



University of Engineering and Management  
Institute of Engineering & Management, Salt Lake Campus  
Institute of Engineering & Management, New Town Campus  
University of Engineering & Management, Jaipur



4<sup>th</sup> Semester Syllabus for B.Tech ECE Admission Batch 2023

**For 2023-2027 batch (present 2<sup>nd</sup> year)**

[illegible]

| Subject Code | Subject_Name                                                 | Sem | Type      | Credit | Dept | Degree | Admission Year | Faculty Name |
|--------------|--------------------------------------------------------------|-----|-----------|--------|------|--------|----------------|--------------|
| PCCECE401    | Analog & Digital Communication                               | 4   | Th.       | 3      | ECE  | B.Tech | 2023           | KLB          |
| PCCECE402    | Digital Electronics                                          | 4   | Th.       | 3      |      | B.Tech | 2023           | CPH          |
| PCCECE403    | Introduction to Artificial Intelligence and Machine Learning | 4   | Th.       | 3      |      | B.Tech | 2023           | PRN          |
| MCC401       | Sustainability & Environmental Science                       | 4   | Th.       | 2      |      | B.Tech | 2023           | RKJ          |
| BSM401       | Mathematics-IV                                               | 4   | Th.       | 3      |      | B.Tech | 2023           | RSA          |
| ESP402       | Essential Studies for Professionals IV                       | 4   | Th.       | 0.5    |      | B.Tech | 2023           | HU           |
| PCCECE491    | Analog & Digital Communication Laboratory                    | 4   | Pr.       | 2      |      | B.Tech | 2023           | KLB, LRM     |
| PCCECE492    | Digital Electronic Laboratory                                | 4   | Pr.       | 2      |      | B.Tech | 2023           | CPH, LRM     |
| PCCECE493    | Artificial Intelligence and Machine Learning Laboratory      | 4   | Pr.       | 2      |      | B.Tech | 2023           | PRN          |
| OEC481       | Object Oriented Programming using JAVA                       | 4   | Sessional | 2      |      | B.Tech | 2023           | SBK          |
| SDP482       | Skill Development for Professionals-IV                       | 4   | Th.       | 0.5    |      | B.Tech | 2023           | HU           |
| PRJECE481    | Mini Project                                                 | 4   | Pr.       | 1      |      | B.Tech | 2023           | MENTOR       |
| MAR481       | Mandatory Additional Requirement (MAR)                       | 4   | VAC       | 0      |      | B.Tech | 2023           | MENTOR       |
| IFC          | Industry and Foreign Certification                           | 4   | VAC       | 0      |      | B.Tech | 2023           | MENTOR       |
| MOOCS        | Massive Open Online Courses (MOOCs)                          | 4   | VAC       |        |      | B.Tech | 2023           | MENTOR       |



**University of Engineering and Management, Kolkata  
Institute of Engineering & Management, Salt Lake Campus  
Institute of Engineering & Management, New Town Campus  
University of Engineering & Management, Jaipur**



**Syllabus for B.Tech (Admission Batch 2023)**

**Subject Name: Analog and Digital Communication**

**Credit: 3**

**Lecture Hours: 36**

**Subject Code: PCCECE401**

**Pre-requisite:** Signals and Systems, Mathematics.

**Coursera link:** <https://www.coursera.org/learn/wireless-communications?>

**LinkedIn link:** <https://www.linkedin.com/learning/iot-foundations-low-power-wireless-networking>

**NPTEL link:** [https://onlinecourses.nptel.ac.in/noc22\\_ee05/preview](https://onlinecourses.nptel.ac.in/noc22_ee05/preview)

**COURSE OBJECTIVE:**

1. To learn about Analog Modulation
2. To learn about Digital Modulation

3. To learn impact of Noise in communication
4. To learn about Waveform Coding Techniques
5. To learn about Superheterodyne Receiver

### COURSE OUTCOMES:

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth.
2. Understand the behavior of a communication system at receiver in presence of noise.
3. Investigate pulsed modulation system, baseband transmission and analyze their system performance.
4. Analyze different digital modulation schemes and can compute the bit error performance trade off issues, equalization, carrier recovery

| Mod<br>ule<br>num<br>ber | Topic                        | Sub-Topics                                                                                                                                                                                              | Mapping with Industry<br>and International<br>Academia                                                                                                                                                                                                                                        | Lect<br>ure<br>Hou<br>rs | Corresponding Lab<br>Assignment                                                                                                                                                                                             | Text Books/<br>Study<br>Material                                                                          |
|--------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| 1                        | <b>Analog<br/>modulation</b> | Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB, Angle Modulation and Demodulation, Representation of FM and PM | <b>International<br/>Academia:</b> ( <a href="https://web.stanford.edu/class/ee179/">https://web.stanford.edu/class/ee179/</a> )<br><br><b>AICTE-prescribed<br/>syllabus:</b> ( <a href="https://www.aicteindia.org/sites/default/files">https://www.aicteindia.org/sites/default/files</a> ) | 8                        | <ol style="list-style-type: none"> <li>1. Design, Simulation and implementation of amplitude modulation and demodulation using MATLAB.</li> <li>2. Design, Simulation and implementation of frequency modulation</li> </ol> | Ref:<br>B.P.Lathi,<br>Zhi Ding<br>“Modern<br>Digital and<br>Analog<br>Communicati<br>on”, 4 <sup>th</sup> |

|  |  |                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                             |  |                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                       |
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|  |  | <p>signals, Spectral characteristics of angle modulated signals.</p> <p>AI in Signal Detection and Classification: Application: Use of machine learning (ML) algorithms like convolutional neural networks (CNNs) and recurrent neural networks (RNNs) for the detection, classification, and identification of AM and FM signals in noisy environments.</p> | <p><u>es/Model Curriculum/Final ECE.pdf)</u></p> <p><b>Industry Mapping:</b></p> <p>MATLAB/ Simulink applications designs and real time implementation.</p> |  | <p>and demodulation using MATLAB.</p> <ol style="list-style-type: none"> <li>3. Measurement of Modulation Index of An Amplitude Modulated Signal using Transistor/ IC.</li> <li>4. Study of Modulation and Demodulation of Single Side Band Suppressed Carrier (SSB-SC) using IC.</li> <li>5. Study of Modulation and Demodulation of Frequency Modulation using IC.</li> </ol> | <p>edition, Oxford university pub: Chapter 3 and 4</p> <p>Study Material:<br/> <a href="https://drive.google.com/file/d/1UbrF2Ckbb_YYpNbMqsrhJzqnznKChYq/view?usp=sharing">https://drive.google.com/file/d/1UbrF2Ckbb_YYpNbMqsrhJzqnznKChYq/view?usp=sharing</a> </p> |
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| 2 | Noise | <p>Noise Introduction, Sources of Noise, Classification of Noise, Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De-emphasis, Threshold effect in angle modulation.</p> <p>Application of AI technique for minimization of noise in communication system.</p> | <p><b>International Standards:</b>(<a href="https://web.stanford.edu/class/ee179/">https://web.stanford.edu/class/ee179/</a>)</p> <p><b>AICTE prescribed syllabus:</b></p> <p>(<a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf</a>)</p> <p><b>Industry Mapping:</b></p> <p>MATLAB/ Simulink applications designs and real time implementation.</p> | 6 | <ol style="list-style-type: none"> <li>1. Study of SNR calculation using MATLAB.</li> <li>2. SNR measurement for audio frequency using IC.</li> </ol> | <p>B.P.Lathi, Zhi Ding “Modern Digital and Analog Communication”, 4<sup>th</sup> edition, Oxford university pub.</p> <p>Chapter: 7.</p> <p>Study Material:<br/> <a href="https://drive.google.com/file/d/1BPKkBqsLIdGMIsh6y8LCD-3i61dY1-KG/view?usp=sharing">https://drive.google.com/file/d/1BPKkBqsLIdGMIsh6y8LCD-3i61dY1-KG/view?usp=sharing</a></p> |
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| 3 | <b>Waveform Coding Techniques</b> | <p>Pulse modulation, Sampling process, Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation, Delta modulation, Noise considerations in PCM, Time Division multiplexing, AI based orthogonal multiple access technique, Digital Multiplexers.</p> | <p><b>International Standards:</b><br/>(<a href="https://web.stanford.edu/class/ee179/">https://web.stanford.edu/class/ee179/</a>)</p> <p><b>AICTE prescribed syllabus:</b><br/>(<a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf</a>)</p> <p><b>Industry Mapping:</b></p> <p>MATLAB/Simulink applications designs and real time implementation.</p> | 6 | <ol style="list-style-type: none"> <li>1. Design, Simulation and implementation of PCM.</li> <li>2. Design, Simulation and implementation of DPCM.</li> <li>3. Design, Simulation and implementation of DM.</li> <li>4. Design, Simulation and implementation of ADM.</li> <li>5. Study of Modulation and Demodulation of Pulse Amplitude Modulation (PAM) using Transistor.</li> <li>6. Study of Pulse code Modulation using IC.</li> <li>7. Study of Delta Modulation using IC.</li> </ol> | <p>B.P.Lathi, Zhi Ding<br/>“Modern Digital and Analog Communication”, 4<sup>th</sup> edition, Oxford university pub.<br/>Chapter: 5.</p> <p>Study Material:<br/><a href="https://drive.google.com/file/d/1BPKkBqsLdGMIsh6y8LCD-3i61dY1-KG/view?usp=sharing">https://drive.google.com/file/d/1BPKkBqsLdGMIsh6y8LCD-3i61dY1-KG/view?usp=sharing</a></p> |
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| 4 | <b>Digital Modulation Techniques</b> | <p>Pass-band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.</p> <p>AI-Enabled Digital Carrier Modulation and optimization of those techniques for error minimization. Application of AI-enabled modulation techniques.</p> | <p><b>International Standards:</b><br/>(<a href="https://web.stanford.edu/class/ee179/">https://web.stanford.edu/class/ee179/</a>)</p> <p><b>AICTE prescribed syllabus:</b><br/>(<a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf</a>)</p> <p><b>Industry Mapping:</b></p> <p>MATLAB/Simulink applications designs and real time implementation.</p> | 8 | <ol style="list-style-type: none"> <li>1. Study of Modulation and Demodulation of Amplitude Shift Keying (ASK) using MATLAB.</li> <li>2. Study of Modulation and Demodulation of Phase Shift Keying (PSK) using MATLAB.</li> <li>3. Study of Modulation and Demodulation of Frequency Shift Keying (FSK) using MATLAB.</li> <li>4. Study of Modulation and Demodulation of Amplitude Shift Keying (ASK) using Transistor.</li> <li>5. Study of Modulation and Demodulation of Phase Shift Keying (PSK) using IC.</li> <li>6. Study of Modulation and Demodulation of Frequency Shift Keying (FSK) using IC.</li> </ol> | <p>Simon Haykin, “Communication Systems”, 4<sup>th</sup> edition.</p> <p>Chapter:6.</p> <p>Study Material:<br/><a href="https://drive.google.com/file/d/1lfqmRuxRmTG8AJHXdNvDs2MiwX39NBMH/view?usp=sharing">https://drive.google.com/file/d/1lfqmRuxRmTG8AJHXdNvDs2MiwX39NBMH/view?usp=sharing</a></p> |
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| 5 | <b>Radio Transmitters and Radio Receivers</b> | Overview of Radio Transmitter and Radio Receivers. Super heterodyne receivers: Super heterodyning principle, Intermediate frequency, Local oscillator frequency, Image frequency. Overview of Amplifier, Mixer, Local Oscillator, LNA, Filter. | <p><b>International Standards:</b>(<a href="https://web.stanford.edu/class/ee179/">https://web.stanford.edu/class/ee179/</a>)</p> <p><b>AICTE prescribed syllabus:</b> (<a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf</a>)</p> <p><b>Industry Mapping:</b></p> <p>MATLAB/Simulink applications designs for transmitter and receivers.</p> | 8 | <ol style="list-style-type: none"> <li>1. Detailed study of intermediate frequency, radio frequency and audio frequency response of super-heterodyne receiver using IC.</li> <li>2. Frequency Division Multiplexing and Demultiplexing Through Optical Fiber Cable.</li> <li>3. Analog Communication through Optical Fiber Cable.</li> <li>4. Study of Satellite Communication.</li> </ol> | <p>B.P.Lathi, Zhi Ding “Modern Digital and Analog Communication”, 4<sup>th</sup> edition, Oxford university pub.</p> <p>Chapter: 4.</p> <p>Study Material:<br/> <a href="https://drive.google.com/file/d/1_p22-2oW6PYdPARGgAR6RjF2AczmPHwj/view?usp=sharing">https://drive.google.com/file/d/1_p22-2oW6PYdPARGgAR6RjF2AczmPHwj/view?usp=sharing</a></p> |
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Text Books:

1. B.P.Lathi, Zhi Ding, "Modern Digital and Analog Communication", 4<sup>th</sup> ed., Oxford university pub.
2. Haykin S., "Communications Systems", John Wiley and Sons

Reference Books:

1. Taub, Schilling, "Principles of Communication Systems", 2nd ed., Mc-Graw Hill.
2. Proakis J. G., Salehi M., "Communication Systems Engineering", Pearson Education.



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## **Syllabus for B.Tech Admission Batch 2023**

**Subject Name: Digital Electronics**

**Credit: 3**

**Lecture Hours: 36**

**Subject Code: PCCECE402**

**Pre-requisite:** Mathematics, Basic Electronics

### **Course Objective:**

1. To introduce basic postulates of Boolean algebra and to introduce the methods for simplifying Boolean expressions.
2. To study formal procedures for the analysis and design of combinational and sequential circuits.
3. To introduce the concept of logic families, semiconductor memories and implementation of digital circuits using programmable logic devices.
4. To illustrate the concept of synchronous and asynchronous sequential circuits.

### **Course Outcome:**

- CO 1:** Students will have a thorough knowledge of number system and different codes and also they will be able to apply those knowledge while required.
- CO 2:** After completing this course, the students will be able to design and analyze combinational logic circuits. They will also learn how to use GEN AI for Combinational Logic Circuits.
- CO 3:** Students will acquire a knowledge about sequential logic circuits and solid states memory devices. They will also learn how to use GEN AI for Sequential Logic Circuits.

CO 4: They will be able to design ADC and DAC and also will acquire knowledge on logic families.

### **Relevant Links:**

#### **1. Link for Study Material:**

<https://docs.google.com/document/d/1O4bOy7MkdqVMfc3S1RRUsRwiViZ7A67P/edit?usp=sharing&ouid=116508199826018918971&rtpof=true&sd=true>.

#### **2. Link for NPTEL Course:**

[https://onlinecourses.nptel.ac.in/noc25\\_ee11/preview](https://onlinecourses.nptel.ac.in/noc25_ee11/preview)

#### **3. Link for Coursera Course:**

<https://www.coursera.org/specializations/fpga-design>

#### **4. Link for LinkedIn Learning Course:**

i) [https://www.linkedin.com/learning/learning-pcb-design-with-orcad?trk=learning-topics\\_learning-search-card\\_search-card&upsellOrderOrigin=sem-ga\\_campid.16725959274\\_asid.137912488311\\_crid.590520008629\\_kw.linkedin%2Blearning%2Bpro\\_d.c\\_tid.kwd-1646634661878\\_n.g\\_mt.p\\_geo.9061848](https://www.linkedin.com/learning/learning-pcb-design-with-orcad?trk=learning-topics_learning-search-card_search-card&upsellOrderOrigin=sem-ga_campid.16725959274_asid.137912488311_crid.590520008629_kw.linkedin%2Blearning%2Bpro_d.c_tid.kwd-1646634661878_n.g_mt.p_geo.9061848)

ii) [https://www.linkedin.com/learning/learning-arduino-foundations-2i\)](https://www.linkedin.com/learning/learning-arduino-foundations-2i)

iii) <https://www.linkedin.com/learning/raspberry-pi-weekly>

iv) <https://www.linkedin.com/pulse/teaching-digital-logic-design-online-junaaid-ahmed-memon/>

v) <https://www.linkedin.com/learning/learning-fpga-development>

vi) <https://www.onlinetutorials.org/teaching-academics/basics-of-digital-electronics/>

## 5. Link for Infosys Springboard Course:

i) [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_01384322908053504033837\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384322908053504033837_shared/overview)

## Detailed Syllabus:

| Module number | Topic                                                                                   | Sub-topics                                                                                                                                                                                                                                                           | Mapping with Industry and International Academia                                                                                                                                                          | Lecture Hours | Corresponding Lab Assignment                                                                                                                                                                               |
|---------------|-----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1             | <b>Number System and Logic Families</b><br><br><b>Text Books:</b><br><b>Anand Kumar</b> | Introduction to number systems, Binary, Octal and Hexadecimal representation and their conversions; BCD, ASCII, gray codes and their conversions, thermometric codes, Signed binary number representation with 1's and 2's complement methods ,basic logic functions | <b>International Academia:</b><br>( <a href="https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html">https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html</a> ) | 5             | <ol style="list-style-type: none"><li>1. Simulation of MOS Inverter with different loads using SPICE software.</li><li>2. Simulation of CMOS Inverter for different parameters <math>K_n</math>,</li></ol> |

|   |                                                                                                                      |                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |                                                                                                                                              |
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|   | <b>(Chapter 2, 3, 4)</b>                                                                                             | Standard forms of logic expressions, and simplification of logic expressions using K Map.<br>Review of TTL and CMOS families, their operations and specifications.<br>Overview of Verilog                                           | <b>AICTE-prescribed syllabus:</b><br>( <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf</a> )<br><br><b>Industry Mapping:</b><br>SPICE software, Verilog                                                                                                                                                                                                                                                     |   | Kp as a design variable in SPICE software.<br><br>3. Introduction to programming using Verilog                                               |
| 2 | <b>Introduction to Boolean Algebra and K-map:</b><br><br><b>Text Books: Salivahanan and Arivazhagan: (Chapter 2)</b> | Basic Definitions and Axiomatic Definition of Boolean Algebra, Boolean Functions, Canonical and Standard Forms. The Map Method - K-map, Product of Sums and Sum of Products Simplification, NAND and NOR Implementation.            | <b>International Standards</b><br>:( <a href="https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html">https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html</a> )<br><b>AICTE prescribed syllabus:</b><br>( <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf</a> )<br><br><b>Industry Mapping:</b><br>Hardware Chipsets (IC 7408, 7432,7404),<br>Software-TinkerCad | 5 | 1. Design of BCD-Excess 3 code and vice-versa using basic gates (IC 7408, 7432,7404)<br>2. Design of basic digital circuits using Tinkercad. |
| 3 | <b>Designing Combinational Logic Circuits:</b><br><br><b>Text Book:</b>                                              | Arithmetic circuits (ADDER and SUBTRACTOR), multiplier, comparators, decoders, encoders, multiplexers, de-multiplexers, parity generator and checker and their use in logic synthesis; Potential hazards in combinational circuits. | <b>International Standards</b><br>:<br>( <a href="https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html">https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html</a> )                                                                                                                                                                                                                                                                                                                      | 6 | 1. Design of Adder and Subtractor using basic gates (IC 7408, 7432,7404) and use of IC 74LS83 as BCD                                         |

|   |                                                                                                                      |                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |                                                                                                                                                                                                                                                                                                                                                                                                    |
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|   | Salivahanan and Arivazhagan: (Chapter 5,6)                                                                           |                                                                                                                                                                                                                                             | <p><b>AICTE prescribed syllabus:</b><br/> <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf</a><br/> )</p> <p><b>Industry Mapping:</b><br/> Hardware Chipset (IC 7408, 7432, 7404, 74153, 74155, 74180)</p> <p>Software: LogiSim and VHDL</p>                                                                              |   | <p>adder.</p> <ol style="list-style-type: none"> <li>Design of MUX and DEMUX using basic gates (IC 74153, 74155) and also study the available ICS of MUX and DEMUX. Implement logic functions using these ICs.</li> <li>Design and implementation of 16-bit odd/even parity checker/ generator using IC 74180.</li> <li>Implementation of combinational circuits using LogiSim and VHDL</li> </ol> |
| 4 | <p><b>Designing Sequential Logic Circuits:</b></p> <p><b>Text Book:</b><br/> Anand Kumar (Chapter 8,9,10, 11,12)</p> | Basic memory element-S-R, J-K, D and T Flip Flops, various types of Registers and counters and their design, Design of Synchronous Sequential Circuits- State Table and State Diagrams, Design of Mealy and Moore FSM - Sequence Detection. | <p><b>International Standards:</b><br/> <a href="https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html">https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html</a></p> <p><b>AICTE prescribed syllabus:</b><br/> <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf</a><br/> )</p> | 6 | <ol style="list-style-type: none"> <li>Design of R-S, J-K, D and T Flip flops using universal gates and also study master slave J-K flip flop IC 7476.</li> <li>Design of synchronous and asynchronous counter using Flip Flop IC 7476.</li> <li>Design of 4-bit shift register (shift right) IC 7476/7474</li> </ol>                                                                              |

|   |                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |   |                                                                                                                                                                                                                                                                 |
|---|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   |                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                             | <b>Industry Mapping:</b><br><br>Hardware Chipset<br>(IC 7476, 7474)<br><br>Software: LogiSim<br>and VHDL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   | 8. Implementation of sequential circuits using Logisim and VHDL                                                                                                                                                                                                 |
| 5 | <b>Introduction to Digital Logic Devices, ADC and DAC:</b><br><br><b>Text Book: Salivahanan and Arivazhagan: (Chapter 10, 13)</b> | Introduction of ROM and RAM, PLA, PAL and FPGA.<br><br>IC iCE40 FPGA family<br><br>D/A converter -specifications - weighted resistor type, R-2R Ladder type. A/D Converters specifications - Flash type- Successive Approximation type, Pipeline ADC<br>AFEx8201 16-Bit and 14-Bit Digital-to-Analog Converters (DACs) With Voltage Reference and Diagnostic ADC for Low-Power Applications | <b>AICTE prescribed syllabus:</b><br>( <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf</a> )<br><br><b>Industry Mapping:</b><br><br>Hardware Chipset<br>AFEx8201 ADC<br>AD570, DAC 0808<br>Software TinkerCad<br><br>( <a href="https://www.ti.com/lit/ds/symlink/afe88201.pdf?ts=1700473002665&amp;ref_url=https%253A%252F%252Fwww.ti.com%252Fdata-converters%252Fintegrated-special-function%252Fprecision-adcs-and-">https://www.ti.com/lit/ds/symlink/afe88201.pdf?ts=1700473002665&amp;ref_url=https%253A%252F%252Fwww.ti.com%252Fdata-converters%252Fintegrated-special-function%252Fprecision-adcs-and-</a> | 4 | 9. Design of PLA and PAL using basic logic gates (IC 7408, 7432, 7404)<br>10. Design and testing of half/full adder and multiplexer by burning FPGA Kit.<br>11. Design of ADC and DAC using IC ADC AD570, DAC 0808<br>12. Design of ADC and DAC using TinkerCad |

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|   |                                                                                     |                                                                                                                                            | <a href="#">dacs%252Fproducts.html</a> ) |  |  |
| 6 | <b>GEN AI for Digital Circuits</b><br><br><b>Research papers and study material</b> | Introduction of GEN AI<br>Use of GEN AI for Designing Digital Circuits<br>Use of GEN AI for optimizing power and delay of Digital Circuits |                                          |  |  |
|   |                                                                                     |                                                                                                                                            |                                          |  |  |

#### **Text Books:**

1. Digital Circuits and Design, by S. Salivahanan, S. Arivazhagan, 5th Edition, Oxford University Press India.
2. **Fundamentals of** Digital Circuits; Anand Kumar; PHI Publication
3. Digital Logic and Computer **Design; M Morris Mano, Pearson Publication**

#### **Reference Books:**

1. Digital Design, M. Morris. Mano & Michael D. Ciletti, PEARSON Publication
3. Digital Electronics; Tokheim; TMH Publication



**University of Engineering and Management**  
**Institute of Engineering & Management, Salt Lake Campus**  
**Institute of Engineering & Management, New Town Campus**  
**University of Engineering & Management, Jaipur**



**Subject Name:** Artificial Intelligence & Machine Learning

**Credit:** 3

**Lecture Hours:** 48

**Subject Code:** PCCEC403

**Pre-requisites:** Mathematics, Data Structure and Algorithms

**Relevant Links:**

[Study Materials](#)

[NPTEL](#)

[Coursera](#)

[LinkedIn Learning](#)

**Course Objective:** After completion of this course, the students would be able to:

**Obj 1:** Understand the basics concepts of Artificial Intelligence and Machine Learning

**Obj 2:** Apply different AI and ML models to various datasets

**Course Outcomes:**

**CO1:** Understand core concepts and applications of Artificial Intelligence

**CO2:** Understand and be able to implement various supervised, unsupervised and reinforcement learning algorithms

**CO3:** Explore various tools associated with Artificial Intelligence and Machine Learning Tasks

**CO4:** Develop industry-standard projects using modern Machine Learning pipelines

| Module number                                                             | Topic                                  | Sub-topics                                                                                                                                                                                                                                                                                                                                                                                   | Mappingwith Industry andInternational Academia                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Lecture Hours | CorrespondingLabAssignment                                                        |
|---------------------------------------------------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------------------------------------------|
| 1                                                                         | Introductionto Artificial Intelligence | <p><b>DS: Introduction to Artificial Intelligence and its applications</b> – What is AI, Foundations and History of AI, State of the Art, Risks and Benefits of AI, Advice for a career in AI, Hotbeds of AI Innovation.</p> <p><b>IB: Intelligent Agents:</b> Agents and Environments, Good Behaviour: The concept of rationality, The nature of environments, the structure of agents;</p> | <p><b>International Academia:</b><br/> <a href="https://ocw.mit.edu/courses/6-867-machine-learning-fall-2006/pages/syllabus/">https://ocw.mit.edu/courses/6-867-machine-learning-fall-2006/pages/syllabus/</a></p> <p><b>AICTE-prescribed syllabus:</b><br/> <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf</a></p> <p><b>IndustryMapping:</b><br/> AI using Python</p> | 4             | BasicPracticeprogram using Python and libraries (Numpy, Matplotlib, Pandas, etc.) |
| <p><b>Textbooks:</b><br/> (1) Russell &amp;Norvig: Ch.1,2,3,4,5,6,7,8</p> |                                        |                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |                                                                                   |

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| 2                 | <b>Problem solving techniques</b>       | <p><b>DS: <u>Solving Problems by Searching:</u></b></p> <p><b><u>Uninformed Search:</u></b><br/>State space search, BFS, DFS, Bidirectional Search, Iterative Deepening,</p> <p><b><u>Informed (Heuristic) Search Strategies:</u></b><br/>Greedy Best first search, A* search, Heuristic Functions,</p> <p><b>IB: <u>Search in Complex Environments:</u></b><br/>Hill climbing search, Simulated Annealing, Constraint satisfaction problem, Mean-end analysis</p> <p><b><u>Adversarial Search and Games:</u></b><br/>Game Theory, Optimal Decision in Games:<br/>Min- Max Search, Alpha-Beta Pruning, Heuristic<br/>Alpha-Beta Search Tree, Monte-Carlo Tree Search</p> <p><b>DS: <u>Knowledge Representation:</u></b><br/>Propositional Logic, Predicate Logic</p> | <p><b>AICTE-prescribed syllabus:</b><br/><a href="https://www.aicte-india.org/sites/default/files/UG_Emerging.pdf">https://www.aicte-india.org/sites/default/files/UG_Emerging.pdf</a></p> <p><b>International Academia:</b><br/><a href="https://ocw.mit.edu/courses/6-034-artificial-intelligence-fall-2010/resources/lecture-1-introduction-and-scope/">https://ocw.mit.edu/courses/6-034-artificial-intelligence-fall-2010/resources/lecture-1-introduction-and-scope/</a></p> <p><b>Industry Mapping:</b><br/>Python</p> | 8  | <p>1. Python programming, symbolic algebra, Water Jug Problem</p> <p>2. Perform BFS and DFS analysis on Facebook SN Dataset</p> <p>3. Implementation of A* search</p> <p>4. N-Queens Problem</p>                                                                                                                                                |
| <u>TEXTBOOKS:</u> |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |    |                                                                                                                                                                                                                                                                                                                                                 |
| 3                 | <b>Introduction to Machine Learning</b> | <p><b>DS: Machine Learning Definition &amp; Scope</b> – Evolution of Learning Systems</p> <p><b>Data Representation</b> – Features, Covariance, Orthogonality, Feature Selection vs Feature Extraction overview, Missing Data, Outliers, Noise, Normalization, Standardization, Training Validation and Testing.</p> <p><b>IB: Model Selection</b>- Holdout, Cross validation, k-fold Cross validation, random sampling, Bias-Variance tradeoff, overfitting, underfitting.</p> <p><b>Machine Learning Types</b> – Supervised, Unsupervised, Reinforcement, Adversarial, Meta- Learning - Zero-shot &amp; One-shot Learning, Transfer Learning, Ensemble Learning – Bagging and Boosting. Random Forest</p>                                                          | <p><b>International Academia:</b><br/><a href="https://ocw.mit.edu/courses/6-867-machine-learning-fall-2006/pages/syllabus/">https://ocw.mit.edu/courses/6-867-machine-learning-fall-2006/pages/syllabus/</a></p> <p><b>AICTE-prescribed syllabus:</b><br/><a href="https://www.aicte-india.org/sites/default/files/Mo-del_Curriculum/AICTE%20-%20UG%20CSE.pdf">https://www.aicte-india.org/sites/default/files/Mo-del_Curriculum/AICTE%20-%20UG%20CSE.pdf</a></p> <p><b>Industry Mapping:</b><br/>Python, Weka Toolkit</p>   | 10 | <p>1) Introduction to Weka Toolkit. Load and Interpret Data with Weka in the arff format or csv format using Python.</p> <p>2) Distinguish between normalization and standardization of data sets.</p> <p>3) Implement an algorithm in Python to handle missing data.</p> <p>4) Data visualization using Histogram Plot, Scatter Plot, etc.</p> |
| <u>TEXTBOOKS:</u> |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |    |                                                                                                                                                                                                                                                                                                                                                 |

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| 4 | <b>Supervised Learning</b> | <p><b>DS: Regression</b>–LinearRegression, Polynomial Regression, regularization.</p> <p><b>Classification</b> – Logistic Regression, Decision Trees, K-Nearest Neighbors (KNN), Support Vector Machines.(SVM)</p> <p><b>IB: Probabilistic Reasoning under Uncertainty:</b> Bayesian Classifier, Parametric and Non-parametric estimation of probability densities (Maximum Likelihood Estimate, Bayesian Estimation), Naïve Bayes Classifier, Baye’s Rule and its Use, Naïve Bayes Models,</p> <p><b>DS: Performance Metrics</b>–Confusion Matrix, Precision, Recall,F- Measure, SSE, MME, R2, Kappa, ROC- Curve &amp; AUC, Cross-Entropy Loss</p> | <p><b>International Academia:</b><br/> <a href="https://ocw.mit.edu/courses/6-867-machine-learning-fall-2006/pages/syllabus/">https://ocw.mit.edu/courses/6-867-machine-learning-fall-2006/pages/syllabus/</a><br/> <a href="https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/pages/syllabus/">https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/pages/syllabus/</a></p> <p><b>AICTE-prescribed syllabus:</b><br/> <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf</a></p> <p><b>IndustryMapping:</b> Python and Weka Toolkit, Sci-kit Learning and Matplotlib Visualization</p> | 8 | <p>1) Using Weka and Python compare the performance of Decision Trees, Random Forest, Naïve Bayes and K-Nearest Neighbor algorithms</p> <p>2) Using LibSVM implement support vector machines and compare the different kernel functions.</p> <p>3) Implement K Nearest Neighbor Algorithm</p> <p>4) Implement a perceptron using python and develop the perceptron training rule.</p> |
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TEXTBOOKS:

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| 5 | <b>Unsupervised Learning</b> | <p><b>IB: Dimensionality Reduction:</b> Eigen Value Decomposition, PrincipalComponentAnalysis, Linear Discriminant Analysis, SingularValueDecomposition</p> <p><b>DS: Clustering:</b> Gaussian Mixture Models, Expectation Maximization, K-Means Algorithms, DBSCAN, Hierarchical Clustering (AGNES)</p> <p><b>Metrics:</b> Similarity Measures, silhouette coefficient, Cluster LinkageMetrics,ClusterValidity Indices.</p> | <p><b>International Academia:</b><br/> <a href="https://ocw.mit.edu/courses/6-867-machine-learning-fall-2006/pages/syllabus/">https://ocw.mit.edu/courses/6-867-machine-learning-fall-2006/pages/syllabus/</a></p> <p><b>AICTE-prescribed syllabus:</b><br/> <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf</a></p> <p><b>Industry Mapping:</b> WekaToolkit,Sci-kit Learning and Matplotlib Visualization</p> | 6 | <p>1) Use Weka and Python to implement various feature extraction techniques</p> <p>2) Visualize data clusters using t-SNE visualization and silhouette coefficient</p> <p>3) Implement K-Means Clustering</p> <p>4) Find the correct value of K in K Means Clustering using Cluster Validity Indices.</p> |
|---|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

TEXTBOOKS:

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| 6                                                                                                                                                                                                                                                                                             | <b>Reinforcement Learning</b> | <b>IB: (entire module)</b><br><br><b>Probabilistic Reasoning over Time:</b> Time and Uncertainty, Inference in Temporal Models, Hidden Markov Models and Kalman Filters; Markov Chain Monte Carlo, Markov Decision Process (MDP) and Dynamic Programming<br><br><b>Definition and Key Concepts:</b> Agent, Environment, Reward, Policy, Value Function,<br><br>Temporal Differences, Learning from Experiences<br><b>Algorithms:</b> Q-learning, Exploration and Exploitation, Convergence, Issues and Challenges, Evaluating RL Algorithms, On-Policy Learning, RL with Generalization, SARSA with Linear Function Approximation, Escaping Local Optima,<br><br><b>Applications and Social Impact of Reinforcement Learning</b> – Data-Driven Model-less Optimal Control Engineering, in game playing, robot-control, driverless cars, self-guided drones, etc. | <b>International Academia:</b><br><a href="https://ocw.mit.edu/courses/6-867-machine-learning-fall-2006/pages/syllabus/">https://ocw.mit.edu/courses/6-867-machine-learning-fall-2006/pages/syllabus/</a> <a href="https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/pages/syllabus/AICTE-prescribed-syllabus/">https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/pages/syllabus/AICTE-prescribed-syllabus/</a> <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf</a><br><br><b>Industry Mapping:</b><br>Open AI Gymnasium | 12 | <b>Project 3:</b> Use the OpenAI Gymnasium to train a Reinforcement Learning Bot. |
| <p><b>TEXT-BOOKS:</b><br/> (1) Aurelien Geron: 18;<br/> (2) Ethem Alpaydin: Ch. 15,16, 18</p> <p><b>REFERENCE BOOKS:</b><br/> (1) Tom Mitchell: Ch.13;<br/> (2) Russell and Norvig: Ch. 14, 16, 22;<br/> (3) Poole and Mackworth: Ch. 9,10, 12. 13<br/> (4) Sutton, Barto Bach: 1,3,4,5,6</p> |                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |                                                                                   |

**Text-Books for Artificial Intelligence (Modules 1,2,3):**

- (1) 'Artificial Intelligence: A Modern Approach'--- by Stuart Russell and Peter Norvig (Pearson India, 4<sup>th</sup>ed, 2022);
- (2) 'Artificial Intelligence: Foundations of Computational Agents' - by David L. Poole and Alan K. Mackworth (Cambridge University Press, 3<sup>rd</sup>ed, 2023);

**Text-Books for Machine Learning (Modules 4,5,6):**

- (1) 'Machine Learning' – by Aurelien Geron (O'Reilly, SPD, 3<sup>rd</sup>ed, 2022);
- (2) 'Introduction to Machine Learning' - by Ethem Alpaydin (MIT Press and PHI, 3rd ed, 2014)

**Reference Books for Artificial Intelligence (Modules 1,2,3):**

- (1) 'Artificial Intelligence and Soft Computing' – by Amit Konar (CRC Press, 2000)
- (2) 'Artificial Intelligence' – by George Luger, (Pearson, 6<sup>th</sup>ed, 2021)
- (3) 'Artificial Intelligence' – by Saroj Kaushik (Cengage, 2011)
- (4) 'Artificial Intelligence' - by N. P. Padhy, (Oxford University Press, 2005)
- (5) 'A First Course in Artificial Intelligence' – by Deepak Khemani (McGraw Hill, 2013)

**Reference Books for Machine Learning (Modules 4,5,6):**

- (1) 'An Introduction to Statistical Learning – with Applications in Python' by Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani (Springer, 2023)
- (2) 'Pattern Recognition and Machine Learning' – by Christopher M. Bishop (Springer, 2006)
- (3) 'Pattern Recognition' – by Richard O. Duda, Peter E. Hart, and David G. Stork (WILEY India, 2021)
- (4) 'Pattern Recognition – An Introduction' – by V. Susheela Devi and M. Narasimha Murty (Universities Press (India) Pvt. Ltd., 2011)
- (5) 'Understanding Machine Learning From Theory to Algorithms' - by Shai Shalev-Shwartz and Shai Ben-David (Cambridge University Press, 2014)
- (6) 'Machine Learning The Art and Science of Algorithms that Make Sense of Data' - by Peter Flach (Cambridge Univ. Press, 2012)
- (7) 'Machine Learning' – by Tom Mitchell (McGraw Hill India, 1998)
- (8) 'Reinforcement Learning' - by Richard S. Sutton, Andrew G. Barto, Francis Bach (MIT Press; 2nd ed., 2018)



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Institute of Engineering & Management, Salt Lake Campus  
Institute of Engineering & Management, New Town Campus  
University of Engineering & Management, Jaipur



## Syllabus for B.Tech Admission Batch 2023

**Subject Name:** Environmental Science

**Credit:** 02

**Lecture Hours:** 36

**Subject Code:** MCC401

**Pre-requisite:** Basic knowledge of Environmental Science

### Relevant Links:

[Study Material](#)

[Coursera](#)

[NPTEL](#)

[Linkedin](#)

[Infosys Springboard](#)

### COURSE OBJECTIVES:

1. To make students aware and to encourage them to think about environmental issues from an interdisciplinary perspectives.
2. To improve their understanding about the present critical condition faced by the various ecological cycles, climate changes, sustainable development leading to probable solution and environmental management.

## COURSE OUTCOMES:

**CO1:** To understand the natural environment and its relationships with human activities.

**CO2:** To apply the fundamental knowledge of science and engineering to assess environmental and health risk

**CO3:** To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations

**CO4:** Acquire skills for scientific problem-solving related to air, water, noise& land pollution

| Module number | Topic    | Sub-topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Mapping with Industry and International Academia                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Lecture Hours | Corresponding Lab Assignment    |
|---------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------|
| 1             | Overview | Basic ideas of environment, basic concepts, man, society & environment, their interrelationship Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. Importance, | <b>International Academia:</b><br><a href="https://online.stanford.edu/courses/xeiet100-clean-renewable-energy-storage-sustainable-future">https://online.stanford.edu/courses/xeiet100-clean-renewable-energy-storage-sustainable-future</a><br><br><b>AICTE-prescribed syllabus:</b><br><a href="https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf">https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf</a><br><br><b>Industry Mapping:</b><br><a href="https://cbs.umn.edu/pop">https://cbs.umn.edu/pop</a> | 4             | There are no corresponding labs |

|   |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |   |                                 |
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|   |                | scope and principles of EIA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <a href="#">ulus/downloadplant(W WTP) .</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |                                 |
| 2 | <b>Ecology</b> | <p>Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem-components types and function. (1L)</p> <p>Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.( 2L)</p> <p>Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. (1L)</p> <p>Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to</p> | <p><b>International Academia:</b><br/> <a href="https://ocw.mit.edu/course/s/1-020-ecology-ii-engineering-for-sustainability-spring-2008/">https://ocw.mit.edu/course/s/1-020-ecology-ii-engineering-for-sustainability-spring-2008/</a></p> <p><b>AICTE-prescribed syllabus:</b><br/> <a href="https://old.aicte-india.org/downloads/Environmental%20Studies%20curriculum.pdf">https://old.aicte-india.org/downloads/Environmental Studies curriculum.pdf</a></p> <p><b>Industry Mapping:</b><br/> <a href="https://vsni.co.uk/solutions/ecology">https://vsni.co.uk/solutions/ecology</a></p> | 6 | There are no corresponding labs |

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|   |                      | biodiversity, Conservation of biodiversity.( 2L)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="https://www.helsinki.fi/en/researchgroups/statistical-ecology/software">https://www.helsinki.fi/en/researchgroups/statistical-ecology/software</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |                                 |
| 3 | <b>Air Pollution</b> | <p>Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L)</p> <p>Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.( 1L)</p> <p>Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L)</p> <p>Lapse rate: Ambient lapse rate</p> <p>Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L)</p> <p>Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L)</p> <p>Definition of pollutants and contaminants, Primary and secondary pollutants: emission</p> | <p><b>International Academia:</b><br/> <a href="https://ocw.mit.edu/course/s/1-84j-atmospheric-chemistry-fall-2013/pages/lecture-notes/">https://ocw.mit.edu/course/s/1-84j-atmospheric-chemistry-fall-2013/pages/lecture-notes/</a></p> <p><b>AICTE-prescribed syllabus:</b><br/> <a href="https://old.aicte-india.org/downloads/Environmental%20Studies%20curriculum.pdf">https://old.aicte-india.org/downloads/Environmental Studies curriculum.pdf</a></p> <p><b>Industry Mapping:</b><br/> <a href="https://www.who.int/europe/tools-and-toolkits/airq---software-tool-for-health-risk-assessment-of-air-pollution">https://www.who.int/europe/tools-and-toolkits/airq---software-tool-for-health-risk-assessment-of-air-pollution</a></p> | 6 | There are no corresponding labs |

|   |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |                                 |
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|   |                        | standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. (2L) Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. (1L) Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). (1L)               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |                                 |
| 4 | <b>Water Pollution</b> | Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenating, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication [Definition, source and effect]. Waste water standard [BOD, COD], Water Treatment system, primary and secondary treatments, tertiary treatment definition. Water pollution due to the toxic elements. USEPA and WHO guidelines for drinking water. | <p><b>International Academia:</b><br/> <a href="https://online.stanford.edu/courses/cee270m-aquatic-and-organic-chemistry-environmental-engineering">https://online.stanford.edu/courses/cee270m-aquatic-and-organic-chemistry-environmental-engineering</a></p> <p><b>AICTE-prescribed syllabus:</b><br/> <a href="https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf">https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf</a></p> | 6 | There are no corresponding labs |

|   |                    |                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |   |                                 |
|---|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------|
|   |                    |                                                                                                                                                                                                                                                                                                                                                        | <b>Industry Mapping:</b><br>Activated Sludge Simulation (ASIM), Sewage Treatment Operation and Analysis Over Time (STOAT), and GPS-X are the common softwares used for waste water treatment plant(WWTP).                                                                                                                                                                                                                                                                                                                                                                  |   |                                 |
| 5 | <b>Lithosphere</b> | Lithosphere; Internal structure of earth, rock and soil (1L). Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).(2L) | <b>International Academia:</b><br><a href="https://ocw.mit.edu/courses/1-34-waste-containment-and-remediation-technology-spring-2004/">https://ocw.mit.edu/courses/1-34-waste-containment-and-remediation-technology-spring-2004/</a><br><br><b>AICTE-prescribed syllabus:</b><br><a href="https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf">https://old.aicte-india.org/downloads/Environmental_Studies_curriculum.pdf</a><br><br><b>Industry Mapping:</b><br><a href="https://www.wasteworksonline.com/">https://www.wasteworksonline.com/</a> | 5 | There are no corresponding labs |

|   |                          |                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |                                 |
|---|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------|
| 6 | Noise pollution          | Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] (1L) Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index) ,n Ld.Noise pollution control. (1L) | <p><b>International Academia:</b><br/><i>No link found</i></p> <p><b>AICTE-prescribed syllabus:</b><br/><a href="https://old.aicte-india.org/downloads/Environmental%20Studies%20curriculum.pdf">https://old.aicte-india.org/downloads/Environmental Studies curriculum.pdf</a></p> <p><b>Industry Mapping:</b><br/><a href="#">No software found</a></p>                                                                                                                                                                                                                            | 5 | There are no corresponding labs |
| 7 | Environmental Management | Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/agreement/ protocol. (2L)                                                                                                                                   | <p><b>International Academia:</b><br/><a href="https://ocw.mit.edu/courses/11-601-introduction-to-environmental-policy-and-planning-fall-2016/">https://ocw.mit.edu/courses/11-601-introduction-to-environmental-policy-and-planning-fall-2016/</a></p> <p><b>AICTE-prescribed syllabus:</b><br/><a href="https://old.aicte-india.org/downloads/Environmental%20Studies%20curriculum.pdf">https://old.aicte-india.org/downloads/Environmental Studies curriculum.pdf</a></p> <p><b>Industry Mapping:</b><br/><a href="https://www.intellex.com/p">https://www.intellex.com/p</a></p> | 4 | There are no corresponding labs |

|  |  |  |                                             |  |  |
|--|--|--|---------------------------------------------|--|--|
|  |  |  | <a href="#"><u>roducts/environment/</u></a> |  |  |
|--|--|--|---------------------------------------------|--|--|

### TEXT BOOK:

1. [M.P. Poonia & S.C. Sharma, Environmental Studies, Khanna Publishing House \(AICTE Recommended Textbook – 2018\)](#)

### REFERENCE BOOKS:

1. Masters, G. M., “Introduction to Environmental Engineering and Science”, Prentice-Hall of India Pvt. Ltd.,1991.
2. De, A. K., “Environmental Chemistry”, New Age International
3. Das Mohapatra Gourkrishna, Basic Environmental Engineering and Elementary Biology, Vikas Publishing.,(1 January 2017) .



**University of Engineering and Management**  
**Institute of Engineering & Management, Salt Lake**  
**Campus Institute of Engineering & Management,**  
**New Town Campus University of Engineering &**  
**Management, Jaipur**



**4<sup>th</sup> Semester Syllabus for B.Tech in ECE Batch 2023-2027**

**Subject Name: Mathematics-IV**

**Credit: 3**

**Lecture Hours: 36**

**Subject Code: BSM401**

**Relevant Links:**

[Study-material-BSM401](#)

[NPTEL](#)

[Coursera](#)

**Course Objectives:**

1. To learn about Calculus of Complex functions.
2. To learn about Fourier series and Fourier Transform.
3. To learn about Laplace transform.
4. To learn about Z-transform.
5. To develop a basic understanding of Data analysis using Python.

## Course Outcomes:

**CO 1:** Identify different tools for differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

**CO 2:** Appraise the notions of Fourier series and Transform to solve advanced engineering problems.

**CO 3:** Apprehend the concept of Laplace Transform together with its applications in evaluating integrals and solving ordinary differential equations.

**CO 4:** Relate the use of Z-Transform for discrete functions and solve difference equations using Z-Transform technique.

**CO 5:** Acquire an understanding of handling and analyzing datasets, creating data visualizations, solving linear equations.

| Module number | Topics                        | Sub-topics                                                                                                                                                                               | Mapping with Industry and International Academia                                                                                                                                                                                                                   | Lecture Hours | Text Book Mapping                          | Corresponding Lab Assignment                    |
|---------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------------|-------------------------------------------------|
| 1.            | Calculus of Complex Functions | Complex function, Limit, Continuity and Differentiation; Analytic functions, Cauchy-Riemann equations (statement only); Harmonic functions, Harmonic Conjugate; construction of Analytic | <b>International Academia:</b> <ul style="list-style-type: none"><li><a href="https://ocw.mit.edu/courses/18-04-complex-variables-with-applications-spring-2018/">https://ocw.mit.edu/courses/18-04-complex-variables-with-applications-spring-2018/</a></li></ul> | 8             | Text book 1:<br>Chapter 19 &<br>Chapter 20 | ❖ Evaluation of contour integrals using MATLAB. |

|    |                                       |                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |                                                                                                              |                                                                                                                                                                                                                                                                                       |
|----|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                                       | <p>functions; elementary Analytic functions (exponential, trigonometric, logarithmic) and their properties.</p> <p>Statement for Cauchy's Integral formula for evaluation of</p> <p><math>\int_{\Gamma} f(z) dz</math>, where <math>\Gamma</math> is a circle.</p>                    | <p><b>AICTE-prescribed syllabus:</b></p> <ul style="list-style-type: none"> <li>• <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf</a></li> </ul> <p><b>Industry Mapping:</b></p> <p>To analyze the frequency response of filters by evaluating the behavior of complex functions that represent signals or system responses along a contour.</p> <p><a href="https://in.mathworks.com/help/matlab/math/complex-line-integrals.html">https://in.mathworks.com/help/matlab/math/complex-line-integrals.html</a></p> |    |                                                                                                              |                                                                                                                                                                                                                                                                                       |
| 2. | <b>Fourier Series &amp; Transform</b> | <p><i>Fourier Series:</i> Even function, Odd function. Periodic function, Euler's formula, Dirichlet's conditions; Sum of the Fourier series at the point of discontinuity and end points of an interval; Half Range Sine and Cosine Series; Parseval's Theorem (statement only).</p> | <p><b>International Academia:</b></p> <ul style="list-style-type: none"> <li>• <a href="https://see.stanford.edu/Course/EE261">https://see.stanford.edu/Course/EE261</a></li> </ul> <p><b>AICTE-prescribed syllabus:</b></p> <ul style="list-style-type: none"> <li>• <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf</a></li> </ul>                                                                                                                                                                              | 10 | <p><i>Fourier Series:</i> Textbook 1: Chapter 10</p> <p><i>Fourier Transform:</i> Textbook 1: Chapter 22</p> | <ul style="list-style-type: none"> <li>❖ Perform Fourier sine and cosine transforms using <b>MATLAB</b>.</li> <li>❖ Write Fourier series for some elementary functions using <b>MATLAB</b>.</li> <li>❖ Compare Fourier Transform results with Spectrum Analyzer outputs in</li> </ul> |

|    |                          |                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |   |                        |                                                                                                                                                                                                                                                                                                                                           |
|----|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                          | <p><i>Fourier Transforms:</i> Fourier Transform and its properties; Fourier Sine and Cosine Transforms, Fourier Transform of derivatives (statement only); Inverse Fourier Transform (statement only); Convolution theorem (statement only), related problems.</p>                                             | <p><b>Industry Mapping:</b></p> <p>To analyze periodic signals and transform them into frequency components.<br/> <a href="https://in.mathworks.com/help/matlab/math/fourier-transforms.html">https://in.mathworks.com/help/matlab/math/fourier-transforms.html</a></p>                                                                                                                                                                                                                                                                                                                                                                                                         |   |                        | real-world signal frequency analysis.                                                                                                                                                                                                                                                                                                     |
| 3. | <b>Laplace Transform</b> | <p>Laplace Transform and its properties; First and Second Shifting theorems; Laplace Transform of Periodic functions; Inversion of Laplace Transform by different methods, Convolution theorem; evaluation of integrals by Laplace Transform; solving boundary value problems by Laplace Transform method.</p> | <p><b>International Academia:</b></p> <ul style="list-style-type: none"> <li>• <a href="https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/resources/mit6_003f11_lec06/">https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/resources/mit6_003f11_lec06/</a></li> <li>• <a href="https://web.stanford.edu/~boyd/ee102/">https://web.stanford.edu/~boyd/ee102/</a></li> </ul> <p><b>AICTE-prescribed syllabus:</b></p> <ul style="list-style-type: none"> <li>• <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf</a></li> </ul> | 8 | Textbook 1: Chapter 21 | <ul style="list-style-type: none"> <li>❖ Perform Laplace transform of some elementary functions using <b>MATLAB</b>.</li> <li>❖ Perform inverse Laplace transform using <b>MATLAB</b>.</li> <li>❖ Analyze system stability using Laplace Transform and verify results through control lab experiments with real-world systems.</li> </ul> |

|    |                    |                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |                           |                                                                                                                                                                                                                                |
|----|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                    |                                                                                                                                                                                                                                    | <p><b>Industry Mapping:</b></p> <p>To analyze system dynamics, stability, and control in electrical circuits and automation.</p> <p><a href="https://in.mathworks.com/help/symbolic/sym.laplace.html">https://in.mathworks.com/help/symbolic/sym.laplace.html</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   |                           |                                                                                                                                                                                                                                |
| 4. | <b>Z-Transform</b> | Sequence, representation of sequence, Z-Transform and its properties, Shifting theorems, Inverse Z-transform, Convolution theorem, region of convergence, concept of difference equation and their solution by Z-Transform method. | <p><b>International Academia:</b></p> <ul style="list-style-type: none"> <li><a href="https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/64490a008c1c5c25c86044351465abf7/MIT6_003_F11_lec05.pdf">https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/64490a008c1c5c25c86044351465abf7/MIT6_003_F11_lec05.pdf</a></li> </ul> <p><b>AICTE-prescribed syllabus:</b></p> <ul style="list-style-type: none"> <li><a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf</a></li> </ul> <p><b>Industry Mapping:</b></p> <p>To analyze discrete-time systems, especially in control</p> | 6 | Textbook 1:<br>Chapter 23 | <ul style="list-style-type: none"> <li>❖ Compute Z-transform of some elementary of some functions using <b>MATLAB</b>.</li> <li>❖ Solve linear difference equations with constant coefficients using <b>MATLAB</b>.</li> </ul> |

|    |                                   |                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   |             |                                                                                                                                                                                                                                                                      |
|----|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                                   |                                                                                                                                                                                                                                                                                                                    | systems and digital signal processing (DSP).<br><br><a href="https://in.mathworks.com/help/symbolic/sym.ztrans.html">https://in.mathworks.com/help/symbolic/sym.ztrans.html</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   |             |                                                                                                                                                                                                                                                                      |
| 5. | <b>Data Analysis using Python</b> | Arithmetic, logical operations; List, tuple, dictionary, set; Managing arrays and matrices; Solving linear equations; Data handling: Import, clean, sort, filter, summarize, handle missing data; Calculating central tendency, standard deviation of dataset; Data visualization: Line plot, Bar plot, Histogram. | <p><b>International Academia:</b></p> <ul style="list-style-type: none"> <li>• <a href="https://ocw.mit.edu/courses/15-075j-statistical-thinking-and-data-analysis-fall-2011/pages/lecture-notes/">https://ocw.mit.edu/courses/15-075j-statistical-thinking-and-data-analysis-fall-2011/pages/lecture-notes/</a></li> <li>• <a href="https://ocw.mit.edu/courses/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/pages/readings/">https://ocw.mit.edu/courses/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/pages/readings/</a></li> </ul> <p><b>Industry Mapping:</b></p> <ol style="list-style-type: none"> <li>1. To handle datasets and visualize for real-time insights.</li> <li>2. To solve systems of equations for applications like signal processing.</li> </ol> | 4 | Textbook 2: | <ul style="list-style-type: none"> <li>❖ Handling of data using Panda Library.</li> <li>❖ Plot data using Matplotlib.</li> <li>❖ Compute Matrix operations using Numpy library.</li> <li>❖ Calculate central tendencies, standard deviation of a dataset.</li> </ul> |

### **TEXT BOOKS:**

1. **B. S. Grewal**, “Higher Engineering Mathematics”, 44<sup>th</sup> Edition (2021), Khanna Publishers. (Chapter No.s: 10, 19, 20, 21, 22, 23)
2. **Wes Mckinney**, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython”, 2<sup>nd</sup> Edition (2017), United States: O'Reilly Media.

### **REFERENCE BOOKS:**

1. **Biswadip Basu Mallik & Krishanu Deyasi**, “Engineering Mathematics” – Vol. 2B, 1<sup>st</sup> Edition (2020), Cengage Learning.
2. **B. K. Pal & K. Das**, “Engineering Mathematics” - Vol. IIB, 13<sup>th</sup> Edition (2019), Vol. IIIB, 8<sup>th</sup> Edition (2019), U. N. Dhur& Sons.
3. **Erwin Kreyszig**, “Advanced Engineering Mathematics”, 10<sup>th</sup> Edition (2017), John Wiley & Sons.
4. **R. K. Jain and S. R. K. Iyengar**, “Advanced Engineering Mathematics”, 5<sup>th</sup> Edition (2016), Narosa Publication House.
5. **B. V. Ramana**, “Higher Engineering Mathematics”, 11th Reprint (2017), Tata McGraw Hill.



**University of Engineering and Management**  
**Institute of Engineering & Management, Salt Lake Campus**  
**of Engineering & Management, New Town Campus**  
**University of Engineering & Management, Jaipur**



**Syllabus for B.Tech Admission Batch 2023**

**Subject Name: Essential Studies for Professionals-IV      Credit: 0.5      Lecture Hours: 48 Subject Code: ESP401**

| Module number | Topic                 | Sub-topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Mapping with International/National/ State Level Exams                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Lecture Hours | Corresponding Assignment                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1             | Constitution of India | <p><b>Textbook:</b><br/> <b>IGNOU-Block 2</b><br/> <b>BPSC-102</b><br/> Egyankosh URL for subject matter:</p> <ol style="list-style-type: none"> <li>Central Legislative System of India (Unit-7)<br/> <a href="https://egyankosh.ac.in/handle/123456789/57908">https://egyankosh.ac.in/handle/123456789/57908</a></li> <li>State Legislative System of India (Unit-7)<br/> <a href="https://egyankosh.ac.in/handle/123456789/57908">https://egyankosh.ac.in/handle/123456789/57908</a></li> <li>Constitutional Amendments.<br/> (Chapter 10 &amp; Appendix – IV – Indian Polity – M.Laxmikanth)</li> </ol> <p>(In brief and Capsule Form)</p> | <p><b>National Exams:</b><br/> 1. <i>UPSC Civil Services Exam</i><br/> (<a href="https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf">https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf</a>), pg 25-26<br/> 2. <i>UPSC Combined Defence Services</i><br/> (<a href="https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf">https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf</a>), pg 20-21<br/> 3. <i>Combined Graduate Level conducted by SSC</i><br/> (<a href="https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304_2023.pdf">https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304_2023.pdf</a>) pg. 20-22<br/> 4. <i>Intelligence Bureau ACIO</i><br/> (<a href="https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-">https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-</a></p> | 10            | <p><u>Assignment:</u><br/> Evolution of the Indian Parliament: A Historical Overview</p> <p>Discuss the powers, responsibilities, and challenges faced by the Speaker of the Lok Sabha in maintaining order and impartiality.</p> <p><u>Discussion:</u><br/> Anti-defection Law: Impact on Indian Politics</p> <p><u>Debate:</u><br/> The Efficacy of Parliamentary Sessions: Quality vs. Quantity</p> <p><b>** All the assignments are in line of GS Paper I of UPSC CSE Mains Examination</b></p> |

|   |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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|   |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p><a href="#">Notification-Emp-News.pdf</a> )</p> <p><b>State Level Exams:</b></p> <p>1.Civil Services Executive Exam (WBCS) (<a href="https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisement">https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisement</a>), pg 1</p> <p>2. Miscellaneous Services Recruitment Examination (<a href="https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf">https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf</a>) ) pg 1</p>                                                                                                                                                                                                                                                                                                                                             |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 2 | History | <p><b>MODULE 2.1</b></p> <p><b>Our Freedom Struggle</b></p> <p>Textbook:</p> <p><b>IGNOU: BHIC-134</b></p> <p><b>History of India: 1707-1950</b></p> <p>1. Partition of Bengal, Swadeshi and Boycott Movement. (Unit 10.11) <a href="https://egyankosh.ac.in/handle/123456789/73867">https://egyankosh.ac.in/handle/123456789/73867</a></p> <p>2. Nationalist Movements under Mahatma Gandhi (Unit 11) <a href="https://egyankosh.ac.in/handle/123456789/73867">https://egyankosh.ac.in/handle/123456789/73867</a></p> <p>3. Advent of Freedom (Unit 13) <a href="https://egyankosh.ac.in/handle/123456789/73867">https://egyankosh.ac.in/handle/123456789/73867</a></p> | <p><b>National Exams:</b></p> <p>1.UPSC Civil Services Exam (<a href="https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf">https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf</a> ), pg 25-26</p> <p>2. UPSC Combined Defence Services (<a href="https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf">https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf</a> ), pg 20-21)</p> <p>3. Combined Graduate Level conducted by SSC (<a href="https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304_2023.pdf">https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304_2023.pdf</a> ) pg. 20-22</p> <p>4. Intelligence Bureau ACIO (<a href="https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf">https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf</a></p> | 12 | <p><u>Assignment:</u></p> <p>Discuss the significance of the Quit India Movement in the final push for independence.</p> <p><u>Discussion:</u></p> <p>The Art of Temple Building: Architectural Innovations under the Cholas</p> <p><u>Debate:</u></p> <p>“In achieving Indian independence, Mahatma Gandhi's non-violent resistance was a more effective strategy than Subhash Chandra Bose's call for armed struggle.”</p> <p>** All the assignments are in line of GS Paper I of UPSC CSE Mains Examination.</p> |

|   |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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|   |           | <p>(In brief and Capsule Form)</p> <p><b>MODULE 2.2</b></p> <p><b><u>Hindu Kingdoms of Early Medieval India</u></b></p> <p><b>Textbook:</b></p> <p><b>IGNOU: BHIC-132</b><br/><b>(History of India from c. 300 to 1206)</b></p> <ol style="list-style-type: none"> <li>1. Chalukya Dynasty (Unit 6.3)<br/><a href="https://egyankosh.ac.in/handle/123456789/61907">https://egyankosh.ac.in/handle/123456789/61907</a></li> <li>2. The Imperial Cholas (Unit 6.4)<br/><a href="https://egyankosh.ac.in/handle/123456789/61907">https://egyankosh.ac.in/handle/123456789/61907</a></li> </ol> <p>(In brief and Capsule Form)</p> | <p><b>State Level Exams:</b></p> <p><b>1.Civil Services Executive Exam (WBCS)</b><br/>(<a href="https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisement">https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisement</a>, pg 1</p> <p><b>2. Miscellaneous Services Recruitment Examination</b><br/>(<a href="https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf">https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf</a>)), pg 1</p>   |    |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 3 | Geography | <p>Textbook:</p> <p><b>Textbook:</b><br/><b><u>BGGET- 141</u></b></p> <p><b>IGNOU-Block 1</b><br/>Egyankosh URL for subject matter:</p> <ol style="list-style-type: none"> <li>1. Rivers of India (Unit 3)<br/><a href="http://egyankosh.ac.in/handle/123456789/80896">http://egyankosh.ac.in/handle/123456789/80896</a></li> <li><b>IGNOU-Block 2</b></li> <li>2. Multipurpose River Valley Projects (Unit 7)<br/><a href="http://egyankosh.ac.in/handle/123456789/80896">http://egyankosh.ac.in/handle/123456789/80896</a></li> </ol>                                                                                        | <p><b>National Exams:</b></p> <p><b>1.UPSC Civil Services Exam</b><br/>(<a href="https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf">https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf</a>), pg 25-26</p> <p><b>2. UPSC Combined Defence Services</b><br/>(<a href="https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf">https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf</a>), pg 20-21</p> <p><b>3. Combined Graduate Level conducted by SSC</b><br/>(<a href="https://ssc.nic.in/SSCFileSer">https://ssc.nic.in/SSCFileSer</a></p> | 12 | <ol style="list-style-type: none"> <li>1. <u>Rivers of India</u><br/>Assignment: Major rivers of India. creating a detailed itinerary, documenting key geographical features, historical landmarks, and ecological zones along the river.</li> <li>2. <u>Multipurpose River Valley Projects:</u><br/>Essay writing on “Pros and Cons of a constructing multipurpose river valley project in-terms of ecological, social impacts.”</li> </ol> |

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|   |                  | <p><a href="http://ndle/123456789/80606">ndle/123456789/80606</a></p> <p>3. Thermal Power Projects (Unit 10)<br/><a href="http://egyankosh.ac.in//ha/ndle/123456789/80609">http://egyankosh.ac.in//ha/ndle/123456789/80609</a></p> <p>4. Insights on Economic Geography of India: Ores and Minerals (Unit 9)<br/><a href="http://egyankosh.ac.in//ha/ndle/123456789/80608">http://egyankosh.ac.in//ha/ndle/123456789/80608</a>,<br/><b>IGNOU-Block 3</b></p> <p>Industries of India Unit 12)<br/><a href="http://egyankosh.ac.in//ha/ndle/123456789/80262">http://egyankosh.ac.in//ha/ndle/123456789/80262</a>,<br/>Transport Geography. (Unit 13)<br/><a href="http://egyankosh.ac.in//ha/ndle/123456789/80263">http://egyankosh.ac.in//ha/ndle/123456789/80263</a></p> <p>(In brief and Capsule Form)</p> | <p><a href="http://ver/PortalManagement/UploadedFiles/notice_CGLE_0304_2023.pdf">ver/PortalManagement/UploadedFiles/notice_CGLE_0304_2023.pdf</a> ) pg. 20-22</p> <p>4. <b>Intelligence Bureau ACIO</b> (<a href="https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf">https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf</a> )</p> <p><b>State Level Exams:</b></p> <p>1. <b>Civil Services Executive Exam</b> (WBCS) (<a href="https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisment">https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisment</a>, pg 1</p> <p>2. <b>Miscellaneous Services Recruitment Examination</b> (<a href="https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf">https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf</a>) pg 1</p> |    | <p>3. <b>Thermal Power Projects:</b><br/>Debate on Future of Thermal Power:</p> <p>4. <b>Case Study on Energy Resource Assessment:</b> Assess India's energy resources, including coal, petroleum, natural gas, and renewable energy sources, and analyze their role in shaping the country's industrial development and energy security.</p> <p><b>** All the assignments are in line of GS Paper I of UPSC CSE Mains Examination.</b></p> |
| 4 | <b>Economics</b> | <p><b>Textbook:</b><br/><b>IGNOU</b></p> <p>1. Tax System of India (Textbook: Principles of Microeconomics: N Geogory Mankiew, Chapter-12)</p> <p>2. Balance of Payment (BECC-106, Block-3, Unit-8)<br/><a href="http://egyankosh.ac.in//ha/ndle/123456789/75074">http://egyankosh.ac.in//ha/ndle/123456789/75074</a></p> <p>3. Industrial Reforms</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p><b>National Exams:</b></p> <p>1. <b>UPSC Civil Services Exam</b> (<a href="https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf">https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf</a> ), pg 25-26</p> <p>2. <b>UPSC Combined Defence Services</b> (<a href="https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf">https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf</a> ), pg 20-21</p> <p>3. <b>Combined Graduate Level conducted by SSC</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 09 | <p>1. <b>Tax System of India</b><br/>Assignment on “how different tax policies impact various socio-economic groups and propose measures to enhance fairness and inclusivity”.</p> <p>2. <b>Balance of Payment</b>,<br/>Debate on “Impact of trade policies on the balance of payments”</p> <p>3. <b>Industrial Reforms</b><br/>Brainstorming session on “Digital Industry</p>                                                              |

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|   |                                       | <p>(BECC-113, Block-1, Unit-9)</p> <p><a href="http://egyankosh.ac.in/handle/123456789/89588">http://egyankosh.ac.in/handle/123456789/89588</a></p> <p>4. NITI Aayog and its relationship with 5-year plan (Textbook: Indian Economy: Misra &amp; Puri, Chapter-56,58,61,63)</p> <p>5. Sustainable Development Goals(BECC-114, Block-5, Unit-11)</p> <p><a href="http://egyankosh.ac.in/handle/123456789/90544">http://egyankosh.ac.in/handle/123456789/90544</a></p> <p>(In brief and Capsule Form)</p> | <p>(<a href="https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304_2023.pdf">https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304_2023.pdf</a>) pg. 20-22</p> <p>4. <b>Intelligence Bureau ACIO</b> (<a href="https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf">https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf</a>)</p> <p><b>State Level Exams:</b></p> <p>1. <b>Civil Services Executive Exam (WBCS)</b> (<a href="https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisement">https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisement</a>), pg 1</p> <p>2. <b>Miscellaneous Services Recruitment Examination</b> <a href="https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf">https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf</a>) pg 1</p> |   | <p>Transformation”</p> <p>4. <u>NITI Aayog and its relationship with 5 year plan</u><br/>Policy Debate: NITI Aayog vs. Five-Year Plans</p> <p>5. <u>Sustainable Development Goals</u><br/>Building of Sustainable Business plan aligned with one or more SDGs. They should consider environmental, social, and economic aspects, outlining how their business would contribute positively to the goals.</p> |
| 5 | <b>Current Affairs and Static GK:</b> | <p>National News, International News, MOU's and agreements, Summits and Conclaves, Obituaries, Awards and Events, Sports, Important Days, Banking and Economic Awareness</p>                                                                                                                                                                                                                                                                                                                             | <p><b>National Exams:</b></p> <p>1. <b>UPSC Civil Services Exam</b> (<a href="https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf">https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf</a>), pg 25-26</p> <p>2. <b>UPSC Combined Defence Services</b> (<a href="https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf">https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf</a>), pg 20-21</p> <p>3. <b>RBI Grade B</b> (<a href="https://rbidocs.rbi.org.in/rdo">https://rbidocs.rbi.org.in/rdo</a>)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 5 | <p>1. Discussion on National and International affairs</p> <p>2. Discussion on MOU's and agreements, Summits and Conclaves</p> <p>3. Discussion on recent Awards and Events, Sports.</p> <p>4. Discussion on Economic Awareness</p>                                                                                                                                                                         |

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|  |  |  | <p><a href="https://www.ibps.in/wp-content/uploads/Detailed-Advt.-CRP-PO-XII.pdf">cs/Content/PDFs/DADVTGRB09052023FA65E4FB1C2CF473396B4FD7E5F69CDDE.PDF</a> ), pg 22-23</p> <p>4. <b>IBPS Probationary officer</b>(<a href="https://www.ibps.in/wp-content/uploads/Detailed-Advt.-CRP-PO-XII.pdf">https://www.ibps.in/wp-content/uploads/Detailed-Advt.-CRP-PO-XII.pdf</a> ) , Pg 7.</p> <p>5. <b>Combined Graduate Level conducted by SSC</b> (<a href="https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf">https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf</a> ) pg. 20-22</p> <p>6. <b>Intelligence Bureau ACIO</b> (<a href="https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf">https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf</a> )</p> <p><b>State Level Exams:</b></p> <p>1.<b>Civil Services Executive Exam</b> (WBCS) (<a href="https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisement">https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisement</a>, pg 1</p> <p>2. <b>Miscellaneous Services Recruitment Examination</b> (<a href="https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf">https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf</a>)), pg 1</p> |  |
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**Learning Resources:****Reference Books:**

1. Current Affairs Magazine of IEM-UEM
2. Lucent GK



University of Engineering and Management  
Institute of Engineering & Management, Salt Lake Campus  
Institute of Engineering & Management, New Town Campus  
University of Engineering & Management, Jaipur



**Syllabus for B.Tech Admission Batch 2023-2026**

**Subject Name:** Object Oriented Programming with Java

**Credit:** 2

**Lecture Hours:** 30

**Subject Code:** OEC481

**Pre-requisite:** C, Basic knowledge of programming language.

**Relevant Links:**

[Study Material](#)

[Coursera](#)

[NPTEL](#)

[Linkedin Learning](#)

[Infosys Springboard](#)

**Course Objectives:**

1. To introduce the object-oriented programming concepts.
2. To understand object-oriented programming concepts, and apply them in solving problems.
3. To introduce the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes, the concepts of exception handling.
4. To introduce the design of Graphical User Interface using applets and swing controls.

**Course Outcomes:**

Students will be able to

**CO1:**Identify the need for solving the real world problems using the concepts of java programming – advantages of java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class.

**CO2:** Understand the implementation of Object oriented concepts using Java through. Class, object, message passing, inheritance, encapsulation, polymorphism.

**CO3:**Apply the concept of mutable and immutable string, basics of I/O operations – keyboard input using Buffered Reader & Scanner classes for real life applications.

**CO4:**Create web applications and GUI based applications.

| Module number | Topic                                                              | Sub-topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Mapping with Industry and International Academia                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Lecture Hours | Text Book Mapping                     | Corresponding Lab Assignment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1             | <b>Concepts of object oriented programming language using Java</b> | Basic concepts of java programming – advantages of java, byte-code & JVM, JDK, JRE , concepts of classes and objects, variables and data types, access modifiers, operators, control statements & loops, array, creation of class. Methods and, Visibility, switch-case, Use of Static, final, Java Stack and Heap with Reference Variables, Records.<br><br>Ways of creating Objects, cloning of Objects, compiling Java programs using command line, creating and deploying | <b>International Academia:</b><br><a href="https://drive.google.com/file/d/10z00dMd26WjiPThhCercGbsi6u3ciE62/view?usp=drive_link">https://drive.google.com/file/d/10z00dMd26WjiPThhCercGbsi6u3ciE62/view?usp=drive_link</a><br><br><a href="https://drive.google.com/file/d/1k3qrfDL9p5_IJR_iP2mt6c6AzwmByNtf/view?usp=sharing">https://drive.google.com/file/d/1k3qrfDL9p5_IJR_iP2mt6c6AzwmByNtf/view?usp=sharing</a><br><br><b>AICTE-prescribed syllabus:</b><br><a href="https://www.aicte-india.org/sites/default">https://www.aicte-india.org/sites/default</a> | 4             | <b>Chapter 1, 2, 3, 4, 5, 6, 7, 8</b> | <ol style="list-style-type: none"><li>1. WAP in Java to create a class with two methods to perform area and perimeter of a circle.</li><li>2. WAP in java to show the use of methods with return types and methods without return types.</li><li>3. WAP in java to show how to take user defined input using Command Line argument.</li><li>4. WAP to show how using command Line arguments String, Float, Double variables are accessed in a code.</li><li>5. WAP in java to show how to use “for” loops in the main class to evaluate any iterative classes.</li></ol> |

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|   |                                 | <p>executable programs using JARs, creating Jars using command line, Primitive Types in Java, Casting in Java, Operators, operands and expressions using Java.</p> <p>Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, message passing, inheritance, encapsulation, polymorphism.</p> <p>Interfaces, Abstract Classes. Overloading, Overriding(Method and constructor overloading), Static and Instance variables. final and static keywords in javaConstructors in Java, Types of constructors, Copy constructors.</p> | <p><a href="/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf">/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf</a></p> <p><b>Industry Mapping:</b><br/>Hackerrank, TCS<br/>Codevita projects,<br/>GitHub Platform.<br/>NetBeans and Eclipse IDE will be used.</p>                                                                                                                                                                                                 |   |                         | 6. Create a calculator to show basic operations like addition, multiplication and Subtraction.                                                                                                                                                                                                                                                                                                                                                                                    |
| 2 | <b>Object oriented concepts</b> | Implementation of Object oriented concept.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p><b>International Standards</b><br/><a href="https://drive.google.com/file/d/1Rc1KOzkVRHqLEWApFBplwz7s8IwsyFlf/view?usp=sharing">https://drive.google.com/file/d/1Rc1KOzkVRHqLEWApFBplwz7s8IwsyFlf/view?usp=sharing</a></p> <p><a href="https://drive.google.com/file/d/1e8g7D6nuMwEruToXtNDbh68vx2VKUrgS/view?usp=sharing">https://drive.google.com/file/d/1e8g7D6nuMwEruToXtNDbh68vx2VKUrgS/view?usp=sharing</a></p> <p><b>AICTE prescribed syllabus:</b></p> | 4 | <b>Chapter 8, 9, 32</b> | <ol style="list-style-type: none"> <li>1. Defined methods to perform basic operations like add, subtract, division, multiplication where values must be passed from the main method.</li> <li>2. Define user-defined methods for the following: without argument and without return type, with argument/s and without return type, with argument/s and with return type. Call all from the main.</li> <li>3. Write the program to show: single inheritance, multilevel</li> </ol> |

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|  |  |  | <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf</a> |  |  | <p>inheritance, hierarchical inheritance, multiple inheritance.</p> <ol style="list-style-type: none"> <li>Write a program to show the polymorphism: constructor overloading, method overloading, method overriding.</li> <li>WAP to show how the “final” keyword can be used to prevent method overriding.</li> <li>WAP to show what are the significant uses of “final” keyword in java.</li> <li>WAP to show how “static” keyword can be used to create static variables.</li> <li>WAP to show how “static” block can be created.</li> <li>WAP to show how “static” keywords can be used with a constructor.</li> <li>Justify when method overloading behaves like method overriding.</li> <li>WAP in java to show “multiple inheritance” can be implemented in java.</li> <li>WAP in java to show “interface can be extended in java”</li> </ol> |
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**Industry Mapping:** Hackerrank , TCS Codevita projects, GitHub platform. NetBeans and Eclipse IDE will be used.

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|   |                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                        |   |                             | <p>13. WAP in java to show using Single inheritance how a method can be overloaded.</p> <p>14. WAP to define “abstract” class in java.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 3 | <p><b>Object properties Language features to be covered:</b></p> <p><b>Java Collection Framework</b></p> | <p>Object, constructor, garbage collection in java (finalize())<br/>Use of method overloading, this keyword, use of objects as parameter &amp; methods returning objects, call by value &amp; call by reference, static variables &amp; methods, basic string handling concepts.</p> <p>Concept of mutable and immutable string. String Buffer and StringBuilder</p> <p>Basics of I/O operations – keyboard input using Buffered Reader &amp; Scanner classes.</p> <p>List, ArrayList, Map, HashMap, Set, TreeSet, HashSet.</p> | <p><b>International Standards :</b></p> <p><b>AICTE prescribed syllabus:</b><br/> <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf</a></p> <p><b>Industry Mapping:</b><br/>Hackerrank, TCS Codevita projects, GitHub Platform. NetBeans and Eclipse IDE will be used.</p> | 8 | Chapter 6, 7, 13, 15 and 17 | <p>1. Write a program to demonstrate for the following: object as a parameter of method, object type as return type of a method.</p> <p>2. Consider a class Visit, on creation of each object value of a counter variable is incremented by 1 and shows the value each time. Use the static variable and write the program.</p> <p>3. Write a program to show the use of command argument passing.</p> <p>4. Write a program to take input of first name, last name. Then print as full name.</p> <p>5. Write a program to take user inputs for int, float, double, String using Scanner class. Then print all.</p> <p>6. Take a string input and show use of different string methods.</p> <p>7. WAP in java to show String in java is “mutable” or</p> |

|   |                               |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   |                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
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|   |                               |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   |                      | "immutable."                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 4 | <b>Reusability properties</b> | <p>Super class &amp; subclasses including multilevel hierarchy.</p> <p>Process of constructor calling in inheritance, use of super and final keywords with super() method.</p> <p>Dynamic method dispatch, use of abstract classes &amp; methods, interfaces.</p> | <p><b>International Standards:</b><br/> <a href="https://ocw.mit.edu/ans7870/6/6.005/s16/classes/09-immutability/">https://ocw.mit.edu/ans7870/6/6.005/s16/classes/09-immutability/</a><br/> <a href="https://ocw.mit.edu/courses/6-088-introduction-to-c-memory-management-and-c-object-oriented-programming-january-iap-2010/67b1aec3f2867734ec0fb33034c8b5c8_MIT6_088IAP10_1ec05.pdf">https://ocw.mit.edu/courses/6-088-introduction-to-c-memory-management-and-c-object-oriented-programming-january-iap-2010/67b1aec3f2867734ec0fb33034c8b5c8_MIT6_088IAP10_1ec05.pdf</a></p> <p><b>AICTE prescribed syllabus:</b><br/> <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf</a></p> <p><b>Industry Mapping:</b><br/> Hackerrank, TCS<br/> Codevita projects,<br/> GitHub Platform.<br/> NetBeans and Eclipse IDE will be used.</p> | 6 | <b>Chapter 8, 15</b> | <ol style="list-style-type: none"> <li>1. Write a program to show the use of super and super().</li> <li>2. "Super class gets constructed before subclasses". write a program to support this in multilevel and hierarchical inheritance.</li> <li>3. Create an abstract class named "Shape" with an abstract method "calculateArea()". Implement two subclasses, "Circle" and "Rectangle," which extend the "Shape" class and provide their implementations for the "calculateArea()" method.</li> <li>4. Create an abstract class named "Vehicle" with instance variables for "model" and "year." Include an abstract method named "start()" and a non-abstract method "displayDetails()" that prints the model and year. Implement two subclasses, "Car" and "Motorcycle," each with its own version of the "start()" method.</li> <li>5. Create an abstract class "Bank" with an abstract method "calculateInterest()". Implement two subclasses, "SavingsAccount" and "LoanAccount," each with its own implementation of the "calculateInterest()" method.</li> <li>6. Create an interface named "Drawable" with a method</li> </ol> |

|   |                                          |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |   |                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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|   |                                          |                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |   |                          | <p>"draw()". Implement two classes, "Circle" and "Rectangle," each implementing the "Drawable" interface with its own version of the "draw()" method.</p> <ol style="list-style-type: none"> <li>WAP to show multilevel inheritance, deal with default constructors and find the order of output being encountered.</li> <li>WAP program in java to show how hybrid inheritance can be implemented in java.</li> <li>WAP in java to show how constructors can be used while using inheritance.</li> </ol>                                                                                                                                                                                                                  |
| 5 | <b>Exception handling Multithreading</b> | System defined and Used define Packages,Exception handling basics, Basics of multithreading. | <p><b>International Standards:</b><br/> <a href="https://drive.google.com/file/d/1kbRGF396sQPdQbA4w-N81EIKU_bdGgFs/view?usp=sharing">https://drive.google.com/file/d/1kbRGF396sQPdQbA4w-N81EIKU_bdGgFs/view?usp=sharing</a></p> <p><b>AICTE prescribed syllabus:</b><br/> <a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf</a></p> <p><b>Industry Mapping:</b><br/> Hackerrank, TCS<br/> Codevita projects,<br/> GitHub</p> | 4 | <b>Chapter 10 and 11</b> | <ol style="list-style-type: none"> <li>WAP to show how "ArithmeticException" and "ArrayIndexOutOfBoundsException" can be used.</li> <li>WAP to justify "is it possible to use"try " without"catch " block".</li> <li>WAP to show the use of "Nested Try Catch" in java.</li> <li>WAP to show how to use system defined packages in java.</li> <li>WAP to use how to create user defined packages in java.</li> <li>Consider a method div that takes two arguments of int type to perform division. Use try, catch, finally so that the program will not be terminated due to any exception for all scenario (values passes through div).</li> <li>Write a program to show the working of multiple threads using</li> </ol> |

|   |                                     |                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                      |   |                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   |                                     |                                                                                                                                                                                                              | platform. NetBeans and Eclipse IDE will be used.                                                                                                                                                                                                                                                                                                                                     |   |                          | Thread class, and Runnable interface.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 6 | <b>Applet and swing Programming</b> | <p>Basics of applet programming, applet life cycle.</p> <p>Difference between application &amp; applet programming.</p> <p>Server/client communication, Hardware communication, Enterprise communication</p> | <p><b>AICTE prescribed syllabus:</b><a href="https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf">https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf</a></p> <p><b>Industry Mapping:</b><br/>Hackerrank, TCS<br/>Codevita projects,<br/>GitHub Platform.<br/>NetBeans and Eclipse IDE will be used.</p> | 4 | <b>Chapter 13 and 29</b> | <ol style="list-style-type: none"> <li>1. WAP in java using an applet to show how to draw “Line,Arc,Oval, Rectangle and String.”</li> <li>2. WAP in java to show how to color boundaries and complete area of specific objects designed by applet.</li> <li>3. WAP in java Design an applet program to design different shapes.</li> <li>4. Develop an applet program to demonstrate lifecycle of applet.</li> <li>5. Design a swing application to show the user of Listener.</li> <li>6. Design a swing application of basic calculators.</li> <li>7. Design and implementation Printer driver.</li> <li>8. Designing of Enterprise Resource Planning (ERP) and application.</li> <li>9. Designing of Customer Relationship Management (CRM).</li> </ol> |

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|  |  |  |  |  |  | 10. TCP<br>communication<br>programming). | Client-Server<br>(Socket |
|--|--|--|--|--|--|-------------------------------------------|--------------------------|

### **Text Books:**

1. Schildt, H., Java: The Complete Reference 12th Edition, McGraw-Hill Education Group.

### **Reference Books:**

1. Horton, I. (2004). Beginning Java™ 2. John Wiley & Sons.



University of Engineering and Management  
Institute of Engineering & Management, Salt Lake Campus  
Institute of Engineering & Management, New Town Campus  
University of Engineering & Management, Jaipur



## Syllabus for B.Tech Admission Batch 2022

**Subject Name: Skill Development for Professionals-IV**

**Credit: 0.5**

**Lecture Hours: 48**

**Subject Code: SDP482**

**Pre-requisite:** Basic & fundamental knowledge of mathematics up to class 10th standard, Logical & Analytical skill.

### **COURSE OBJECTIVES:**

1. To improve verbal ability skill and communicative skill of the students.
2. To enhance the analytical skill and problem solving skill of the students.
3. To make them prepare for various public and private sector exams & placement drives.

## COURSE OUTCOMES:

- CO 1:** It will improve verbal ability skill among students.  
**CO 2:** Students will communicate effectively & appropriately in real life situation.  
**CO 3:** Apply the rules and solve the problems.  
**CO 4:** Analyze the given set of data and reach conclusion.  
**CO 5:** Evaluate the table and problem statement and solve the problem statements.

| Module number | Topic                        | Sub-topics                                                                                                                                                                                                                                                                                                                                                                                                        | Mapping with Industry and International Academia                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Lecture Hours | Corresponding Lab Assignment                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1             | <b>Quantitative Aptitude</b> | <u>Permutation &amp; Combination:</u><br>Numbers, Alphabets, Linear arrangement, Circular arrangement, Repetition, Selection based<br><u>Probability:</u> Coins, Dices, Drawing of balls, Cards, Numbers, Miscellaneous.<br><u>Mensuration</u> – Rectangle, Square, Triangle, Rhombus, Parallelogram, Cylinder, Cone, Sphere, Hemisphere<br><u>Geometry-</u> Lines, Angles, Triangles, Quadrilateral and circles. | <b>International Exams</b><br><b>1. GRE</b><br>( <a href="https://www.ets.org/pdfs/gre/gre-math-review.pdf">https://www.ets.org/pdfs/gre/gre-math-review.pdf</a> )<br><b>2. GMAT</b><br>( <a href="https://downloads.mba.com/downloads/gmat-handbook.pdf">https://downloads.mba.com/downloads/gmat-handbook.pdf</a> )<br><br><b>National Exams:</b><br><b>1. UPSC Civil Services Exam</b><br>( <a href="https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf">https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf</a> ), pg 25-26<br><b>2. UPSC Combined Defence Services</b><br>( <a href="https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf">https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf</a> ) | 12            | 1. Permutation & Combination<br>a. How to arrange different numbers in different sequences.<br>b. Questions based on Alphabet arrangements.<br>c. Problems based on linear and circular arrangements.<br>d. Problems based on garlands and Necklaces.<br>e. Problems based on selection of things and persons.<br>2. Probability<br>a. Problems based on different numbers of coin tossed.<br>b. Problems based on rolling dices.<br>c. Problems based on forming of |

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|  |  |  | <p><a href="#">ult/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf</a> ), pg 20-21</p> <p>3. RBI Grade B<br/>(<a href="https://rbidocs.rbi.org.in/rdocs/Content/PDFs/DADVTGRB09052023EA65E4FB1C2CE473396B4FD7E5F69CDDE.PDF">https://rbidocs.rbi.org.in/rdocs/Content/PDFs/DADVTGRB09052023EA65E4FB1C2CE473396B4FD7E5F69CDDE.PDF</a> ), pg 22-23</p> <p>4. IBPS Probationary officer(<a href="https://www.ibps.in/wp-content/uploads/Detailed-Advt.-CRP-PO-XII.pdf">https://www.ibps.in/wp-content/uploads/Detailed-Advt.-CRP-PO-XII.pdf</a> ) , Pg 7.</p> <p>5. Combined Graduate Level conducted by SSC<br/>(<a href="https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf">https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf</a> ) pg. 20-22</p> <p>6. Intelligence Bureau ACIO<br/>(<a href="https://www.pw.live/exams/wp-content/uploads/2023/11/TB-ACIO-Recruitment-2023-Notification-Emp-News.pdf">https://www.pw.live/exams/wp-content/uploads/2023/11/TB-ACIO-Recruitment-2023-Notification-Emp-News.pdf</a> )</p> <p>7. XAT<br/>(<a href="https://xat.org.in/xat-syllabus/">https://xat.org.in/xat-syllabus/</a></p> | <p>committees based on selection.</p> <p>d. Problems based on drawing of cards</p> <p>3. Mensuration.</p> <p>a. Problems based on 2D and 3D shapes.</p> <p>b. Finding area based on mixed shapes.</p> <p>c. Finding the volume based on different shapes.</p> <p>d. Problems based on Prism Pyramid.</p> <p>4. Geometry:</p> <p>a. Problems based on Lines and Angles.<br/>Problems based on complementary, supplementary, corresponding, alternative angles.</p> <p>c. Problems based on acute, right, obtuse, scalene, equilateral, isosceles triangles.</p> <p>d. Basis problems based on Quadrilaterals.</p> <p>e. Basic Problems based on chords and</p> |
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|   |                          |                                                                                                                      | <p>)</p> <p><b>8. GATE</b><br/> <a href="https://gate2024.iisc.ac.in/papers-and-syllabus/">(https://gate2024.iisc.ac.in/papers-and-syllabus/)</a></p> <p><b>9. CAT</b><br/> <a href="https://iimcat.ac.in/per/g01/publish/756/ASM/WebPortal/1/index.html?756@@1@@1">https://iimcat.ac.in/per/g01/publish/756/ASM/WebPortal/1/index.html?756@@1@@1</a></p> <p><b>State Level Exams:</b></p> <p><b>1. Civil Services Executive Exam (WBCS)</b><br/> <a href="https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisement">https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisement</a>, pg 1</p> <p><b>2. Miscellaneous Services Recruitment Examination</b><br/> (file:///C:/Users/UEMK/Downloads/2707970_2019.pdf), pg 1</p> |    | <p>tangents.</p> <p>** All the assignments are in line of GSPaper I of UPSC CSE Mains Examination</p>                                                                                             |
| 2 | <b>Logical Reasoning</b> | <p>1) Calendar</p> <p>2) Analogy &amp; Classification</p> <p>3) Dice &amp; Cube, Puzzles and Sitting Arrangement</p> | <p><b>National Exams:</b></p> <p><b>1. UPSC Civil Services Exam</b><br/> <a href="https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf">https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf</a>), pg 25-26</p> <p><b>2. UPSC Combined Defence</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 12 | <p>1. Calendar</p> <p>a. Problems based basic structure of a calendar and a concept of an odd day.</p> <p>b. Problems based on leap year in centuries.</p> <p>Problems based on exact day and</p> |

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|  |  |  | <p>Services(<a href="https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf">https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf</a> , pg 20-21)</p> <p>3. Combined Graduate Level conducted by SSC<br/>(<a href="https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf">https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf</a>) pg. 20-22</p> <p>4. Intelligence Bureau ACIO<br/>(<a href="https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf">https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf</a>)</p> <p><b>State Level Exams:</b></p> <p>1. Civil Services Executive Exam (WBCS)<br/>(<a href="https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisement">https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisement</a>, pg 1</p> <p>2. Miscellaneous Services Recruitment Examination<br/>(<a href="file:///C:/Users/UEMK/Downloads/2707970_2019.pdf">file:///C:/Users/UEMK/Downloads/2707970_2019.pdf</a>),</p> | <p>comparison of day.</p> <p>d. Finding the day when another day is given or not given.</p> <p>2. Analogy &amp; Classification</p> <p>a. Problems based on letter or word based analogy.</p> <p>b. Problems based on Number based analogy.</p> <p>c. Problems based on Mixed analogy.</p> <p>d. Problems based on image analogy.</p> <p>3. Dice &amp; Cube</p> <p>a. Problems based on standard dice and ordinary dice.</p> <p>b. Problems based on single dice.</p> <p>c. Problems based on two or more dices.</p> |
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|   |                            |                                                                                                                                                  | <i>pg 1</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 3 | <b>Objective English-2</b> | 1) Application of Adverbs<br>2) Active Passive Voice<br>3) Direct and Indirect Speech<br>4) Reading Comprehension<br>5) Technical Report Writing | <p><i>International Exams</i></p> <p><b>1. GRE</b><br/> (<a href="https://www.ets.org/gre/test-takers/general-test/prepare/content/verbal-reasoning.html#accordion-9f58105fc6-item-88093eca37">https://www.ets.org/gre/test-takers/general-test/prepare/content/verbal-reasoning.html#accordion-9f58105fc6-item-88093eca37</a>)</p> <p><i>National Exams:</i></p> <p><b>1. UPSC Civil Services Exam</b><br/> (<a href="https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf">https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf</a>), pg 25-26</p> <p><b>2. UPSC Combined Defence Services</b><br/> (<a href="https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf">https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf</a>), pg 20-21</p> <p><b>3. Combined Graduate Level conducted by SSC</b><br/> (<a href="https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304">https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304</a>)</p> | 12 | <p>1. <u>Application of Adverbs</u><br/>Practice set based on Spotting the Error.</p> <p>2. <u>Active Passive Voice Practice</u><br/>set based on conversion of active sentences to passive and vice-versa</p> <p>3. <u>Direct and Indirect Speech</u><br/>Practice set based on conversion of direct speech to indirect speech and vice-versa</p> <p>4. <u>Reading Comprehension</u><br/>Reading unseen passages and answering questions based on the same</p> <p>2. <u>Technical Report Writing</u><br/>Need to submit assignment with one report written on each type of technical report namely White paper,</p> |

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|   |                                     |  | <p><a href="#">2023.pdf</a>) pg. 20-22</p> <p>4. <i>Intelligence Bureau ACIO</i><br/> <a href="https://www.pw.live/exams/wp-content/uploads/2023/11/TB-ACIO-Recruitment-2023-Notification-Emp-News.pdf">https://www.pw.live/exams/wp-content/uploads/2023/11/TB-ACIO-Recruitment-2023-Notification-Emp-News.pdf</a> )</p> <p><i>State Level Exams:</i></p> <p>1. <i>Civil Services Executive Exam (WBCS)</i><br/> <a href="https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisement">https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&amp;param2=advertisement</a>, pg 1</p> <p>2. <i>Miscellaneous Services Recruitment Examination</i><br/> <a href="file:///C:/Users/UEMK/Downloads/2707970_2019.pdf">file:///C:/Users/UEMK/Downloads/2707970_2019.pdf</a> ) pg 1</p> |    | Case Studies, Technical Proposals, SDK Documentation                                                                                                                                                                                        |
| 4 | <b>Data Interpretation level-II</b> |  | <p><i>International Exams</i></p> <p>1. <i>GRE</i><br/> <a href="https://www.ets.org/gre/test-takers/general-test/prepare/content/quantitative-reasoning.html#accordion-eb7b696bc8-item-f763480e0e">https://www.ets.org/gre/test-takers/general-test/prepare/content/quantitative-reasoning.html#accordion-eb7b696bc8-item-f763480e0e</a> )</p> <p><i>National Exams:</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                             | 12 | <ol style="list-style-type: none"> <li>1. Problems based on mixed diagrams.</li> <li>2. Problems based on Profit and loss.</li> <li>3. Problems based on Simple and compound interest</li> <li>4. Problems based on time series.</li> </ol> |

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|  |  |  | <p><b>1. UPSC Civil Services Exam</b><br/> (<a href="https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf">https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf</a> ), pg 25-26</p> <p><b>2. UPSC Combined Defence Services</b><br/> (<a href="https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf">https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf</a> ), pg 20-21</p> <p><b>3. Combined Graduate Level conducted by SSC</b><br/> (<a href="https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304_2023.pdf">https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_0304_2023.pdf</a> ) pg. 20-22</p> <p><b>4. Intelligence Bureau ACIO</b><br/> (<a href="https://www.pw.live/exams/wp-content/uploads/2023/11/TB-ACIO-Recruitment-2023-Notification-Emp-News.pdf">https://www.pw.live/exams/wp-content/uploads/2023/11/TB-ACIO-Recruitment-2023-Notification-Emp-News.pdf</a> )</p> <p><b>State Level Exams:</b></p> <p><b>1. Civil Services Executive Exam (WBCS)</b><br/> (<a href="https://wbpsc.gov.in/Download?param1=20230225142430">https://wbpsc.gov.in/Download?param1=20230225142430</a></p> |  |  |
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|  |  |  | <a href="#">_Syllabus.pdf&amp;param2=advertisement</a> ), pg 1<br>2. Miscellaneous Services<br>Recruitment Examination<br>( <a href="#">file:///C:/Users/UEMK/Downloads/2707970_2019.pdf</a> ) pg<br>1 |  |  |
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### TEXT BOOK:

1. [Objective General English- S.P Bakshi](#)

### REFERENCE BOOKS:

1. Quantitative Aptitude-R.S Agarwal
2. English Grammar and Competition-S.C Gupta
2. Fast Track Objective Arithmetic- Rajesh Verma
3. Advance Maths- Rakesh Yadav
4. Verbal and Non-Verbal Reasoning- R.S Agarwal
5. A new approach to Reasoning- BS Sijwali



**University of Engineering and Management, Kolkata  
Institute of Engineering & Management, Salt Lake Campus  
Institute of Engineering & Management, New Town Campus  
University of Engineering & Management, Jaipur**



**Syllabus for B.Tech (Admission Batch 2023)**

**Subject Name: Analog and Digital Communication Lab**

**Subject Code: PCCECE491**

**Lecture Hours: 30**

**Pre-requisite:** Signals and Systems, Mathematics, Basic electronics.

**Coursera link:** <https://www.coursera.org/learn/wireless-communications?>

**Linked link:** <https://www.linkedin.com/learning/iot-foundations-low-power-wireless-networking>

**NPTEL link:** [https://onlinecourses.nptel.ac.in/noc22\\_ee05/preview](https://onlinecourses.nptel.ac.in/noc22_ee05/preview)

**COURSE OBJECTIVE:**

1. To learn about Analog Modulation
2. To learn about Digital Modulation

3. To learn about Waveform Coding Techniques
4. To learn about Transmitter/Receiver

#### **COURSE OUTCOMES:**

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth.
2. Investigate pulsed modulation system, baseband transmission and analyze their system performance.
3. Analyze different digital modulation schemes and can compute the bit error performance trade off issues, equalization, carrier recovery

| <b>Module number</b> | <b>Topic</b>                    | <b>Sub-Topics</b>                                                                                                                                         | <b>Lecture Hours</b> |
|----------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 1                    | Signal generator                | Low frequency message and high frequency carrier signal generation using suitable oscillator.                                                             | 3                    |
| 2                    | Analog modulation-I             | Construct a modulator and demodulator based amplitude modulation (AM) system and test an analog filter to evaluate the effects of noise on audio signals. | 3                    |
| 3                    | Analog modulation-II            | Construct a modulator of frequency modulation (FM) system and tuning a certain station of FM band to test the performance of filter.                      | 3                    |
| 4                    | Transmitter and receiver design | A proper antenna design technique to transmit a certain band of AM signal and to receive it at certain receiver.                                          | 3                    |
| 5                    | Digital Modulation-I            | Construction of baseband modulation technique to obtain digital signal from an audio input and transmit it at suitable band of transmission.              | 3                    |
| 6                    | Digital Modulation-II           | Construction of a practical higher order modulation (like, QAM-256) to minimize the error and to enhance the data rate of communication system.           | 6                    |

|          |                                     |                                                                                                                                                |          |
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| <b>7</b> | <b>AI based detection technique</b> | <b>AI based channel estimation and demodulation technique for both analog and digital communication technique using MATLAB or Python code.</b> | <b>3</b> |
| <b>8</b> | <b>Project work</b>                 | <b>Assignment I and Assignment-II</b>                                                                                                          | <b>6</b> |



# University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus

University of Engineering and Management Jaipur

## 4<sup>th</sup> Semester Syllabus for B.Tech in ECE Batch 2023-2027

**Subject Name:** Digital Electronics Laboratory **Credit:** 1 **Lecture Hours:** 2

**Subject Code:** (PCCECE492)

### COURSE OBJECTIVES:

1. To impart knowledge of number systems, binary arithmetic, and Boolean algebra.
2. To impart knowledge on Design and implement combinational circuits like adders, subtractors, and multiplexers.
3. To impart knowledge on sequential circuits and understand their timing diagrams
4. To impart knowledge on simulation tools like Multisim, Xilinx, or VHDL/Verilog for digital circuit design and testing.

### COURSE OUTCOMES:

**CO 1:** Demonstrate knowledge of basic digital logic gates, truth tables, Boolean algebra and K-Map to simplify logical expressions.

**CO 2:** Design and implement combinational Circuits using both hardware and software.

**CO 3:** Design and implement sequential Circuits using both hardware and software.

**CO 4:** Design and implementation of ADC-DAC

## Digital Electronics Laboratory (PCCECE492)

| Serial No | Experiment Title                                     | Description                                                                                                                                             |
|-----------|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1         | Introduction to Lab Components and Equipment.        | Overview of breadboards, Basic Gates FPGAs, power supplies, and digital ICs.                                                                            |
| 2         | Introduction to VHDL and Basic Syntax                | Basic VHDL programming concepts: entity, architecture, signals, and assignments.                                                                        |
| 3         | Combinational Circuit Design (Hardware and Software) | Design of <b>Multi-bit binary adder /Basic arithmetic units in small-scale processors</b> using VHDL/Verilog. Also perform the experiment using IC7483. |
| 4         |                                                      | Design of <b>Carry Look-Ahead Subtractor</b> circuit using VHDL/Verilog and verify the result on FPGA board.                                            |

|    |                                                          |                                                                                                                                                                         |
|----|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5  |                                                          | Design <b>16X1 Multiplexer using 4X1 multiplexer</b> using VHDL/Verilog and verify the result on FPGA board.<br>Also perform the experiment using TTL and CMOS ICs.     |
| 6  |                                                          | Design <b>1-16 Demultiplexer using 1-4 Demultiplexer</b> using VHDL/Verilog and verify the result on FPGA board.<br>Also perform the experiment using TTL and CMOS ICs. |
| 7  |                                                          | Design a <b>code converter circuit</b> using FPGA Board.                                                                                                                |
| 8  | <b>Sequential Circuit Design (Hardware and Software)</b> | Design and simulate flip-flop circuits (SR, D, JK, T) using VHDL.<br>Build a <b>small RAM module</b> using <b>D flip-flops</b> .                                        |
| 9  |                                                          | Design a sequential <b>circuit to control a traffic light system with specific timing</b> using VHDL/Verilog.<br>Also perform the experiment using Flip flop ICs.       |
| 10 |                                                          | Design a circuit that detects a <b>specific binary sequence</b> using hardware.                                                                                         |
| 11 |                                                          | Design a sequential circuit which can convert <b>serial Data to parallel data</b> using register.                                                                       |
| 12 | <b>A/D and D/A Converters</b>                            | Design of <b>Temperature Indicator</b> using IC ADC AD570.                                                                                                              |
|    |                                                          | Design a circuit using IC Chip <b>AFEx8201 Digital-to-Analog Converters (DACs)</b> for PLC applications.                                                                |

## Textbooks and Resources

Digital Design with VHDL by Mark Zwolinski

Digital Systems Design Using VHDL by Charles H. Roth



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### Syllabus for BTech (ECE) – 4<sup>th</sup> Semester (2023-27 Batch)

Subject Name: **Artificial Intelligence & Machine Learning Laboratory** Credit: 2 Lab Hours: 36  
Subject Code: **PCCECE493**

**Prerequisites:** Data Structure & Algorithms,  
Python coding using various libraries: Numpy, Pandas, Matplotlib, Keras with Tensorflow, Scikitlearn, etc.  
:

#### Course Objective:

- Obj 1.** The students will understand the basics concepts of Artificial Intelligence and Machine Learning models, including Deep Learning models.  
**Obj 2.** They will also learn and will be able to apply different Artificial Intelligence and Machine Learning models (including Deep Learning) to various datasets.

#### Course Outcome:

- CO 1:** Students will be able to understand the foundational concepts for building on their knowledge in the domain, including Intelligent Agents, Nature of Agents, Learning Agents.  
**CO 2:** Students will know the concept of Machine Intelligence through Learning from Data sets, as opposed to Pre-determined and pre-programmed Logic and search algorithms.  
**CO 3:** The student will be able to understand and apply, depending on the individual cases, the different models for Supervised and Unsupervised Learning methodologies.  
**CO 4:** Students will know the shortcomings of classical Machine Learning models and how Deep Learning model (includes Backpropagation with Gradient Descent) has been able to overcome those to a significant extent. Students will be able to use Deep Learning models, e.g to analyze and classify images, and for Sequential and Time Series Data. Also will be able to use Generative-AI for different applications in various domains.

| Assignment Number | Topic                               | Sub- Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Mapping with Industry and International Academia                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| 1                 | Lab Assignment on Feature Selection | <p>Use t-SNE to reduce the MNIST dataset down to two dimensions and plot the result using Matplotlib. You can use a scatterplot using 10 different colors to represent each image's target class. Alternatively, you can replace each dot in the scatterplot with the corresponding instance's class (a digit from 0 to 9), or even plot scaled-down versions of the digit images themselves (if you plot all digits, the visualization will be too cluttered, so you should either draw a random sample or plot an instance only if no other instance has already been plotted at a close distance). You should get a nice visualization with well-separated clusters of digits. Try using other dimensionality reduction algorithms such as PCA, LLE, or MDS and compare the resulting visualizations.</p> <p><b>Industry Application:</b> As a part of the Data-Centric AI approach innovated and initiated by Prof Andrew Ng of Stanford University, data pre-processing techniques is a must learn skill without which implementing ML/DL algorithms is an impossibility. Taking a cue from the above-mentioned point, dimension reduction techniques form one of the basic building pillars for Data analytics. Can be and actually used in multiple industry-based projects.</p> | <p><i>AICTE-prescribed syllabus:</i></p> <p><a href="https://www.aicte-india.org/sites/default/files/UG_Emerging.pdf">https://www.aicte-india.org/sites/default/files/UG_Emerging.pdf</a></p> <p><i>International Academia:</i></p> <p><a href="https://ocw.mit.edu/courses/6-034-artificial-intelligence-fall-2010/resources/lecture-1-introduction-and-scope/">https://ocw.mit.edu/courses/6-034-artificial-intelligence-fall-2010/resources/lecture-1-introduction-and-scope/</a></p> |
| 2                 | Lab Assignment on Regression        | <p>This lab assignment will teach students the power of Linear Regression in understanding factors influencing the pricing of cars and to model the price of cars which could prove to be an effective way to understand and appreciate <b>dynamic pricing of the car industry</b>. Students shall also get introduced to various performance metrics like R-Square, Adjusted R-Square, RMSE etc and many other important concepts like that of multi-collinearity.</p> <p><b>Industry Application:</b> Core application area is the Car industry. Techniques that will be learnt spins around dynamic pricing strategies which are even applicable for other industries like that of the airline.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p><i>Basic Programs using Python from:</i></p> <p><a href="https://onlinecourses.swayam2.ac.in/ai-c20_sp33/preview">https://onlinecourses.swayam2.ac.in/ai-c20_sp33/preview</a></p> <p><a href="https://www.coursera.org/learn/introduction-tensorflow">https://www.coursera.org/learn/introduction-tensorflow</a></p>                                                                                                                                                                  |

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| 3 | Lab Assignment on Classification | <p>Project on <b>Multi-Class Classification [On Molecular Oncology]</b>: Using suitable dataset, students will be asked to build multiple classifiers and cross-compare results. The lab assignment would test the students on the followings:</p> <p>Initial <b>Data Pre-processing</b> steps including <b>but not limited to</b></p> <ul style="list-style-type: none"><li>▪ Missing value imputation</li><li>▪ Feature Selection</li><li>▪ Feature engineering</li><li>▪ Outlier Detection</li></ul> <p>Data splitting in Train-Validation-Test and using Hyper-parameter tuning using Grid Search CV and Randomized Search CV.</p> <p>Building Multiple Classifiers using various algorithms like Logistic Regression, KNN, SVM, Decision Trees, Random Forest etc.</p> <p>Cross—comparing various models using the several performance metrics.</p> <p><b>Industry Application:</b> This lab assignment is of much use in medical domain and beyond. Although core area of application is the medical domain but the techniques that the student shall learn can be generalized to other industry needs/domains as well</p> | <p><i>Industry Mapping:</i><br/><i>Python, TensorFlow Keras, PyTorch</i></p> |
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| 4 | <b>Lab Assignment on Clustering</b>                                    | <p><b>On Customer Segmentation:</b> Using some suitable dataset, students will be asked to perform Clustering using various algorithms like K-Means, DB Scan etc. The ideas will help students to perform and understand the need for Customer Segmentation which comes under Marketing analytics.</p> <p><b>Industry Application:</b> Immensely used in Marketing domain to enable differential strategies including but not limited to differential pricing. Outsourced by the marketing firm of various companies even to Service industries.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p><i>AICTE-prescribed syllabus:</i><br/> <a href="https://www.aicte-india.org/sites/default/files/UG_Emerging.pdf">https://www.aicte-india.org/sites/default/files/UG_Emerging.pdf</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 5 | <b>Lab to demonstrate the impact of different activation functions</b> | <p>Design an experiment to empirically demonstrate the impact of different activation functions (e.g., sigmoid, ReLU, tanh) on the convergence speed and final accuracy of backpropagation in training deep neural networks. Discuss how your findings contribute to understanding activation function selection in practice.</p> <p><b><u>Industry Application:</u></b><br/> Relevance of Activation Functions in Deep Learning for Industrial Applications:</p> <p>Activation functions are critical components in deep learning architectures, enabling neural networks to model complex relationships and solve intricate problems. Their significance extends beyond theoretical constructs, finding practical applications across various industrial sectors. This overview highlights the role of activation functions in deep learning and their relevance to real-world industrial applications.</p> <p><b><u>Understanding Activation Functions</u></b><br/> Activation functions introduce non-linearity into neural networks, allowing them to learn complex patterns in data. Without these functions, a neural network would merely perform linear transformations, limiting its ability to capture intricate relationships within datasets. Common activation functions include:</p> <ul style="list-style-type: none"> <li>• Sigmoid: Maps inputs to a range between 0 and 1, useful for binary classification tasks.</li> <li>• Tanh: Outputs values between -1 and 1, providing zero-centered outputs that can enhance learning.</li> <li>• ReLU (Rectified Linear Unit): Outputs the input directly if positive; otherwise, it outputs zero. This function is popular due to its simplicity and efficiency in training deep networks.</li> <li>• Leaky ReLU: A variant of ReLU that allows a small gradient when the input is negative, addressing the "dying ReLU" problem.</li> <li>• Softmax: Used in the output layer for multi-class classification tasks, converting logits into probabilities.</li> </ul> <p><b><u>Industrial Applications</u></b><br/> The application of activation functions in industrial settings can be categorized into several key areas:</p> | <p><i>International Academia:</i><br/> <a href="https://ocw.mit.edu/courses/6-034-artificial-intelligence-fall-2010/resources/lecture-1-introduction-and-scope/">https://ocw.mit.edu/courses/6-034-artificial-intelligence-fall-2010/resources/lecture-1-introduction-and-scope/</a></p> <p><i>Basic Programs using Python from:</i><br/> <a href="https://onlinecourses.swayam2.ac.in/ai-c20-sp33/preview">https://onlinecourses.swayam2.ac.in/ai-c20-sp33/preview</a><br/> <a href="https://www.coursera.org/learn/introduction-tensorflow">https://www.coursera.org/learn/introduction-tensorflow</a></p> <p><i>Industry Mapping: Python, TensorFlow Keras, PyTorch</i></p> |

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|   |                        | <p>1. Computer Vision</p> <p>Deep learning models utilizing convolutional neural networks (CNNs) rely heavily on activation functions to process and classify <b>images</b>. For instance, ReLU is frequently used in hidden layers of CNNs due to its ability to accelerate convergence during training, which is crucial for real-time image processing tasks such as facial recognition and autonomous driving systems</p> <p>2. Natural Language Processing (NLP)</p> <p>In NLP applications like sentiment analysis and language translation, activation functions help models understand contextual relationships within text data. The choice of activation function can significantly impact the model's ability to learn nuanced language patterns, with functions like softmax being essential for generating probability distributions over vocabulary during text generation tasks</p> <p>3. Predictive Maintenance</p> <p>In manufacturing and industrial settings, predictive maintenance models leverage deep learning to predict equipment failures. Activation functions enable these models to learn from historical operational data, identifying complex patterns that signify potential breakdowns. For example, using ReLU can enhance the model's performance by effectively handling large datasets typical in industrial IoT applications</p> <p>4. Financial Forecasting</p> <p>Activation functions play a vital role in financial modeling applications such as stock price prediction and risk assessment. Non-linear activation functions allow models to capture the volatility and non-linear trends inherent in financial data, leading to more accurate predictions and better decision-making tools for investors</p> <p>5. Healthcare Diagnostics</p> <p>Deep learning models applied in medical diagnostics utilize activation functions to analyze complex medical images or patient data. For instance, CNNs equipped with ReLU can efficiently process MRI scans or X-rays, improving diagnostic accuracy by identifying subtle patterns that may indicate disease</p> <p>Conclusion</p> <p>Activation functions are indispensable in deep learning architectures, facilitating the modeling of non-linear relationships essential for solving complex real-world problems across various industries. Their ability to enhance learning capabilities directly impacts the effectiveness of applications ranging from computer vision to predictive maintenance and healthcare diagnostics. As industries continue to adopt AI technologies, understanding and optimizing activation functions will remain crucial for developing robust deep learning models that drive innovation and efficiency.</p> |  |
| 6 | Lab on training an MLP | <p>Train a deep MLP on the MNIST dataset (you can load it using <code>`tf.keras.datasets.mnist.load_data()`</code>).</p> <p>See if you can get over 98% accuracy by manually tuning the hyperparameters. Try searching for the optimal learning rate by using the approach presented in this chapter (i.e., by growing the learning rate exponentially, plotting the loss, and finding the point where the loss shoots up).</p> <p><u><b>Advantages of MLP and some of their their industrial applications areas:</b></u></p> <p>Advantages of Multilayer Perceptrons over classical Machine Learning models:</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |

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|   |                                                                | <ul style="list-style-type: none"><li>• <b>Versatility:</b> MLPs can be applied to both classification and regression tasks across various domains.</li><li>• <b>Non-linearity:</b> They utilize activation functions that enable the modeling of non-linear relationships in data.</li><li>• <b>Scalability:</b> MLPs can be scaled to handle large datasets effectively, particularly when combined with modern computational techniques like GPU acceleration</li></ul> <p>Key Applications in Industry</p> <p><b>1. Image and Speech Recognition</b><br/>The ability to handle non-linear relationships makes MLPs particularly effective in these domains.</p> <p><b>2. Financial Forecasting</b><br/>Their capability to approximate complex functions allows them to capture market dynamics effectively.</p> <p><b>3. Data Compression and Encryption</b><br/>MLPs play a vital role in data compression and encryption. They can identify redundant data elements that can be removed without losing quality, optimizing storage and transmission. In encryption, MLPs help secure sensitive information by transforming data into formats that are difficult to decipher without the appropriate keys<br/>. This application is particularly important for businesses handling personal or proprietary information.</p> <p><b>4. User Profiling and Recommendation Systems</b><br/>Businesses utilize MLPs for user profiling and creating recommendation systems. By analyzing user behavior and preferences, MLPs can suggest products or services tailored to individual needs, enhancing customer experience and engagement<br/>. This is widely seen in e-commerce platforms and streaming services.</p> <p><b>5. Healthcare Applications</b><br/>In healthcare, MLPs are used for diagnosing diseases based on patient data analysis. For instance, they can assist in identifying cancerous cells in medical images or predicting patient outcomes based on historical health records<br/>. The ability to learn from complex datasets makes them invaluable in improving diagnostic accuracy.</p> |  |
| 7 | Lab on Image Recognition by CNN from scratch (computer vision) | <p><u>CNN:</u></p> <p><u>Advantages of CNN and some of their their industrial applications areas:</u></p> <p>Convolutional Neural Networks (CNNs) have become a cornerstone of modern artificial intelligence, finding applications across various industries. Their ability to process and analyze visual data makes them particularly effective in tasks that involve image and video analysis. Below are some notable real-life industrial applications of CNNs:</p> <p>Image Classification and Recognition</p> <p>CNNs excel in <b>image classification</b> and <b>recognition</b>, Object Detection and Localization<br/>In <b>autonomous vehicles</b>, CNNs are vital for <b>object detection</b> and <b>localization</b>, allowing cars to identify obstacles, pedestrians, and traffic signs in real-time. Techniques like YOLO (You Only Look Once) and SSD (Single Shot</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |

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|  | <p>Multibox Detector) are commonly used for this purpose</p> <ul style="list-style-type: none"><li>· CNNs play a significant role in <b>medical imaging</b> by analyzing diagnostic images such as X-rays, MRIs, and CT scans. They can detect anomalies like tumors with high accuracy, often surpassing human capabilities. For instance, CNNs have been shown to identify cancerous cells with up to 95% accuracy</li><li>· This application enhances early disease detection and improves patient outcomes.</li></ul> <p><b>In agriculture</b>, CNNs analyze aerial images to assess crop health, predict yields, and detect diseases early. This application aids farmers in making informed decisions that enhance productivity and sustainability</p> <ul style="list-style-type: none"><li>· Beyond visual tasks, CNNs are also applied in <b>natural language processing (NLP)</b>. They can perform text classification, sentiment analysis, and even language translation by treating text as a 2D structure similar to images. This capability helps improve customer service automation and information extraction</li></ul> <p>CNNs are utilized for <b>environmental monitoring</b>, analyzing satellite imagery to detect changes in land use or natural disasters. This application supports timely responses to environmental challenges</p> <p>In the realm of <b>video analytics</b>, CNNs are employed for action detection, object tracking, and scene segmentation. They help identify unusual events in real-time surveillance footage, enhancing security measures</p> <p><u><b>We will build dense neural networks on the MNIST dataset.</b></u></p> <p><u><b>Load the data and create train-test splits:</b></u></p> <p>1: Preprocessing:</p> <ul style="list-style-type: none"><li>Normalize the data: map each feature value from its current representation (an integer between 0 and 255) to a floating-point value between 0 and 1.0.</li><li>Store the floating-point values in x_train_normalized and x_test_normalized.</li><li>Map the class label to a on-hot-encoded value. Store in y_train_encoded and y_test_encoded.</li></ul> <p>2: Create a deep neural net model</p> <ul style="list-style-type: none"><li>Implement a create_model function which defines the topography of the deep neural net, specifying the following:<ul style="list-style-type: none"><li>The number of layers in the deep neural net: Use 2 dense layers for now.</li><li>The number of nodes in each layer: these are parameters of your function.</li><li>Any regularization layers. Add at least one dropout layer.</li><li>The optimizer and learning rate. Make the learning rate a parameter of your function as well.</li></ul></li><li>Consider:<ul style="list-style-type: none"><li>What should be the shape of the input layer?</li><li>Which activation function you will need for the last layer, since this is a 10-class classification problem?</li></ul></li></ul> |  |
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|   |                                                                                                    | <p>3: Create a training function<br/>Implement a <code>train_model</code> function which trains and evaluates a given model.<br/>It should do a train-validation split and report the train and validation loss and accuracy, and return the training history.</p> <p>4: Evaluate the model<br/>Train the model with a learning rate of 0.003, 50 epochs, batch size 4000, and a validation set that is 20% of the total training data. Use default settings otherwise.<br/>Plot the learning curve of the loss, validation loss, accuracy, and validation accuracy.</p> <p>5. Finally, report the performance on the test set.<br/>Optimize the model<br/>Try to optimize the model, either manually or with a tuning method. At least optimize the following:<br/>the number of hidden layers<br/>the number of nodes in each layer<br/>the amount of dropout layers and the dropout rate<br/>Try to reach at least 96% accuracy against the test set.</p>                                                                                                                                                                                                                                           |  |
| 8 | Lab on improving accuracy of image recognition using CNN                                           | <p>Build your own CNN from scratch and try to achieve the highest possible accuracy on MNIST.<br/>The following model uses 2 convolutional layers, followed by 1 pooling layer, then dropout 25%, then a dense layer, another dropout layer but with 50% dropout, and finally the output layer. It reaches about 99.2% accuracy on the test set. This places this model roughly in the top 20% in the MNIST Kaggle competition). Can you do better? To reach 99.5 to 99.7% accuracy on the test set, you need to add image augmentation, batch norm, use a learning schedule such as 1-cycle, and possibly create an ensemble.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
| 9 | Lab on 1-D and 2-D Sequential and Time-Series Data using RNN: Next Word Prediction using RNN-LSTM: | <p><b><u>RNN-LSTM:</u></b><br/><b><u>Industrial Applications of RNN and LSTM</u></b><br/>Recurrent Neural Networks (RNNs) and their advanced variant, Long Short-Term Memory networks (LSTMs), have found significant applications across various industries due to their ability to process sequential data. Here are some key industrial applications:</p> <ol style="list-style-type: none"><li>1. Natural Language Processing (NLP)<ul style="list-style-type: none"><li>• Machine Translation: RNNs and LSTMs are extensively used in translating text from one language to another by understanding the context of sentences over time</li><li>• Text Generation: These networks can generate coherent text based on a given input, making them useful for applications such as chatbots and automated content creation</li><li>• Sentiment Analysis: Businesses utilize RNNs to analyze customer feedback and social media content to gauge public sentiment towards products or services</li></ul></li><li>2. Speech Recognition<br/>RNNs are pivotal in converting spoken language into text. They analyze audio signals sequentially, enabling accurate transcription of speech in</li></ol> |  |

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|  | <p>real-time applications like virtual assistants and automated customer service systems</p> <p>.3. Healthcare</p> <p>In the healthcare sector, RNNs and LSTMs are employed to predict patient outcomes by analyzing sequences of medical records. This includes forecasting disease progression based on historical patient data, which aids in personalized treatment plans</p> <p>4. Financial Forecasting</p> <p>RNNs are used in stock market prediction and risk assessment by analyzing time-series data of stock prices and other financial indicators. Their ability to remember past trends helps in making informed predictions about future market movements</p> <p>5. Image and Video Processing</p> <ul style="list-style-type: none"><li>• Image Captioning: RNNs can generate descriptive captions for images by processing the visual data sequentially</li><li>• Video Analysis: They are used for video tagging and summarization, where they analyze frames over time to provide insights or generate summaries of video content</li></ul> <p>.6. Anomaly Detection</p> <p>RNNs are effective in detecting anomalies in time-series data, such as monitoring network traffic or financial transactions for fraudulent activities. By learning normal patterns over time, they can identify deviations that may indicate security threats</p> <p>7. Music Generation</p> <p>LSTMs have been successfully applied in generating music compositions by learning from existing musical patterns and structures, allowing for the creation of new melodies that adhere to learned styles</p> <p>.8. Robotics and Automation</p> <p>In robotics, RNNs help in motion prediction and control by processing sequences of sensor data, enabling robots to make decisions based on past movements and environmental changes</p> <p>Conclusion</p> <p>The versatility of RNNs and LSTMs makes them invaluable across various sectors, particularly where sequential data is prevalent. Their ability to remember previous inputs allows for more accurate predictions and analyses, leading to enhanced decision-making processes in industrial applications.</p> <p><b><u>Lab-Assignment:</u></b></p> <p>The word prediction problem comes in three levels: word completion, next-word prediction and multi-word prediction. This simple next-word prediction is the process of predicting the next word given a sequence of words, and is based on the previous history. These kinds of applications can be seen in smartphones and virtual keyboards on desktops. Since a sequence is a sequence of words, we use RNN-LSTM to predict the next word.</p> <p>Dataset: The Hill of Dreams by Arthur Machen (1907).<br/>For processing, the sentences are split into words, and a sequence of these words are taken as the input and the next word is taken as the output (or label).</p> |  |
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| 10 | <b>Lab on application of to predicting stock market – using Sequential and Time-Series Data using RNN, LSTM and Bi-LSTM</b> | <p>Take as your input TRAINING DATA the last 5 years DAILY CLOSING STOCK VALUES of INFOSYS, UPTO 31st. DECEMBER, 2023 (from yahoo finance):</p> <p>Based on this input, predict the CLOSING STOCK VALUE of INFOSYS using the following DEEP LEARNING models:</p> <p>(1) Normal conventional RNN;</p> <p>(2) LSTM;</p> <p>(3) Bidirectional LSTM</p> <p>Using EACH of the 3 models as above, show the predicted values of the CLOSING STOCK PRICES of INFOSYS, using each model, for the following dates in 2024:</p> <p>10 January, 10 June, 30 August, 01 October</p> <p>Plot these 3 curves on the same graph along with 1 additional curve for ACTUAL TRUE CLOSING STOCK PRICES of INFOSYS on those dates.</p> <p>Compute the average % error in each model.</p> |  |
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**TEXTBOOKS:**

- 1. ML & DL: ‘Hands-On Machine Learning’ (**Part-I: Machine Learning; Part-II: Deep Learning**), by Aurelien Geron, (O’Reilly, SPD, **3<sup>rd</sup> edition**, 2022)
- 2. ML: ‘An Introduction to Statistical Learning – with Applications in Python’ by Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani (Springer, 2023)
- 3. DL: ‘Deep Learning with Python’ -- by Francois Chollet (Manning Publishing Co., NY, USA; **2<sup>nd</sup> edition**, 2021)

**REFERENCE BOOKS:**

- 1. DL: ‘Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms’ by Nithin Buduma, Nikhil Buduma, Joe Papa (O'Reilly - SPD, 2nd edition, 2022)
- 2. Python Coding: ‘PYTHON ODYSSEY’ – by Subhabrata Banerjee (Gyanavi Publishers & Distributers, New Delhi, 2025)

**<https://www.linkedin.com/learning/learning-python-14393370>**

**Mandatory Prerequisite: (To be completed before the start of the class)**