 Credits

**Course Objectives:** The main Objectives of this Course are to:

1. Develop an appreciation of Rural culture, life-style and wisdom among the Students.
2. Learn about the various livelihood activities that contribute to Rural economy.
3. Familiarize the Rural Institutions and the Rural Development Programmes in India.

**Course Outcomes:** After the completion of this Course, Student will be able to:

1. Gain an understanding of Rural life, Culture and Social realities.
2. Develop a sense of empathy and bonds of mutuality with Local Communities.
3. Appreciate significant contributions of Local communities to Indian Society and Economy.
4. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
5. Utilise the opportunities provided by Rural Development Programmes.

**Module I Appreciation of Rural Society**

Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources, elaboration of 'soul of India lies in villages' (Gandhi), Rural Infrastructure.

**Module II Understanding Rural Economy and Livelihood**

Agriculture, Farming, Landownership, Water management, Animal Husbandry, Non-farm Livelihood and Artisans, Rural Entrepreneurs, Rural markets, Rural Credit Societies, Farmer Production Organization/Company.

**Module III Rural Institutions**

Traditional Rural organizations, Self-Help Groups, Panchayati Raj Institutions (Gram Sabha), Gram Panchayat, Standing Committees, Local Civil Society, Local Administration.

**Module IV Rural Development Programmes**

History of Rural Development in India, Current National Programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman, Bharat, Swachh Bharat, PM Awas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA etc.

**Text Books:**

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015, un.org/sdgs
4. M.P Boraia, Best Practices in Rural Development, Shanlax Publishers, 2016.

**Journals:**

1. Journal of Rural development (published by NIRD & PR, Hyderabad).
2. Indian Journal of Social Work, (by TISS, Bombay).
3. Indian Journal of Extension Educations (by Indian Society of Extension Education).
4. Journal of Extension Education (by Extension Education Society).
5. Kurukshetra (Ministry of Rural Development, GOI).
6. Yojana (Ministry of Information & Broadcasting, GOI).



# CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

## Scheme of Instructions of I Semester of B.E.-Artificial Intelligence & Machine Learning as per AICTE Model Curriculum 2021-22

### SEMESTER – II

S. No	CourseCode	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
<b>THEORY</b>									
1	20MT C03	Differential Equations & Transform Theory	3	-	-	3	40	60	3
2	20CY C01	Chemistry	3	-	-	3	40	60	3
3	20CS C05	Industry 4.0	3	-	-	3	40	60	3
4	20CS C03	Object Oriented Programming	3	-	-	3	40	60	3
<b>PRACTICAL</b>									
5	20MT C04	Differential Equations & Transform Theory Lab	-	-	2	3	50	50	1
6	20CY C02	Chemistry Lab	-	-	4	3	50	50	2
7	20CS C04	Object Oriented Programming Lab	-	-	2	3	50	50	1
8	20ME C02	Workshop / Manufacturing Practice	-	-	5	3	50	50	2.5
9	20ME C03	Engineering Exploration	90 Hours / 4P			-	50	-	1.5
<b>TOTAL</b>			<b>12</b>	<b>-</b>	<b>13</b>	<b>-</b>	<b>410</b>	<b>440</b>	<b>20</b>

**L: Lecture**

**T: Tutorial**

**P: Practical**

**CIE - Continuous Internal Evaluation**

**SEE - Semester End Examination**

**20MT C03**

**DIFFERENTIAL EQUATIONS & TRANSFORM THEORY**

**(CSE, IT, AI&ML, CSE (AI&ML), AI&DS, CSE (IOT & Cyber Security including Block Chain Technology))**

Instruction	3 L per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

**Course Objectives:** The objectives of this course are

1. To explain the relevant methods to solve first order differential equations.
2. To explain the relevant methods to solve higher order differential equations.
3. To discuss the properties of Legendre's Polynomials and Bessel's functions
4. To explain the Z-Transform and Inverse Z-Transforms.
5. To discuss Fourier transform for solving engineering problems.

**Course Outcomes:** Upon completing this course, students will be able to:

1. Calculate the solutions of first order linear differential equations.
2. Calculate the solutions of higher order linear differential equations.
3. Examine the series solutions for higher order differential equations.
4. Evaluate the Improper integrals by Fourier Transform.
5. Solve the difference equations by Z-transforms.

**UNIT - I**

**Differential Equations of First Order:** Exact Differential Equations, Equations Reducible To Exact Equations, Linear Equations, Bernoulli's Equations, Riccati's and Clairaut's Equations, Orthogonal trajectories.

**UNIT-II**

**Higher Order Linear Differential Equations:** Solutions of higher order linear equations with constants coefficients, Method of variation of parameters, solution of Cauchy's homogeneous linear equation. applications: LR and LCR circuits.

**UNIT-III**

**Series Solutions of Differential Equations:** Ordinary point, singular point and regular singular point, Series solution when  $x=a$  is an ordinary point of the equation. Legendre's equation, Legendre's Polynomial of first kind (without proof), Rodrigue's formula, orthogonality of Legendre polynomials. Bessel's equation, Bessel's function of the first kind of order  $n$  (without proof), recurrence formulae for  $J_n(x)$  and related problems (i.e.  $J_0(x)$ ,  $J_1(x)$ ,  $J_{1/2}(x)$ ,  $J_{-1/2}(x)$ ,  $J_{3/2}(x)$ ,  $J_{-3/2}(x)$ ).

**UNIT-IV**

**Fourier Transforms:** Fourier integral theorem (statement), Complex form of Fourier integrals. Fourier transforms, Inverse Fourier Transforms, Fourier Sine and Cosine transforms, Inverse Fourier Sine and Cosine Transforms. Properties of Fourier transforms: Linear property, change of scale property, shifting property and Modulation theorem.

**UNIT-V**

**Z-Transforms:** Definition, some standard Z-transforms, linearity property, damping rule, shifting  $U_n$  to the right, shifting  $U_n$  to the left, multiplication by 'n', initial and final value theorems. Inverse Z-Transform: evaluation of Inverse Z-transform by Convolution theorem, partial fractions method. Z- Transform application to difference equations.

**Text Books:**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9<sup>th</sup> Edition, John Wiley & Sons, 2006.
3. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5<sup>th</sup> edition, 2016.

**Suggested Reading:**

1. N.P.Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11<sup>th</sup> Reprint, 2010.
3. A.R. Vasishtha, and R.K.Guptha Integral transforms, Krishna Prakashan Media, Reprint, 2016

## 20CY C01

### CHEMISTRY (Common to all branches)

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

**Course Objectives:** The objectives of this course are

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

**Course Outcomes:** At the end of the course student will be able to:

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

#### UNIT-I Atomic and molecular structure and Chemical Kinetics:

**Atomic and molecular structure:** Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions ( $H_2$ ,  $He^+$ ,  $N_2$ ,  $O_2$ ,  $O_2^-$ ,  $CO$ ,  $NO$ ).  $\pi$ -molecular orbitals of benzene and its aromaticity.

**Chemical Kinetics:** Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction-Characteristics: units of first order rate constant & its half-life period, second order reaction- Characteristics: units of second order rate constant & its half- life period. Numericals.

#### UNIT-II Use of free energy in chemical equilibria

Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials, electrode potentials, – Reference electrodes (NHE, SCE)- electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations. Numericals.

**Battery technology:** Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO<sub>2</sub> and Li-ion batteries. Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages.

Construction, working & applications of methanol-oxygen fuel cell.

#### UNIT- III Stereochemistry and Organic reactions

**Stereochemistry:** Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – confirmations of n-butane (Newman and sawhorse representations), Configurational isomerism - Geometrical (cis-trans) isomerism & Optical isomerism- optical activity,

Symmetry and chirality: Enantiomers (lactic acid) & Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.

**Types of Organic reactions:** Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (SN1& SN2); Free Radical Substitution (Halogenation of Alkanes)

Addition Reactions: Electrophilic Addition – Markonikoff’s rule, Free radical Addition - Anti Markonikoff’s rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds)

Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides) Cyclization (Diels - Alder reaction)

#### **UNIT-IV Water Chemistry:**

Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process), ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

#### **UNIT-V Engineering Materials and Drugs:**

Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) & Thermosetting polymers (Bakelite); Elastomers (Natural rubber). Conducting polymers- Definition, classification and applications.

**Polymers for Electronics:** Polymer resists for integrated circuit fabrication, lithography and photolithography.

Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (only Principle).

Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

#### **Text Books:**

1. P.C. Jain and M. Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company Ltd., New Delhi, 16th edition (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, “Selected topics in Inorganic Chemistry”, S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, “Organic Chemistry”, Pearson, Delhi, 7<sup>th</sup> edition (2019).
4. A Textbook of Polymer Science and Technology, Shashi Chawla, Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, “Drugs”, Universities Press (India) Limited, Hyderabad (2007).

#### **Suggested Readings:**

1. B. H. Mahan, “University Chemistry”, Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, “Principles of Physical Chemistry”, S. Nagin Chand & Company Ltd., 46th edition (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, “Organic Chemistry”, Wiley, 12th edition (2017).
4. P.W. Atkins, J.D. Paula, “Physical Chemistry”, Oxford, 8th edition (2006).



## 20CS C05

### INDUSTRY 4.0

Instruction	3 Hours per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40Marks
Credits	3

**Prerequisite:** Nil. No prior technical background is required

**Course Objectives:** The main objectives of this course are to:

1. Offer the students an introduction to Industry 4.0 and its applications to in the business world
2. Give deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges

**Course Outcomes:** On successful completion of this course, students will be able to:

1. Identify the key drivers and enablers of Industry 4.0
2. Describe the smartness in smart factories, smart cities, smart products, ad smart services
3. Determine various systems used in manufacturing plants, and their role in an Industry 4.0 world
4. Illustrate the power of Cloud Computing in a networked economy
5. Understand the opportunities, challenges, brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits

#### UNIT-1

**Introduction to Industry 4.0:** Various Industrial revolutions, Digitalization and the networked economy, drivers, enablers, compelling forces and challenges for Industry 4.0, Mega trends, Tipping points, comparison of Industry 4.0 Factory and Today's Factory, trends of industrial Big Data and predictive analytics for business transformation

#### UNIT-2

**Road to Industry 4.0:** Internet of Things (IoT) and Industrial Internet of Things(IoT) and Internet of Services, smart manufacturing, smart devices and products, smart logistics, smart cities, predictive analytics

#### UNIT-3

**Related disciplines, systems, technologies for enabling Industry 4.0:** Cyber physical systems, robotic automation and collaborative robots, support system for Industry 4.0, mobile computing, related disciplines, Cyber security, Augmented Reality and Virtual Reality, Artificial Intelligence

#### UNIT-4

**Role of data, information, knowledge and collaboration:** Resource-based view of a firm, data as a new resource for organizations, harnessing and sharing knowledge in organizations, cloud computing basics, cloud computing and Industry 4.0

#### UNIT-5

**Other Applications and Case Studies:** Industry 4.0 laboratories, IIoT case studies, Opportunities and challenges, future of works and skills for workers in the Industry 4.0 era, strategies for competing in an Industry world

#### Text Book:

1. Klaus Schwab. The Fourth Industrial Revolution. 2017. Portfolio Penguin.
2. Pranjali Sharma. India Automated: How the Fourth Industrial Revolution is Transforming India. 2019. Macmillan; 1edition
3. [https://swayam.gov.in/nd1\\_noc20\\_cs69/preview](https://swayam.gov.in/nd1_noc20_cs69/preview)

**Suggested Reading:**

1. Bruno S. Sergi, Elena G. Popkova, Aleksei V. Bogoviz, Tatiana N. Litvinova. Understanding Industry 4.0: AI, the Internet of Things, and the Future of Work. 2019. Emerald Publishing Limited. ISBN: 9781789733129
2. Dominik T. Matt, Vladimír Modrák, Helmut Zsifkovits. Industry 4.0 for SMEs: Challenges, Opportunities and Requirements. Palgravemacmillan

## 20CS C03

### OBJECT ORIENTED PROGRAMMING

Instruction	3 Periods per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

**Course Objectives:** The objectives of this course are

1. Describe the principles of Object-Oriented Programming.
2. Enable the students to solve problems using OOPs features.
3. Debugging in programs and files.
4. Use of library modules to develop GUI applications.

**Course Outcomes:** On Successful completion of the course, students will be able to

1. Demonstrate the concepts of Object-Oriented Programming languages to solve problems.
2. Apply the constructs like selection, repetition, functions and packages to modularize the programs.
3. Design and build applications with classes/modules.
4. Find and rectify coding errors in a program to assess and improve performance.
5. Develop packages for solving simple real world problems.
6. Analyze and use appropriate library software to create graphical interface, mathematical software.

#### Unit-I

**Introduction to Object Oriented Programming:** Computer Programming and Programming Languages, Programming Paradigms, Features of Object Oriented Programming, Merits and Demerits of OOPs

**Basics of Python Programming:** Features of Python, Variables, Identifiers, Datatypes, Input/Output operations, Operators and Expressions, Operations on Strings, Type Conversion.

#### Unit-II

**Decision Control Statement :** Selection/Conditional Branching, Loop Control Structures, Nested Loops. **Functions and Modules:** Uses of functions, Function definition, function call, Variable scope and Lifetime, Recursion, Lambda functions, map, reduce and filter built-in functions, Recursive Functions, Modules, Packages.

#### Unit-III

**Classes and Objects:** Introduction, Classes and Objects, init method, Class variables, and Object variables, Public and Private Data members, calling methods from other methods, built-in class attributes, garbage collection, class methods, static methods.

#### Unit-IV

**Inheritance:** Introduction, Inheriting classes, Polymorphism and method overloading, Composition or Containership, Abstract classes and inheritance.

**Operator Overloading:** Introduction, Implementation of Operator Overloading, Overriding.

**File Handling:** File types, opening and closing files, reading and writing files, file positions, Regular Expressions.

#### Unit-V

**Error and Exception Handling:** Introduction to errors and exceptions, Handling Exceptions, Simple GUI Programming with tkinter package, Sample Graphics using Turtle, Plotting Graphs in Python.

#### Text Books:

1. Reema Thareja, "Python Programming", Oxford Press, 2017.
2. Mike Mc Grath "Python in easy steps: Makes Programming Fun", Kindle Edition, 2017.

**Suggested Readings:**

1. Mark Lutz “Learning Python”, O’Reilly Media Inc., 5<sup>th</sup> Edition 2013
2. Mark Summerfield “Programming in Python 3: A Complete Introduction to the Python, Addison–Wesley, 2<sup>nd</sup> Edition.

**References:**

1. [https://anandology.com/python-practice-book/object\\_oriented\\_programming.html](https://anandology.com/python-practice-book/object_oriented_programming.html)
2. [http://python-textbok.readthedocs.io/en/1.0/Object\\_Oriented\\_Programming.html](http://python-textbok.readthedocs.io/en/1.0/Object_Oriented_Programming.html)
3. [http://www.tutorialspoint.com/python/python\\_classes\\_objects.html](http://www.tutorialspoint.com/python/python_classes_objects.html)
4. <https://docs.python.org/3/>

**20MT C04**

**DIFFERENTIAL EQUATIONS & TRANSFORM THEORY LAB**  
(CSE, IT, AI&ML, CSE(AI&ML), AI&DS, CSE (IOT & Cyber Security including Block Chain Technology))

Instruction	2P Hours per week
Duration of SEE	3Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

**Course Objectives:** The objectives of this course are

1. To explain the relevant methods to solve first order differential equations.
2. To explain the relevant methods to solve higher order differential equations.
3. To discuss the properties of Legendre's Polynomials and Bessel's functions
4. To explain the Z-Transform and Inverse Z-Transforms.
5. To discuss Fourier transform for solving engineering problems.

**Course Outcomes:** Upon completing this course, students will be able to:

1. Explore all the possible solutions of first order differential equation.
2. Analyse the solutions of higher order linear differential equations.
3. Examine the series solutions for higher order differential equations.
4. Evaluate the Improper integrals by Fourier Transform.
5. Apply the Z-transform to solve the difference equations.

**List of Programmes:**

1. Solution of first order linear differential equations.
2. Solution of first order non linear differential equations
3. Geometrical view of Particular integral of higher order differential equations.
4. Simulations of Legendre's differential equations.
5. Geometrical view of Rodrigue's theorem.
6. Simulations of Bessel's first kind solution.
7. Solutions of Bessel's first kind  
(i.e.  $J_0(x)$ ,  $J_1(x)$ ,  $J_{1/2}(x)$ ,  $J_{3/2}(x)$ ,  $J_{-1/2}(x)$ ,  $J_{-3/2}(x)$ )
8. Waveform generation continuous signals
9. Computation of Fourier Transformations
10. Discrete Cosine Transforms
11. Digitization of continuous functions.

**Text Books / Suggested Reading / Online Resources:**

1. [https://www.scilab.org/sites/default/files/Scilab\\_beginners\\_0.pdf](https://www.scilab.org/sites/default/files/Scilab_beginners_0.pdf)
2. <https://www.scilab.org/tutorials>
3. <https://nptel.ac.in/courses/106102064/>
4. <https://www.udemy.com/algorithms-and-data-structures-in-python/>

## 20CY C02

### CHEMISTRY LAB (Common to all branches)

Instruction	4 Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2

**Course Objectives :** The objectives of this course are

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. To provide the knowledge in both qualitative and quantitative chemical analysis
3. The student should be conversant with the principles of volumetric analysis
4. To apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theoretical concepts in the preparation of new materials like drugs and polymers.

**Course Outcomes :** At the end of the course student will be able to:

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

#### Chemistry Lab

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions ( $\text{Co}^{+2}$  &  $\text{Ni}^{+2}$ ) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and  $\text{CH}_3\text{COOH}$  present in the given mixture of acids Conductometrically using NaOH solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of  $\text{Fe}^{+2}$  Potentiometrically using  $\text{KMnO}_4$  solution
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

#### Text Books:

1. J. Mendham and Thomas, "Vogel's text book of quantitative chemical analysis", Pearson education Pvt. Ltd. New Delhi, 6<sup>th</sup> ed. 2002.
2. Senior practical physical chemistry by B.D.Khosla, V.C.Garg & A.Gulati,; R. Chand & Co. : New Delhi (2011).

#### Suggested Readings:

1. Dr.Subdharani, "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara, "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9<sup>th</sup> revised edition, 2015.

## 20CS C04

### OBJECT ORIENTED PROGRAMMING LAB

Instruction	2 Periods per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

**Course Objectives:** The objectives of this course are

1. Identification and installation of required software to work with Python.
2. Program development using OOPs concepts.
3. Handling of errors in program code.
4. Use of library modules to develop GUI applications.

**Course Outcomes:** On Successful completion of the course, students will be able to

1. Inspect and identify suitable programming environment to work with Python.
2. Choose appropriate control constructs, data structures to build the solutions.
3. Develop the solutions with modular approach using functions, packages to enhance the code efficiency.
4. Analyze and debug the programs to verify and validate code.
5. Demonstrate use of STLs and modules to build graphical interfaces, mathematical software.
6. Determine the requirements of real-world problems and use appropriate modules to develop solutions.

#### Lab Experiments:

1. Installation of any Object Oriented Programming Language and IDE.
2. Simple scripts to demonstrate the use of basic data types and operators.
3. Simple scripts to demonstrate the use of control structures.
4. Functions and Lambda function and parameter passing.
5. Experimentation with Modules.
6. Implementation of classes with attributes and methods.
7. Demonstration of inheritance.
8. Experiments on Overloading.
9. Files and Regular Expressions.
10. Exceptions and built-in tools.
11. Experiments on System interfaces and GUIs.

#### Text Book:

1. Reema Thareja, "Python Programming", Oxford Press, 2017.

#### Online Resources:

1. <https://vknights.org/cfm/labsheets/04-object-oriented-programming/>
2. <http://learning-python.com/class/Workbook/x-exercises.htm>
3. <https://inst.eecs.berkeley.edu/~cs61a/fa14/lab/lab06/#inheritance>
4. [https://anandology.com/python-practice-book/object\\_oriented\\_programming.html](https://anandology.com/python-practice-book/object_oriented_programming.html)
5. <http://stanfordpython.com/>
6. <https://docs.python.org/3/>

## 20ME C02

### WORKSHOP / MANUFACTURING PRACTICE

Instruction	5P Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	2.5

**Course Objectives:** The objectives of this course are

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive & team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

**Course Outcomes:** At the end of the course, the students are able to

1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes.
3. Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House wiring.
4. Perform various operations in welding, machining and casting processes.
5. Conceptualize and produce simple device/mechanism of their choice.

#### List of Exercises

##### CYCLE 1

##### Exercises in Carpentry

1. To plane the given wooden piece to required size
2. To make a lap joint on the given wooden piece according to the given dimensions.
3. To make a dove tail-joint on the given wooden piece according to the given dimensions.

##### Exercises in Tin Smithy

1. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
2. To make a scoop.
3. To make a pamphlet box.

##### Exercises in Fitting

1. To make a perfect rectangular MS flat and to do parallel cuts using Hacksaw
2. To make male and female fitting using MS flats-Assembly 1
3. To make male and female fitting using MS flats-Assembly 2

##### Exercises in House Wiring

1. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch, and wiring of one buzzer controlled by a bell push
2. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket
3. Stair case wiring-wiring of one light point controlled from two different places independently using two 2-way switches.



## **CYCLE 2**

### **Exercises in Casting**

1. Study of Sand casting process and its applications.
2. Green sand moulding practice for a single piece pattern
3. Green sand moulding practice for a split pattern with a horizontal core

### **Exercises in Welding**

1. Study of gas welding equipment and process. Identification of flames, making of Butt joint with gas welding.
2. Study of Arc welding process, making Butt joint with DCSP,DCRP
3. Study of Arc welding process, making Lap joint with A.C

### **Exercises in Machine shop**

1. Study of Machine Tools like Lathe, Drilling, Milling and Shaper.
2. Facing, Plain turning and Step turning operations on Lathe machine.
3. Knurling and Taper turning on Lathe machine

### **Open ended Exercise:**

1. Student should produce a component /mechanism by applying the knowledge of any one trade or combination of trades.

### **Text 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. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata Mc Graw Hill House, 2017.

### **Suggested Reading:**

1. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I”, Pearson Education, 2008.
2. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4<sup>th</sup> edition, Prentice Hall India, 1998.

## 20ME C03

### ENGINEERING EXPLORATION (PRACTICAL)

Instruction	4 Hours per week
Duration of SEE	Nil
SEE	Nil
CIE	50 Marks
Credits	1.5

Prerequisites: Nil

**Course Outcomes:** At the end of the course, the students are able to

1. Understand the role of an engineer as a problem solver.
2. Identify multi-disciplinary approaches in solving an engineering problem.
3. Build simple systems using engineering design process.
4. Analyze engineering solutions from ethical and sustainability perspectives.
5. Use basics of engineering project management skills in doing projects.

#### UNIT- I

**Role of Engineers:** Introduction, science, engineering, technology, engineer, scientist, role of engineer, various disciplines of engineering, misconception of engineering, expectations for the 21<sup>st</sup> century engineer and NBA graduate attributes.

Engineering problems and Design: Multidisciplinary facet of design, pair wise comparison chart, introduction to econometrics system, generation of multiple solution, Pugh chart, motor and battery sizing concepts, introduction to PCB design.

#### UNIT- II

**Mechanisms:** Basic components of a mechanism, degrees of freedom or mobility of a mechanism, 4-bar chain, crank rocker mechanism, slider crank mechanism, simple robotic arm building.

Platform-based development: Introduction to programming platforms (Arduino) and its essentials, sensors, transducers and actuators and their interfacing with Arduino.

#### UNIT- III

**Data Acquisition and Analysis:** Types of data, descriptive statistics techniques as applicable to different types of data, types of graphs and their applicability, usage of tools (MS-Office / Open Office/ Libre Office / Scilab) for descriptive statistics, data acquisition (temperature and humidity) using sensors interfaced with Arduino, exporting acquired data to spreadsheets, and analysis using representation.

#### UNIT- IV

**Process Management:** Introduction to Agile practice, significance of team work, importance of communication in engineering profession, project management tools, checklist, timeline, Gantt chart, significance of documentation.

#### UNIT -V

**Engineering Ethics & Sustainability in Engineering:** Identifying Engineering as a profession, significance of professional ethics, code of conduct for engineers, identifying ethical dimensions in different tasks of engineering, applying moral theories and codes of conduct for resolution of ethical dilemmas.

**Sustainability in Engineering:** Introduction, sustainability leadership, life cycle assessment, carbon foot print.

#### Text Books:

1. Clive L. Dym, Patric Little, Elizabeth J Orwin, "Engineering Design: A project-based introduction", 4th edition, Willey.

2. Matthew Python, “Arduino programming for beginners”, Independently published, 2020.
3. Patrick F. Dunn , “Measurement and data Analysis for engineering and science” , third edition, 2014.
4. Andrew Stellman, Jennifer Greene, “Head First Agile: A brain-friendly guide to Agile principles, ideas, and real-world practices”, Kindle Edition.

**Suggested Reading:**

1. Charles B. Fleddermann, “Engineering ethics”, fourth edition, Prentice Hall, 2012.
2. Rob Lawlor, “Engineering in society”, second edition, Royal academy of engineering.
3. Richard Dodds, Roger Venables, “Engineering for sustainable development: Guiding principles”, The Royal Academy of engineering, 2005.
4. Richard S. Paul, “Robot Manipulators: Mathematics, Programming, and Control”, MIT Press.

<b>ENGINEERING EXPLORATION ASSESSMENT SCHEME</b>				
<b>S. No</b>	<b>Name of the module</b>	<b>Work Hours</b>	<b>Marks</b>	<b>Evaluation</b>
1	Role of Engineers	4	-	Evaluation - I
2	Engineering Design	16	5	
3	Mechanisms	6	3	
4	Engineering Ethics	2	2	
5	Platform-based Development	16	5	Evaluation - II
6	Data Acquisition and Analysis	6	4	Evaluation-III
7	Project Management	4	4	
8	Sustainability in Engineering	6	2	
9	Course Project Reviews	12	20	Final Evaluation
10	Code of conduct	-	5	
<b>Total</b>		<b>72</b>	<b>50</b>	