



**Prof. Ram Meghe Institute Of Technology  
And Research Badnera -Amravati**

**An Autonomous Institute Affiliated to  
Sant Gadge Baba Amravati University,  
Amravati, Maharashtra (India)**

**PROGRAMME SCHEME & SYLLABI  
2024-2025**

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**B.Tech.  
Artificial Intelligence and  
Data Science  
(v1.0)**



**Prof. Ram Meghe Institute Of Technology And Research,  
Badnera - Amravati.**

**Published By  
Principal**

Prof. Ram Meghe Institute Of Technology And Research, Badnera - Amravati.

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**Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati**  
**(An Autonomous Institute)**  
**Four Year Under Graduate Degree Program in Bachelor of Technology**  
**Choice Based Credit System (Semester Pattern)**  
**Branch : Artificial Intelligence (AI) and Data Science**

| SEMESTER: I       |             |                                              |                 |          |           |       |                   |           |                         |                      |                      |               |            |                           |              |      |            |                    |
|-------------------|-------------|----------------------------------------------|-----------------|----------|-----------|-------|-------------------|-----------|-------------------------|----------------------|----------------------|---------------|------------|---------------------------|--------------|------|------------|--------------------|
| Sr. No.           | Course Code | Course Name                                  | Teaching Scheme |          |           |       |                   |           | Examination Scheme      |                      |                      |               |            |                           |              |      |            |                    |
|                   |             |                                              | Hours/ Week     |          |           | Group | Total Hours/ Week | Credits   | THEORY                  |                      |                      |               |            |                           | PRACTICAL    |      |            |                    |
|                   |             |                                              | Lecture         | Tutorial | P/D       |       |                   |           | Duration of paper (Hrs) | Max. Marks ESE/ ESSE | Internal Marks       |               | Total      | Overall Min Passing Marks | Max. Marks   |      | Total      | Min. Passing Marks |
|                   |             |                                              |                 |          |           |       |                   |           |                         |                      | Max. Marks MSE/ MSIE | Max. Marks TA |            |                           | Int.         | Ext. |            |                    |
| <b>Theory</b>     |             |                                              |                 |          |           |       |                   |           |                         |                      |                      |               |            |                           |              |      |            |                    |
| 1                 | 1SF01       | Applied Mathematics - I                      | 3               |          |           | BSC   | 3                 | 3         | 3                       | 60                   | 30                   | 10            | 100        | 40                        |              |      |            |                    |
| 2                 | 1SF02       | Applied Physics                              | 3               |          |           | BSC   | 3                 | 3         | 3                       | 60                   | 30                   | 10            | 100        | 40                        |              |      |            |                    |
| 3                 | 1SF03       | Engineering Graphics                         | 2               |          |           | ESC   | 2                 | 2         | 3                       | 60                   | 30                   | 10            | 100        | 40                        |              |      |            |                    |
| 4                 | 1SF04       | Programming for Problem Solving              | 2               |          |           | ESC   | 2                 | 2         | 3                       | 60                   | 30                   | 10            | 100        | 40                        |              |      |            |                    |
| 5                 | 1SF05       | Professional Communication Skills*           | 1               | 1        |           | HSSM  | 2                 | 2         |                         |                      |                      | 50            | 50         | 25                        |              |      |            |                    |
| 6                 | 1SAKNX01    | Multimedia and Web Designing                 | 3               |          |           | ESC   | 3                 | 3         | 3                       | 60                   | 30                   | 10            | 100        | 40                        |              |      |            |                    |
| 7                 | 1SF06       | Design Thinking **                           | 1               |          |           | ESC   | 1                 | 1         |                         |                      |                      | 50            | 50         | 25                        |              |      |            |                    |
| <b>Practicals</b> |             |                                              |                 |          |           |       |                   |           |                         |                      |                      |               |            |                           |              |      |            |                    |
| 08                | 1SF07       | Applied Physics Lab                          |                 |          | 2         | BSC   | 2                 | 1         |                         |                      |                      |               |            |                           | 25           | 25   | 50         | 25                 |
| 09                | 1SF08       | Engineering Graphics Lab                     |                 |          | 2         | VSEC  | 2                 | 1         |                         |                      |                      |               |            |                           | 25           | 25   | 50         | 25                 |
| 10                | 1SF09       | Programming for Problem Solving Lab          |                 |          | 2         | ESC   | 2                 | 1         |                         |                      |                      |               |            |                           | 25           | 25   | 50         | 25                 |
| 11                | 1SAKNX02    | Multimedia and Web Designing Lab             |                 |          | 2         | ESC   | 2                 | 1         |                         |                      |                      |               |            |                           | 25           | 25   | 50         | 25                 |
| 12                | 1SF10       | NSS/Sports/Yoga/Cultural/Community Service # |                 |          | 2         | LLC   | 2                 | 1         |                         |                      |                      |               |            |                           | 50           |      | 50         | 25                 |
| <b>Total</b>      |             |                                              | <b>15</b>       | <b>1</b> | <b>10</b> |       | <b>26</b>         | <b>21</b> |                         |                      |                      |               | <b>600</b> |                           |              |      | <b>250</b> |                    |
|                   |             |                                              |                 |          |           |       |                   |           |                         |                      |                      |               |            |                           | <b>Total</b> |      | <b>850</b> |                    |

\* Assessment will be based on Test and Assignments

\*\* Assessment will be based on Case Studies and Assignments

# Assessment will be based on participation in associated activities of not less than 30 hours

**Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati**  
**(An Autonomous Institute)**  
**Four Year Under Graduate Degree Program in Bachelor of Technology**  
**Choice Based Credit System (Semester Pattern)**  
**Branch : Artificial Intelligence (AI) and Data Science**

| SEMESTER: II |             |                                     |                      |               |      |       |                   |         |                         |                      |                |    |       |                           |            |       |       |                    |  |
|--------------|-------------|-------------------------------------|----------------------|---------------|------|-------|-------------------|---------|-------------------------|----------------------|----------------|----|-------|---------------------------|------------|-------|-------|--------------------|--|
| Sr. No.      | Course Code | Course Name                         | Teaching Scheme      |               |      |       |                   |         | Examination Scheme      |                      |                |    |       |                           |            |       |       |                    |  |
|              |             |                                     | Hours/ Week          |               |      | Group | Total Hours/ Week | Credits | THEORY                  |                      |                |    |       |                           | PRACTICAL  |       |       |                    |  |
|              |             |                                     | Lecture              | Tutorial      | P/D  |       |                   |         | Duration of paper (Hrs) | Max. Marks ESE/ ESSE | Internal Marks |    | Total | Overall Min Passing Marks | Max. Marks |       | Total | Min. Passing Marks |  |
|              |             |                                     | Max. Marks MSE/ MSIE | Max. Marks TA | Int. | Ext.  |                   |         |                         |                      |                |    |       |                           |            |       |       |                    |  |
| Theory       |             |                                     |                      |               |      |       |                   |         |                         |                      |                |    |       |                           |            |       |       |                    |  |
| 01           | 2SF01       | Applied Mathematics - II            | 3                    |               |      | BSC   | 3                 | 3       | 3                       | 60                   | 30             | 10 | 100   | 40                        |            |       |       |                    |  |
| 02           | 2SF02       | Applied Chemistry                   | 3                    |               |      | BSC   | 3                 | 3       | 3                       | 60                   | 30             | 10 | 100   | 40                        |            |       |       |                    |  |
| 03           | 2SF03       | Basics of Electrical Engineering    | 2                    |               |      | ESC   | 2                 | 2       | 3                       | 60                   | 30             | 10 | 100   | 40                        |            |       |       |                    |  |
| 04           | 2SF04       | Biology for Engineers               | 2                    |               |      | BSC   | 2                 | 2       | 3                       | 60                   | 30             | 10 | 100   | 40                        |            |       |       |                    |  |
| 05           | 2SF05       | Universal Human Values*             | 2                    |               |      | HSSM  | 2                 | 2       |                         |                      |                | 50 | 50    | 25                        |            |       |       |                    |  |
| 06           | 2SAEKNX01   | Introduction to Python              | 3                    |               |      | ESC   | 3                 | 3       | 3                       | 60                   | 30             | 10 | 100   | 40                        |            |       |       |                    |  |
| 07           | 2SF06       | Indian Knowledge Systems *          | 2                    |               |      | HSSM  | 2                 | 2       |                         |                      |                | 50 | 50    | 25                        |            |       |       |                    |  |
| Practicals   |             |                                     |                      |               |      |       |                   |         |                         |                      |                |    |       |                           |            |       |       |                    |  |
| 08           | 2SF07       | Applied Chemistry Lab               |                      |               | 2    | BSC   | 2                 | 1       |                         |                      |                |    |       |                           | 25         | 25    | 50    | 25                 |  |
| 09           | 2SF08       | Basic of Electrical Engineering Lab |                      |               | 2    | ESC   | 2                 | 1       |                         |                      |                |    |       |                           | 25         | 25    | 50    | 25                 |  |
| 10           | 2SAEKNX02   | Introduction to Python Lab          |                      |               | 2    | ESC   | 2                 | 1       |                         |                      |                |    |       |                           | 25         | 25    | 50    | 25                 |  |
| 11           | 2SF09       | Workshop/Digital Fabrication Lab    |                      |               | 2    | VSEC  | 2                 | 1       |                         |                      |                |    |       |                           | 25         | 25    | 50    | 25                 |  |
| Total        |             |                                     | 17                   |               | 8    |       | 25                | 21      |                         |                      |                |    | 600   |                           |            |       | 200   |                    |  |
|              |             |                                     |                      |               |      |       |                   |         |                         |                      |                |    |       |                           |            | Total | 800   |                    |  |

\* Assessment will be based on Unit Tests and Assignments

**Exit Option: To qualify for UG Certificate in Artificial Intelligence and Data Science**

| Title                                                | Credit   |
|------------------------------------------------------|----------|
| 1. Two relevant MOOC/NPTEL courses as decided by BOS | 4        |
| AND                                                  |          |
| 1. Internship (Min 60 hrs)                           | 4        |
| <b>Total</b>                                         | <b>8</b> |

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**Branch : Artificial Intelligence (AI) and Data Science**

| SEMESTER: III |             |                                    |                 |          |     |       |                    |         |                         |                      |                      |               |       |                           |            |      |       |                    |
|---------------|-------------|------------------------------------|-----------------|----------|-----|-------|--------------------|---------|-------------------------|----------------------|----------------------|---------------|-------|---------------------------|------------|------|-------|--------------------|
| Sr. No.       | Course Code | Course Name                        | Teaching Scheme |          |     |       |                    |         | Examination Scheme      |                      |                      |               |       |                           |            |      |       |                    |
|               |             |                                    | Hours/ Week     |          |     | Group | Total Hours / Week | Credits | THEORY                  |                      |                      |               |       |                           | PRACTICAL  |      |       |                    |
|               |             |                                    | Lecture         | Tutorial | P/D |       |                    |         | Duration of paper (Hrs) | Max. Marks ESE/ ESSE | Internal             |               | Total | Overall Min Passing Marks | Max. Marks |      | Total | Min. Passing Marks |
|               |             |                                    |                 |          |     |       |                    |         |                         |                      | Max. Marks MSE/ MSIE | Max. Marks TA |       |                           | Int.       | Ext. |       |                    |
| Theory        |             |                                    |                 |          |     |       |                    |         |                         |                      |                      |               |       |                           |            |      |       |                    |
| 01            | 3SA01       | Discrete Mathematics               | 2               |          |     | PCC   | 2                  | 2       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 02            | 3SA02       | Data Structures                    | 3               |          |     | PCC   | 3                  | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 03            | 3SA03       | Programming Methodology            | 2               |          |     | PCC   | 2                  | 2       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 04            | 3SA04       | Analog and Digital Electronics     | 2               |          |     | PCC   | 2                  | 2       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 05            | 3SAOE1      | Open Elective Course - 1 (OE - 1)  | 3               |          |     | OE    | 3                  | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 06            | 3SA05       | Financial Literacy*                | 2               |          |     | EEMC  | 2                  | 2       | --                      | --                   | --                   | 50            | 50    | 25                        |            |      |       |                    |
| 07            | 3SA06       | Environmental Science*             | 2               |          |     | VEC   | 2                  | 2       | --                      | --                   | --                   | 50            | 50    | 25                        |            |      |       |                    |
| Practicals    |             |                                    |                 |          |     |       |                    |         |                         |                      |                      |               |       |                           |            |      |       |                    |
| 08            | 3SA07       | Data Structures Lab                |                 |          | 2   | PCC   | 2                  | 1       |                         |                      |                      |               |       |                           | 25         | 25   | 50    | 25                 |
| 09            | 3SA08       | Programming Methodology Lab        |                 |          | 2   | PCC   | 2                  | 1       |                         |                      |                      |               |       |                           | 25         | 25   | 50    | 25                 |
| 10            | 3SA09       | Analog and Digital Electronics Lab |                 |          | 2   | PCC   | 2                  | 1       |                         |                      |                      |               |       |                           | 25         | 25   | 50    | 25                 |
| 11            | 3SA10       | CEP/FP: Innovation and Creativity  |                 |          | 4   | ELC   | 4                  | 2       |                         |                      |                      |               |       |                           | 25         | 25   | 50    | 25                 |
| Total         |             |                                    | 16              |          | 10  |       | 26                 | 21      |                         |                      |                      |               | 600   |                           |            |      | 200   |                    |
|               |             |                                    |                 |          |     |       |                    |         |                         |                      |                      |               |       |                           | Total      |      | 800   |                    |

\* Assessment will be based on Unit Tests, Assignments and Teacher assessment during the semester.

**Open Elective Course-1:** (i) 3SAOE1A Social Science (ii) 3SAOE1B Ancient Management Paradigms (iii) 3SAOE1C Introduction to Constitutional Law

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| SEMESTER: IV |             |                                       |                 |          |     |                      |                    |         |                         |                      |          |    |       |                           |            |       |       |                    |  |
|--------------|-------------|---------------------------------------|-----------------|----------|-----|----------------------|--------------------|---------|-------------------------|----------------------|----------|----|-------|---------------------------|------------|-------|-------|--------------------|--|
| Sr. No.      | Course Code | Course Name                           | Teaching Scheme |          |     |                      |                    |         | Examination Scheme      |                      |          |    |       |                           |            |       |       |                    |  |
|              |             |                                       | Hours/ Week     |          |     | Group                | Total Hours / Week | Credits | THEORY                  |                      |          |    |       |                           | PRACTICAL  |       |       |                    |  |
|              |             |                                       | Lecture         | Tutorial | P/D |                      |                    |         | Duration of paper (Hrs) | Max. Marks ESE/ ESSE | Internal |    | Total | Overall Min Passing Marks | Max. Marks |       | Total | Min. Passing Marks |  |
|              |             |                                       |                 |          |     | Max. Marks MSE/ MSIE | Max. Marks TA      | Int.    | Ext.                    |                      |          |    |       |                           |            |       |       |                    |  |
| Theory       |             |                                       |                 |          |     |                      |                    |         |                         |                      |          |    |       |                           |            |       |       |                    |  |
| 01           | 4SA01       | Artificial Intelligence               | 3               |          |     | PCC                  | 3                  | 3       | 3                       | 60                   | 30       | 10 | 100   | 40                        |            |       |       |                    |  |
| 02           | 4SA02       | Operating Systems                     | 3               |          |     | PCC                  | 3                  | 3       | 3                       | 60                   | 30       | 10 | 100   | 40                        |            |       |       |                    |  |
| 03           | 4SA03       | Theory of Computation                 | 3               |          |     | PCC                  | 3                  | 3       | 3                       | 60                   | 30       | 10 | 100   | 40                        |            |       |       |                    |  |
| 04           | MDM1        | Multidisciplinary Minor - 1 (MDM - 1) | 3               |          |     | MDM                  | 3                  | 3       | 3                       | 60                   | 30       | 10 | 100   | 40                        |            |       |       |                    |  |
| 05           | 4SAOE2      | Open Elective Course - 2 (OE - 2)     | 3               |          |     | OE                   | 3                  | 3       | 3                       | 60                   | 30       | 10 | 100   | 40                        |            |       |       |                    |  |
| 06           | 4SA04       | Business Communication*               | 2               |          |     | AEC                  | 2                  | 2       | --                      | --                   | --       | 50 | 50    | 25                        |            |       |       |                    |  |
| 07           | 4SA05       | Entrepreneurship and Start-ups*       | 2               |          |     | EEMC                 | 2                  | 2       | --                      | --                   | --       | 50 | 50    | 25                        |            |       |       |                    |  |
| Practicals   |             |                                       |                 |          |     |                      |                    |         |                         |                      |          |    |       |                           |            |       |       |                    |  |
| 08           | 4SA06       | Artificial Intelligence Lab           |                 |          | 2   | PCC                  | 2                  | 1       |                         |                      |          |    |       |                           | 25         | 25    | 50    | 25                 |  |
| 09           | 4SA07       | Operating Systems Lab                 |                 |          | 2   | PCC                  | 2                  | 1       |                         |                      |          |    |       |                           | 25         | 25    | 50    | 25                 |  |
| 10           | 4SA08       | Computer Skill Laboratory - 1         |                 |          | 2   | PCC                  | 2                  | 1       |                         |                      |          |    |       |                           | 25         | 25    | 50    | 25                 |  |
| 11           | 4SA09       | Report Writing and Presentation Skill |                 |          | 4   | VSEC                 | 4                  | 2       |                         |                      |          |    |       |                           | 50         | --    | 50    | 25                 |  |
| Total        |             |                                       | 19              |          | 10  |                      | 29                 | 24      |                         |                      |          |    | 600   |                           |            |       | 200   |                    |  |
|              |             |                                       |                 |          |     |                      |                    |         |                         |                      |          |    |       |                           |            | Total | 800   |                    |  |

\* Assessment will be based on Unit Tests and Assignments.

Open Elective Course - 2: (i) 4SAOE2A Intellectual Property Right (ii) 4SAOE2B Introduction to Cyber Law (iii) 4SAOE2C Stress Management

Exit Option: To qualify for Diploma in Artificial Intelligence and Data Science

| Title                                             | Credit |
|---------------------------------------------------|--------|
| Two relevant MOOC/NPTEL courses as decided by BOS | 4      |
| AND                                               |        |
| Internship (Min 60 hrs)                           | 4      |

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Branch : Artificial Intelligence (AI) and Data Science

| SEMESTER: V |             |                                         |                 |          |     |                      |                    |         |                         |                      |          |    |       |                           |            |    |       |                    |
|-------------|-------------|-----------------------------------------|-----------------|----------|-----|----------------------|--------------------|---------|-------------------------|----------------------|----------|----|-------|---------------------------|------------|----|-------|--------------------|
| Sr. No.     | Course Code | Course Name                             | Teaching Scheme |          |     |                      |                    |         | Examination Scheme      |                      |          |    |       |                           |            |    |       |                    |
|             |             |                                         | Hours/ Week     |          |     | Group                | Total Hours / Week | Credits | THEORY                  |                      |          |    |       |                           | PRACTICAL  |    |       |                    |
|             |             |                                         | Lecture         | Tutorial | P/D |                      |                    |         | Duration of paper (Hrs) | Max. Marks ESE/ ESSE | Internal |    | Total | Overall Min Passing Marks | Max. Marks |    | Total | Min. Passing Marks |
|             |             |                                         |                 |          |     | Max. Marks MSE/ MSIE | Max. Marks TA      | Int.    | Ext.                    |                      |          |    |       |                           |            |    |       |                    |
| Theory      |             |                                         |                 |          |     |                      |                    |         |                         |                      |          |    |       |                           |            |    |       |                    |
| 01          | 5SA01       | Data Analytics and Visualization        | 3               |          |     | PCC                  | 3                  | 3       | 3                       | 60                   | 30       | 10 | 100   | 40                        |            |    |       |                    |
| 02          | 5SA02       | Computer Network                        | 3               |          |     | PCC                  | 3                  | 3       | 3                       | 60                   | 30       | 10 | 100   | 40                        |            |    |       |                    |
| 03          | 5SA03       | Compiler Design                         | 3               |          |     | PCC                  | 3                  | 3       | 3                       | 60                   | 30       | 10 | 100   | 40                        |            |    |       |                    |
| 04          | 5SA04       | Programme Elective Course - 1 (PEC - 1) | 3               |          |     | PEC                  | 3                  | 3       | 3                       | 60                   | 30       | 10 | 100   | 40                        |            |    |       |                    |
| 05          | MDM2        | Multidisciplinary Minor - 2 (MDM - 2)   | 3               |          |     | MDM                  | 3                  | 3       | 3                       | 60                   | 30       | 10 | 100   | 40                        |            |    |       |                    |
| 06          | 5SAOE3      | Open Elective Course - 3 (OE - 3)       | 3               |          |     | OE                   | 3                  | 3       | 3                       | 60                   | 30       | 10 | 100   | 40                        |            |    |       |                    |
| Practicals  |             |                                         |                 |          |     |                      |                    |         |                         |                      |          |    |       |                           |            |    |       |                    |
| 07          | 5SA05       | Data Analytics and Visualization Lab    |                 |          | 2   | PCC                  | 2                  | 1       |                         |                      |          |    |       |                           | 25         | 25 | 50    | 25                 |
| 08          | 5SA06       | Computer Network Lab                    |                 |          | 2   | PCC                  | 2                  | 1       |                         |                      |          |    |       |                           | 25         | 25 | 50    | 25                 |
| 09          | 5SA07       | Compiler Design Lab                     |                 |          | 2   | PCC                  | 2                  | 1       |                         |                      |          |    |       |                           | 25         | 25 | 50    | 25                 |
| 10          | 5SA08       | Computer Skill Laboratory - 2           |                 |          | 2   | PEC                  | 2                  | 1       |                         |                      |          |    |       |                           | 25         | 25 | 50    | 25                 |
| Total       |             |                                         | 18              |          | 8   |                      | 26                 | 22      |                         |                      |          |    | 600   |                           |            |    | 200   |                    |
|             |             |                                         |                 |          |     |                      |                    |         |                         |                      |          |    |       |                           | Total      |    | 800   |                    |

PEC - 1 : (i) 5SA04PE1A Data and Internet Security (ii) 5SA04PE1B Probability and Statistics (iii) 5SA04PE1C Expert System Design

Open Elective Course - 3: (i) 5SAOE3B Business Intelligence (ii) 5SAOE3C Project Management (iii) 5SAOE3D Aptitude for Engineers

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| SEMESTER: VI |             |                                         |                 |          |     |       |                    |         |                         |                      |                      |               |       |                           |            |      |       |                    |
|--------------|-------------|-----------------------------------------|-----------------|----------|-----|-------|--------------------|---------|-------------------------|----------------------|----------------------|---------------|-------|---------------------------|------------|------|-------|--------------------|
| Sr. No.      | Course Code | Course Name                             | Teaching Scheme |          |     |       |                    |         | Examination Scheme      |                      |                      |               |       |                           |            |      |       |                    |
|              |             |                                         | Hours/ Week     |          |     | Group | Total Hours / Week | Credits | THEORY                  |                      |                      |               |       |                           | PRACTICAL  |      |       |                    |
|              |             |                                         | Lecture         | Tutorial | P/D |       |                    |         | Duration of paper (Hrs) | Max. Marks ESE/ ESSE | Internal             |               | Total | Overall Min Passing Marks | Max. Marks |      | Total | Min. Passing Marks |
|              |             |                                         |                 |          |     |       |                    |         |                         |                      | Max. Marks MSE/ MSIE | Max. Marks TA |       |                           | Int.       | Ext. |       |                    |
| Theory       |             |                                         |                 |          |     |       |                    |         |                         |                      |                      |               |       |                           |            |      |       |                    |
| 01           | 6SA01       | Data Science                            | 3               |          |     | PCC   | 3                  | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 02           | 6SA02       | Design and Analysis of Algorithms       | 3               |          |     | PCC   | 3                  | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 03           | 6SA03       | Database Management Systems             | 2               |          |     | PCC   | 2                  | 2       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 04           | 6SA04       | Programme Elective Course - 2 (PEC - 2) | 3               |          |     | PEC   | 3                  | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 05           | 6SA05       | Programme Elective Course - 3 (PEC - 3) | 3               |          |     | PEC   | 3                  | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 06           | MDM3        | Multidisciplinary Minor - 3 (MDM - 3)   | 3               |          |     | MDM   | 3                  | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 07           | 6SDMP       | Disaster Management and Preparedness    | 2               |          |     | VEC   | 2                  |         |                         |                      |                      |               |       |                           |            |      |       |                    |
| Practicals   |             |                                         |                 |          |     |       |                    |         |                         |                      |                      |               |       |                           |            |      |       |                    |
| 07           | 6SA06       | Data Science Lab                        |                 |          | 2   | PCC   | 2                  | 1       |                         |                      |                      |               |       |                           | 25         | 25   | 50    | 25                 |
| 08           | 6SA07       | Design and Analysis of Algorithms Lab   |                 |          | 2   | PCC   | 2                  | 1       |                         |                      |                      |               |       |                           | 25         | 25   | 50    | 25                 |
| 09           | 6SA08       | Database Management Systems Lab         |                 |          | 2   | PCC   | 2                  | 1       |                         |                      |                      |               |       |                           | 25         | 25   | 50    | 25                 |
| 10           | 6SA09       | Computer Skill Laboratory - 3           |                 |          | 4   | VSEC  | 4                  | 2       |                         |                      |                      |               |       |                           | 25         | 25   | 50    | 25                 |
| Total        |             |                                         | 19              |          | 10  |       | 29                 | 22      |                         |                      |                      |               | 600   |                           |            |      | 200   |                    |
|              |             |                                         |                 |          |     |       |                    |         |                         |                      |                      |               |       |                           | Total      |      | 800   |                    |

PEC - 2 : (i) 6SA04PE2A Cyber Security   (ii) 6SA04PE2B Programming with Large Dataset   (iii) 6SA04PE2C Applied Artificial Intelligence

PEC - 3 : (i) 6SA05PE3A Network Security   (ii) 6SA05PE3B Data Mining and Data Warehousing   (iii) 6SA05PE3C Artificial Neural Network

Exit Option: To qualify for B. Voc. (Artificial Intelligence and Data Science)

| Title                                             | Credit |
|---------------------------------------------------|--------|
| Two relevant MOOC/NPTEL courses as decided by BOS | 4      |
| AND                                               |        |
| Internship (Min 60 hrs)                           | 4      |

Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati  
(An Autonomous Institute)  
Four Year Under Graduate Degree Program in Bachelor of Technology  
Choice Based Credit System (Semester Pattern)  
Branch : Artificial Intelligence (AI) and Data Science

| SEMESTER: VII |             |                                         |                 |          |     |       |                   |         |                         |                      |                      |               |       |                           |            |      |       |                    |
|---------------|-------------|-----------------------------------------|-----------------|----------|-----|-------|-------------------|---------|-------------------------|----------------------|----------------------|---------------|-------|---------------------------|------------|------|-------|--------------------|
| Sr. No.       | Course Code | Course Name                             | Teaching Scheme |          |     |       |                   |         | Examination Scheme      |                      |                      |               |       |                           |            |      |       |                    |
|               |             |                                         | Hours/ Week     |          |     | Group | Total Hours /Week | Credits | THEORY                  |                      |                      |               |       |                           | PRACTICAL  |      |       |                    |
|               |             |                                         | Lecture         | Tutorial | P/D |       |                   |         | Duration of paper (Hrs) | Max. Marks ESE/ ESSE | Internal             |               | Total | Overall Min Passing Marks | Max. Marks |      | Total | Min. Passing Marks |
|               |             |                                         |                 |          |     |       |                   |         |                         |                      | Max. Marks MSE/ MSIE | Max. Marks TA |       |                           | Int.       | Ext. |       |                    |
| Theory        |             |                                         |                 |          |     |       |                   |         |                         |                      |                      |               |       |                           |            |      |       |                    |
| 01            | 7SA01       | Cloud Computing                         | 2               |          |     | PCC   | 2                 | 2       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 02            | 7SA02       | Machine Learning                        | 3               |          |     | PCC   | 3                 | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 03            | 7SA03       | Programme Elective Course - 4 (PEC - 4) | 3               |          |     | PEC   | 3                 | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 04            | 7SA04       | Programme Elective Course - 5 (PEC - 5) | 2               |          |     | PEC   | 2                 | 2       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| 05            | MDM4        | Multidisciplinary Minor - 4 (MDM - 4)   | 3               |          |     | MDM   | 3                 | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        |            |      |       |                    |
| Practicals    |             |                                         |                 |          |     |       |                   |         |                         |                      |                      |               |       |                           |            |      |       |                    |
| 06            | 7SA05       | Machine Learning Lab                    |                 |          | 2   | PCC   | 2                 | 1       |                         |                      |                      |               |       |                           | 25         | 25   | 50    | 25                 |
| 07            | 7SA06       | Computer Skill Laboratory - 4           |                 |          | 2   | PEC   | 2                 | 1       |                         |                      |                      |               |       |                           | 25         | 25   | 50    | 25                 |
| 08            | 7SA07       | Research Methodology                    |                 |          | 4   | ELC   | 4                 | 2       |                         |                      |                      |               |       |                           | 50         | --   | 50    | 25                 |
| 09            | 7SA08       | Project                                 |                 |          | 12  | ELC   | 12                | 6       |                         |                      |                      |               |       |                           | 100        | 100  | 200   | 100                |
| Total         |             |                                         | 13              |          | 20  |       | 33                | 23      |                         |                      |                      |               | 500   |                           |            |      | 350   |                    |
|               |             |                                         |                 |          |     |       |                   |         |                         |                      |                      |               |       |                           | Total      |      | 850   |                    |

PEC - 4: (i) 7SA03PE4A Cryptography   (ii) 7SA03PE4B Big Data Analytics and Hadoop   (iii) 7SA03PE4C Generative Artificial Intelligence

PEC - 5: (i) 7SA04PE5A Digital Forensic   (ii) 7SA04PE5B Natural Language Processing   (iii) 7SA04PE5C Blockchain with AI

7SA07 Research Methodology: Assessment will be in Two parts. 1) Practical Work and Evaluation (25 Marks) and 2) Seminar Report Preparation and Presentation (25 Marks).

Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati  
(An Autonomous Institute)  
Four Year Under Graduate Degree Program in Bachelor of Technology  
Choice Based Credit System (Semester Pattern)  
Branch : Artificial Intelligence (AI) and Data Science

| SEMESTER: VIII |             |                                                     |                 |          |     |       |                    |         |                         |                      |                                |               |       |                           |            |      |       |                    |
|----------------|-------------|-----------------------------------------------------|-----------------|----------|-----|-------|--------------------|---------|-------------------------|----------------------|--------------------------------|---------------|-------|---------------------------|------------|------|-------|--------------------|
| Sr. No.        | Course Code | Course Name                                         | Teaching Scheme |          |     |       |                    |         | Examination Scheme      |                      |                                |               |       |                           |            |      |       |                    |
|                |             |                                                     | Hours/ Week     |          |     | Group | Total Hours / Week | Credits | THEORY                  |                      |                                |               |       |                           | PRACTICAL  |      |       |                    |
|                |             |                                                     | Lecture         | Tutorial | P/D |       |                    |         | Duration of paper (Hrs) | Max. Marks ESE/ ESSE | Internal                       |               | Total | Overall Min Passing Marks | Max. Marks |      | Total | Min. Passing Marks |
|                |             |                                                     |                 |          |     |       |                    |         |                         |                      | Max. Marks INTERNAL ASSESSMENT | Max. Marks TA |       |                           | Int.       | Ext. |       |                    |
| Theory         |             |                                                     |                 |          |     |       |                    |         |                         |                      |                                |               |       |                           |            |      |       |                    |
| 01             | 8SA01       | Deep Learning                                       | 3               |          |     | PCC   | 3                  | 3       | 3                       | 60                   | 30                             | 10            | 100   | 40                        |            |      |       |                    |
| 02             | 8SA02       | Programme Elective Course - 6 (PEC - 6)             | 3               |          |     | PEC   | 3                  | 3       | 3                       | 60                   | 30                             | 10            | 100   | 40                        |            |      |       |                    |
| Practical      |             |                                                     |                 |          |     |       |                    |         |                         |                      |                                |               |       |                           |            |      |       |                    |
| 03             | 8SA03       | Internship / On Job Training (OJT) / Apprenticeship |                 |          | 24  | ELC   | 24                 | 12      |                         |                      |                                |               |       |                           | 150        | 150  | 300   | 150                |
| Total          |             |                                                     | 6               |          | 24  |       | 30                 | 18      |                         |                      |                                |               | 200   |                           |            |      | 300   |                    |
|                |             |                                                     |                 |          |     |       |                    |         |                         |                      |                                |               |       |                           | Total      |      | 500   |                    |

PEC - 6 : (i) 8SA02PE6A Basics of Ethical Hacking (ii) 8SA02PE6B Ethics in Data Science (iii) 8SA02PE6C Safe and Responsible use of AI

\* Internal Assessment Marks (Total 30 Marks) will be calculated on the basis of MCQ Test Online (15 Marks) UNIT-1 and UNIT-2 and Case Study (15 Marks) based on subject's syllabus

| Sem     | SEM I | SEM II | SEM III | SEM IV | SEM V | SEM VI | SEM VII | SEM VIII | Total |
|---------|-------|--------|---------|--------|-------|--------|---------|----------|-------|
| Credits | 21    | 21     | 21      | 24     | 22    | 22     | 23      | 18       | 172   |

Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati  
(An Autonomous Institute)  
Four Year Under Graduate Degree Program in Bachelor of Technology  
Choice Based Credit System (Semester Pattern)  
Branch : Artificial Intelligence (AI) and Data Science

| HONORS     |             |                                       |                 |          |     |        |                    |         |                         |                      |                      |               |       |                           |            |      |       |                    |
|------------|-------------|---------------------------------------|-----------------|----------|-----|--------|--------------------|---------|-------------------------|----------------------|----------------------|---------------|-------|---------------------------|------------|------|-------|--------------------|
| SEMESTER   | Course Code | Course Name                           | Teaching Scheme |          |     |        |                    |         | Examination Scheme      |                      |                      |               |       |                           |            |      |       |                    |
|            |             |                                       | Hours/ Week     |          |     | Group  | Total Hours / Week | Credits | THEORY                  |                      |                      |               |       |                           | PRACTICAL  |      |       |                    |
|            |             |                                       | Lecture         | Tutorial | P/D |        |                    |         | Duration of paper (Hrs) | Max. Marks ESE/ ESSE | Internal             |               | Total | Overall Min Passing Marks | Max. Marks |      | Total | Min. Passing Marks |
|            |             |                                       |                 |          |     |        |                    |         |                         |                      | Max. Marks MSE/ MSIE | Max. Marks TA |       |                           | Int.       | Ext. |       |                    |
| Theory     |             |                                       |                 |          |     |        |                    |         |                         |                      |                      |               |       |                           |            |      |       |                    |
| IV         | 4SAH        | Advanced Programming for Data Science | 3               | -        | -   | Honors | 3                  | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        | -          | -    | -     | -                  |
| V          | 5SAH        | Advanced Data Science and Analytics   | 3               | -        | -   | Honors | 3                  | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        | -          | -    | -     | -                  |
| VI         | 6SAH        | Business and Web Analytics            | 3               | -        | -   | Honors | 3                  | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        | -          | -    | -     | -                  |
| VII        | 7SAH        | Data Engineering                      | 3               | -        | -   | Honors | 3                  | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        | -          | -    | -     | -                  |
| VIII       | 8SAH1       | Deep Learning and its Applications    | 3               | -        | -   | Honors | 3                  | 3       | 3                       | 60                   | 30                   | 10            | 100   | 40                        | -          | -    | -     | -                  |
| Practicals |             |                                       |                 |          |     |        |                    |         |                         |                      |                      |               |       |                           |            |      |       |                    |
| VIII       | 8SAH2       | Minor Project                         | -               | -        | 6   | Honor  | 6                  | 3       | -                       | -                    | -                    | -             | -     | -                         | 50         | 50   | 100   | 50                 |
| Total      |             |                                       | 15              |          | 6   |        | 21                 | 18      |                         |                      |                      |               | 500   |                           |            |      | 100   |                    |
|            |             |                                       |                 |          |     |        |                    |         |                         |                      |                      |               |       |                           | Total      |      | 600   |                    |

|  | MDM BASKETS OF COURSES FOR ALL Departments |         |             |                                                      |          |                                                  |                                               |
|--|--------------------------------------------|---------|-------------|------------------------------------------------------|----------|--------------------------------------------------|-----------------------------------------------|
|  |                                            |         |             |                                                      |          |                                                  |                                               |
|  | MDM Basket/ Track Name                     | Sr. No. | Course Code | Course Name                                          | Semester | Students from following Departments can Register | Offered by Department of                      |
|  | Artificial Intelligence                    | 1       | 4SAMDM1     | Artificial Intelligence and Expert Systems           | IV       | CE, CSE, EXTC, IT, CSE(IoT), ME                  | Artificial Intelligence and Data Science      |
|  |                                            | 2       | 5SAMDM2     | Applied Artificial Intelligence                      | V        |                                                  |                                               |
|  |                                            | 3       | 6SAMDM3     | Generative Artificial Intelligence                   | VI       |                                                  |                                               |
|  |                                            | 4       | 7SAMDM4     | Safe and Responsible Artificial Intelligence Systems | VII      |                                                  |                                               |
|  | Data Science                               | 1       | 4SAMDM5     | Programming for Data Science                         | IV       | CE, CSE, EXTC, IT, CSE(IoT), ME                  |                                               |
|  |                                            | 2       | 5SAMDM6     | Business Intelligence and Analytics                  | V        |                                                  |                                               |
|  |                                            | 3       | 6SAMDM7     | Data Engineering                                     | VI       |                                                  |                                               |
|  |                                            | 4       | 7SAMDM8     | Ethics in Data Science                               | VII      |                                                  |                                               |
|  | Civil Engineering                          | 1       | 4SCMDM1     | Introduction to Environmental Engineering            | IV       | AI&DS, CSE, EXTC, IT, CSE(IoT), ME               | Civil Engineering                             |
|  |                                            | 2       | 5SCMDM2     | Introduction to Water Resource Engineering           | V        |                                                  |                                               |
|  |                                            | 3       | 6SCMDM3     | Introduction to Transportation Engineering           | VI       |                                                  |                                               |
|  |                                            | 4       | 7SCMDM4     | Basics of Structural Analysis                        | VII      |                                                  |                                               |
|  | Construction Technology                    | 1       | 4SCMDM5     | Building Planning                                    | IV       | AI&DS, CSE, EXTC, IT, CSE(IoT), ME               |                                               |
|  |                                            | 2       | 5SCMDM6     | Construction Materials                               | V        |                                                  |                                               |
|  |                                            | 3       | 6SCMDM7     | Basics of Surveying                                  | VI       |                                                  |                                               |
|  |                                            | 4       | 7SCMDM8     | Basics of Geotechnical Engineering                   | VII      |                                                  |                                               |
|  | Computer Science and Engineering           | 1       | 4SKMDM1     | Fundamentals of Data Structures                      | IV       | CE, EXTC, CSE(IoT), ME                           | Computer Science and Engineering              |
|  |                                            | 2       | 5SKMDM2     | Introduction to Algorithms                           | V        |                                                  |                                               |
|  |                                            | 3       | 6SKMDM3     | Database Management System                           | VI       |                                                  |                                               |
|  |                                            | 4       | 7SKMDM4     | Basics of Enterprise Resource Planning               | VII      |                                                  |                                               |
|  | Software Engineering                       | 1       | 4SKMDM5     | Software Requirements Engineering                    | IV       | AI&DS, CE, EXTC, IT, CSE(IoT), ME                |                                               |
|  |                                            | 2       | 5SKMDM6     | Software Architecture                                | V        |                                                  |                                               |
|  |                                            | 3       | 6SKMDM7     | Software Project Management                          | VI       |                                                  |                                               |
|  |                                            | 4       | 7SKMDM8     | Software Testing and Quality Assurance               | VII      |                                                  |                                               |
|  | Electronics and Communication Engineering  | 1       | 4SEMDM1     | Electronic Instrumentation                           | IV       | AI&DS, CE, CSE, IT, CSE(IoT), ME                 | Electronics and Telecommunication Engineering |
|  |                                            | 2       | 5SEMDM2     | Electronic Devices and Circuits                      | V        |                                                  |                                               |
|  |                                            | 3       | 6SEMDM3     | Analog and Digital Communication                     | VI       |                                                  |                                               |
|  |                                            | 4       | 7SEMDM4     | Electronic Circuit Design                            | VII      |                                                  |                                               |
|  | Telecommunication Engineering              | 1       | 4SEMDM5     | Basic Electronic Communication Systems               | IV       | AI&DS, CE, CSE, IT, ME                           |                                               |
|  |                                            | 2       | 5SEMDM6     | Introduction to Wireless Communication               | V        |                                                  |                                               |
|  |                                            | 3       | 6SEMDM7     | Introduction to Mobile Computing                     | VI       |                                                  |                                               |
|  |                                            | 4       | 7SEMDM8     | Satellite and Optic Fiber Communication              | VII      |                                                  |                                               |

|  | MDM BASKETS OF COURSES FOR ALL Departments |         |             |                                              |          |                                                  |                                      |
|--|--------------------------------------------|---------|-------------|----------------------------------------------|----------|--------------------------------------------------|--------------------------------------|
|  |                                            |         |             |                                              |          |                                                  |                                      |
|  | MDM Basket/ Track Name                     | Sr. No. | Course Code | Course Name                                  | Semester | Students from following Departments can Register | Offered by Department of             |
|  | Information Technology                     | 1       | 4SNMDM1     | Data Transmission and Information Technology | IV       | AI&DS, CE, CSE, EXTC, CSE(IoT), ME               | Information Technology               |
|  |                                            | 2       | 5SNMDM2     | Data Communication Networks                  | V        |                                                  |                                      |
|  |                                            | 3       | 6SNMDM3     | E-Commerce                                   | VI       |                                                  |                                      |
|  |                                            | 4       | 7SNMDM4     | Management Information Systems               | VII      |                                                  |                                      |
|  | Cyber Security                             | 1       | 4SNMDM5     | Introduction to Cyber Security               | IV       | CE, EXTC, CSE(IoT), ME                           |                                      |
|  |                                            | 2       | 5SNMDM6     | Fundamentals of Cryptography                 | V        |                                                  |                                      |
|  |                                            | 3       | 6SNMDM7     | Basics of Ethical Hacking                    | VI       |                                                  |                                      |
|  |                                            | 4       | 7SNMDM8     | Blockchain Technology                        | VII      |                                                  |                                      |
|  | Mechanical Engineering                     | 1       | 4SMMDM1     | Energy Engineering                           | IV       | AI&DS, CE, CSE, EXTC, IT, CSE(IoT)               | Mechanical Engineering               |
|  |                                            | 2       | 5SMMDM2     | Automobile Engineering and Electric Vehicles | V        |                                                  |                                      |
|  |                                            | 3       | 6SMMDM3     | Industrial Engineering                       | VI       |                                                  |                                      |
|  |                                            | 4       | 7SMMDM4     | Industrial Automation                        | VII      |                                                  |                                      |
|  | Robotics and Automation Engineering        | 1       | 4SMMDM5     | Mechatronics                                 | IV       | AI&DS, CE, CSE, EXTC, IT, CSE(IoT)               |                                      |
|  |                                            | 2       | 5SMMDM6     | Rapid Prototyping                            | V        |                                                  |                                      |
|  |                                            | 3       | 6SMMDM7     | Automation Engineering                       | VI       |                                                  |                                      |
|  |                                            | 4       | 7SMMDM8     | Robotics and industrial Application          | VII      |                                                  |                                      |
|  | Internet of Things                         | 1       | 4SXMDM1     | Fundamentals of IoT                          | IV       | AI&DS, CE, CSE, EXTC, IT, ME                     | Computer Science & Engineering( IoT) |
|  |                                            | 2       | 5SXMDM2     | Sensors and Actuators                        | V        |                                                  |                                      |
|  |                                            | 3       | 6SXMDM3     | Single Board Computers                       | VI       |                                                  |                                      |
|  |                                            | 4       | 7SXMDM4     | Industrial Internet of Things                | VII      |                                                  |                                      |

| DOUBLE MINOR ( SPECIALIZATION) BASKETS OF COURSES FOR ALL DEPARTMENTS |         |             |                                                        |          |                                                  |                                               |  |
|-----------------------------------------------------------------------|---------|-------------|--------------------------------------------------------|----------|--------------------------------------------------|-----------------------------------------------|--|
| Double Minor / Specialization Minor Basket Track Name                 | Sr. No. | Course Code | Course Name                                            | Semester | Students from following Departments can Register | Offered by Department of                      |  |
| Advanced Programming                                                  | 1       | 3SASM       | Programming Language for Data Science                  | III      | CSE, CE, EXTC, IT, CSE(IoT), ME                  | Artificial Intelligence and Data Science      |  |
|                                                                       | 2       | 4SASM       | Advanced Java Programming                              | IV       |                                                  |                                               |  |
|                                                                       | 3       | 5SASM       | Mobile Application Development                         | V        |                                                  |                                               |  |
|                                                                       | 4       | 6SASM       | Introduction to Gaming                                 | VI       |                                                  |                                               |  |
|                                                                       | 5       | 7SASM       | Introduction to Software Development Platform (GitHub) | VII      |                                                  |                                               |  |
|                                                                       | 6       | 8SASM       | Databases and SQL for Data Science                     | VIII     |                                                  |                                               |  |
| Construction Management and Environmental Engineering                 | 1       | 3SCSM       | Environmental Pollution and Control                    | III      | AI&DS, CSE, EXTC, IT, CSE(IoT), ME               | Civil Engineering                             |  |
|                                                                       | 2       | 4SCSM       | Water Treatment Engineering                            | IV       |                                                  |                                               |  |
|                                                                       | 3       | 5SCSM       | Waste Water Treatment Engineering                      | V        |                                                  |                                               |  |
|                                                                       | 4       | 6SCSM       | Project Management and Planning                        | VI       |                                                  |                                               |  |
|                                                                       | 5       | 7SCSM       | Construction Material Management                       | VII      |                                                  |                                               |  |
|                                                                       | 6       | 8SCSM       | Construction Quality Management                        | VIII     |                                                  |                                               |  |
| Web Technology                                                        | 1       | 3SKSM       | Introduction of HTML                                   | III      | AI&DS, CE, EXTC, IT, CSE(IoT), ME                | Computer Science and Engineering              |  |
|                                                                       | 2       | 4SKSM       | Javascript                                             | IV       |                                                  |                                               |  |
|                                                                       | 3       | 5SKSM       | Web Engineering                                        | V        |                                                  |                                               |  |
|                                                                       | 4       | 6SKSM       | Cloud Technology                                       | VI       |                                                  |                                               |  |
|                                                                       | 5       | 7SKSM       | Distributed Database                                   | VII      |                                                  |                                               |  |
|                                                                       | 6       | 8SKSM       | User Experience Design                                 | VIII     |                                                  |                                               |  |
| Embedded System                                                       | 1       | 3SESM       | Fundamentals of Digital Electronics                    | III      | AI&DS, CE, CSE, IT, ME                           | Electronics and Telecommunication Engineering |  |
|                                                                       | 2       | 4SESM       | Digital System Design                                  | IV       |                                                  |                                               |  |
|                                                                       | 3       | 5SESM       | Introduction to Microprocessors                        | V        |                                                  |                                               |  |
|                                                                       | 4       | 6SESM       | Microcontroller and Applications                       | VI       |                                                  |                                               |  |
|                                                                       | 5       | 7SESM       | Advanced Microcontrollers                              | VII      |                                                  |                                               |  |
|                                                                       | 6       | 8SESM       | Embedded System and RTOS                               | VIII     |                                                  |                                               |  |
| Information Processing                                                | 1       | 3SNSM       | Fundamentals of Information Technology                 | III      | CE, CSE, EXTC, CSE(IoT), ME                      | Information Technology                        |  |
|                                                                       | 2       | 4SNSM       | Database Processing                                    | IV       |                                                  |                                               |  |
|                                                                       | 3       | 5SNSM       | Network Processing                                     | V        |                                                  |                                               |  |
|                                                                       | 4       | 6SNSM       | Data Mining and Warehousing                            | VI       |                                                  |                                               |  |
|                                                                       | 5       | 7SNSM       | Data Visualaization                                    | VII      |                                                  |                                               |  |
|                                                                       | 6       | 8SNSM       | Big Data Processing                                    | VIII     |                                                  |                                               |  |
| Manufacturing Techniques                                              | 1       | 3SMSM       | Manufacturing Processes-I                              | III      | AI&DS, CE, CSE, EXTC, IT, CSE(IoT),              | Mechanical Engineering                        |  |
|                                                                       | 2       | 4SMSM       | Manufacturing Processes -II                            | IV       |                                                  |                                               |  |
|                                                                       | 3       | 5SMSM       | Modern Manufacturing Techniques                        | V        |                                                  |                                               |  |
|                                                                       | 4       | 6SMSM       | Production Management                                  | VI       |                                                  |                                               |  |
|                                                                       | 5       | 7SMSM       | Productivity Techniques                                | VII      |                                                  |                                               |  |
|                                                                       | 6       | 8SMSM       | Computer Integrated Manufacturing                      | VIII     |                                                  |                                               |  |
| Industrial IoT                                                        | 1       | 3SXSM       | Introduction to Internet of Things                     | III      | AI&DS, CE, CSE, EXTC, IT, ME                     | Computer Science & Engineering( IoT)          |  |
|                                                                       | 2       | 4SXSM       | Industrial Sensors and Actuators                       | IV       |                                                  |                                               |  |
|                                                                       | 3       | 5SXSM       | Edge and Fog Computing                                 | V        |                                                  |                                               |  |
|                                                                       | 4       | 6SXSM       | Embedded System for Internet of Things                 | VI       |                                                  |                                               |  |
|                                                                       | 5       | 7SXSM       | Application of IoT in Healthcare and Agriculture       | VII      |                                                  |                                               |  |
|                                                                       | 6       | 8SXSM       | Internet of Things Security                            | VIII     |                                                  |                                               |  |

|  |                                                      |                |                    |                                                 |                 |
|--|------------------------------------------------------|----------------|--------------------|-------------------------------------------------|-----------------|
|  |                                                      |                |                    |                                                 |                 |
|  | <b>Honors Baskets of Courses for all Departments</b> |                |                    |                                                 |                 |
|  |                                                      |                |                    |                                                 |                 |
|  | <b>Name of Department</b>                            | <b>Sr. No.</b> | <b>Course Code</b> | <b>Course Name</b>                              | <b>Semester</b> |
|  | Artificial Intelligence and Data Science             | 1              | 4SAH               | Advanced Programming for Data Science           | IV              |
|  |                                                      | 2              | 5SAH               | Advanced Data Science and Analytics             | V               |
|  |                                                      | 3              | 6SAH               | Business and Web Analytics                      | VI              |
|  |                                                      | 4              | 7SAH               | Data Engineering                                | VII             |
|  |                                                      | 5              | 8SAH1              | Deep Learning and its Applications              | VIII            |
|  |                                                      | 6              | 8SAH2              | Minor Project                                   | VIII            |
|  | Civil Engineering                                    | 1              | 4SCH               | Air Pollution and Control                       | IV              |
|  |                                                      | 2              | 5SCH               | Structural Dynamics                             | V               |
|  |                                                      | 3              | 6SCH               | Geographic Information Systems                  | VI              |
|  |                                                      | 4              | 7SCH               | Advanced Foundation Engineering                 | VII             |
|  |                                                      | 5              | 8SCH1              | Finite Element Method                           | VIII            |
|  |                                                      | 6              | 8SCH2              | Minor Project                                   | VIII            |
|  | Computer Science and Engineering                     | 1              | 4SKH               | Data Science and Analytics                      | IV              |
|  |                                                      | 2              | 5SKH               | Natural Language Processing and Text Analytics  | V               |
|  |                                                      | 3              | 6SKH               | Artificial Neural Network                       | VI              |
|  |                                                      | 4              | 7SKH               | Optimization Techniques for Data Analytics      | VII             |
|  |                                                      | 5              | 8SKH1              | Computer Vision                                 | VIII            |
|  |                                                      | 6              | 8SKH2              | Minor Project                                   | VIII            |
|  | Electronics and Telecommunication Engineering        | 1              | 4SEH               | PLC & SCADA                                     | IV              |
|  |                                                      | 2              | 5SEH               | Electronics Circuit Design                      | V               |
|  |                                                      | 3              | 6SEH               | Cognitive Radio                                 | VI              |
|  |                                                      | 4              | 7SEH               | Biomedical Signal Processing                    | VII             |
|  |                                                      | 5              | 8SEH1              | VLSI Design Verification and Testing            | VIII            |
|  |                                                      | 6              | 8SEH2              | Minor Project                                   | VIII            |
|  | Information Technology                               | 1              | 4SNH               | Advanced Data Science                           | IV              |
|  |                                                      | 2              | 5SNH               | Artificial Neural Network                       | V               |
|  |                                                      | 3              | 6SNH               | Advanced Artificial Intelligence                | VI              |
|  |                                                      | 4              | 7SNH               | Advanced Machine Learning                       | VII             |
|  |                                                      | 5              | 8SNH1              | Advanced Speech and Natural Language Processing | VIII            |
|  |                                                      | 6              | 8SNH2              | Minor Project                                   | VIII            |

|  |                                                      |                |                    |                                 |                 |
|--|------------------------------------------------------|----------------|--------------------|---------------------------------|-----------------|
|  |                                                      |                |                    |                                 |                 |
|  | <b>Honors Baskets of Courses for all Departments</b> |                |                    |                                 |                 |
|  |                                                      |                |                    |                                 |                 |
|  | <b>Name of Department</b>                            | <b>Sr. No.</b> | <b>Course Code</b> | <b>Course Name</b>              | <b>Semester</b> |
|  | Mechanical Engineering                               | 1              | 4SMH               | Energy Audit                    | IV              |
|  |                                                      | 2              | 5SMH               | Computer Aided Design           | V               |
|  |                                                      | 3              | 6SMH               | Advance Heat Transfer           | VI              |
|  |                                                      | 4              | 7SMH               | 3D Printing and Application     | VII             |
|  |                                                      | 5              | 8SMH1              | Design of Transmission System   | VIII            |
|  |                                                      | 6              | 8SMH2              | Minor Project                   | VIII            |
|  | Computer Science &<br>Engineering( IoT)              | 1              | 4SXH               | IoT Architectures and Protocols | IV              |
|  |                                                      | 2              | 5SXH               | Internet of Things Security     | V               |
|  |                                                      | 3              | 6SXH               | Embedded Systems and IoT        | VI              |
|  |                                                      | 4              | 7SXH               | Machine Learning For IoT        | VII             |
|  |                                                      | 5              | 8SXH1              | Data Science in IoT             | VIII            |
|  |                                                      | 6              | 8SXH2              | Minor Project                   | VIII            |

|                                                              |             |                                              |                 |          | Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati |                                    |                                                                   |         |                        |                           |                     |               |       |                           |           |           |       |                   |    |
|--------------------------------------------------------------|-------------|----------------------------------------------|-----------------|----------|------------------------------------------------------------------------|------------------------------------|-------------------------------------------------------------------|---------|------------------------|---------------------------|---------------------|---------------|-------|---------------------------|-----------|-----------|-------|-------------------|----|
|                                                              |             |                                              |                 |          |                                                                        |                                    | (An Autonomous Institute)                                         |         |                        |                           |                     |               |       |                           |           |           |       |                   |    |
|                                                              |             |                                              |                 |          |                                                                        |                                    | Four Year Under Graduate Degree Program in Bachelor of Technology |         |                        |                           |                     |               |       |                           |           |           |       |                   |    |
|                                                              |             |                                              |                 |          |                                                                        |                                    | Choice Based Credit System (Semester Pattern)                     |         |                        |                           |                     |               |       |                           |           |           |       |                   |    |
|                                                              |             |                                              |                 |          |                                                                        |                                    | Branch:All Branches                                               |         |                        |                           |                     |               |       |                           |           |           |       |                   |    |
| MDM1 BASKET OF COURSES for 4th Sem (Semester: IV)            |             |                                              |                 |          |                                                                        |                                    |                                                                   |         |                        |                           |                     |               |       |                           |           |           |       |                   |    |
|                                                              |             |                                              |                 |          |                                                                        |                                    |                                                                   |         |                        |                           |                     |               |       |                           |           |           |       |                   |    |
| Semester: IV                                                 |             |                                              |                 |          |                                                                        |                                    |                                                                   |         |                        |                           |                     |               |       |                           |           |           |       |                   |    |
| Sem                                                          | Course Code | Course Name                                  | Teaching Scheme |          |                                                                        |                                    |                                                                   |         | Examination Scheme     |                           |                     |               |       |                           |           |           |       |                   |    |
|                                                              |             |                                              | Hours / Week    |          |                                                                        | MDM1 Applicable to                 | Total Hrs/ Week                                                   | Credits | Theory                 |                           |                     |               |       |                           |           | Practical |       |                   |    |
|                                                              |             |                                              | Lecture         | Tutorial | P/D                                                                    |                                    |                                                                   |         | Duration of paper (Hr) | Max Marks Paper ESE/ ESSE | Internal            |               | Total | Overall Min Passing Marks | Max Marks |           | Total | Min Passing Marks |    |
|                                                              |             |                                              |                 |          |                                                                        |                                    |                                                                   |         |                        |                           | Max Marks MSE/ MSIE | Max. Marks TA |       |                           | Int.      | Ext.      |       |                   |    |
| Theory                                                       |             |                                              |                 |          |                                                                        |                                    |                                                                   |         |                        |                           |                     |               |       |                           |           |           |       |                   |    |
| IV                                                           | 4SAMDM1     | Artificial Intelligence and Expert Systems   | 3               | --       | --                                                                     | CE, CSE, EXTC, IT, CSE(IoT), ME    | 3                                                                 | 3       |                        | 3                         | 60                  | 30            | 10    | 100                       | 40        | --        | --    | --                | -- |
| IV                                                           | 4SAMDM5     | Programming for Data Science                 | 3               | --       | --                                                                     | CE, CSE, EXTC, IT, CSE(IoT), ME    | 3                                                                 | 3       |                        | 3                         | 60                  | 30            | 10    | 100                       | 40        | --        | --    | --                | -- |
| IV                                                           | 4SCMDM1     | Introduction to Environmental Engineering    | 3               | --       | --                                                                     | AI&DS, CSE, EXTC, IT, CSE(IoT), ME | 3                                                                 | 3       |                        | 3                         | 60                  | 30            | 10    | 100                       | 40        | --        | --    | --                | -- |
| IV                                                           | 4SCMDM5     | Building Planning                            | 3               | --       | --                                                                     | AI&DS, CSE, EXTC, IT, CSE(IoT), ME | 3                                                                 | 3       |                        | 3                         | 60                  | 30            | 10    | 100                       | 40        | --        | --    | --                | -- |
| IV                                                           | 4SKMDM1     | Fundamentals of Data Structures              | 3               | --       | --                                                                     | CE, EXTC, CSE(IoT), ME             | 3                                                                 | 3       |                        | 3                         | 60                  | 30            | 10    | 100                       | 40        | --        | --    | --                | -- |
| IV                                                           | 4SKMDM5     | Software Requirements Engineering            | 3               | --       | --                                                                     | AI&DS, CE, EXTC, IT,CSE(IoT), ME   | 3                                                                 | 3       |                        | 3                         | 60                  | 30            | 10    | 100                       | 40        | --        | --    | --                | -- |
| IV                                                           | 4SEMDM1     | Electronic Instrumentation                   | 3               | --       | --                                                                     | AI&DS, CE, CSE, IT, CSE(IoT), ME   | 3                                                                 | 3       |                        | 3                         | 60                  | 30            | 10    | 100                       | 40        | --        | --    | --                | -- |
| IV                                                           | 4SEMDM5     | Basic Electronic Communication Systems       | 3               | --       | --                                                                     | AI&DS, CE, CSE, IT, ME             | 3                                                                 | 3       |                        | 3                         | 60                  | 30            | 10    | 100                       | 40        | --        | --    | --                | -- |
| IV                                                           | 4SNMDM1     | Data Transmission and Information Technology | 3               | --       | --                                                                     | AI&DS, CE, CSE, EXTC, CSE(IoT), ME | 3                                                                 | 3       |                        | 3                         | 60                  | 30            | 10    | 100                       | 40        | --        | --    | --                | -- |
| IV                                                           | 4SNMDM5     | Introduction to Cyber Security               | 3               | --       | --                                                                     | CE, EXTC, CSE(IoT), ME             | 3                                                                 | 3       |                        | 3                         | 60                  | 30            | 10    | 100                       | 40        | --        | --    | --                | -- |
| IV                                                           | 4SXMDM1     | Fundamentals of IoT                          | 3               | --       | --                                                                     | AI&DS, CE, CSE, EXTC, IT, ME       | 3                                                                 | 3       |                        | 3                         | 60                  | 30            | 10    | 100                       | 40        | --        | --    | --                | -- |
| IV                                                           | 4SMMDM1     | Energy Engineering                           | 3               | --       | --                                                                     | AI&DS, CE, CSE, EXTC, IT, CSE(IoT) | 3                                                                 | 3       |                        | 3                         | 60                  | 30            | 10    | 100                       | 40        | --        | --    | --                | -- |
| IV                                                           | 4SMMDM5     | Mechatronics                                 | 3               | --       | --                                                                     | AI&DS, CE, CSE, EXTC, IT, CSE(IoT) | 3                                                                 | 3       |                        | 3                         | 60                  | 30            | 10    | 100                       | 40        | --        | --    | --                | -- |
|                                                              |             | Total                                        | 3               |          | 0                                                                      |                                    | 3                                                                 | 3       |                        |                           |                     |               |       | 100                       |           | --        | --    | --                | -- |
| Please Note the Track from the Multidisciplinary Minor table |             |                                              |                 |          |                                                                        |                                    |                                                                   |         |                        |                           |                     |               |       |                           |           | Total     |       | 100               |    |

|                                                                        |             |                                        |                 |          |     |                                                                        |                                               |         |  |                        |                           |                     |               |       |                           |           |      |           |                   |  |
|------------------------------------------------------------------------|-------------|----------------------------------------|-----------------|----------|-----|------------------------------------------------------------------------|-----------------------------------------------|---------|--|------------------------|---------------------------|---------------------|---------------|-------|---------------------------|-----------|------|-----------|-------------------|--|
|                                                                        |             |                                        |                 |          |     | Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati |                                               |         |  |                        |                           |                     |               |       |                           |           |      |           |                   |  |
|                                                                        |             |                                        |                 |          |     |                                                                        | (An Autonomous Institute)                     |         |  |                        |                           |                     |               |       |                           |           |      |           |                   |  |
|                                                                        |             |                                        |                 |          |     | Four Year Under Graduate Degree Program in Bachelor of Technology      |                                               |         |  |                        |                           |                     |               |       |                           |           |      |           |                   |  |
|                                                                        |             |                                        |                 |          |     |                                                                        | Choice Based Credit System (Semester Pattern) |         |  |                        |                           |                     |               |       |                           |           |      |           |                   |  |
|                                                                        |             |                                        |                 |          |     |                                                                        | Branch: All Branches                          |         |  |                        |                           |                     |               |       |                           |           |      |           |                   |  |
| SPECIALIZATION MINOR (SM) BASKET OF COURSES (DOUBLE MINOR) for 3rd Sem |             |                                        |                 |          |     |                                                                        |                                               |         |  |                        |                           |                     |               |       |                           |           |      |           |                   |  |
|                                                                        |             |                                        |                 |          |     |                                                                        |                                               |         |  |                        |                           |                     |               |       |                           |           |      |           |                   |  |
| Semester: IV                                                           |             |                                        |                 |          |     |                                                                        |                                               |         |  |                        |                           |                     |               |       |                           |           |      |           |                   |  |
| Sem                                                                    | Course Code | Course Name                            | Teaching Scheme |          |     |                                                                        |                                               |         |  | Examination Scheme     |                           |                     |               |       |                           |           |      |           |                   |  |
|                                                                        |             |                                        | Hours / Week    |          |     | SM Applicable to                                                       | Total Hrs/ Week                               | Credits |  | Theory                 |                           |                     |               |       |                           |           |      | Practical |                   |  |
|                                                                        |             |                                        | Lecture         | Tutorial | P/D |                                                                        |                                               |         |  | Duration of paper (Hr) | Max Marks Paper ESE/ ESSE | Internal            |               | Total | Overall Min Passing Marks | Max Marks |      | Total     | Min Passing Marks |  |
|                                                                        |             |                                        |                 |          |     |                                                                        |                                               |         |  |                        |                           | Max Marks MSE/ MSIE | Max. Marks TA |       |                           | Int.      | Ext. |           |                   |  |
|                                                                        |             |                                        |                 |          |     |                                                                        |                                               |         |  |                        |                           |                     |               |       |                           |           |      |           |                   |  |
| Theory                                                                 |             |                                        |                 |          |     |                                                                        |                                               |         |  |                        |                           |                     |               |       |                           |           |      |           |                   |  |
| III                                                                    | 3SASM       | Programming Language for Data Science  | 3               | --       | --  | CE, CSE, EXTC, IT, CSE(IoT), ME                                        | 3                                             | 3       |  | 3                      | 60                        | 30                  | 10            | 100   | 40                        | --        | --   | --        | --                |  |
| III                                                                    | 3SCSM       | Environmental Pollution and Control    | 3               | --       | --  | AI&DS, CSE, EXTC, IT, CSE(IoT), ME                                     | 3                                             | 3       |  | 3                      | 60                        | 30                  | 10            | 100   | 40                        | --        | --   | --        | --                |  |
| III                                                                    | 3SKSM       | Introduction of HTML                   | 3               | --       | --  | AI&DS, CE, EXTC, IT, CSE(IoT), ME                                      | 3                                             | 3       |  | 3                      | 60                        | 30                  | 10            | 100   | 40                        | --        | --   | --        | --                |  |
| III                                                                    | 3SESM       | Fundamentals of Digital Electronics    | 3               | --       | --  | AI&DS, CE, CSE, IT, ME                                                 | 3                                             | 3       |  | 3                      | 60                        | 30                  | 10            | 100   | 40                        | --        | --   | --        | --                |  |
| III                                                                    | 3SNSM       | Fundamentals of Information Technology | 3               | --       | --  | CE, CSE, EXTC, CSE(IoT), ME                                            | 3                                             | 3       |  | 3                      | 60                        | 30                  | 10            | 100   | 40                        | --        | --   | --        | --                |  |
| III                                                                    | 3XSXM       | Introduction to Internet of Things     | 3               | --       | --  | AI&DS, CE, CSE, EXTC, IT, ME                                           | 3                                             | 3       |  | 3                      | 60                        | 30                  | 10            | 100   | 40                        | --        | --   | --        | --                |  |
| III                                                                    | 3SMSM       | Manufacturing Processes-I              | 3               | --       | --  | AI&DS, CE, CSE, EXTC, IT, CSE(IoT)                                     | 3                                             | 3       |  | 3                      | 60                        | 30                  | 10            | 100   | 40                        | --        | --   | --        | --                |  |
|                                                                        |             | Total                                  | 3               | 0        | 0   |                                                                        | 3                                             | 3       |  |                        |                           |                     |               | 100   |                           |           |      |           |                   |  |
|                                                                        |             |                                        |                 |          |     |                                                                        |                                               |         |  |                        |                           |                     |               |       |                           | Total     |      | 100       |                   |  |

|                                                                        |             |                                  |                 |          | Prof. Ram Meghe Institute of Technology and Research, Badnera-Amravati |                                    |                 |         |  |                        |                      |                |               |       |                           |           |      |       |                   |
|------------------------------------------------------------------------|-------------|----------------------------------|-----------------|----------|------------------------------------------------------------------------|------------------------------------|-----------------|---------|--|------------------------|----------------------|----------------|---------------|-------|---------------------------|-----------|------|-------|-------------------|
|                                                                        |             |                                  |                 |          | (An Autonomous Institute)                                              |                                    |                 |         |  |                        |                      |                |               |       |                           |           |      |       |                   |
|                                                                        |             |                                  |                 |          | Four Year Under Graduate Degree Program in Bachelor of Technology      |                                    |                 |         |  |                        |                      |                |               |       |                           |           |      |       |                   |
|                                                                        |             |                                  |                 |          | Choice Based Credit System (Semester Pattern)                          |                                    |                 |         |  |                        |                      |                |               |       |                           |           |      |       |                   |
|                                                                        |             |                                  |                 |          | Branch: All Branches                                                   |                                    |                 |         |  |                        |                      |                |               |       |                           |           |      |       |                   |
| SPECIALIZATION MINOR (SM) BASKET OF COURSES (DOUBLE MINOR) for 4th Sem |             |                                  |                 |          |                                                                        |                                    |                 |         |  |                        |                      |                |               |       |                           |           |      |       |                   |
|                                                                        |             |                                  |                 |          |                                                                        |                                    |                 |         |  |                        |                      |                |               |       |                           |           |      |       |                   |
| Semester: IV                                                           |             |                                  |                 |          |                                                                        |                                    |                 |         |  |                        |                      |                |               |       |                           |           |      |       |                   |
| Sem                                                                    | Course Code | Course Name                      | Teaching Scheme |          |                                                                        |                                    |                 |         |  | Examination Scheme     |                      |                |               |       |                           |           |      |       |                   |
|                                                                        |             |                                  | Hours / Week    |          |                                                                        | SM Applicable to                   | Total Hrs/ Week | Credits |  | Theory                 |                      |                |               |       |                           | Practical |      |       |                   |
|                                                                        |             |                                  | Lecture         | Tutorial | P/D                                                                    |                                    |                 |         |  | Duration of paper (Hr) | Max Marks Paper ESE/ | Internal       |               | Total | Overall Min Passing Marks | Max Marks |      | Total | Min Passing Marks |
|                                                                        |             |                                  |                 |          |                                                                        |                                    |                 |         |  |                        |                      | Max Marks MSE/ | Max. Marks TA |       |                           | Int.      | Ext. |       |                   |
| Theory                                                                 |             |                                  |                 |          |                                                                        |                                    |                 |         |  |                        |                      |                |               |       |                           |           |      |       |                   |
| III                                                                    | 4SASM       | Advanced Java Programming        | 3               | --       | --                                                                     | CSE, CE, EXTC, IT, CSE(IoT), ME    | 3               | 3       |  | 3                      | 60                   | 30             | 10            | 100   | 40                        | --        | --   | --    | --                |
| III                                                                    | 4SCSM       | Water Treatment Engineering      | 3               | --       | --                                                                     | AI&DS, CSE, EXTC, IT, CSE(IoT), ME | 3               | 3       |  | 3                      | 60                   | 30             | 10            | 100   | 40                        | --        | --   | --    | --                |
| III                                                                    | 4SKSM       | Javascript                       | 3               | --       | --                                                                     | AI&DS, CE, EXTC, IT, CSE(IoT), ME  | 3               | 3       |  | 3                      | 60                   | 30             | 10            | 100   | 40                        | --        | --   | --    | --                |
| III                                                                    | 4SESM       | Digital System Design            | 3               | --       | --                                                                     | AI&DS, CE, CSE, IT, ME             | 3               | 3       |  | 3                      | 60                   | 30             | 10            | 100   | 40                        | --        | --   | --    | --                |
| III                                                                    | 4SNSM       | Database Processing              | 3               | --       | --                                                                     | CE, CSE, EXTC, CSE(IoT), ME        | 3               | 3       |  | 3                      | 60                   | 30             | 10            | 100   | 40                        | --        | --   | --    | --                |
| III                                                                    | 4SXSM       | Industrial Sensors and Actuators | 3               | --       | --                                                                     | AI&DS, CE, CSE, EXTC, IT, ME       | 3               | 3       |  | 3                      | 60                   | 30             | 10            | 100   | 40                        | --        | --   | --    | --                |
| III                                                                    | 4SMSM       | Manufacturing Processes -II      | 3               | --       | --                                                                     | AI&DS, CE, CSE, EXTC, IT, CSE(IoT) | 3               | 3       |  | 3                      | 60                   | 30             | 10            | 100   | 40                        | --        | --   | --    | --                |
|                                                                        |             | Total                            | 3               |          | 0                                                                      |                                    | 3               | 3       |  |                        |                      |                |               | 100   |                           |           |      |       |                   |
|                                                                        |             |                                  |                 |          |                                                                        |                                    |                 |         |  |                        |                      |                |               |       |                           | Total     |      | 100   |                   |
|                                                                        |             |                                  |                 |          |                                                                        |                                    |                 |         |  |                        |                      |                |               |       |                           |           |      |       |                   |

[illegible]

## B.Tech. First Year (All Branches)

| Course Code | Course Title            | L  | T  | P  | C  |
|-------------|-------------------------|----|----|----|----|
| 1SF01       | Applied Mathematics - I | 03 | 00 | 00 | 03 |

### Course Prerequisite:

1. Basic idea of differential and integral calculus.
2. Fundamental knowledge of trigonometric functions.
3. Essential knowledge of Differential Equation.

### Course Learning Objectives:

1. To familiarize with techniques in calculus.
2. To evaluate partial derivatives of explicit, implicit functions, maxima and minima values of the functions.
3. To solve differential equation of certain type of differential equations and its applications.
4. To determine infinite series and their convergence and divergence.

### Course Outcomes:

Students will be able to:

1. Make use of derivatives for finding nth derivatives and to solve indeterminate forms.
2. Extend the basic ideas of the calculus of functions of single variables to functions of several variables and its concept.
3. Find maximum and minimum value of a function.
4. Solve certain types of differential equations by various methods.
5. Utilize it for engineering problems of electrical circuit.
6. Determine infinite series and their convergence and divergence.

|          |                                                                                                                                                                                                                                                                   |          |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|          | <b>Subject:</b> (1SF01) Applied Mathematics - I                                                                                                                                                                                                                   | <b>L</b> |
| Unit I   | <b>Differential Calculus I:</b> Successive differentiation, Leibnitz's theorem on the nth derivative of a product, Indeterminate forms.                                                                                                                           | 7        |
| Unit II  | <b>Differential Calculus II:</b> Partial differentiation, Euler's theorem on homogeneous function.                                                                                                                                                                | 6        |
| Unit III | <b>Differential Calculus II:</b> Partial differentiation, Euler's theorem on homogeneous function.                                                                                                                                                                | 7        |
| Unit IV  | <b>Ordinary differential equations of first order and first degree:</b> Non-homogeneous differential equation, Linear differential equation, reducible to Linear differential equation, Exact differential equation and reducible to Exact differential equation. | 7        |
| Unit V   | <b>Differential equations of first order and higher degree:</b> Solvable for p, solvable for x and solvable for y, Application to Orthogonal Trajectories and Electrical circuits by Kirchoff's law.                                                              | 6        |
| Unit VI  | <b>Infinite Series:</b> Tests for convergence by p-series test, Comparison test, Ratio test, Rabbe's test and Root test.                                                                                                                                          | 7        |
|          | <b>Total</b>                                                                                                                                                                                                                                                      | 40       |

**Text Books:**

1. Wartikar P.N. & Wartikar J.N.- A Text Book of Applied Mathematics Vol.-I & II, Pune V.G. Prakashan, Pune.
2. Grewal B.S. - Higher Engineering Mathematics, 40/e, Khanna Publishers.

**Reference Books:**

1. Kreyszig E.K. - Advanced Engineering Mathematics, John Wiley.
2. Ramana B.V. - Higher Engineering Mathematics, (TMH).
3. Singh R.R. & Bhatt M. - Engineering Mathematics, (TMH).
4. Dass H. K. – Advance Engineering Mathematics, S. Chand.

## B.Tech. First Year (All Branches)

| Course Code | Course Title    | L  | T  | P  | C  |
|-------------|-----------------|----|----|----|----|
| 1SF02       | Applied Physics | 03 | 00 | 00 | 03 |

### Course Prerequisites:

- 1) Elementary idea about electric charge, electricity & magnetism.
- 2) Basic knowledge of material science.
- 3) Fundamental knowledge of optics.

### Course Learning Objectives:

- 1) To impart the essential knowledge and applications of ballistics of charged particles in electric and magnetic fields.
- 2) To impart the fundamentals of optics, fibre optics and laser physics and their various applications in engineering fields.
- 3) To impart the knowledge of crystallography, fluid dynamics and cathode ray oscilloscope and their applications.
- 4) To enhance the imagination and creativity in students by performing practical experiments on related topics.

### Course Outcomes:

Students will be able to,

- 1) Apply the concepts of electric and magnetic fields in mass spectrograph and Cathode Ray Oscilloscope.
- 2) The students will gain the basic ideas about crystallography and will be able to identify different types of crystal structures in solids.
- 3) The students will be able to utilize the knowledge of interference and diffraction.
- 4) The Students will gain the knowledge of LASER, its types and applications.
- 5) The Students will acquire the knowledge of fibre optics, its types and applications.
- 6) The Students will gain the knowledge of fluid dynamics and its applications.

|        |                                                                                                                                                                                                                                                                  |          |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|        | <b>Subject:</b> (1SF02) Applied Physics                                                                                                                                                                                                                          | <b>L</b> |
| UNIT I | <b>Electron Ballistics:</b><br>Motion of charged particle in uniform transverse electric and transverse magnetic fields, velocity selector (energy filter), Bainbridge mass spectrograph, Hall effect, cathode ray oscilloscope : working and its block diagram. | 8        |

|          |                                                                                                                                                                                                                                                                                                                    |    |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| UNIT II  | <b>Crystallography:</b><br>Crystal structure, Unit cell, Cubic crystal structure: SC, BCC and FCC, Unit cell characteristics: Effective number of atoms per unit cell, atomic radius, coordination number, atomic packing fraction, Miller indices, Bravais lattice Inter-planar distance between adjacent planes. | 6  |
| UNIT III | <b>Interference and Diffraction of Light:</b><br>Fundamental condition of interference, thin film interference due to reflected light, Newton's rings experiment and its applications, Fresnel and Fraunhofer diffraction, plane transmission diffraction grating.                                                 | 7  |
| UNIT IV  | <b>Laser Physics:</b><br>Absorption, spontaneous and stimulated emission of radiation, population inversion, pumping, metastable state, characteristics and applications of laser, Ruby laser, He-Ne Laser.                                                                                                        | 6  |
| UNIT V   | <b>Fibre Optics:</b><br>Snell's law, total Internal reflection, construction of optical fibre, acceptance angle and acceptance cone, numerical aperture, types of optical fibre, attenuation, fibre optic communication system.                                                                                    | 7  |
| UNIT VI  | <b>Fluid Dynamics:</b><br>Viscosity, Stoke's law, streamline and turbulent flow of liquid, Poiseuille's equation, Continuity equation, Bernoulli's theorem.                                                                                                                                                        | 6  |
|          | <b>Total</b>                                                                                                                                                                                                                                                                                                       | 40 |

**Text Books:**

- 1) R.K.Gaur & S.L.Gupta: Engineering Physics, Dhanpat Rai & Sons.
- 2) Hitendra K. Malik & A.K.Singh: Engineering Physics, Tata McGraw Hill
- 3) M.N. Avadhanulu & P.G. Kshirsagar: Engineering Physics, S.Chand Pub., 2008

**Reference Books:**

- 1) Orazio Svelto: Principle of Lasers, Springer
- 2) Frank L.Pedrotti, Leno M. Pedrotti, Leno S. Pedrotti: Introduction to optics.

### **B.Tech. First Year (All Branches)**

| Course Code | Course Title         | L  | T  | P  | C  |
|-------------|----------------------|----|----|----|----|
| 1SF03       | Engineering Graphics | 02 | 00 | 00 | 02 |

#### **Course Prerequisites:**

1. Knowledge of basic math concepts and terms.
2. Ability to visualize objects in three dimensions.
3. Computer literacy.

#### **Course Learning Objectives:**

1. To acquire and apply engineering graphics knowledge for communicating ideas, information and instructions.
2. To understand the representations of 3D objects and their projections.
3. To understand the representations of orthographic and isometric views of objects.
4. To introduce & apply different drafting commands of CAD software.

#### **Course Outcomes:**

At the end of course, Learner will be able to:

1. Use the drawing instruments effectively to dimension the given figures and describe the methods of projection.
2. Construct the various types of plane in different orientation.
3. Apply knowledge of projection to construct different view of regular solid objects
4. Identify the pictorial views of the object.
5. Recognize the pictorial views of the object and construct isometric scale, isometric projection & views
6. Develop the lateral surfaces of primitive solids by using CAD Software.

|         | <b>Subject: (1SF03) Engineering Graphics</b>                                                                                                                                                                                                            | <b>L</b>  |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Unit I  | <b>Basics of Engineering Drawing and Projection:</b><br>Introduction to drawing instrument and their uses, concept of dimensioning and scales, geometric construction. Projection of Point, Projection of Line.                                         | <b>04</b> |
| Unit II | <b>Projection of Plane:</b><br>Projection of different types of planes such as triangular plane, square plane, rectangular plane, pentagonal plane, hexagonal plane, circular plane etc. by using change of position method and auxiliary plane method. | <b>04</b> |

|          |                                                                                                                                                                                                                                                |           |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Unit III | <b>Projection of Solids:</b><br>Projection of solids for Prism, Pyramid, Cone and Cylinder.                                                                                                                                                    | <b>05</b> |
| Unit IV  | <b>Orthographic Projection:</b><br>Construction of elevation, plan and side view of given object by using first and third angle projection methods.                                                                                            | <b>05</b> |
| Unit V   | <b>Isometric Views and Projection:</b><br>Construction of isometric scale, isometric views and projection.                                                                                                                                     | <b>06</b> |
| Unit VI  | <b>Fundamental of CAD Software:</b><br>Drafting environment and drafting screen, coordinate systems, drafting and dimensioning commands, editing commands, drafting of basic geometrical shapes, display commands, CAD software customization. | <b>06</b> |
|          | <b>Total</b>                                                                                                                                                                                                                                   | <b>30</b> |

### **Text Books:**

1. Bhatt N. D. & Panchal V. M. Engineering Drawing, 49th Edn., Charotar Pub. House, Anand, Gujrat, 2007.
2. Shah P. J. – Engineering Drawing, S. Chand Publication, 2008.
3. Dhawan R. K. – Engineering Drawing, S. Chand Publication, (5th edition, 2008).
4. Ingole D.S. – Engineering Graphics, Nirali Publication, Pune (1st Edition 2020).
5. Tickoo Sham – AutoCAD, BPB Publications.

**B.Tech. First Year (All Branches)**

| Course code | Course Title                    | L  | T  | P  | C  |
|-------------|---------------------------------|----|----|----|----|
| 1SF04       | Programming for Problem Solving | 02 | 00 | 00 | 02 |

**Course Prerequisites:** Basic Computer Knowledge and Logical Thinking.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of the Programming for Problem Solving

1. Develop a solid understanding of the fundamental concepts of programming and problem-solving, including the input-process-output cycle, algorithms, and program design principles such as top-down and bottom-up approaches.
2. Acquire proficiency in the C programming language, including the ability to write and execute basic C programs, effectively use input-output functions, work with variables, data types, and operators, and understand the concept of program execution.
3. Demonstrate competence in using control constructs such as decision-making statements and looping statements to create efficient and structured programs.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Understand the basic concepts of computer organization, program design and Algorithms.
2. Explain the basic structure and fundamentals of C programming.
3. Compare and contrast the decision-making constructs and looping statements in C programming.
4. Understand the concept of arrays and string functions in C language.
5. Demonstrate the ability to write and use the concept of functions.
6. Apply the concepts of pointer declaration, assignment and arithmetic operation.

|               |                                                                                                                                                                                                                    |           |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | <b>Subject:</b> (1SF04) Programming for Problem Solving                                                                                                                                                            | L         |
| <b>Unit-1</b> | <b>Introduction:</b> Characteristics of Computer, Organization of Computer, Input – Process Output Cycle Various Types of Memory (Primary Memory & Secondary Memory), Introduction to C language, Basic structure. | <b>05</b> |
| <b>Unit-2</b> | <b>C Fundamentals:</b> Program Execution First C Program, Input Output using scanf() and printf(), Data type, Variables, Keywords, Operators and their precedence.                                                 | <b>05</b> |
| <b>Unit-3</b> | <b>C Control construct:</b> Decision making using if, if-else,if-else-if and switch. Looping using for, while, do while, Jumps Statements (break, continue, goto, return), Basic Programs.                         | <b>05</b> |

|               |                                                                                                                                                                                                            |           |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-4</b> | <b>Array and Strings:</b> Introduction to Array, 1-D array: Declaration & Initialization, 2-D array: Declaration & Initialization, Strings: Declaration & Initialization, String functions.                | <b>05</b> |
| <b>Unit-5</b> | <b>Functions:</b> Function: Pre defined functions; User defined functions, Multi-function Program, Elements of user defined functions, Return value and their types, Function calls, Function Declaration. | <b>05</b> |
| <b>Unit-6</b> | <b>Pointers:</b> Definition and uses of pointers, pointer declaration, pointer assignment, pointer arithmetic, Pointers and Functions: Call by value and call by reference.                                | <b>05</b> |
|               | <b>Total</b>                                                                                                                                                                                               | <b>30</b> |

**Text Book:**

1. R. S. Salaria: Programming for Problem Solving, Khanna Publication.
2. E Balagurusamy: Computing Fundamentals and C Programming- Tata McGraw Hill, Second Edition

**Reference Books:**

1. Herbert Schildt- C Complete reference (Tata McGraw Hill)
2. Yashwant Kanetkar- Let us C- Seventh Edition

## B.Tech. First Year (All Branches)

| Course Code | Course Title                      | L  | T  | P  | C  |
|-------------|-----------------------------------|----|----|----|----|
| 1SF05       | Professional Communication Skills | 01 | 01 | 00 | 02 |

### Course Prerequisites:

- 1) Basic knowledge of vocabulary and grammar of English.
- 2) Basic knowledge of LSWR skills.

### Course Learning Objectives:

1. Introduce communication skills and improve vocabulary.
2. Enhance the Employability skills and develop problem solving attitude.
3. Develop confidence and help them attend interviews successfully.
4. Develop the importance of team building and networking.

### Course Outcomes:

Students will be able to

1. Use words correctly in a sentence.
2. Become a competent communicator.
3. Express and present their ideas relevant to the given topic.
4. Develop critical thinking skills, decision making ability and team spirit.
5. Develop skills needed for approaching different types of interviews.
6. Become ethical confident individual professionally and socially.

|          | <b>Subject:</b> (1SF05) Professional Communication Skills                                                                                                                                                                                                                                                                                                                              | <b>L</b> |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Unit I   | Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers | 5        |
| Unit II  | Unseen passage, vocabulary building (Synonyms & Antonyms, Prefix and Suffix, Error Analysis, one word substitute), developing story on given outline.                                                                                                                                                                                                                                  | 5        |
| Unit III | Self-Introduction-organizing the material - introducing the topic – extempore speech –<br>Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—Visual presentation                                                                                                                         | 5        |
| Unit IV  | Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic – questioning and clarifying –GD strategies- activities to improve GD skills                                                                                                                                                                             | 5        |

|         |                                                                                                                                                                                                     |           |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Unit V  | Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview & panel interview – FAQs related to job interviews                     | 5         |
| Unit VI | Recognizing differences between groups and teams- networking professionally- respecting social protocols-understanding career management-developing a long- term career plan-making career changes. | 5         |
|         | <b>Total</b>                                                                                                                                                                                        | <b>30</b> |

**Text Books:**

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. Interact English Lab Manual for Undergraduate Students, OrientBlackSwan: Hyderabad, 2016.
3. M.Ashraf Rizvi, Effective technical communication. Tata McGraw-Hill Publishing Company Limited. New Delhi.

**Reference Books:**

1. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015.
2. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014.
3. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.
4. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011.

**Term Work (50 marks):**

- 1) **Oral Communication:** Self introduction, Extempore, Group discussion, Presentation, Role plays and Mock interview (Students should complete any two oral activities).
- 2) **Non verbal communication:** Body language, facial expressions, tone of voice.
- 3) **Written communication:** Test (short answers, developing story, expanding an idea, comprehending unseen passage) and Assignments based on the syllabus.

**Marking Scheme: -**

- 1) Oral activity I: 10 marks
- 2) Oral activity II: 10 marks
- 3) Written test based on syllabus: 10 marks
- 4) Assignments based on syllabus: 10 marks
- 5) Personal Interview: 10 marks

## B.Tech. First Year

| Course Code | Course Title                 | L  | T  | P  | C  |
|-------------|------------------------------|----|----|----|----|
| 1SAKNX01    | Multimedia and Web Designing | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Nil.

**Course Learning Objectives:**

Throughout the course, students will be expected to demonstrate their understanding of Multimedia and Web Design by being able to do each of the following:

1. Understand the fundamental concepts and components of multimedia, its historical development and current trends.
2. Learn multimedia authoring tools and techniques to create and manipulate graphics, images, and multimedia content.
3. Understand web technologies, including web architecture, protocols, web server-client communication, and the creation of web pages using HTML and CSS.

**Course Outcomes:**

After Successful completion of this course, the student will be able to:

1. Describe the key components of multimedia technology recognizing its past, present, and future.
2. Identify different multimedia authoring tools, techniques and use graphics and image data representations.
3. Illustrate the architecture of the web, examine its history, and discuss the major issues in web solution development.
4. Explain the basics of HTTP and the concepts of persistent and non-persistent connections.
5. Utilize the elements and attributes of HTML
6. Compare and contrast the advantages and compatibility of CSS

|               |                                                                                                                                                                 |           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | <b>Subject:</b> (1SAKNX01) Multimedia and Web Designing                                                                                                         | <b>L</b>  |
| <b>Unit-1</b> | <b>Introduction to multimedia:</b> Introduction and Multimedia Data Representations, Introduction to Multimedia, Components of Multimedia, Multimedia: Past and | <b>07</b> |

|               |                                                                                                                                                                                                                                                                                  |           |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | Present Early History of Multimedia, Hypermedia, Multimedia Software Tools, Multimedia in the Future.                                                                                                                                                                            |           |
| <b>Unit-2</b> | <b>Multimedia Authoring and Data Representations:</b> - Multimedia Authoring and Tools: Multimedia Authoring, VRML. Graphics and Image Data Representations: Graphics/Image Data Types, 1-Bit Images, 8-Bit Gray-Level, Images, Image Data Types.                                | <b>07</b> |
| <b>Unit-3</b> | <b>Introduction to the Web:</b> - History of web, Protocol governing the web, Web architecture, Major issues in Web solution development, Web servers, Web browsers, Internet Standards, TCP/IP protocol suites, IP Address, MIME.                                               | <b>07</b> |
| <b>Unit-4</b> | <b>Hypertext Transfer Protocol [HTTP]:</b> - Introduction to HTTP, Web Server and Client, Web Resources, URL and its Anatomy, Message Format, Persistent and non-persistent Connections, Web caching, Proxy.                                                                     | <b>07</b> |
| <b>Unit-5</b> | <b>Hypertext Markup language [HTML]:</b> - History of HTML, HTML basics, Elements, attributes and tags of HTML, Various Types of Tags: (Basic Tags, Advanced Tags, Images, Meta Tag) Planning of web page, Model Structure of web site, Designing web pages, Multimedia content. | <b>07</b> |
| <b>Unit-6</b> | <b>Cascading Style Sheet [CSS]:</b> - Introduction, advantages, Adding Cascading Style Sheet (CSS), Browser compatibility, Cascading Style Sheet (CSS) and page layout, Selectors, Grouping, Type Selectors.                                                                     | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                     | <b>42</b> |

#### **Text Books:**

1. Ze-Nian, Li, Mark S. Drew “Fundamentals of Multimedia” (Pearson Education)
2. Roy Uttam K: Web Technologies, Oxford University Press, 2010.

#### **Reference Books:**

1. Rajan Parekh “Principles of Multimedia” (Tata McGraw-Hill)
2. S.J.Gibbs & D.C.Tsichritzis “Multimedia Programming”, Addison Wesley 1995
3. Mohler J.L. & Duff J.M.: Designing Interactive Web Sites, CENGAGE Learning.
4. Joel Sklar: Text Book of Web Design, CENGAGE Learning.

## B.Tech. First Year (All Branches)

| Course Code | Course Title    | L  | T  | P  | C  |
|-------------|-----------------|----|----|----|----|
| 1SF06       | Design Thinking | 01 | 00 | 00 | 01 |

**Course Prerequisites:** Nil

**Course Learning Objectives:**

1. To familiarize students with design thinking concepts and principles.
2. To ensure students can practice the methods, processes and tools of design thinking.
3. To ensure students can apply the design thinking approach and have ability to model real world situations.

**Course Outcomes:**

Students will be able to –

1. Understand design thinking principles and concepts.
2. Practice the methods, processes, and tools of design thinking.
3. Describe the role and purpose of the observation phase.
4. Explain the purpose and structure of the point-of-view phase.
5. Illustrate the purpose, flow, and importance of the ideate phase.
6. Clarify the role and purpose of the prototype phase.

|          | <b>Subject:</b> (1SF06) Design Thinking                                                                                                                                  | <b>L</b> |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Unit I   | <b>Fundamentals of Design Thinking:</b> Principles of Design Thinking, the process of Design Thinking, how to plan a Design Thinking project                             | 2        |
| Unit II  | <b>Understanding the Design Problem:</b> Search field determination, Problem clarification, Understanding of the problem, Problem analysis, Reformulation of the problem | 3        |
| Unit III | <b>Observing the Problem:</b> Observation Phase, Empathetic design, Tips for observing, Methods for Empathetic Design                                                    | 2        |
| Unit IV  | <b>Defining the Problem:</b> Point-of-View Phase, Characterization of the target group, Description of customer needs                                                    | 3        |
| Unit V   | <b>Finding and Selecting Ideas:</b> Ideate Phase, The creative process and creative principles, Creativity techniques, Evaluation of ideas                               | 2        |
| Unit VI  | <b>Prototyping:</b> Prototype Phase, Lean Startup Method for Prototype Development, Visualization and presentation techniques                                            | 2        |
|          | <b>Total</b>                                                                                                                                                             | 14       |

**Text Books:**

- 1) Christian Mueller-Roterberg, Handbook of Design Thinking, Research Gate November 2018.
- 2) Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Amazon books.

**Reference Books:** Dr. D. Ravindran, Introduction to Design Thinking, Notion Press.

**Term Work (50 marks)**

Students should complete the following activities

- 1) Participate in a design challenge to solve the real-world problem using design thinking principles.
- 2) Analyze case studies on design thinking application in various industries.
- 3) Design a project that applies design thinking principles to a specific problem or opportunity.

**Marking Scheme: -**

- 1) Participation in a design challenge -10
- 2) Case Study-10
- 3) Designing of a project-10
- 4) Assignments-10
- 5) Attendance in theory classes- 10

**B.Tech. First Year (All Branches)**

| Course Code | Course Title        | L  | T  | P  | C  |
|-------------|---------------------|----|----|----|----|
| 1SF07       | Applied Physics Lab | 00 | 00 | 02 | 01 |

**Course Prerequisites:**

- 1) Identify and handle various equipment like vernier caliper, micrometer screw gauge, multimeter, spectrometer.
- 2) Basic knowledge of graphical representation of observed values.

**Course Learning Objectives:**

- 1) To gain practical knowledge by applying experimental methods to correlate with the theory.
- 2) Apply the analytical techniques and graphical analysis to the experimental data.
- 3) To develop basic understanding of various experimental principles involved.

**Course Outcomes:**

Students will be able to,

- 1) Develop experimental skills to impart practical knowledge in real time.
- 2) Understand principle, concept, working and applications of areas in physics and compare the results obtained with theoretical calculations.
- 3) Conduct experiment and record experimental data, Analyse the obtained data and Draw conclusions from the Laboratory exercise based on the analysed data.

|          |                                                                                                 |
|----------|-------------------------------------------------------------------------------------------------|
|          | <b>Subject:</b> (1SF07) Applied Physics Lab                                                     |
| Expt. 1  | Study of CRO I: To measure A.C voltage, D.C voltage and frequency using CRO.                    |
| Expt. 2  | Study of CRO II: To determine frequency of unknown signal by using Lissajous patterns.          |
| Expt. 3  | To determine wavelength of monochromatic light by using Newton's Ring experiment.               |
| Expt. 4  | To determine wavelength of monochromatic light by using Plane transmission diffraction grating. |
| Expt. 5  | Determination of grating element of diffraction grating, using LASER beam.                      |
| Expt. 6  | Study of various crystal structures.                                                            |
| Expt. 7  | To determine Miller Indices of crystal planes.                                                  |
| Expt. 8  | To plot the V-I characteristics of LED and to find it's striking potential.                     |
| Expt. 9  | To measure the intensity and divergence of given LASER beam.                                    |
| Expt. 10 | To determine the coefficient of viscosity using Stoke's law.                                    |
| Expt. 11 | Study of Hall effect in semiconductor.                                                          |
|          | Total (Minimum 8 particles are to be performed)                                                 |

**Text Books:**

- 1) Dr. Ruby Das & C. S. Robinson: Engineering Physics Practical, Laxmi Publications.
- 2) Dr. B. Shriniwas Rao: Engineering Physics Practical, Laxmi Publication.

**Reference Books:**

- 1) William David Cooper: Electronic Instrumentation and Measurement Techniques, Eastern Economy Edition publications.

## **B.Tech. First Year**

| Course Code | Course Title             | L  | T  | P  | C  |
|-------------|--------------------------|----|----|----|----|
| 1SF08       | Engineering Graphics Lab | 00 | 00 | 02 | 01 |

### **Course Prerequisite:**

1. Knowledge of basic math concepts and terms.
2. Ability to visualize objects in three dimensions.
3. Computer literacy.

### **Course Learning Objectives:**

1. To understand the concepts of drawing as a language of communication of Engineers
2. To improve the visualization skills for better understanding of solids using CAD software.
3. To acquire skills to interpret and convert multi-views drawing into single view and vice-versa.

### **Course Outcomes:**

At the end of course, Learner will be able to –

1. Illustrate the projection of points, lines and surfaces
2. Understand the concept of orthographic and isometric projection
3. Construct different types of solids in different positions by using CAD software

### **List of Practical:**

Every student will submit a set of at least FIVE drawing sheets (from 1 to 6 listed below) and perform at least TWO practical (from 7 to 9 listed below) using CAD software.

Examination will consist of viva-voce based on the syllabus.

1. Projection of straight line
2. Projection of plane
3. Projection of solids
4. Orthographic projection
5. Isometric projection/view
6. Free hand sketches of simple machine elements, like
  - (a) Screw threads ISI profile

(b) Types of nuts, bolts, studs, set screws, washers, locking arrangement of nuts & bolts

(c) Foundation bolts – Rag, eye, lewis types

7. Drafting of basic 2D geometrical shapes using CAD software
8. Drafting of basic 3D geometrical shapes using CAD software
9. Drafting of 2D and 3D objects using surface modelling commands

## B.Tech. First Year

| Course Code | Course Title                        | L  | T  | P  | C  |
|-------------|-------------------------------------|----|----|----|----|
| 1SF09       | Programming for Problem Solving Lab | 00 | 00 | 02 | 01 |

**Course Prerequisite:** Nil

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Programming for Problem Solving Lab by being able to do each of the following:

1. Set up and use a C programming development environment (IDE, compiler, etc.) to write, compile, and run programs.
2. Understand and apply fundamental programming constructs such as variables, control structures, functions, arrays, strings, and pointers in C.
3. Develop algorithmic thinking using flowcharts or pseudocode to solve problems through a structured, top-down approach.

### Course Outcomes:

After successfully completing the course, students will be able to-

1. Develop and execute basic C programs to solve simple problems using appropriate programming constructs.
2. Analyze and apply control flow mechanisms and data structures (arrays, strings, functions, and pointers) to implement efficient C programs.
3. Demonstrate problem-solving skills through the application of algorithmic logic and programming techniques

### List of Experiment:

*Minimum 8 to 10 practical's are to be conducted based on subject* **1SF04 Programming for Problem Solving**

### List of Experiments/ Practical's:

Minimum 8 experiments are to be performed.

1. Set up a C programming environment (compiler, IDE, etc.).
2. Write a simple program to display "Hello, World!".
3. Solve a simple problem using a top-down approach and develop a program accordingly.
4. Use flowcharts or pseudo code to represent the algorithm for a specific problem.
5. Write program to illustrate precedence of operator
6. Write programs that demonstrate the use of if, if-else, and switch statements for decision making.
7. Create and manipulate 1-D, 2-D arrays (declaration, initialization, accessing elements).
8. Explore string manipulation functions (strcpy, strcat, strlen, etc.)
9. Write programs using user-defined functions to solve specific tasks
10. Understand and use return values and their types.
11. Explore the concept of call by value using pointers.
12. Explore the concept of call by reference using pointers

### **B.Tech. First Year**

| <b>Course Code</b> | <b>Course Title</b>              | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------------|----------------------------------|----------|----------|----------|----------|
| 1SAKNX02           | Multimedia and Web Designing Lab | 00       | 00       | 02       | 01       |

**Course Prerequisite:** Nil.

**Course Learning Objectives:**

1. To introduce students to the fundamentals of HTML and web technologies, enabling them to create basic web pages using HTML tags and structure.
2. To learn the Cascading Style Sheets (CSS) for enhancing the presentation of web pages and improving user interface design.
3. To provide hands-on experience in building static websites and integrating multimedia elements to reinforce practical knowledge through mini projects.

**Course Outcomes (CO):**

After successful completion of this lab course, the student will be able to:

1. Demonstrate the ability to write and execute basic HTML code to create structured web pages including text, links, lists, and tables.
2. Apply CSS to style HTML elements and enhance the visual presentation of web content.
3. Develop a mini project showcasing a functional and visually appealing static website that integrates multimedia.

**Perform any 8 Practical's from following list of practicals:**

1. Introduction to Hyper Text Mark-up Language (HTML) and how to create HTML file using notepad
2. Demonstrate the use of some of basic html tags
3. Design a web page and include link to redirect on another webpage.
4. Write a HTML Program to demonstrate various List tags.
5. Write a HTML program to design static webpage which should allow to enter user's personal data

6. Write a HTML program to demonstrate the use of various Image tags
7. Write a HTML Program to create a table using table tags of HTML
8. Make a form in html web page which takes all the details of person
9. Design a web page using HTML Style sheet.
10. Create html page which make a use of Internal/ External CSS file. A CSS File must use following CSS Selector
11. Create a HTML web page which uses CSS Border, Background, Padding
12. Create a web page which embed image, video and Links in Table
13. Create a HTML page which showcase images in gallery
14. Create a Mini project for
  - a. Students Notice Board
  - b. Result Display Board
  - c. Personal information ValetAny other relavant

## B.Tech. First Year (All Branches)

| Course Code | Course Title                               | L  | T  | P  | C  |
|-------------|--------------------------------------------|----|----|----|----|
| 1SF10       | NSS/Sports/Yoga/Cultural/Community Service | 00 | 00 | 02 | 01 |

### Course Prerequisites:

1. Basic physical and mental fitness.
2. Willingness to volunteer time.

### Course Learning Objectives:

1. To develop a sense of responsibility, discipline and social values through participation in community base activity.
2. To enhance physical, mental and emotional wellbeing while fostering teamwork.
3. To strengthen, problem solving, decision making and organizing skill by addressing real world issues in the community.

### Course Outcomes:

Students will be able to –

1. Demonstrate and understand community service and social responsibility through the participation in NSS activities.
2. Demonstrate proficiency in basic yoga posture and breathing techniques.
3. Develop leadership, creativity, self-expression and time management skills through the participation in sports activities, music, dance, drama or fine art.

|              |                                                                                                                                                                                                            |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | <b>Subject:</b> (1SF10) NSS/Sports/Yoga/Cultural/Community Service                                                                                                                                         |
| ACTIVITY- I  | NSS- Cleanliness drive, Blood donation, Tree plantation, Health and hygiene awareness program, Plastic waste management.                                                                                   |
| ACTIVITY-II  | SPORTS- Introduction to Sports, Importance of health and fitness, Brief information of any one outdoor game, Brief information of any one indoor game, Article writing on any recent match of your choice. |
| ACTIVITY-III | YOGA- Introduction to yoga, Importance of yoga, Suryanamaskar (12 yoga postures) with benefits, Importance of balanced diet, Meditation for mental health.                                                 |
| ACTIVITY-IV  | CULTURAL- Skit, Mime & Street play, Light music (singing), Any one dance form, Poster/Rangoli (any theme ).                                                                                                |

|            |                                                                                                                                       |
|------------|---------------------------------------------------------------------------------------------------------------------------------------|
| ACTIVITY-V | COMMUNITY SERVICE- Visit to blind home, Visit to Old age home, Visit to Orphanage, Distribution of clothes, medicine to needy people. |
|------------|---------------------------------------------------------------------------------------------------------------------------------------|

**Text Book:**

- 1) “National Service Scheme: A Handbook for Volunteers” by Dr. A. R. Anuradha.
- 2) “Sports and Physical Education” by Dr. S. K. Sharma.

**Reference Book:**

- 1) “The Yoga Sutras of Patanjali” by Swami Sivananda.

**Term Work (50 marks):**

1. Field visits to ‘Old age home’, Orphanage or Ashram shala to run activities such as cleaning the premises, tree plantation, donating medicines, cloths etc., to develop the values of selfless service.
2. Participation in yoga sessions to promote physical and mental fitness and also to get aware about yoga.
3. Participation in outdoor and indoor games to promote physical
4. Participation in various cultural activities for the development of skills and to encourage creativity and talent.
5. Participation in community services such as making water bowls for birds, tree plantation, distribution of food to underprivileged families, etc.

**Marking Scheme:**

1. Field visit: 10
2. Participation in yoga: 10
3. Participation in outdoor and indoor games: 10
4. Participation in various cultural activities: 10
5. Participation in community services: 10

## B.Tech. First Year (All Branches)

| Course Code | Course Title             | L  | T  | P  | C  |
|-------------|--------------------------|----|----|----|----|
| 2SF01       | Applied Mathematics - II | 03 | 00 | 00 | 03 |

### Course Requisite:

- 1) Basic Knowledge of Matrix and Complex number.
- 2) Elementary Integral Calculus.

### Course Learning Objectives:

- 1) To deal with system of equations and solutions of Eigen value problem.
- 2) To express real valued periodic function in terms of sines and cosines
- 3) To Use Complex number theory in engineering application such as signal processing.
- 4) To familiarize with techniques in double and triple integrals and its applications.

### Course Outcomes:

Students will be able to:

1. Make use of system of equations in matrix forms.
2. Find the periodic functions as an infinite series.
3. Apply De Moivre's theorem in various concepts of complex number.
4. Use new technique DUIS and to evaluate Beta and Gamma function.
5. Evaluate double integrals over bounded regions.
6. Evaluate triple integral and its applications.

|              |                                                                                                                                                                                           |           |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|              | <b>Subject:</b> (2SF01) Applied Mathematics - II                                                                                                                                          | <b>L</b>  |
| Unit I       | <b>Matrices:</b> Rank of a matrix, Consistency of linear system of equations by matrix method, Eigen values and Eigen vectors, Cayley-Hamilton theorem (without proof).                   | 7         |
| Unit II      | <b>Fourier series:</b> Fourier expansion of function in $(C, C+2L)$ , half range Fourier series.                                                                                          | 6         |
| Unit III     | <b>Complex Numbers:</b> Roots of complex number by deMoivre's theorem, Hyperbolic and inverse hyperbolic functions, Separation of real and imaginary parts, Logarithm of complex numbers. | 7         |
| Unit IV      | <b>Integral Calculus I:</b> Differentiation under integral sign, Beta Function and Gamma Function.                                                                                        | 7         |
| Unit V       | <b>Integral Calculus II:</b> Double integration, change of order of integration, transformation to polar coordinates, Evaluation of area by double integration.                           | 6         |
| Unit VI      | <b>Integral Calculus III:</b> Triple integration, Transformation to spherical polar coordinates, Volume of solid by triple integration.                                                   | 7         |
| <b>Total</b> |                                                                                                                                                                                           | <b>40</b> |

### Text Books:

1. Wartikar P.N. & Wartikar J.N.- A Text Book of Applied Mathematics Vol.-I & II, Pune V.G. Prakashan, Pune.
2. Grewal B.S. - Higher Engineering Mathematics, 40/e, Khanna Publishers.

**Reference Books:**

1. Kreyszig E.K. - Advanced Engineering Mathematics, John Wiley.
2. Ramana B.V. - Higher Engineering Mathematics, (TMH).
3. Singh R.R. & Bhatt M. - Engineering Mathematics, (TMH).
4. Dass H. K. – Advance Engineering Mathematics, S. Chand.

## B.Tech. First Year (All Branches)

| Course Code | Course Title      | L  | T  | P  | C  |
|-------------|-------------------|----|----|----|----|
| 2SF02       | Applied Chemistry | 03 | 00 | 00 | 03 |

### Course Prerequisites:

1. Fundamentals of redox reactions and electrochemistry.
2. Knowledge of chemical reaction.
3. Basic knowledge of qualitative and quantitative analysis.

### Course Learning Objectives:

1. To enable students to manufacture functional materials on the basis of chemical forces.
2. To provide the knowledge of characteristics and application of cement, fuels and lubricants.
3. To impart knowledge of characteristics of water and methods for the removal of impurities from water.
4. To summarize students with operating principles, working processes and applications of energy conversion, storage devices and also with corrosion and corrosion control methods.

### Course Outcomes:

Students will be able to

1. Apply the knowledge of chemical forces to design functional materials.
2. Apply the knowledge of useful engineering materials such as cement and lubricant.
3. Describe properties of hard water, its disadvantages and various processes for removal of water impurities.
4. Describe properties of chemical fuels, analysis methods and its applications.
5. Identify various types of corrosion, mechanism and control methods to protect metals.
6. Describe operating principles working processes and applications of energy conversion and storage devices.

|         | Subject: (2SF02) Applied Chemistry                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | L |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| UNIT I  | <b>Engineering Materials and Their Properties:</b> Introduction, Classification of Engineering materials, Chemical Forces in materials- Primary forces and Secondary forces, Properties of materials, Role of chemical forces in alteration of magnitude of the properties such as Density, Melting Point, Solubility, Strength, Stiffness, Elasticity and Plasticity. Real life examples where these interactions played major role to enhanced their properties: - vulcanized rubber and plasticized PVC.   | 6 |
| UNIT II | <b>Cement Engineering:</b> Introduction, Types of cement, Raw materials used for the manufacturing of Portland cement, Manufacturing of Portland cement by wet process. Functions of chemical constituents of cement: Tri-calcium aluminate, Tri-calcium silicate, Di-calcium silicate, Tetra-calcium aluminato ferrite, magnesia, sulphur trioxide, iron oxide, alkalis, free lime, alumina. Physical Properties of Portland cement: Heat of hydration, Fitness, Soundness, Strength, Setting and hardening. | 6 |

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| UNIT III | <b>Water Characteristics &amp; Their Effects on Boiler:</b> Introduction. Characteristics of water: - Hardness, pH, alkalinity, DO, TDS and Chloride ion concentration. Disadvantages of characteristics of water in Boiler: - Scale & sludge, Priming & Foaming, Caustic embrittlement and Boiler corrosion. Methods of analysis: - EDTA method, Iodometric method and conductometric titration. Methods for removal of impurities: Sedimentation, Neutralization, Zeolite process, De-Ionization process and Reverse osmosis. Calculation of hardness by data obtained from EDTA and zeolite processes. | 8  |
| UNIT IV  | <b>Fuel and Lubricant:</b> Introduction, Types of Fuels, Properties of Fuels: Ignition Temperature, Calorific value. Types of calorific value.<br>Solid Fuel: Coal, classification of coal, analysis of coal: ultimate analysis.<br>Liquid Fuel: Crude oil, Fractional distillation of crude oil, Properties of liquid fuel: Octane number and Cetane number.<br>Gaseous Fuel: Hydrogen gas, economy of hydrogen gas as fuel.<br>Lubricants: Introduction, classification of lubricants, properties of lubricants, uses of lubricants.                                                                    | 7  |
| UNIT V   | <b>Energy Sources &amp; Storage Devices:</b> Introduction, Principle of batteries, Types of Batteries: Primary Batteries-Dry Cell, Mercury cell, Secondary Batteries- NICAD (Ni-Cd) battery, Lithium-ion battery. Green energy sources: Photo voltaic cell (Solar Cell), Fuel Cell.                                                                                                                                                                                                                                                                                                                       | 6  |
| UNIT VI  | <b>Corrosion &amp; Its Control:</b> Introduction, Types of corrosion: Dry and Wet corrosion, Mechanism of dry and wet corrosion, Factor affecting corrosion: Nature of metal and nature of environment, Types of wet corrosion- Pitting corrosion, waterline corrosion, stress and galvanic corrosion, Methods of corrosion control- Cathodic protection: Sacrificial anode and impressed current method, Protective coating: Galvanizing and Tinning process.                                                                                                                                            | 7  |
|          | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 40 |

#### Text Books:

1. Textbook of Engineering Chemistry by Dara S S and Umare S S.
2. Engineering Chemistry by Jain & Jain (Dhanpat Rai & Sons)
3. Engineering chemistry by S. S. Dara, S. Chand Publication
4. Engineering & Technology by Shashi Chawala, Dhanpat Rai & Sons.
5. Engineering Chemistry by K. Sesha Maheswaramma, Mridula Chugh, Pearson.

#### Reference Books:

- 1) Engineering Chemistry: Fundamentals and Applications by Shikha Agarwal.
- 2) Chemistry for Engineers by B K Ambasta
- 3) Engineering Chemistry by N Krishnamurthy and P Vallinayagam.
- 4) Engineering & Technology Vol-I & II-by Rajaram& Kuriocose.
- 5) Engineering Chemistry by Prasanta Rath (Cengage learning).

## B.Tech. First Year (All Branches)

| Course Code | Course Title                     | L  | T  | P  | C  |
|-------------|----------------------------------|----|----|----|----|
| 2SF03       | Basics of Electrical Engineering | 02 | 00 | 00 | 02 |

### Pre-requisites:

1. Concepts of Electrostatics and Current Electricity.
2. Fundamentals of Magnetic effect of electric current, magnetism and Electromagnetic Induction.

### Course Learning Objectives:

1. To introduce students with different terminologies in electrical engineering and network simplification methods of resistances.
2. To understand DC and AC Circuit analysis.
3. To understand magnetic circuits and Electromagnetic induction.
4. To understand single phase Transformer and Safety in electrical installation.

### Course Outcomes:

After completion of this course the student shall be able to:

1. Understand fundamentals of Electrical Engineering and be adequately trained to solve Network of resistances by using transformation techniques.
2. Demonstrate DC circuits by finding different parameters like voltage, currents, resistance using laws and theorems.
3. Explain different properties of electromagnets and phenomenon of electromagnetic induction in magnetic circuits.
4. Illustrate the different terms of AC and analyze single phase AC circuits.
5. Explain Three phase A.C circuits
6. Explain single phase Transformer and Safety in electrical installation.

|          |                                                                                                                                                                                                                                                                                        |           |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|          | <b>Subject:</b> (2SF03) Basics of Electrical Engineering                                                                                                                                                                                                                               | <b>L</b>  |
| UNIT I   | <b>Fundamentals of Electrical Engineering:</b> Basic concepts of Current, Voltage, Power, energy and relationship between them. Resistance, Resistivity, Conductance, Conductivity, Network simplification of Resistances (Series, Parallel, Delta-Star and Star-Delta transformation) | <b>05</b> |
| UNIT II  | <b>DC Circuit Analysis:</b> Types of Sources, Current and voltage division principle, Source Transformation, Ohm's Law, Kirchoff's Laws (KCL and KVL), Superposition Theorem, Thevenin's Theorem.                                                                                      | <b>05</b> |
| UNIT III | <b>Magnetic circuits and Electromagnetic Induction:</b> Basic concepts of Flux, flux density, MMF, Reluctance, Permeance, Magnetic field intensity and their relationship. Series Magnetic circuits, B-H curve, Principle of electromagnetic                                           | <b>05</b> |

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|         | induction, Types of Magnetically induced EMF, Concept of self and mutual Inductance.                                                                                                                                                                                                                                                                                                                                                                     |           |
| UNIT IV | <b>A.C. Fundamentals:</b> Generation of sinusoidal alternating voltages and currents, Different terminologies associated with AC circuit. Behavior of AC circuit containing Pure R, L, and C. Phasor representation in rectangular & polar form, Impedance and admittance concept. Series R-L, R-C and R-L-C circuit, Resonance in Series R-L-C circuit, Power in single phase circuit: - Concepts of active, reactive and apparent power, Power factor. | <b>05</b> |
| UNIT V  | <b>Polyphase Circuits:</b> Generation of Three phase voltages, current and power, Star connected and delta connected balanced circuits, Relationship between line current, phase current and line voltage, phase voltage, analysis of balanced three phase circuits Power measurement in Three phase circuit.                                                                                                                                            | <b>05</b> |
| UNIT VI | <b>Single phase Transformer:</b> Single-phase transformer construction and working (Ideal and practical), Types of Transformers, EMF equation of Transformer, Efficiency & Regulation of transformer, condition for maximum efficiency. <b>Electrical Safety:</b> Safety precautions in electrical installation, Earthing, Types of Earthing (Plate and Pipe Earthing)                                                                                   | <b>05</b> |
|         | Total                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>30</b> |

#### Text Books:

1. B. L. Thereja, Basic electrical engineering, S. Chand Publications.
2. D.P. Kothari, I.J. Nagrath, "Basic Electrical Engineering", TMH Publishing Co. Ltd., New Delhi, 3rd edition
3. Leonard S. Bobrow, "Fundamentals of Electrical Engineering", 2nd Edition, Oxford Press.
4. Kulshreshtha D.C., "Basic Electrical Engineering", First Ed., TMH

#### Reference Books:

1. Leonard S. Bobrow, "Fundamentals of Electrical Engineering", 2nd Edition, Oxford Press. R
2. A.E. Fitzgerald, D.E. Higginbotham, "Basic Electrical Engineering", McGraw Hill Book Co., New York, 2nd edition
3. Dr.S.L.Uppal, "Electrical Wiring, Estimating and Costing", Khanna Publishers.

## B.Tech. First Year (All Branches)

| Course Code | Course Title          | L  | T  | P  | C  |
|-------------|-----------------------|----|----|----|----|
| 2SF04       | Biology for Engineers | 02 | 00 | 00 | 02 |

**Pre-requisites: Nil**

### Course Learning Objectives:

1. To acquire the knowledge of basic concepts of biology and the need of the subject in Engineering.
2. To study the human organs and their analogy with engineering applications.
3. To be acquainted with the latest trends in bio-engineering.
4. To become familiar with the concept of Bio-mimicry and understand how nature has inspired innovations in technology.

### Course outcomes:

1. Understand basic biological concepts and define the terminologies.
2. Understand various organs in body, their function; it's analogy with engineering applications.
3. Acquire knowledge of medical tools and machineries used in the treatment.
4. Understand the concepts of 3D printing and its biomedical applications and trends in bio-engineering
5. Understand the concepts like biosensors, biofuels and biochips.
6. Understand the concept of Bio-mimicry and nature inspired technology

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|         | <b>Subject:</b> (2SF04) Biology for Engineers                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>L</b>  |
| UNIT I  | <b>Introduction to Basic Biology:</b><br>Cell: What is a Cell, Cell theory, Cell shapes, structure of a Cell, Cell cycle chromosomes, The Plant Cell and animal Cell, protoplasm, prokaryotic and eukaryotic Cell, Plant Tissue and Animal Tissue. Carbohydrates, proteins, Amino acid, nucleic acid (DNA and RNA) and their types                                                                                                                                                                        | <b>04</b> |
| UNIT II | <b>Human Organ Systems and Bio Designs – 1</b><br>Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics.). Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signaling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). | <b>04</b> |

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |           |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| UNIT III | <b>Human Organ Systems and Bio Designs – 2</b><br>Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).                                                                                                                                                               | <b>05</b> |
| UNIT IV  | <b>Trends in Bioengineering-1</b><br>Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D Printed tooth, Dental implants, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis                                                                                                                                                                                                                       | <b>05</b> |
| UNIT V   | <b>Trends in Bioengineering-2</b><br>Cloning in microbes, plants and animals, Basics of biosensors, biochips, Bio fuels. Tissue engineering And its application, transgenic plants and animals                                                                                                                                                                                                                                                                    | <b>06</b> |
| UNIT VI  | <b>Nature-Bioinspired Materials and Mechanisms:</b><br>Bio-mimicry, Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perfluorocarbons (PFCs). | <b>06</b> |
|          | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>30</b> |

#### Reference Books:

1. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
2. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
3. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
4. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
5. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
6. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
7. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
8. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.

## B.Tech. First Year (All Branches)

| Course Code | Course Title                 | L  | T  | P  | C  |
|-------------|------------------------------|----|----|----|----|
| 2SF05       | Universal Human Values (UHV) | 02 | 00 | 00 | 02 |

**Course Prerequisites:** NIL

**Course Learning Objectives:**

1. To facilitate in students the understanding of Universal Human Values.
2. To imbibe professional Ethics in students.
3. To aware students about their role in all aspects of life, including their place in the family, society and nature.

**Course Outcomes:**

Students will be able to

1. Understand the need for value education and its significance in personal and societal development.
2. Understand the harmony between the 'I' and the body and its significance for overall well- being.
3. Identify and appreciate the values in human-human relationships, emphasizing trust (Vishwas) and respect (Samman).
4. Develop a holistic perception of harmony at all levels of existence.
5. Communicate effectively about the importance of harmony in nature, promoting awareness and inspiring others to adopt sustainable practices.
6. Recognize the relevance of a humanistic constitution and humanistic universal order.

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                      |          |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|          | <b>Subject:</b> (2SF05) Universal Human Values                                                                                                                                                                                                                                                                                                                                                                                       | <b>L</b> |
| UNIT I   | <b>Process for Value Education:</b> Understanding nature and scope for Value Education, Self-Exploration–concept and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being | 5        |
| UNIT II  | <b>Understanding Harmony in the Human Being - Harmony in Myself:</b> Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’, Understanding the needs of Self (‘I’) and ‘Body’ – Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer), Understanding the characteristics and activities of ‘I’ and harmony in ‘I’, Understanding the harmony of I with the Body       | 5        |
| UNIT III | <b>Understanding Harmony in the Family and Society- Harmony Human - Human Relationship:</b> Understanding harmony in the Family- the basic unit of human interaction, understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas.              | 5        |
| UNIT IV  | <b>Building the Universal Harmonious Order:</b> Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society                                                                                                                                                                                                     | 5        |

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|         | being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitvaas comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!                                                                                                                                                                                                                                                                                                                   |    |
| UNIT V  | <b>Understanding Harmony in the Nature and Existence - Whole existence as Co-existence:</b> Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self- regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence                                                                                                                                             | 5  |
| UNIT VI | <b>Implications of the above Holistic Understanding of Harmony on Professional Ethics:</b> Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics, Strategy for transition from the present state to Universal Human Order:<br>a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations. | 5  |
|         | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 30 |

**Text Books:** R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

**Reference Books:**

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA.
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991.
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome’s report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.

**Term Work (50 marks):**

1. Analyze case studies on universal human values, such as ethical dilemmas or social issues.
2. Participate in group discussions on universal human values, including debates and presentations.
3. Visit community centers or NGOs working to uplift communities to demonstrate the values of selfless service.
4. Reading an article or literature on the people who were involved in selfless activities and prepare the report to express a view on the article.

**Marking Scheme: -**

- 1) Case Study: 10 Marks
- 2) Group Discussion: 10 Marks
- 3) Visit to community Centre: 10 Marks
- 4) Report on Article Reading: 10 Marks
- 5) Attendance -10 Marks

## B.Tech. First Year (All Branches)

| Course Code | Course Title           | L  | T  | P  | C  |
|-------------|------------------------|----|----|----|----|
| 2SAEKNX01   | Introduction to Python | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Basic Knowledge of Computer.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Introduction to Python by being able to do each of the following:

1. Develop a strong foundational understanding of the Python programming language, including its basic concepts, data types, operators, and control flow structures.
2. Gain proficiency in working with strings, functions, and various data structures such as lists, tuples, and dictionaries.
3. Acquire skills in file handling, data manipulation using Pandas and NumPy, and object-oriented programming principles.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Define the basic concepts of Python, including variables, data types, and operators.
2. Explain different string manipulation techniques and functions.
3. Use python program flow to explore logic.
4. Create module to understand modularity.
5. Implement the concepts and procedures of file handling in Python for real-world scenarios.
6. Demonstrate the application of object-oriented programming principles in Python.

|               |                                                                                                                                                                                                                                                                                                          |           |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | <b>Subject:</b> (2SAEKNX01) Introduction to Python                                                                                                                                                                                                                                                       | <b>L</b>  |
| <b>Unit-1</b> | <b>An Introduction to Python:</b> Characteristics of Python, Why Python, Print statement, Comments, Python Variables, Data types, Operators in Python, Global and local variables, Basic Programs.                                                                                                       | <b>07</b> |
| <b>Unit-2</b> | <b>Data Structures in Python:</b> Python Data Structures (List, Tuples, Dictionaries, Sets), Function related to data structure, Basic String Operations in Python (String Manipulation, Accessing Strings, Basic Operations, String slices), Simple Input and Output, Output formatting, Basic Programs | <b>07</b> |

|               |                                                                                                                                                                                                             |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-3</b> | <b>Python Program Flow:</b> Indentation, if statement, and its related statements, while loop, for loop, range statement, break and continue, Assert, Examples of Looping.                                  | <b>07</b> |
| <b>Unit-4</b> | <b>Functions and Modules:</b> Function: Functions, defining a function, Calling a function, Types of functions, Function Arguments, Create a Module, Standard Modules, Exception Handling                   | <b>07</b> |
| <b>Unit-5</b> | <b>Working with Data in Python:</b> Modes of file handling (Opening and closing file, Reading and writing files), Date and Time with its functions, Introduction to Modules and packages.                   | <b>07</b> |
| <b>Unit-6</b> | <b>Classes and Objects:</b> Overview of OOP, Class Definition, Creating Objects, Objects as Arguments, Objects as Return Values, Built-in Class Attributes, Inheritance, Overloading, Overriding, Programs. | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                | <b>42</b> |

#### **Text Book:**

1. Martin C Brown, —Python: The Complete Referencel, McGraw Hill.
2. J. Mueller and L. Massaron, Python for data science. 2nd edition. Hoboken, NJ, John Wiley & Sons, Inc, 2019.

#### **Reference Books:**

1. Larry Lutz, — Python for Beginners: Step By Step Guide to Learning Python Programming, CreateSpace Independent Publishing Platform, First edition, ISBN: 1717410588, 9781717410580, 2018.
2. Nicholas Ayden, — Python Programming, Independently Published, First Edition, ISBN: 1707051933,9781707051939, 2019.
3. Michal Jaworski, Tarek Ziadé, — Expert Python Programming, Packt Publishing Ltd., Third Edition, ISBN: 9781789808896, 2019.

## B.Tech. First Year (All Branches)

| Course Code | Course Title             | L  | T  | P  | C  |
|-------------|--------------------------|----|----|----|----|
| 2SF06       | Indian Knowledge Systems | 02 | 00 | 00 | 02 |

**Course Prerequisites:** Nil

### Course Learning Objectives:

In this course students will know and understand contribution of ancient Indian scientists through

1. Introduction to contribution of Indian scientist in various fields of Science and Technology and Astronomy
2. Introduce to contribution of Indian scientist in Chemistry, Metallurgy and Mathematics.
3. Introduction to contribution of Indian scientist in Medical Sciences and Life Sciences.

### Course Outcomes:

Students will be able to –

1. Discuss contribution of Indian Scientists in various fields of scientists and technology.
2. Narrate contribution of Indian Scientists in the field of Astronomy.
3. Discuss contribution of Indian Scientists in the field of Chemistry and Metallurgy.
4. Discover contribution of Indian Scientists in the field of Mathematics.
5. Collect contribution of Indian Scientists in the field of Medical Science and Ayurveda.
6. Discuss contribution of Indian Scientists in the field of Plant and Animal Science.

|          | <b>Subject:</b> (2SF06) Indian Knowledge Systems                                                                                                                                                                                                                                                  | <b>L</b> |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| UNIT I   | India's Contribution to Science and Technology: Pre-Independence contribution. Brief information about various fields of contributions.                                                                                                                                                           | 4        |
| UNIT II  | Contribution in Astronomy: The Beginnings of Indian Astronomy, The Early Historical Period, The Siddhāntic Era, The Kerala School, Other Post-Siddhāntic Developments.                                                                                                                            | 4        |
| UNIT III | Contribution to Chemistry and Metallurgy: Early Chemical Techniques, Atomism in Vaiśeṣika, Chemistry in Early Literature, Classical Age, Laboratories and Apparatus Metallurgy before and during the Harappan Civilization, Iron Metallurgy and its applications, Zinc Metallurgy                 | 4        |
| UNIT IV  | Contributions to Mathematics: First Steps , contributions from: early historical period, the classical period, the classical period: post Aryabhata, contributions of Shri P C Mahalanobis, Shri Shrinivasa Ramajujan.                                                                            | 5        |
| UNIT V   | Contributions to Medical Science and Ayurveda as way of life, health and well being The tradition of surgery, Inoculation for smallpox, Microbiology and Paracitology, Communicable diseases and epidemics, An evolving pharmacopoeia, Cross-cultural interactions, What is Ayurveda? Integrative | 5        |

|         |                                                                                                                                                                        |    |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|         | approach to healthcare, Integrative approach to healthcare, Principles of Ayurvedic healing, Five elements, three Doshas and Treating diseases to restore health.      |    |
| UNIT VI | Contributions to Plant and Animal Science Plant Science in Ancient India, Animal Science in Ancient India, Indian Traditional Knowledge on Environmental Conservation. | 4  |
|         | Total                                                                                                                                                                  | 26 |

**Text Book:**

- 1) Indian Contributions to Science compiled by Vijnana Bharati

**Reference Books:**

- 1) History of Science and technology in India by Dr. Binod bihari satpathy
- 2) Hindu achievements In exact science by Benoy Kumar Sarkar
- 3) Science in Ancient India by Subhash C. Kak

**Term Work: (50 Marks)**

- 1) Interaction with traditional practitioners (Vaidyas, artists, craftsmen) and prepare a report after the interaction.
- 2) Drawing or designing based on traditional Indian art (Madhubani, Warli, etc).
- 3) Project on traditional agriculture, water harvesting system, mathematics in ancient India etc.
- 4) Research paper on specific topics in IKS, such as the significance of Ayurveda in modern healthcare, chemistry in ancient era etc.

**Marking scheme:**

- 1) Report on the interaction: 10 marks
- 2) Drawing or designing on traditional Indian art: 10 marks
- 3) Project on traditional activities: 10 marks
- 4) Research paper on specific topic of IKS: 10 marks
- 5) Attendance in theory classes: 10 marks

## B.Tech. First Year (All Branches)

| Course Code | Course Title          | L  | T  | P  | C  |
|-------------|-----------------------|----|----|----|----|
| 2SF07       | Applied Chemistry Lab | 00 | 00 | 02 | 01 |

### Course Prerequisites:

1. Basic knowledge of qualitative and quantitative analysis.
2. Basic knowledge of titrations-based experiments.
3. Knowledge of chemistry lab precautions, prohibitions and safety aids.

### Course Learning Objectives:

1. To impart skills of quantitative and qualitative analysis.
2. To provide knowledge of synthesis of co-crystal.
3. To familiar students with some fundamental of chemistry experiments.

### Course Outcomes:

Students will be able to

1. Determine the properties of water, chemical fuel, lubricant and cement based on laboratory techniques.
2. Synthesis of co-crystals and determination of its melting point.
3. Handle some important analytical instruments.

|         | <b>Subject:</b> (2SF07) Applied Chemistry Lab                                                 |
|---------|-----------------------------------------------------------------------------------------------|
| Expt. 1 | Preparation of Paracetamol and oxalic acid co-crystal and determination of its melting point. |
| Expt. 2 | Determination of hardness of water by EDTA method.                                            |
| Expt.3  | Determination Alkalinity (NaOH and Na <sub>2</sub> CO <sub>3</sub> ) in given water sample    |
| Expt.4  | Determination of chlorine in water sample. (Iodometry)                                        |
| Expt.5  | Determination of Dissolved Oxygen in Water Sample.                                            |
| Expt.6  | Determination of pH of unknown sample by pH meter                                             |
| Expt.7  | Determination of H <sup>+</sup> ion concentration by conductivity meter.                      |
| Expt.8  | Determination of % CaO in given cement sample.                                                |
| Expt.9  | Determination of % of moisture in coal sample by proximate analysis.                          |
| Expt.10 | Determination of viscosity of lubricating oil by Redwood viscometer No.1                      |
| Expt.11 | Determination of viscosity of lubricating oil by Redwood viscometer No. 2                     |
| Expt.12 | Determination of flash point of lubricating oil by Abel's apparatus                           |
| Expt.13 | Determination of acid value of lubricating oil.                                               |
| Expt.14 | Determination of mass of Zn coating on galvanized article                                     |

|  |                                                                 |
|--|-----------------------------------------------------------------|
|  | Total hours for the completion of minimum nine (09) experiments |
|--|-----------------------------------------------------------------|

**Text Books:**

1. Experiments and Calculations in Engineering Chemistry by S. S. Dara, S. Chand & Company LTD.
2. Engineering Chemistry Practical Book by Dipika Jaspal and Arti Malviya.
3. Laboratory Manual on Engineering Chemistry by S. K. Bhasin and Sudha Rani, Dhanpat Rai Publishing Company.

**Reference Books:**

1. Experiments In Engineering Chemistry by Payal B Joshi.
2. Principles of Analytical Chemistry by Miguel Valcarcel

## **B.Tech. First Year (All Branches)**

| <b>Course Code</b> | <b>Course Title</b>                 | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------------|-------------------------------------|----------|----------|----------|----------|
| 2SF08              | Basic of Electrical Engineering Lab | 00       | 00       | 02       | 01       |

**Course Prerequisite:** Nil.

### **Course Learning Objectives:**

1. To analyze DC Circuits.
2. To analyze single phase and three phase AC circuits.
3. To understand single phase transformers.

### **Course Outcomes:**

After completion of this course the student shall be able to:

1. Estimate different electrical parameter like voltage, current in DC circuits using basic laws and theorems.
2. Determine various parameters of AC circuits and find relation between them in single phase AC circuits.
3. Analyze relation between electrical parameter of balanced three phase AC circuits and transformers.

### **List of Experiments:**

**Minimum 08 Practical's are to be conducted out of the following:**

1. To validate Kirchoff's Current Law for DC Circuits.
2. To validate Kirchoff's Voltage Law for DC Circuits
3. To verify Thevenin theorems for DC Circuits.
4. To verify Superposition theorem for DC Circuits.
5. To analyze RLC Series circuit and to plot its phasor diagram.
6. To verify relationships between line and phase values for Star connected load.
7. To verify relationships between line and phase values for Delta connected load.
8. To conduct load test on single phase transformer and pre-determine its efficiency and regulation.
9. Open circuit and short circuit test on Single phase transformer.
10. Demonstration of Earthing.

## B.Tech. Second Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title               | L  | T  | P  | C  |
|-------------|----------------------------|----|----|----|----|
| 2SAEKNX02   | Introduction to Python Lab | 00 | 00 | 02 | 01 |

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Introduction to Python Lab by being able to do each of the following:

1. To introduce the fundamentals of Python programming including syntax, control structures, functions, and data types relevant to problem-solving.
2. To develop skills for working with Python libraries and modules that support data structures, file handling, and object-oriented programming.
3. To enable students to write, test, and debug Python programs for solving problems.

### Course Outcomes:

After successfully completing the course, students will be able to-

1. Apply foundational knowledge of Python programming to design and conduct experiments aligned with specified objectives.
2. Use computer hardware, software tools, and relevant resources for the execution of Python-based practical tasks.
3. Analyze outputs, interpret results, formulate findings, and draw appropriate conclusions based on the objectives of the given practical.

### List of Experiment:

*Minimum 8 to 10 practical's are to be conducted based on subject 2SAEKNX01 Introduction to Python.*

### List of Experiments/ Practical's:

*The following is a probable list of experiments/practical's; however, the teacher may prepare or design and conduct other relevant practical's based on the syllabus.*

1. Introduction and Installation of Python.
2. Write a python program to find largest of three numbers.
3. Write a python script that prints prime numbers less than 20.
4. Write python program in which a function is defined and calling that function prints Hello World
5. Write python program to store data in list and then try to print them.
6. Write python program to print list of numbers using range and for loop
7. Write python program to demonstrate working with dictionaries in python.

8. Write python program to demonstrate working with tuples in python.
9. Write python program to create, concatenate and print the string and accessing substring from given string.
10. Write python program to load data from dataset and analyze the data.
11. Write python program to subtract five days from current date.
12. Write python program to convert string to date-time.

**Software Tools:**

**Python** (Basic Programming: math, random, datetime; Data Handling: pandas, NumPy; Visualization matplotlib, seaborn; File Handling and OS: os, sys, shutil, Json; Data Analysis and visualization Libraries: Pandas, NumPy, Matplotlib, Seaborn, Plotly, Bokeh).

**Python Interpreter Tool:** Python (CPython) Version: 3.8 or above

**Integrated Development Environments (IDEs):** VS Code (Visual Studio Code), PyCharm Community Edition, Thonny, Jupyter Notebook, Anaconda Distribution.

## B.Tech. First Year (All Branches)

| Course Code | Course Title                     | L  | T  | P  | C  |
|-------------|----------------------------------|----|----|----|----|
| 2SF09       | Workshop/Digital Fabrication Lab | 00 | 00 | 02 | 01 |

### Course Learning Objectives:

1. To make familiar with different tools, equipment and to understand their basic purposes.
2. To develop skills and get hands on experience of marking, measuring, cutting, machining, shaping and forming processes.
3. To learn and develop skills for different joining processes.
4. To make the students well versed with basic electrical, electronics and computer components.
5. To learn the modern manufacturing techniques such as CNC, Robotic Operations and 3D printing.

### Course Outcomes:

At the end of this course, the students will be able to

1. Understand manufacturing processes, tools & equipment's, which are commonly employed in industries.
2. Apply craftsmanship & fabricate the components using various manufacturing techniques.
3. Understand the modern electrical, electronics & computer components & their applications

### Group A

- 1) **Fitting** : Introduction to different tools , equipment's and operations in Fitting Shop. Prepare one job in the Fitting shop, involving operations like marking, filing, hacksaw cutting, drilling and tapping etc.
- 2) **Sheet Metal** : Introduction to Sheet Metal tools and equipment's, their uses, different sheet metal joints and operations in Sheet Metal. Prepare one job in the Sheet Metal shop.
- 3) **Welding** : Introduction to Welding, welding tools and equipment's, their uses. Brief introduction to different welding processes, different welding joints. Prepare one job in the Welding shop.

- 4) **Smithy** : Introduction to different tools , equipments and Smithy operations like upsetting, drawing ,bending, forming etc. Prepare one job in the smithy shop.
- 5) **Carpentry** : Introduction to different wood working tools , equipment's and machines , types of joints and operations performed in Carpentry Shop. Prepare one job in the Carpentry shop.
- 6) **Machining** :- Introduction and practice of basic machining operations on Drilling , Lathe and shaper machine tools.

#### **Group B**

- 1) To identify the computer hardware parts, understand working of these parts, & Assemble demonstrate its working
- 2) Identification of various electrical & electronic components & tools used in domestic/industrial applications
- 3) Development of circuit schematic using EDA tools
- 4) 3D printing demonstration
- 5) Robotic operations demonstration
- 6) CNC operations demonstrations

**Note-** Students have to perform any 4 practical from group A & any 3 practical from group B

## B.Tech. Third Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title         | L  | T  | P  | C  |
|-------------|----------------------|----|----|----|----|
| 3SA01       | Discrete Mathematics | 02 | 00 | 00 | 02 |

**Course Prerequisite:** Basic knowledge of Mathematics.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Discrete Structure by being able to do each of the following:

1. Learn basic terminology, formal logic, proofs, sets, relations, functions, and recursion.
2. Use formal logic proof and logical reasoning to solve problems.
3. Relate the ideas of mathematical induction to recursion and recursively defined structures.
4. Relate interpret and apply the concepts of discrete mathematics to various areas of Computer Science.

### Course Outcomes:

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

1. Describe predicates, quantifiers, and logical connectives.
2. Explain deductive logic and examine the solution based on logical inference.
3. Examine properties of relations and identify equivalence and partial order relations.
4. Investigate Semi-group and monoids, and Product and Quotient of Groups.
5. Assess algebraic structure for a given mathematical problem.
6. Inspect different traversal methods for trees and graphs.

|        | Subject: (3SA01) Discrete Mathematics                                                                                                                                        | L  |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Mathematical Logic:</b> Statements & Notation, Connectives, Equivalence Formula, Duality Law, Tautological Implication, Normal forms.                                     | 05 |
| Unit-2 | <b>Theory of inference:</b> The theory of inference for the statement calculus, Validity using truth tables, Predicate calculus, Inference theory of the Predicate Calculus. | 05 |
| Unit-3 | <b>Set Theory:</b> Basic concepts, Venn Diagrams, Representation of Discrete Structure, Relation and ordering, Partial Ordering, Functions, Recursions, Sets and predicates. | 05 |
| Unit-4 | <b>Algebraic Structures:</b> Semi-groups and Monoids, Product & Quotients of semi-groups, Polish expression & their compilation, Groups, Product and Quotients of Groups.    | 05 |
| Unit-5 | <b>Lattice &amp; Boolean Algebra:</b> Boolean algebra, Functions on Boolean Algebra, Boolean Functions as Boolean Polynomials, Minimization of Boolean Functions.            | 05 |

|               |                                                                                                                                                      |           |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-6</b> | <b>Graphs Theory:</b> Basic concepts, Paths, Reachability & connectedness, Matrix representation of graphs, Trees: tree searching, undirected trees. | <b>05</b> |
|               | <b>Total</b>                                                                                                                                         | <b>30</b> |

**Text Book:**

J.P.Trembley and R.Manohar, “Discrete Mathematical Structures with application to Computer Science” 1988 (MCG)

**Reference Books:**

1. C.L.Liu : “Combinational Mathematics” Mc Graw Hill, 1988.
2. Stanant “Discrete Structure” Prentice Hall.
3. C.L.Liu “Element of Discrete Mathematics” Second Edition McGrawHill, 1987.
4. Norman L.Biggs “Discrete Mathematics” Second Edition, Oxford.

## B.Tech. Third Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title    | L  | T  | P  | C  |
|-------------|-----------------|----|----|----|----|
| 3SA02       | Data Structures | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Basic Knowledge of Programming and Discrete Mathematics.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Data Structure by being able to do each of the following:

1. To understand the linear and nonlinear data Structures and its memory representations.
2. To perform different operations on data structures such as insertion, deletion, searching and traversing.
3. To understand various data searching and sorting methods with its complexity.
4. To introduce various techniques for representation of the data in the real world.

### Course Outcomes:

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

1. Describe algorithm complexity and string processing techniques.
2. Discuss linear arrays and record structures using sorting and searching algorithms.
3. Examine memory representation and operations on linked lists, including insertion, deletion, and traversal.
4. Analyze stack and queue data structures and recursions.
5. Inspect binary trees and binary search trees.
6. Design graphs using traversal algorithms and illustrate the efficiency of sorting algorithms.

|        | Subject: (3SA02) Data Structures                                                                                                                                                                                                                                                           | L  |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Introduction to Data Structures:</b> Introduction to Data structures, Data Structure Operations, Algorithmic Notation, and Complexity of algorithms. String processing: storing strings, character data type, string operations, word processing, and First pattern matching algorithm. | 07 |
| Unit-2 | <b>Array &amp; Record Structure:</b> Linear arrays: Memory Representation of arrays, traversing linear arrays, insertion & deletion operations, Bubble sort, linear search and Binary search algorithms. Multi-dimensional arrays, Pointer arrays. Record structures and Matrices.         | 07 |
| Unit-3 | <b>Linked lists:</b> Linked lists: Memory Representation of Linked List, traversing a linked list, searching a linked list. Memory allocation & garbage collection. Insertion & deletion operations on linked lists. Header linked lists, Two- way linked lists.                           | 07 |

|               |                                                                                                                                                                                                                                |           |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-4</b> | <b>Stack &amp; Queue:</b> Stacks: Sequential Memory Representation of Stack, Arithmetic expressions: Polish notation. Recursion, Tower of Hanoi. Queues: Sequential Memory Representation of Queue, DE Queue, Priority queues. | 07        |
| <b>Unit-5</b> | <b>Trees:</b> Introduction to Trees, Binary trees, Memory Representation of Binary Tree, Traversing binary trees, Header nodes, Binary Search Tree, Heap and heap sort, Path length & Huffman's algorithm.                     | 07        |
| <b>Unit-6</b> | <b>Graph &amp; Sorting Algorithms:</b> Introduction to Graphs, Memory representation of graphs, Warshalls' algorithm, operations on Graphs, Breadth First Search, Depth First Search, Sorting: Insertion Sort, Selection Sort. | 07        |
|               | <b>Total</b>                                                                                                                                                                                                                   | <b>42</b> |

**Text Book:**

Seymour Lipschutz: Data Structures, Schaum's Outline Series, McGraw-Hill, International Editions.

**Reference Books:**

1. Ellis Horowitz, Sartaj Sahni: Fundamentals of Data Structures, CBS Publications.
2. Data Structure Using C, Balagurusamy.
3. Standish: Data Structures in Java, Pearson Education.
4. Trembley, Sorenson: An Introduction to Data Structures with Applications, McGraw Hill.

**B.Tech Third Semester (Artificial Intelligence and Data Science)**

| Course code | Course Title            | L  | T  | P  | C  |
|-------------|-------------------------|----|----|----|----|
| 3SA03       | Programming Methodology | 02 | 00 | 00 | 02 |

**Course Prerequisite:** Basic Knowledge of Programming

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Object-Oriented Programming by being able to do each of the following:

1. To learn object-oriented concepts using Java programming language.
2. To implement classical problems using object-oriented programming.
3. To demonstrate software development skills using Java programming language for real-world applications.

**Course Outcomes:** On completion of the course, student will be able to—

1. Describe the basics of object-oriented design concepts like classes, objects, encapsulation, abstraction, inheritance, and polymorphism.
2. Outline the different methods and classes and objects.
3. Examine the concept of Inheritance and Polymorphism.
4. Identify the Exception Handling Techniques.
5. Inspect applications in Java by applying concepts like interfaces, packages and exception handling.
6. Construct application using Java concepts like API, Event Handling, Swing and AWT.

|        | Subject: (3SA03) Programming Methodology                                                                                                                                                                                                                                                                   | L  |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Introduction to Object Oriented Programming:</b> Introduction, Need of OOP, Principles of Object-Oriented Languages, Java Virtual Machine, Java Features, Program Structures, Variables, Primitive Data Types, Identifier, Literals, Operators, Primitive Type Conversion and Casting, Flow of Control. | 05 |
| Unit-2 | <b>Classes and Objects Classes:</b> Objects, Methods, Constructors, Class Variable, this keyword, Arrays, Command Line Arguments, User-defined inputs using I/O package.                                                                                                                                   | 05 |
| Unit-3 | <b>Inheritance and Polymorphism:</b> Inheritance, Method Overriding, super keyword, final keyword, Abstract class, polymorphism, Interfaces, Packages.                                                                                                                                                     | 05 |

|               |                                                                                                                                                                                                                                                  |           |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-4</b> | <b>Exception Handling and File Handling:</b> Introduction to Exception, Exception handling Techniques, User-defined exception. Input/ Output The java.io.File Class, Reading and Writing Files using Java I/O packages, Random Access Files.     | <b>05</b> |
| <b>Unit-5</b> | <b>AWT and Event Handling:</b> Introduction to AWT, Components and Containers, Layout Managers, Basic AWT Components (Label, TextField, Button), Event Handling, Event Sources, Listeners, Adapters and Anonymous Inner Classes.                 | <b>05</b> |
| <b>Unit-6</b> | <b>Exploring Swing:</b> Introduction to Swing and its Features, Simple Swing Application, MVC Architecture, Layout Managers, Swing Components: JLabel, ImageIcon, JTextField, JButton, JToggleButton, JCheckBox, JRadioButton, JList, JComboBox. | <b>05</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                     | <b>30</b> |

**Text Book:**

1. Herbert Schildt: Java Complete References (McGraw Hill) (7th Edition).

**Reference Books:**

1. E. Balagurusamy: Programming with Java (McGraw Hill)
2. Sachin Malhotra and Saurabh Choudhary: Programming in Java, Oxford University Press 2010.
3. Khalid Mughal: A Programmer's Guide to Java Certification, 3rd Edition (Pearson)
4. Liang: A text Book of Java Programming, (PHI)
5. Sharnam Shah and Vaishali Shah: Core Java for Beginners, (SPD), 2010.

## B.Tech. Third Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                   | L  | T  | P  | C  |
|-------------|--------------------------------|----|----|----|----|
| 3SA04       | Analog and Digital Electronics | 02 | 00 | 00 | 02 |

**Course Prerequisite:** Applied Physics and Basics of Electrical Engineering.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding by being able to do each of the following:

1. To get the introductory knowledge of basic analog devices like PN Junction Diode, Bipolar Junction Transistor and Field Effect Transistor.
2. To understand number systems and conversion between different number systems.
3. To get basic knowledge about digital ICs and digital systems.
4. To study the design of combinational circuits and sequential circuits

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

1. Describe the basic concepts of semiconductor devices.
2. Explain BJT operations and characteristics.
3. Examine different operational amplifier and its application.
4. Compare and contrast different Number System and basics of conversion of number systems.
5. Realize different minimization techniques to obtain minimized expressions.
6. Design Combinational and Sequential Circuits.

|        | Subject: (3SA04) Analog and Digital Electronics                                                                                                                                                                                                                                                                                                           | L  |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>PN Diode and its application:</b> PN-Junction Diode, Characteristics and Parameters, Static and Dynamic Resistance, Zener diode: Characteristics and application as Voltage regulator.                                                                                                                                                                 | 05 |
| Unit-2 | <b>BJT FET and MOSFET:</b> BJT operation, BJT Voltages and Currents, BJT as Switch, Common-Base Characteristics, Common-Emitter Characteristics, Common-Collector Characteristics.                                                                                                                                                                        | 05 |
| Unit-3 | <b>FET and MOSFET:</b> Basic operation of Junction Field Effect Transistors, MOSFETs & CMOS. Introduction to Operational amplifier.                                                                                                                                                                                                                       | 05 |
| Unit-4 | <b>Number System &amp; Minimization Technique:</b> Binary Number System, Signed and unsigned Number, Octal Number System, Hexadecimal Number System, Conversions Between Number Systems, 1s and 2s Complements Representation, Subtraction using 1's and 2's Complements, Gray Code Minimization Technique: Logic Gates, Karnaugh Map (up to 4 variable). | 05 |
| Unit-5 | <b>Combinational Circuits:</b> Introduction, Design Procedure, Adders, Subtractors, Binary Parallel Adder, 4 Bit Parallel Subtractor BCD adder, BCD Subtractor, Multiplexer, De-multiplexer.                                                                                                                                                              | 05 |

|               |                                                                                                                                                                                         |           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-6</b> | <b>Sequential Circuits:</b> Flip-flops: S-R, J-K, Master slave J-K, D-type, T-type, Registers: SISO, SIPO, PISO, PIPO, Counters: Asynchronous and Synchronous counter, Up/Down counter. | <b>05</b> |
|               | <b>Total</b>                                                                                                                                                                            | <b>30</b> |

**Text Book:**

1. David A. Bell: “Electronic Devices and Circuits”, 5th Ed, Oxford University Press.
2. Jain R.P. “Modern Digital Electronics”, 3rd Ed, TMH.

**References:**

1. Anand Kumar, Pulse and Digital Circuits, Prentice-Hall of India Pvt. Limited.
2. Morris Mano, "Digital Design", Prentice-Hall, 3rd Edition.

### **B.Tech. Third Semester (Artificial Intelligence and Data Science)**

| Course Code | Course Title                          | L  | T  | P  | C  |
|-------------|---------------------------------------|----|----|----|----|
| 3SAOE1A     | (Open Elective – 1(A)) Social Science | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Nil.

#### **Course Learning Objectives:**

1. Understand key social science concepts, Indian culture, social structures, and governance.
2. Study the impact of industry and environment on society and sustainable development.
3. Identify and evaluate major social problems in the context of Indian society.

#### **Course Outcomes:**

After successfully completing the course, students will be able to:

1. Understand the basic concepts in social science in the era of globalization
2. Comprehend the knowledge of Indian Culture, social structure and marriage institutions in India
3. Understand the environment in industry and its impact on society
4. Understand the Indian federal system and its executive framework
5. Explore the major social problems in India
6. Understand the human society and social sustainable development.

|               | <b>Subject: (3SAOE1A) (Open Elective - 1) Social Science</b>                                                                                                                                                                                                                     | <b>L</b>  |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-1</b> | <b>Introduction to Social Science:</b><br>Importance to Engineer, Seven categories of Social Sciences (Anthropology, Sociology, History, Geography, Political science, Economics and Linguistics), Rural and Urban problems associated with society.                             | <b>07</b> |
| <b>Unit-2</b> | <b>Fundamental concept in social science:</b><br>i. Indian Culture- Aryan culture and Dravidian Culture<br>ii. Social structure and social system in India.<br>iii. Family and marriage institutions in India.                                                                   | <b>07</b> |
| <b>Unit-3</b> | <b>Impact of Industrialization on society:</b><br>i. Environment in industry with development of science and technology.<br>ii. Fatigue of workers.<br>iii. Motivation, selection and training of workers.                                                                       | <b>07</b> |
| <b>Unit-4</b> | <b>Indian Constitution and Parliament:</b> Salient features of Indian constitution. Fundamental Rights and Duties. Directive Principles of State, Composition and powers of Indian Parliament, President of India: Election and Powers. Prime Ministers and Council of Minister. | <b>07</b> |

|               |                                                                                                                                                                                                                                                                                                             |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-5</b> | <b>Major social problems in India:</b><br>i. Illiteracy    ii. Un-employment    iii. High population.    iv. Poverty.<br>v. Corruption.                                                                                                                                                                     | <b>07</b> |
| <b>Unit-6</b> | <b>Human Society and Environment:</b><br>i. Human values and professional ethics.<br>ii. General issues on environment ecology, bi-diversity and climate change.<br>iii. Economics and social sustainable development<br>iv. Human resource management, public health, law enforcement and good governance. | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                | <b>42</b> |

#### **Text Books:**

1. Social Problems in India, Ram Ahuja, Rawat Publication New Delhi.
2. A New Look into Social Sciences: Sheikh Sabir, A.M.Shiekh and Jaya Dwadshiwar, Sage Publication New Delhi.
3. Ethical Science, Dr. G. N. Nimbarte, Dattson Publication, Nagpur.

#### **Reference Books:**

1. Labour Problems and Social Welfare: R. C. Saxsena, Prakashan Kendra, Lucknow.
2. Introduction to Sociology, Vidhyabhushan and Sachdeva, KitabMahal, New Delhi

## **B.Tech. Third Semester (Artificial Intelligence and Data Science)**

| Course Code | Course Title                                       | L  | T  | P  | C  |
|-------------|----------------------------------------------------|----|----|----|----|
| 3SAOE1B     | (Open Elective – 1(B)) Ancient Management Paradigm | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Nil

### **Course Learning Objectives:**

The course is designed with the following main objectives

1. To identify some of the commonly felt problems that individuals, organizations and the society faces.
2. To illustrate the usefulness of Gita in addressing real-life problems and challenges.
3. To demonstrate how alternative world views and paradigms of management could be developed with a knowledge of Ancient Indian wisdom such as Gita.
4. To provide a good introduction to Ancient Indian wisdom using Gita as a vehicle

### **Course Outcomes:**

After successfully completing the course, students will be able to-

1. Describe the insights into ethics and values to promote meaningful impact in organizations.
2. Discuss the notion of spirituality in workplace.
3. Develop an understanding about leadership excellence.
4. Examine insights into how to make effective choices.
5. Assess the concepts of contemporary management and value-based leadership.
6. Analyze the insights about how to lead a life with excellence and happiness.

|               | <b>Subject: 3SAOE1B (Open Elective - 1) Ancient Management Paradigm</b>                                                                                                                                                                                                                     | <b>L</b>  |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-1</b> | <b>Spirituality in Business and Workplace:</b> Current Challenges in Business Management & Society, Relevance of Ancient Indian Wisdom for contemporary society, Spirituality in Business, Visada Yoga, Sankhya Yoga, Karma Yoga.                                                           | <b>07</b> |
| <b>Unit-2</b> | <b>Spirituality in Workplace:</b> The notion of Spirituality, An introduction to Bhagavad Gita & its relevance, Jnana Yoga, Karma Vairagya Yoga.                                                                                                                                            | <b>07</b> |
| <b>Unit-3</b> | <b>Perspectives on Leadership:</b> Abhyasa Yoga, Paramahansa Vijnana Yoga, Perspectives on Leadership, Failed Leadership: Causes & Concerns, Leadership Perspectives in the Gita.                                                                                                           | <b>07</b> |
| <b>Unit-4</b> | <b>Perspectives on Work:</b> Aksara-Parabrahman Yoga, Raja-Vidya-Guhya Yoga, Vibhuti-Vistara-Yoga, Perspectives on Work, Axioms of Work & Performance, The Notion of Meaningful Work.                                                                                                       | <b>07</b> |
| <b>Unit-5</b> | <b>Perspectives on Self-Management:</b> Mind as a key player in an individual, Meditation as a tool for self-management, Role of Yoga in addressing stress & burnout of managers, Mind as a key player in an individual, Visvarupa-Darsana Yoga, Bhakti Yoga, Ksetra-Ksetrajna Vibhaga Yoga | <b>07</b> |

|               |                                                                                                                                                                                                                      |           |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-6</b> | <b>Perspectives on Understanding:</b> Self-Management by understanding the world within, Values & their role in Self-management, Shaping the personality through Trigunas, Gunatraya-Vibhaga Yoga, Purusottama Yoga. | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                         | <b>42</b> |

#### **Prescribed Books:**

1. The Bhagabad Gita- S. Radhakrishnan (Trs & Ed)
2. Bhagwat Gita from Geeta Press, Gorakhpur, UP.

#### **Reference Books:**

1. Mahadevan, B. Writings on Gita & Management, Amazon Asia-Pacific Holdings Private Limited.
2. Swami Ranganathananda, (2001), “Universal Message of the Bhagavad Gita”, 3 Volumes, Advaita Ashrama, Kolkata.
3. Swami Dayananda Saraswati, (2007), “The value of values”, Arsha Vidya Research & Publication Trust, Chennai.
4. Swami Chinmayananda, (1996), “Holy Geeta”, Central Chinmaya Mission Trust, Mumbai.
5. Concept of Yoga in the Gita- S. C. Panigrahi
6. Bhagabad Gita & Modern Life- K. M. Munshi & R. R. Diwakar
7. The Lord Speaks (2016)- B. K. Tripathy
8. Srīmad Bhagabad Gita Bhasya of Sri Sankaracharya- A. G. K. Warriar (Trs)
9. The Ethical Philosophy of Gita- P. N. Srinivasachari

#### **Suggested Online Link:**

1. <https://www.youtube.com/watch?v=8g90E9nBnyE> (English)
2. <https://www.youtube.com/watch?v=Tsg3lWHCm0k> (Hindi)

## **B.Tech. Third Semester (Artificial Intelligence and Data Science)**

| Course Code | Course Title                                              | L  | T  | P  | C  |
|-------------|-----------------------------------------------------------|----|----|----|----|
| 3SAOE1C     | (Open Elective – 1(C)) Introduction to Constitutional Law | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Nil.

### **Course Learning Objectives:**

The course is designed with the following main objectives

1. Explain the basic principles of the Constitution and the salient features of the Indian Constitution.
2. Examine the distinction between Fundamental Rights and Directive Principles, and evaluate their enforceability and the constitutional remedies available.
3. The reasons and justifications of the growth of fundamental rights in India have to be understood through judicial intervention.
4. Explore the setup and powers of the Constitutional Judiciary in India, focusing on the jurisdiction and independence of Supreme Court and High Courts.

### **Course Outcomes:**

After successfully completing the course, students will be able to-

1. Describe foundational concepts of the Indian Constitution, such as its preamble's significance and interpretive role.
2. Discuss the Prescription of fundamental rights and Human rights and its Judicial Interpretation.
3. Examine the concept of Right to Equality & the different facets of Right to Freedoms.
4. Investigate the concept of Freedom against exploitation, freedom of religion, Minority Rights and the Constitutional remedies for violation of fundamental rights.
5. Assess the concept of directives principles and its relations with fundamental rights.
6. Inspect the Constitutional Judiciary's role within India's legal framework, including its jurisdiction, independence, and the power of judicial review.

|               | <b>Subject: 3SAOE1C (Open Elective - 1) Introduction to Constitutional Law</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>L</b>  |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-1</b> | <b>Historical Backgrounds to the framing of the Indian, Constitution:</b> General Idea about the Constitution. Assembly of India, Preamble- Nature & significance and Salient Features of the Constitution of India.                                                                                                                                                                                                                                                                                                                                                  | <b>07</b> |
| <b>Unit-2</b> | <b>Fundamental Rights:</b> Its meaning, nature & significance, Relationship of fundamental Rights and Human Rights, Citizenship, State: Definition and Judicial Interpretation. [A. 12], Law: Meaning of Law and Judicial Review, Laws inconsistent with, or in derogation of fundamental Rights; Doctrine of severability.                                                                                                                                                                                                                                           | <b>07</b> |
| <b>Unit-3</b> | <b>Right to Equality [A. 14 to A. 18]:</b> Concept and significance of the Right to Equality, Doctrine of Reasonable classification, Prohibition Against Discrimination, Equality in Public Employments, Abolition of Untouchability.<br><b>Right to Freedoms [A. 19 to A. 22]:</b> Six fundamental freedoms; Freedom of speech and expression, Freedom to assemble peacefully and without arms, Freedom to from Associations and unions, Freedom to move freely throughout the territory of India, Freedom to practice any profession or to carry on any occupation, | <b>07</b> |

|               |                                                                                                                                                                                                                                                                                                                                                |           |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | trade or business.<br><b>Protection in Respect of Conviction for offences:</b> No ex-post-facto Law, No Double Jeopardy, No Self- Incrimination.                                                                                                                                                                                               |           |
| <b>Unit-4</b> | Right to Life and Personal Liberty, Right to Education.<br><b>Right against Exploitation [A. 23 and A. 24]:</b> Prohibition of traffic in human beings and forced labour, Prohibition of compulsory services, Prohibition of Child Labour.<br>Right to Freedom of Religion [A. 25 to A. 28]. Cultural and Educational Right [A. 29 and A, 30]. | <b>07</b> |
| <b>Unit-5</b> | <b>Right to Constitutional Remedies [A. 32]:</b> Writs; Types and Scope<br><b>Directive Principal of State Policy [A. 36to A.51]:</b> Concept of Welfare State and Social Justice, Meaning, Nature and Significance of Directive Principles, Fundamental Duties [A. 52-A].                                                                     | <b>07</b> |
| <b>Unit-6</b> | <b>Constitutional Judiciary</b> and the power of Judicial Review Judicial Setup in India; Difference between Constitutional Courts, Courts and Tribunals Constitutional Courts- Supreme Court and High Courts - Jurisdiction and power Independence of Judiciary under Indian Constitution, Judicial Appointments etc.                         | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                   | <b>42</b> |

#### **Text Books:**

1. G C V Subba Rao, Indian Constitutional Law, S Gogia& Company, Hyderabad
2. J N Pandey, Constitutional Law of India, Central Law Agency, Allahabad
3. Dr D DBasu, Introduction to the Constitution of India, Butterworth Lexis Nexis.

#### **Reference Books:**

1. M P Jain, Indian Constitutional Law, Wadhwa& Company, Nagpur.
2. V N Shukla, Constitution of India, Eastern Book Company, Lucknow.
3. Granville Austin, Indian Constitution: Cornerstone of a Nation, Oxford University Press, New Delhi.
4. H. M. Seervai, Constitutional Law of India (3 Volumes) Universal Law Publishing Co Pvt Ltd.

## B.Tech. Third Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title       | L  | T  | P  | C  |
|-------------|--------------------|----|----|----|----|
| 3SA05       | Financial Literacy | 02 | 00 | 00 | 02 |

**Course Prerequisite:** General Awareness, Logical and Analytical Thinking.

**Course Learning Objectives:**

1. Explain foundation of financial literacy such as savings, investment, taxation, and insurance
2. Teach the relevance and process of financial planning
3. Relate and promote financial well-being

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

1. Describe different types of accounts and investment instruments.
2. Explain different types of government investment policies.
3. Examine different Equity Linked Savings Schemes and Deposit Schemes.
4. Identify different types of Loans and roles of Reserve Bank of India.
5. Assess various banking and insurance products.
6. Inspect financial market and different products.

|        | Subject: (3SA05) Financial Literacy                                                                                                                                                                                                             | L         |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Unit-1 | Basics of Savings and Investment: Why are investing and savings important? Savings Vs Investment, Power of Compounding, What should be the investment objectives?                                                                               | 05        |
| Unit-2 | Risk and Return, Inflation effects on Investment, Investor's Age and Assets Allocation. Tax saving Schemes Government Schemes-National Saving Certificates, Public Provident Fund, Post Office Schemes.                                         | 05        |
| Unit-3 | Equity Linked Savings Schemes, Retirement Benefits Schemes- NPS (New Pension System), Banking Activities: Deposits and Types of Deposits-Saving Bank Accounts, Fixed Deposit Accounts, Recurring Deposit Account, Special Term Deposit Schemes. | 05        |
| Unit-4 | Loans and Types of loan advanced by Banks and Other secondary functions of Bank. Banking structure in India and Role of Reserve Bank of India.                                                                                                  | 05        |
| Unit-5 | Insurance related Products: Role of Insurance as risk management tool, various types of Insurance: Life Insurance, Term Life Insurance, Endowment Policies, ULIP, Health Insurance, Regulatory role of IRDA.                                    | 05        |
| Unit-6 | Financial Markets: Capital Market Vs Money Market, Securities and its types, i.e., Equity, Debentures or Bonds, IPOs and FPOs, Mutual Funds, Types of Mutual Funds, Brokers, sub-brokers.                                                       | 05        |
|        | <b>Total</b>                                                                                                                                                                                                                                    | <b>30</b> |

**Reference Books:**

1. Investment Planning by SEBI
2. Indian financial System, by T.R.Jain and R.L.Sharma, V.K. Global Publisher
3. Money and Banking by T.R. Jain and R.K. Kaundal, VK Global Publisher
4. Kothari, R. (2010). Financial Services in India.
5. Financial Literacy Education by A. Zokaityte. Publisher: Palgrave Macmillan.
6. Investment Management by V.A. Avadhani. Publisher: Himalaya Publishing House Pvt. Ltd.

**Term Work:**

Students should complete the following activities:

1. Prepare a personal monthly budget and a basic saving plan using real-life data.
2. Analyze case studies of investment options such as Mutual Funds, PPF, NPS, or Insurance schemes.
3. Prepare a comparative report on different banking products and loan types.
4. Submit assignments based on financial markets, securities, and government schemes.

**Marking Scheme:** (Distribution of 50 Marks (Teacher Assessment))

1. Assignment Based Evaluation (15 Marks)
2. Financial report plan (15 Marks)
3. MCQ Test Based Evaluation (20 Marks)

## B.Tech. Third Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title          | L  | T  | P  | C  |
|-------------|-----------------------|----|----|----|----|
| 3SA06       | Environmental Science | 02 | 00 | 00 | 02 |

**Course Prerequisite:** Nil

**Course Learning Objectives:**

1. The importance of Environmental Studies.
2. The need of renewable and non-renewable energy resources.
3. The components, structures and types of ecosystems.
4. The Impact of different types of pollution.

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

1. Understand the scope and importance of environmental studies.
2. Apply the knowledge of renewable and non-renewable energy resources.
3. Understand the concept of ecosystem.
4. Apply the knowledge of environmental pollution.
5. Understand the current environmental issues of India.
6. Understand the role of Information Technology in environment and human health.

|        | Subject: (3SA06) Environmental Science                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | L  |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>The Multidisciplinary nature of environmental studies:</b> Definition, scope and importance, Need for public awareness.                                                                                                                                                                                                                                                                                                                                                                                                                                                | 05 |
| Unit-2 | <b>Renewable and non renewable resources:</b> Natural resources and associated problems, Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests and tribal people. Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.<br>Energy Resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies, Role of individual in conservation of natural resources. | 05 |
| Unit-3 | <b>Eco Systems:</b> Concept of an eco system, structure and function of an eco system, Producers, consumers, decomposers, Food chains, food webs. Introduction, types, characteristic features, structure and function of the following eco systems: Forest ecosystem, Grass land ecosystem, Desert ecosystem, Aquatic eco systems (ponds, streams, lakes, rivers, oceans, estuaries)                                                                                                                                                                                     | 05 |
| Unit-4 | <b>Environmental Pollution:</b> Definition, Causes, effects and control measures of: Air pollution, Water pollution, Noise pollution, role of an individual in prevention of pollution, Pollution Case Studies.                                                                                                                                                                                                                                                                                                                                                           | 05 |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-5</b> | <b>Current Environmental Issues in India:</b> Water conservation-development of watersheds, Rain water harvesting and ground water recharge, Eutrophication and restoration of lakes, Conservation of wetlands, Ramsar sites in India. Climate Changes – Global warming, Acid rain, Ozone layer Deflection, Waste Management - Swachha Bharat Abhiyan.                                                                                                                                                          | 05        |
| <b>Unit-6</b> | <b>Human population and the environment:</b> Population explosion- family welfare program, Environment and human health, Human rights, Women and child welfare, Role of information technology in Environment and human health. Visit to environment assets-river / forest / grassland / hill / mountain. Visit to a polluted site-urban/rural/industrial/agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hills slopes, etc (field work equal to 5 lecture works) | 05        |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>30</b> |

**Text Book:**

1. Textbook of Environmental studies, Erach Bharucha, UGC.

**Reference Books:**

1. Fundamental concepts in Environmental Studies, D D Mishra, S Chand & Co Ltd.
2. Environmental studies, Nidhi Dhawan, Kiran Bist, I.K. International House Pvt, Ltd.

**Term Work:** 50 Marks

**Marking Scheme:**

1. Field Visit – 10 Marks
2. Attendance – 10 Marks
3. Class Test (Internal) – 10 Marks
4. Assignment (2 Nos.) – 20 Mark

## **B.Tech. Third Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>        | <b>L</b>  | <b>T</b>  | <b>P</b>  | <b>C</b>  |
|--------------------|----------------------------|-----------|-----------|-----------|-----------|
| <b>3SA07</b>       | <b>Data Structures Lab</b> | <b>00</b> | <b>00</b> | <b>02</b> | <b>01</b> |

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Data Structures Lab by being able to do each of the following:

1. Demonstrate the ability to implement and analyze basic data structures and algorithms.
2. Develop problem-solving skills using appropriate data structures and algorithmic techniques.
3. Enhance understanding of advanced data structure concepts and their applications.

### **Course Outcomes:**

After successfully completing the course, students will be able to-

1. Use his / her understanding / knowledge of Data Structures so as to design / conduct experimentation related to given aim / objective
2. Use Computer Hardware / Software and other concern resources for conduction of practical.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given practical.

### **List of Experiment:**

*Minimum 8 to 10 practical's are to be conducted based on subject 3SA02 – Data Structures Syllabus.*

## B.Tech. Third Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                | L  | T  | P  | C  |
|-------------|-----------------------------|----|----|----|----|
| 3SA08       | Programming Methodology Lab | 00 | 00 | 02 | 01 |

### Course Learning Objectives:

1. Apply object-oriented programming principles using Java to develop modular and reusable applications.
2. Design and implement Java programs with robust exception handling and file I/O operations.
3. To use Java concepts like API, Event Handling, Swing and AWT to develop GUI-based application Programs.

### Course Outcomes:

After successfully completing the course, students will be able to-

1. Use his / her understanding / knowledge of Java for Programming Methodology so as to design / conduct experimentation related to given aim / objective
2. Use Computer Hardware / Software and other concern resources for conduction of practical.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given practical.

### List of Experiment:

*Minimum 8 to 10 practical's are to be conducted based on subject 3SA03 – Programming Methodology Syllabus.*

## **B.Tech. Third Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>                       | <b>L</b>  | <b>T</b>  | <b>P</b>  | <b>C</b>  |
|--------------------|-------------------------------------------|-----------|-----------|-----------|-----------|
| <b>3SA09</b>       | <b>Analog and Digital Electronics Lab</b> | <b>00</b> | <b>00</b> | <b>02</b> | <b>01</b> |

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Analog and Digital Electronics by being able to do each of the following:

1. To get the introductory knowledge of basic analog devices like PN Junction Diode, Bipolar Junction Transistor and Field Effect Transistor.
2. To get basic knowledge about digital ICs and digital systems.
3. To study the design of combinational circuits and sequential circuits.

### **Course Outcomes:**

After successfully completing the course, students will be able to-

1. Use his / her understanding / knowledge of Analog and Digital Electronics and so as to design / conduct experimentation related to given aim / objective
2. Use Computer Hardware / Software and other concern resources for conduction of practical.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given practical.

### **List of Experiment:**

*Minimum 8 to 10 practical's are to be conducted based on subject 3SA04 – Analog and Digital Electronics Syllabus.*

## B.Tech. Third Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                        | L  | T  | P  | C  |
|-------------|-------------------------------------|----|----|----|----|
| 3SA10       | CEP / FP: Innovation and Creativity | 00 | 00 | 04 | 02 |

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Innovation & Creativity by being able to do each of the following:

1. Understand the fundamentals of creative thinking and innovation principles.
2. Apply creative problem-solving techniques to real-world challenges.
3. Develop and refine ideas into functional prototypes using design thinking methods.

### Course Outcomes:

On completion of the course, students will be able to-

1. Recognize on real-world examples of creativity, invention, and innovation,
2. Implement creative problem-solving techniques in real-life situations
3. Learn and implement various creative problem-solving techniques, such as brainstorming, lateral thinking, and design thinking.

### List of Experiments:

*Minimum 8 to 10 practical's are to be performed based on subject related to Innovation and Creativity*

1. To discuss on the definitions and distinctions between creativity, invention, and innovation.

**Field:** Students analyze real-world examples of creativity, invention, and innovation in various industries.

2. To break down the creative process into stages and discuss each stage in detail.

**Field:** Group activity where students brainstorm and identify examples of each stage in a chosen context.

3. To explore different models or analogies for the creative process

**Field:** Students create their own creative process model based on their understanding.

4. To discuss theories on creative potential and common blockages.

**Field:** Self-assessment exercises and group discussions to identify personal creative potential and perceived blockages.

5. To present on common myths and misconceptions about creativity.

**Field:** Debate or discussion on the validity of these myths and their impact on innovation.

6. To provide a list of practical tips for discovering and applying creative potential.

**Field:** In-class exercises where students practice these tips and share their experiences.

7. To understand the importance of teamwork in the creative and innovation process.

**Field:** Group projects where students work together to solve a creative challenge or develop an innovative solution.

8. To discuss examples of nature-inspired innovations (biomimicry).

**Field:** Outdoor field trip or research assignment where students explore natural phenomena and brainstorm potential applications.

9. To explain the principles of idea generation and brainstorming techniques.

**Field:** Conduct brainstorming sessions on specific challenges or topics relevant to the course

## B.Tech. Fourth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title            | L  | T  | P  | C  |
|-------------|-------------------------|----|----|----|----|
| 4SA01       | Artificial Intelligence | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Basic Knowledge of Programming, Introduction to Python, Discrete Mathematics and Data Structures.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of the Artificial Intelligence.

1. To present an overview of Artificial Intelligence (AI) principles and approaches
2. To understand the historical evolution of Artificial Intelligence
3. To learn various searching techniques and identify to address a particular problem

### Course Outcomes:

After successfully completing the course, students will be able to-

1. Describe concepts of Artificial Intelligence and different types of intelligent agents and their architecture.
2. Explain different types of uninformed search strategies.
3. Illustrate different types of heuristic search strategies.
4. Investigate various knowledge representation issues.
5. Use predicate logic for knowledge representation.
6. Inspect adversarial search and game theory.

|        | Subject: (4SA01) Artificial Intelligence                                                                                                                                                                                                                                                                                              | L  |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Introduction to AI:</b> Introduction: What Is AI? The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Risks and Benefits of AI, Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents. | 07 |
| Unit-2 | <b>Uninformed Search Strategies:</b> Problem-Solving Agents, Example Problems, Search Algorithms, Uninformed Search Strategies: Breadth-First Search, Uniform-Cost Search, Depth First Search, Bidirectional Search, Depth Limited Search, Iterative Deepening Depth-First Search.                                                    | 07 |
| Unit-3 | <b>Informed Search Strategies:</b> Basic Concept of Heuristic Search and Knowledge, Designing of Heuristic Function, Heuristic Search Strategies: Generate-And-Test, Best-First Search, Problem Reduction, Hill Climbing, Constraint Satisfaction, Means-Ends-Analysis.                                                               | 07 |
| Unit-4 | <b>Knowledge Representation and Issues:</b> Representation and Mapping. Approaches to Representation, Issues in Representation: Important attribute, relationship among attributes, choosing the granularity of representation, representing sets of Objects, finding the right structures as needed.                                 | 07 |

|               |                                                                                                                                                                                                                                                            |           |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-5</b> | <b>Knowledge Representation using Predicate Logic:</b> Representing Simple Facts in Logic, Representing Instance and ISA relationship, Computable Functions and Predicates, Resolution.                                                                    | 07        |
| <b>Unit-6</b> | <b>Adversarial Search &amp; Games:</b> Game Theory, Optimal Decisions in Games, Mini-Max Search, Alpha Beta Pruning, Additional Refinements, Monte Carlo Tree Search, Stochastic Games, Partially Observable Games, Limitations of Game Search Algorithms. | 07        |
|               | <b>Total</b>                                                                                                                                                                                                                                               | <b>42</b> |

#### **Text Book:**

1. Artificial Intelligence: A Modern Approach by Stuart Russell & Peter Norvig (Pearson - 4th Ed.)
2. Artificial Intelligence by Elaine Rich and Kevin Knight (Tata McGraw Hill - 3rd Ed.)

#### **Reference Books:**

1. Artificial Intelligence by Ela Kumar (IK International Publishing House Pvt. Ltd.)
2. A First Course in Artificial Intelligence by Deepak Khemani (Tata McGraw Hill - 1st Ed.)
3. Artificial Intelligence and Expert Systems by Patterson (PHI)
4. Introduction to Artificial Intelligence by Rajendra Akerkar (PHI Learning Pvt. Ltd.)

## B.Tech. Fourth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title      | L  | T  | P  | C  |
|-------------|-------------------|----|----|----|----|
| 4SA02       | Operating Systems | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Computer Fundamentals, Programming Concepts and Data Structures.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of the Operating System.

1. To understand the fundamental concepts and structure of operating systems
2. To study and analyze process management, scheduling, synchronization, and deadlock handling
3. To explore memory management, file systems, and I/O system design.

### Course Outcomes:

After successfully completing the course, students will be able to-

1. Explain basic Components and Services of Operating system.
2. Analyze and Solve CPU scheduling problems using different scheduling algorithms.
3. Examine the critical section problem and resolve it.
4. Investigate Memory Management issues like Fragmentation, Virtual Memory Management.
5. Assess File-System Interface and Free Space Management.
6. Evaluate Input-Output Systems and Inspect various disk scheduling algorithms.

|        | Subject: (4SA02) Operating Systems                                                                                                                                                                                                                                                                         | L  |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Introduction to Operating System:</b> Introduction: Operating System definition, OS Evolution, Components and Services, Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Inter-process Communication, Threads Overview, Multithreading Models and Threading Issues. | 07 |
| Unit-2 | <b>Process Scheduling:</b> Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non-pre-emptive, FCFS, SJF, RR, Priority.                                     | 07 |
| Unit-3 | <b>Process Synchronization:</b> Process Synchronization Basics: The Critical-Section Problem, Synchronization Hardware, Semaphores, Monitors, Deadlocks: Definition & Characterization, Deadlocks Prevention, Avoidance, Detection and Recovery from Deadlock.                                             | 07 |
| Unit-4 | <b>Memory Management:</b> Memory Management Background, Swapping, Contiguous Memory Allocation Schemes, Paging, Segmentation, Virtual Memory Management: Background, Demand paging scheme, Process Creation, Page Replacement Policies, Allocation of Frames, Thrashing.                                   | 07 |
| Unit-5 | <b>File-System Interface:</b> Directory Structure, File-System Mounting, File Sharing, Protection. File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, File Recovery.                                                                  | 07 |

|               |                                                                                                                                                                                                                                                                                                |           |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-6</b> | <b>I/O System:</b> I/O Systems: Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations, Disk Structure, Disk Scheduling Algorithms: FCFS, SSTF, SCAN, C-SCAN, LOOK, C- LOOK, Disk Management, Swap-Space Management, RAID Structure. | 07        |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                   | <b>42</b> |

**Text Book:**

1. Avi Silberschatz, P.B.Galvin, G.Gagne: “Operating System Concepts” (9/e) John-Wiley & Sons.

**Reference Books:**

1. A.S Tanenbaum “Modern Operating Systems” Pearson Education.
2. William Stallings “Operating Systems” Prentice-Hall.
3. D M Dhamdhare “Operating Systems” Tata McGraw-Hill.
4. P.Balkrishna Prasad: “Operating Systems” Scitech Publications (I) Pvt. Ltd.

## B.Tech. Fourth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title          | L  | T  | P  | C  |
|-------------|-----------------------|----|----|----|----|
| 4SA03       | Theory of Computation | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Discrete Mathematics, Data Structures and Basic Knowledge of Programming.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of the Theory of Computation.

1. To understand different automata theory and its operation.
2. To understand mathematical expressions for the formal languages.
3. To study computing machines and comparing different types of computational models.

### Course Outcomes:

After successfully completing the course, students will be able to-

1. Describe the basic concepts of formal languages of finite automata techniques.
2. Explain the formal relationships among machines, languages and grammars.
3. Classify properties of Regular Languages.
4. Examine context free grammar for various languages.
5. Design Push Down Automata for given languages.
6. Inspect computability, decidability, recursive function theory for problem solving.

|        | Subject: (4SA03) Theory of Computation                                                                                                                                                                                                                                | L  |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Finite State Machines:</b> Alphabet, String, Formal and Natural Language, Operations, Definition and Design DFA (Deterministic Finite Automata), NFA (Non-Deterministic Finite Automata), Conversion of NFA into DFA. Conversion of NFA with epsilon moves to DFA. | 07 |
| Unit-2 | <b>Regular Expression and Regular Sets:</b> Definition and Identities of Regular Expressions, Construction of Regular Expression of the given Language, Construction of Language from the RE, Conversion of FA to RE using Arden's Theorem, Regular grammar.          | 07 |
| Unit-3 | <b>Properties Of Regular Languages:</b> Pumping Lemma for Regular Languages, Applications of the Pumping Lemma, Closure properties of RLs (proofs not required), Decision Properties of Regular Languages, Equivalence and Minimization of Automata, Regular Grammar. | 07 |
| Unit-4 | <b>Context Free Grammar and Languages:</b> Introduction of CFG, Derivation Process: Leftmost Derivation, Rightmost Derivation, Derivation Trees, Ambiguous grammar, Simplification of CFG, Normal Forms (CNF and GNF).                                                | 07 |
| Unit-5 | <b>Pushdown Automata:</b> Introduction and Definition of PDA, Construction of PDA, Acceptance of CFL, Equivalence of CFL and PDA: Inter-conversion, Introduction of DCFL and DPDA, Context Sensitive Language, Linear Bounded Automata.                               | 07 |

|               |                                                                                                                                                                                                                                                                         |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-6</b> | <b>Un-Decidability:</b> Decidability and Undecidability, Properties of recursive & non-recursive enumerable languages, Complements of recursive and RE languages, Post's Correspondence Problem, other undecidable Problems, Introduction to recursive function theory. | 07        |
|               | <b>Total</b>                                                                                                                                                                                                                                                            | <b>42</b> |

**Text Book:**

1. Hopcraft H.E. and Ullman J: Introduction to Automata Theory, Languages and Computation.
2. Mishra and Chandrasekharan: Theory of Computation, PHI, 3rd Edition.

**Reference Books:**

1. Rajesh K. Shukla: Theory of Computation, CENGAGE Learning, 2009.
2. K V N Sunitha and N Kalyani: Formal Languages and Automata Theory, McGraw Hill, 2010.
3. Lewis H.P. and Papadimitriou C.H.: Elements of Theory of Computation.
4. C. K. Nagpal: Formal Languages and Automata Theory, Oxford University Press, 2011.
5. Vivek Kulkarni: Theory of Computation, OUP India, 2013.
6. Peter Linz: An Introduction to Formal Languages and Automata.

## B.Tech. Fourth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                 | L  | T  | P  | C  |
|-------------|------------------------------|----|----|----|----|
| 4SAOE2A     | Intellectual Property Rights | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Nil

### Course Learning Objectives:

1. Impart awareness on Intellectual Property Rights (IPR) and various regulatory issues related to IPR
2. Familiarize students with the shades of Intellectual Property Rights (IPR)
3. Awareness on intellectual property rights and various regulatory issues related to IPR.

### Course Outcomes:

After successfully completing the course, students will be able to-

1. Define the concept of intellectual property and list its various forms.
2. Explain the process of obtaining a patent, including eligibility criteria and rights associated with patents.
3. Apply copyright laws to determine eligibility for protection and understand procedures for registration.
4. Analyze trademark classification and evaluate criteria for registration.
5. Synthesize understanding to develop strategies for registration and protection of industrial designs.
6. Evaluate the significance of trade secrets in business operations and analyze precautionary measures for protection.

|               | Subject: 4SAOE2A (Open Elective – 2(A)) Intellectual Property Rights                                                                                                                                                                                                                                                                                                                                  | L  |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Unit-1</b> | <b>Introduction to Intellectual Property Rights:</b> Role of IP in the Economic and Cultural Development of the Society, IP Governance. IP as a Global Indicator of Innovation, Origin of IP, History of IP in India. Patents, Copyrights and Related Rights, Trademarks, Trade Secrets                                                                                                               | 07 |
| <b>Unit-2</b> | <b>Patents:</b> Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention, Rights Associated with Patents, Enforcement of Patent Rights, Inventions Eligible for Patenting, Non-Patentable Matters, Patent Infringements, Process of Patenting.                                                                                                                           | 07 |
| <b>Unit-3</b> | <b>Copyrights:</b> Classes of Copyrights, Criteria for Copyright, Ownership of Copyright, Copyrights of the Author, Copyright Infringements, Liability of Owner of an Auditorium/Hall, Fair Use Doctrine, Non-Copyright Work, Copyright Registration, Judicial Powers of the Registrar of Copyrights, Fee Structure, Copyright Symbol, Validity of Copyright.                                         | 07 |
| <b>Unit-4</b> | <b>Trademarks:</b> Eligibility Criteria, Who Can Apply for a Trademark, Acts and Laws, Designation of Trademark Symbols, Classification of Trademarks, Registration of a Trademark is Not Compulsory, Validity of Trademark, Types of Trademarks Registered in India, Trademark Registry, Process for Trademarks Registration. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd. | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                                                                            |           |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-5</b> | <b>Industrial Design:</b> Eligibility Criteria, Acts and Laws to Govern Industrial Designs, Design Rights, Enforcement of Design Rights, Non-Protectable Industrial Designs India, Protection Term, Procedure for Registration of Industrial Designs, Importance of Design Registration, Cancellation of the Registered Design, Application Forms, Famous Case Law: Apple Inc. vs. Samsung Electronics Co. | 07        |
| <b>Unit-6</b> | <b>Trade Secret:</b> Criteria for Trade Secret, Registration and Protection Time of Trade Secrets, Rights Associated with Trade Secrets, Enforcement of Trade Secrets, When to Apply for Trade Secret Protection, Precautionary Measures to be Taken by Enterprises/Organizations, Disparity Between Trade Secrets and Patents, Renowned Trade Secrets                                                     | 07        |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                               | <b>42</b> |

#### **Text Book:**

1. Prof. Rupinder Tewari and Ms. Mamta Bhardwaj, "Intellectual Property: A Primer for Academia" by, Publication Bureau, Panjab University, Chandigarh, 2021.
2. K. V. Nithyananda, "Intellectual Property Rights: Protection and Management", by Cengage Learning India Private Limited, 2019.

#### **Reference Books:**

1. Deborah E. Bouchoux, "Intellectual Property for Paralegals – The Law of Trademarks, Copyrights, Patents & Trade Secrets", 4th Edition, Cengage Learning, 2012.
2. N. S. Gopalakrishnan and T. G. Agitha, "Principles of Intellectual Property", Eastern Book Company, Lucknow, 2009.
3. M. M. S. Karki, "Intellectual Property Rights: Basic Concepts", Atlantic Publishers, 2009.
4. Ganguli Prabuddha, "Intellectual Property Rights--Unleashing the Knowledge Economy", Tata McGraw Hill, 2001.

## B.Tech. Fourth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title              | L  | T  | P  | C  |
|-------------|---------------------------|----|----|----|----|
| 4SAOE2B     | Introduction to Cyber Law | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Nil.

**Course Learning Objectives:**

1. Introduction to basics of Computer, Internet and Cyber Law.
2. Demonstrate the concepts of e-Commerce and Inspect the principles of Information Technology Act, 2000.
3. Describe Cyber Crimes and, Enlist and predict the types of Cyber Crimes.
4. Examine the Internet Security issues.

**Course Outcomes:**

After successfully completing the course, students will be able to-

1. Describe the fundamentals of computer, internet and cyber law.
2. Outline the fundamentals of E-Commerce.
3. Illustrate the knowledge of cybercrimes.
4. Classify the cybercrimes.
5. Explain the principles of Information Technology Act.
6. Inspect the Internet security issues.

|               | Subject: 4SAOE2B (Open Elective – 2(B)) Introduction to Cyber Law                                                                                                                                                                                                                 | L  |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Unit-1</b> | <b>Fundamentals of Computer, Internet and Cyber Law</b><br>Functional Components of Computer, applications of computers, Internet architecture, world wide web, internet server and types, Need for Cyber Law, difference between Cyber Crimes and Conventional Crimes.           | 07 |
| <b>Unit-2</b> | <b>Introduction to E-Commerce</b><br>Electronic data interchange and legal issues, e-commerce models, e-banking, credit card, e-mail, e-governance and objective, models and types.                                                                                               | 07 |
| <b>Unit-3</b> | <b>Concepts of Cyber Crime</b><br>Characteristics of Cyber Crime, Causes and Measures to combat Cyber Crimes, Cyber Crimes against Individuals, Institution and State.                                                                                                            | 07 |
| <b>Unit-4</b> | <b>Categories of Cyber Crimes</b><br>Classification of Cyber Crimes, Hacking, Cracking, Digital Forgery, Cyber Stalking/ Harassment, cyber terrorism, Cyber Pornography and Obscenity, Identity Theft, Cyber Defamation, Virus attacks, Computer Fraud, Social Networking Crimes. | 07 |

|               |                                                                                                                                                                                                                                                            |           |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-5</b> | <b>Information Technology Act, 2000</b><br>Silent features of Information Technology Act, 2000, Definitions, Digital Signatures and Certificates, Security Procedures, Electronic Contracts, Penalties and Adjudication, Liabilities of Service Providers. | 07        |
| <b>Unit-6</b> | <b>Internet Security:</b><br>Internet Security, ethical issues of Information Technology- software piracy, firewall and types of firewalls, biometrics and internet security products software.                                                            | 07        |
|               | <b>Total</b>                                                                                                                                                                                                                                               | <b>42</b> |

### **Recommended Books:**

1. Pavan Duggal, "Cyber Law", LexisNexis India Publication, 2023, ISBN: INK8196241070.
2. Pavan Duggal, "Cyber Frauds, Cybercrimes and Law in India", Cyber Law University Publication, 2023.
3. Nilakshi Jain, Ramesh Menon, "Cyber Security and Cyber Laws", Wiley India, 2020, ISBN: 9390395755  
Sharma Vakul - Information Technology Law and Practice
4. Nandan Kamath, "Law Relating to Computer, Internet and E-commerce", LexisNexis India Publication, 5th Edition, 2016, ISBN: 9789350351819.
5. P. Soni, "Cyber Laws", Sony Prakashan, Nagpur, 2020.

## B.Tech. Fourth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title      | L  | T  | P  | C  |
|-------------|-------------------|----|----|----|----|
| 4SAOE2C     | Stress Management | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Nil

**Course Learning Objectives:**

1. Facilitating the Incorporation of Effective Coping Techniques
2. Assisting Students in Achieving a Relaxed Physiological State
3. Exploring the Role of Yoga in Stress Management.

**Course Outcomes:**

After successfully completing the course, students will be able to-

1. Recall the etymology and definitions of yoga.
2. Explain the principles of yoga and yogic practices.
3. Explain the relationship between mind and body in stress management.
4. Apply yoga techniques for managing stress in various life situations.
5. Analyze the relationship between yogic diet and nutrients for positive health.
6. Practice pranayamas and meditative asanas for relaxation and mental clarity.

|        | Subject: 4SAOE2C (Open Elective – 2(C)) Stress Management                                                                                                                                                                                                                          | L  |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Introduction to Yoga and Yogic practices:</b> Etymology of Yoga and Definitions of Yoga, History and Development of Yoga, Aim, Objectives and Misconceptions about Yoga.                                                                                                        | 07 |
| Unit-2 | <b>General Introduction:</b> Shad-darshan, four paths of Yoga, Principles of Yoga and Yogic practices.                                                                                                                                                                             | 07 |
| Unit-3 | <b>Yoga and Stress Management:</b> Human Psyche: Yoga and Modern Concepts, Stress and Psychosomatic Disorders, Relationship between Mind and Body, Mental Hygiene and Role of Yoga in Mental Hygiene, Mental Health: A Yogic perspective, Prayer and Meditation for Mental Health. | 07 |
| Unit-4 | <b>Psycho-Social Environment and its importance for Mental Health:</b> Concept of Stress according to Modern Science and Yoga, Role of Yoga in Stress management, Role of Yoga in Life management.                                                                                 | 07 |
| Unit-5 | <b>Wellness-Prevention and promotion of positive health:</b> Health: meaning and definition, Yogic concepts for health and diseases, Yogic principles for healthy life, Introduction to yogic diet and nutrients.                                                                  | 07 |
| Unit-6 | <b>Pranayamas &amp; Meditative Asanas:</b> Pranayamas: Equal breathing, Intercoastal breathing, clavicular breathing, diaphragm breathing, alternate nostril breathing, Relaxative Asanas: Padmasana, Sthitaprashtasana, Sukhasana, Vajrasana.                                     | 07 |

|  |              |           |
|--|--------------|-----------|
|  | <b>Total</b> | <b>42</b> |
|--|--------------|-----------|

**Text Book:**

1. Iyengar, BKS. (2003). The Art of Yoga. New Delhi: Harper Collins Publishers.
2. Maguire, Imelda. (2005). Yoga for a Healthy Body. London: Greenwich Editions.

**Reference Books:**

1. Nagendra, H.R., & Nagarathana, R. (2004). Yoga Practices for Anxiety & Depression. Bangalore: Swami Sukhabodhanandha Yoga Prakashana.
2. Sukhabodhanandha, Swami. (2002). Stress Management. Bangalore: Prasanna Trust.
3. Andrews, Linda Wasmer. (2005). Stress Control for Peace of Mind. London: Greenwich Editions.
4. Yogendra, Hansa Jayadeva, & Desai, Armaiti Neriosand. (1991). Yoga for Back and Joint Disorders. Mumbai: Dr. Jayadeva Yogendra for the Yoga Institute.

## B.Tech. Fourth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title           | L  | T  | P  | C  |
|-------------|------------------------|----|----|----|----|
| 4SA04       | Business Communication | 02 | 00 | 00 | 02 |

**Course Prerequisite:** Professional Communication Skill.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of the Business Communications.

1. To develop awareness of the complexity of the communication process.
2. To develop effective listening skills in students so as to enable them to comprehend instructions and become a critical listener.
3. To develop effective oral skills so as to enable students to speak confidently interpersonally as well as in large groups.
4. To develop effective writing skills so as to enable students to write in a clear, concise, persuasive and audience centered manner.

**Course Outcomes:**

After successfully completing the course, students will be able to-

1. Describe Nature and Process of Communication.
2. Outline importance of Organizational Communication.
3. Discover the importance of Oral Communication and Applications of Conversation Control.
4. Outline guidelines for improving Listening Skills and developing Non-verbal Communication Skills.
5. Examine draft for structured business messages and cover letters.
6. Design Business Letters from standard layout and formal report using different visual aids.

|        | Subject: (4SA04) Business Communication                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | L  |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>The Nature and Process of Communication:</b> The Role of Communication, Defining Communication, Classification of Communication, The Purpose of Communication, The Process of Communication, The Elements of Communication, The Major Difficulties in Communication, Barriers to Communication, Conditions for Successful Communication, The Seven C's of Communication, Universal Elements in Communication.                                                                                                                                                 | 05 |
| Unit-2 | <b>Organizational Communication:</b> The Importance of Communication in Management, Communication Concerns of the Manager, Communication Training for Managers, Communication Structures in Organizations, Line and Staff Management, Information to be Communicated at the Workplace.<br><b>Intercultural Communication Skills:</b> Globalization and Intercultural Communication, The New Global Mantra: Go Local, Cultural Sensitivity, Developing Cultural Intelligence, Guidelines for Intercultural Communication, E-Mail and Intercultural Communication. | 05 |
| Unit-3 | <b>Oral Communication:</b> What Is Oral Communication? Three Aspects of Oral Communication, INTERCULTURAL COMMUNICATION, Oral Communication and Electronic Media.                                                                                                                                                                                                                                                                                                                                                                                                | 05 |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | <b>Conversation Skills:</b> What is Conversation?, Social Conversation, Effective Conversation, Example: Conversation Control, Applications of Conversation Control.                                                                                                                                                                                                                                                                                                                                                                                             |           |
| <b>Unit-4</b> | <b>Listening:</b> What Is Listening? The Process of Listening, Factors that Adversely Affect Listening, Characteristics of Effective and Ineffective Listeners, Guidelines for Improving Listening Skills, Responsive Listening<br><b>Non-verbal Communication:</b> What is Non-verbal Communication Characteristics of Non-verbal Communication, Classification of Non-verbal Communication, Responding to Power Posturing, Guidelines for Developing Non-verbal Communication Skills.                                                                          | 05        |
| <b>Unit-5</b> | <b>Written Business Communication:</b> The Art of Writing, The Skills Required in Written Communication, INFORMATORY WRITING, The Purpose of Writing, PERSUASIVE WRITING, Clarity in Writing, EXAMPLES OF CLEAR AND UNCLEAR WRITING, REWRITING A LETTER.                                                                                                                                                                                                                                                                                                         | 05        |
| <b>Unit-6</b> | <b>Business Letters:</b> Memos, and E-mails, Introduction, Writing Routine and Good-News Letters, WRITING A PERSUASIVE LETTER, Writing Memos, Essentials of Good Business Letters and Memos, REDRAFTING A MEMO, Form and Layout of Business Letters, Writing E-mails.<br><b>Report Writing:</b> What Is a Report? The Purpose of a Report, Kinds of Reports, The Terms of Reference, The Objectives of a Report, Planning and Organizing Information, Writing Reports, Short Management Reports, Long Formal Reports, Using Diagrams and Visual Aids in Reports. | 05        |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>30</b> |

#### **Text Book:**

1. P. D. Chaturvedi and C. Mukesh, "Business Communication", Pearson Publication.

#### **Reference Books:**

1. Bovee, Courtland, John Thill & Mukesh Chaturvedi. Business Communication Today: Dorling Kindersley, Delhi.
2. P. D. Chaturvedi & M. Chaturvedi, "Business communication: Concepts, cases and applications", Pearson Education, 2<sup>nd</sup> Edition, 2017.
3. M. Raman, & P. Singh, "Business Communication", Oxford University Press, 2<sup>nd</sup> Edition, 2012.

#### **Term Work:**

Student will perform following activities:

- a) Submit the assignment based on syllabus with real time examples.
- b) Identify the topic for presentation to understand the norms of Business Communication.
- c) Attend test to understand the syllabus thoroughly and apply to solve the problems.

#### **Marking Scheme: (Distribution of 50 Marks)**

1. Assignment Based Evaluation (15 Marks)
2. Presentation (15 Marks)
3. MCQ Test Based Evaluation (20 Marks)

## B.Tech. Fourth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                   | L  | T  | P  | C  |
|-------------|--------------------------------|----|----|----|----|
| 4SA05       | Entrepreneurship and Start-ups | 02 | 00 | 00 | 02 |

**Course Prerequisite:** Nil

**Course Learning Objectives:**

1. Acquiring Entrepreneurial quality, competency, motivation, spirit and resourcefulness.
2. Familiarization with various uses of human resource for earning dignified means of living.
3. Understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation.

**Course Outcomes:**

After successfully completing the course, students will be able to-

1. Describe the dynamic role of entrepreneurship and small businesses.
2. Illustrate Business Plan Creation.
3. Create Idea to Startup and Ownership for Small Business.
4. Organize and Manage a Small Business.
5. Inspect Financial Planning and Control.
6. Design strategies New Product or Service Development.

|        | Subject: (4SA05) Entrepreneurship and Start-ups                                                                                                                                                                          | L         |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Unit-1 | <b>Introduction to Entrepreneurship and Start – Ups:</b> Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation Types of Business Structures, Similarities/differences between entrepreneurs and managers. | 05        |
| Unit-2 | <b>Business Ideas and their implementation:</b> Discovering ideas and visualizing the business Activity map Business Plan                                                                                                | 05        |
| Unit-3 | <b>Idea to Start-up:</b> Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Marketing and accounting, Risk analysis                                                       | 05        |
| Unit-4 | <b>Management:</b> Company's Organization Structure, Recruitment and management of talent. Financial organization and management                                                                                         | 05        |
| Unit-5 | <b>Financing and Protection of Ideas:</b> Financing methods available for start-ups in India Communication of Ideas to potential investors – Investor Pitch Patenting and Licenses                                       | 05        |
| Unit-6 | <b>Strategies:</b> Exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy.                                                                                                                | 05        |
|        | <b>Total</b>                                                                                                                                                                                                             | <b>30</b> |

**Reference Books:**

1. Steve Blank and Bob Dorf, “The Startup Owner’s Manual: The Step-by-Step Guide for Building a Great Company”, K & S Ranch, ISBN – 978-0984999392.
2. Eric Ries, “The Lean Startup: How Today’s Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses”, Penguin UK, ISBN – 978-0670921607.
3. Adrian J. Slywotzky with Karl Weber, “Demand: Creating What People Love Before They Know They Want It”, Headline Book Publishing, ISBN – 978-0755388974.
4. Clayton M. Christensen, “The Innovator’s Dilemma: The Revolutionary Book That Will Change the Way You Do Business”, Harvard business ISBN: 978-142219602.

**Term Work:**

Student will perform following activities:

- a) Submit the assignment based on syllabus with real time examples.
- b) Identify business application domain and prepare plan for execution as well as evaluation.
- c) Attend test to understand the syllabus thoroughly and apply to solve the problems.

**Marking Scheme: (Distribution of 50 Marks)**

1. Assignment Based Evaluation (15 Marks)
2. Business Planning Based Evaluation (15 Marks)
3. MCQ Test Based Evaluation (20 Marks)

## **B.Tech. Fourth Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>                | <b>L</b>  | <b>T</b>  | <b>P</b>  | <b>C</b>  |
|--------------------|------------------------------------|-----------|-----------|-----------|-----------|
| <b>4SA06</b>       | <b>Artificial Intelligence Lab</b> | <b>00</b> | <b>00</b> | <b>02</b> | <b>01</b> |

### **Course Learning Objectives:**

1. To present an overview of Artificial Intelligence (AI) principles and approaches.
2. To understand the historical evolution of Artificial Intelligence.
3. To learn various searching techniques and identify to address a particular problem.

### **Course Outcomes:**

After successfully completing the course, students will be able to-

1. Explain different types of uninformed search strategies and informed search strategies.
2. Illustrate different types of heuristic search strategies.
3. Design adversarial search and game theory.

### **List of Experiment:**

*Minimum 8 to 10 practical's are to be conducted based on subject 4SA01 – Artificial Intelligence Syllabus.*

## **B.Tech. Fourth Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>          | <b>L</b>  | <b>T</b>  | <b>P</b>  | <b>C</b>  |
|--------------------|------------------------------|-----------|-----------|-----------|-----------|
| <b>4SA07</b>       | <b>Operating Systems Lab</b> | <b>00</b> | <b>00</b> | <b>02</b> | <b>01</b> |

### **Course Learning Objectives:**

1. To make students aware of the kernel and shell structure of the operating systems.
2. To understand & analyze the concept of process & its scheduling techniques.
3. To understand comprehend memory management techniques.

### **Course Outcomes:**

After successfully completing the course, students will be able to-

1. Use his / her understanding / knowledge of Operating Systems so as to design / conduct experimentation related to given aim / objective
2. Use Computer Hardware / Software and other concern resources for conduction of practical.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given practical.

### **List of Experiment:**

*Minimum 8 to 10 practical's are to be conducted based on subject 4SA02 – Operating Systems Syllabus.*

## **B.Tech. Fourth Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>                      | <b>L</b>  | <b>T</b>  | <b>P</b>  | <b>C</b>  |
|--------------------|------------------------------------------|-----------|-----------|-----------|-----------|
| <b>4SA08</b>       | <b>Computer Skill Laboratory – 1 Lab</b> | <b>00</b> | <b>00</b> | <b>02</b> | <b>01</b> |

### **Course Learning Objectives:**

1. To be able to understand basics of Advance Tools and Technology.
2. To able to Design a program to solve the problems using modern tools.
3. To be able to identify scope and applications of advanced tool.

### **Course Outcomes:**

After successfully completing the course, students will be able to-

1. Use his / her understanding / knowledge of Modern Tools and Technology so as to design / conduct experimentation related to given aim / objective
2. Use Computer Hardware / Software and other concern resources for conduction of practical.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given practical.

### **List of Experiment:**

*Minimum 8 to 10 practical's are to be conducted based on advanced programming technology and tools.*

## **B.Tech. Fourth Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>                          | <b>L</b>  | <b>T</b>  | <b>P</b>  | <b>C</b>  |
|--------------------|----------------------------------------------|-----------|-----------|-----------|-----------|
| <b>4SA09</b>       | <b>Report Writing and Presentation Skill</b> | <b>00</b> | <b>00</b> | <b>04</b> | <b>02</b> |

### **Course Learning Objectives:**

1. To teach the skills using Information and Communication Technology tools.
2. To explain basics of Information Technology and report writing.
3. To explore the internet searching using ICT tools.

### **Course Outcomes:**

After successfully completing the course, students will be able to-

1. Describe the basic concepts of information and communication technology tools.
2. Write effective technical reports and procedures that cater to the needs of their target audience.
3. Apply the concepts of ICT and structure, write and verbally present a professional report.

### **List of Experiment:**

*Minimum 8 practical's are to be conducted based on software Tools and Technology related to Report Writing and Presentation Skill.*

1. Understand and demonstrate Technical Report Formatting in MS-Word.
2. Format Table of Content in MS-Word.
3. Perform Statistical Analysis in MS-Excel.
4. Perform Advanced Statistical Analysis in MS-Excel.
5. Create Presentation in MS Power Point with slide master, graphics, images, clip and multimedia features.
6. Installation of Latex Software on Windows Operating System.
7. Prepare project report using Latex.
8. Perform different operation using NumPy Library in Python.
9. Write commands and perform operation related Python programming.
10. Perform Statistical Tool based operation in R Programming.

## B.Tech Fourth Semester (Artificial Intelligence and Data Science)

### Honors

| Course Code | Course Title                          | L  | T  | P  | C  |
|-------------|---------------------------------------|----|----|----|----|
| 4SAH        | Advanced Programming for Data Science | 03 | 00 | 00 | 03 |

**Course Prerequisite :** Basic Knowledge of Programming and Introduction to Python.

**Course Learning Objectives :**

1. To develop proficiency in performing advanced mathematical and numerical operations using NumPy, enabling efficient handling of large-scale data and complex calculations.
2. To equip students with the skills to effectively arrange, manipulate, and analyze data using Pandas Series, fostering a strong foundation in data cleaning and transformation.
3. To provide students with the capability to import and manage data from CSV files into Pandas DataFrames, preparing them for real-world data handling and preprocessing tasks.
4. To enable students to execute various mathematical and statistical operations on Pandas DataFrames, facilitating comprehensive data analysis and insight extraction.

**Course Outcomes:**

After undergoing the course, the students will be able to:

1. Write mathematical operations by using NumPy.
2. Explain and discuss the data using Pandas Series.
3. Use the data from csv file into Pandas Dataframe.
4. Compare and contrast mathematical and statistical operations on Panadas DataFrame.
5. Evaluate the data using matplotlib library.
6. Construct and synthesize different plots using Seaborn.

|               |                                                                                                                                                                                                                                                                                                                                  |    |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|               | <b>Subject: (4SAH) Programming Language for Data Science</b>                                                                                                                                                                                                                                                                     | L  |
| <b>Unit-1</b> | <b>NumPy:</b> Introduction, Ndarray Object, Creating ndarrays, DataTypes for ndarrays, array attributes of numpy, Indexing and Slicing, Iterating over Array, Array Manipulation, Mathematical Functions, Arithmetic Operations, Statistical Functions, Sort Search and Counting Functions, Matrix Library, numpy.linalg module. | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-2</b> | <b>Pandas Introduction and Series:</b> Introduction, features and installation, Data Structures in Pandas: Series, DataFrame and Panel, Descriptive Statistics Series: Defining series from list,dictionary and numpy arrays, Indexing in series, Creating Series from Dataset with the pd.read_csv() and accessing rows using .head(), tail(), Attributes 40 in Series object (.values, .index, .size, .name, and .is_unique.dtype), Methods on a Series Objects (.sum(), .product(), .mean(), .idxmax(), .idxmin(), .value_counts(), .apply(), .map()), Sorting of series by value and index. | 07        |
| <b>Unit-3</b> | <b>Fundamentals and Basic Operations with DataFrames:</b> Introduction to DataFrames, DataFrame Attributes, Basic DataFrame Operations, DataFrame Methods, Sorting in DataFrame                                                                                                                                                                                                                                                                                                                                                                                                                 | 07        |
| <b>Unit-4</b> | <b>Advanced DataFrame Manipulations and Data Management:</b><br>1. Filtering the Data: Filtering Rows Based on Conditions, Methods for Filtering<br>2. Data Extraction and Indexing: Customize and Reset Index, Row Retrieval, Methods for Data Extraction<br>3. Advanced DataFrame Operations: MultiIndex, GroupBy, Merging, Joining, and Concatenating DataFrames<br>4. Importing and Exporting Data: Importing Excel/CSV Files, Exporting DataFrames to Excel/CSV Files                                                                                                                      | 07        |
| <b>Unit-5</b> | <b>Matplotlib:</b> Introduction to Matplotlib, Parts of Figure, Types of input to plotting functions, Introduction to Pyplot, Figure Class, Axes Class, Different types of plots (Line Graph, Bar Chart, Histogram, Scatter Plot, Pie Chart, Box Chart), Multiplots, The Lifecycle of Plot, Annotations Working with images : Importing image data into numpy arrays, plotting numpy arrays as image                                                                                                                                                                                            | 07        |
| <b>Unit-6</b> | <b>Seaborn:</b> Introduction and features of Seaborn, Seaborn vs Matplotlib, Figure Aesthetic, Color palette, Seaborn Plotting functions: relplot, catplot, Histogram, Bar Plot,Box Plot, Facet Grid, Pair Grid, HeatMap                                                                                                                                                                                                                                                                                                                                                                        | 07        |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>42</b> |

### Text Book:

1. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython By Wes McKinney

### Reference Books

1. Learning the Pandas Library by By Matt Harrison
2. Pandas for Everyone: Python Data Analysis By Daniel Y. Chen.

## **B.Tech. Fifth Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>                     | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------------|-----------------------------------------|----------|----------|----------|----------|
| <b>5SA01</b>       | <b>Data Analytics and Visualization</b> | 03       | 00       | 00       | 03       |

**Course Prerequisite:** Data Structures, Probability and Statistics, Programming Methodology and Python Programming.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Data Analytics and Visualization by being able to do each of the following:

1. To understand Data Analytics Life Cycle and Business Challenges.
2. To equip students with knowledge of big data analytics architecture, processes, and its application in business intelligence.
3. To develop competency in data visualization concepts, tools, and best practices for effective communication of data insights.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe the basics of business intelligence with respect to big data.
2. Discuss various components of Big Data Analytics, including its architecture, stack, and virtualization techniques.
3. Apply the Data Analytics Lifecycle to real-world problems by identifying relevant roles, tasks, and deliverables in each phase from data discovery to operationalization.
4. Design appropriate visualizations (charts, graphs, maps) for various types of data and analytic goals.
5. Evaluate visualization design principles and avoid common design mistakes.
6. Develop effective and ethical data dashboards that account for data integrity, visual clarity, and communication.

|               |                                                                                                                                                                                                                                                                                                                                              |           |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | <b>Subject: (5SA01) Data Analytics and Visualization</b>                                                                                                                                                                                                                                                                                     | <b>L</b>  |
| <b>Unit-1</b> | <b>Introduction to Big Data:</b> Business Intelligence, Decision Support Systems, Data Warehousing; Definition of Big Data, Big data characteristics & considerations, Introduction to Hadoop.                                                                                                                                               | <b>07</b> |
| <b>Unit-2</b> | <b>Big Data Analytics:</b> Big data analytics, Drivers of Big data analytics, Big Data Stack, Typical analytical architecture, Virtualization & Big Data, Virtualization Approaches, Business Intelligence Vs Data science, Applications of Big data analytics                                                                               | <b>07</b> |
| <b>Unit-3</b> | <b>Data Analytics Lifecycle:</b> Need of Data analytic lifecycle, Key roles for successful analytic projects, Various phases of Data Analytic Lifecycle: Discovery, Data Preparation, Model Planning, Model Building, Communicating Results, Operationalization.                                                                             | <b>07</b> |
| <b>Unit-4</b> | <b>Visualization:</b> Why Visualize Data? Types of Data, Data Visualization in Practice, Defining the Goal of Your Data Visualization, Scatter Charts and Bubble Charts, Line Charts, Column Charts, and Bar Charts, Maps, Tables versus Charts.                                                                                             | <b>07</b> |
| <b>Unit-5</b> | <b>Data Visualization and Design:</b> Preattentive Attributes, Gestalt Principles, Data Visualization Design Issues, Common Mistakes in Data Visualization Design, Color and Perception, Color Schemes and Types of Data, Custom Color using HSL Color System, Common Mistakes in the Use of Color in Data Visualization.                    | <b>07</b> |
| <b>Unit-6</b> | <b>Data Dashboards:</b> What Is a Data Dashboard? Data Dashboards Taxonomies, Data Dashboard Design. <b>Explaining Visually to Influence with Data:</b> Know your Audience and Message, Storytelling with Charts, Storytelling and Presentation Design. Missing Data and Data Errors, Biased Data, Adjusting for Inflation Deceptive Design. | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                 | <b>42</b> |

#### Text Book:

1. David Dietrich and Barry Hiller, “Data Science & Big Data Analytics”, EMC education services, Wiley publications, 2012.
2. J. Camm, J. Cochran, M. Fry and J. Ohlmann, “Data Visualization: Exploring and Explaining with Data”, Cengage publications, 2022.

#### Reference Books:

1. Business Intelligence – Data Mining and Optimization for Decision Making – Carlo Vercellis – Wiley Publications.
2. Big Data & Analytics – Seema Acharya & Subhashini Chellappan – Wiley Publications.
3. Big Data (Black Book) – DT Editorial Services – Dreamtech Press.
4. Data Mining: Concepts and Techniques Second Edition – Jiawei Han and Micheline Kamber – Morgan KaufMan Publisher.
5. Beginning R: The Statistical Programming Language – Mark Gardner – Wrox Publication.

## **B.Tech. Fifth Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>     | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------------|-------------------------|----------|----------|----------|----------|
| <b>5SA02</b>       | <b>Computer Network</b> | 03       | 00       | 00       | 03       |

**Course Prerequisite:** Programming Fundamentals, Data Structures, Operating Systems, Analog and Digital Electronics and Discrete Mathematics.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Computer Network by being able to do each of the following:

1. To provide students with fundamental knowledge of computer network architectures, models, and communication technologies.
2. To familiarize students with the principles, protocols, and operations of various network layers including application, transport, network, and data link.
3. To introduce the basics of network management and security practices in modern communication systems.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe the basic concepts of computer networks, network types, network architectures, topologies, OSI and TCP/IP models.
2. Explain the functionalities and protocols of the Application Layer.
3. Analyze the mechanisms of the Transport Layer, including connection-oriented and connectionless protocols.
4. Examine Network Layer services such as routing, addressing (IPv4, NAT), packet switching techniques, and congestion control, and assess their impact on network performance.
5. Apply Data Link Layer protocols and techniques for error detection and correction, media access control, and data link control.
6. Evaluate basic concepts of network management and security to monitor and secure communication systems using SNMP and other tools.

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | <b>Subject: (5SA02) Computer Network</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>L</b>  |
| <b>Unit-1</b> | <b>Introduction and Physical Layer:</b> Introduction to computer network, LAN, MAN, WAN, PAN, Ad-hoc Networks, Network Architectures- ClientServer, Peer to Peer, Network Topologies. Communication Models- OSI Model, TCP/IP Model, Design issues for layers. Transmission media- Guided media, unguided media. Transmission Modes. Network Devices- Hub, Repeater, Bridge, Switch, Router, Gateways.                                                                                  | <b>07</b> |
| <b>Unit-2</b> | <b>Application Layer:</b> Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP).                                                                                                                                                                                                                                                                | <b>07</b> |
| <b>Unit-3</b> | <b>Transport Layer:</b> Introduction, Transport-Layer Services, Connectionless and Connection Oriented Protocols, Transport-Layer Protocols: Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol (GBN), User Datagram Protocols: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, A TCP Connection.                                                                                                           | <b>07</b> |
| <b>Unit-4</b> | <b>Network Layer</b> Introduction to Network layer Network Layer Services: Packetizing, Routing and Forwarding, Other Services Packet Switching: Datagram Approach: Connectionless Service, Virtual-Circuit Approach: Connection-Oriented Service, Network Layer performance: Delay, Throughput, Packet Loss, Congestion Control, IPV4 Address: Address Space, Classful Addressing, Classless Addressing, Dynamic Host Configuration Protocol (DHCP), Network Address Resolution (NAT). | <b>07</b> |
| <b>Unit-5</b> | <b>Data Link Layer:</b> Introduction, Nodes & Links, Services, Two categories of link, Two sub-layers, Error detection and correction: Introduction, Block Coding, Cyclic codes, Checksum, Forward Error Correction, Data link control: DLC services, Data-Link Layer Protocol, HDLC, Point-To-Point Protocol, Media Access Control (MAC): Random Access, Controlled Access, Channelization.                                                                                            | <b>07</b> |
| <b>Unit-6</b> | <b>Network Management &amp; Security:</b> Introduction to Network Management, Configuration Management, Fault Management, Performance Management, Security Management, Accounting Management, SNMP: Managers and Agents, Management Components.                                                                                                                                                                                                                                         | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>42</b> |

**Text Book:**

1. Behrouz A. Forouzan: Data Communication and Networking, (5/e) (TMH).

**Reference Books:**

1. William Stallings: Data & Computer Communications, 6/e, Pearson Education
2. William L. Schweber: Data Communication, McGraw Hill
3. J.Freedy : Computer Communication & Networks, AEW Press
4. D. Corner: Computer Networks & Internet, Pearson Education.

## B.Tech. Fifth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title    | L  | T  | P  | C  |
|-------------|-----------------|----|----|----|----|
| 5SA03       | Compiler Design | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Basic knowledge of Programming in C, Discrete Mathematics, Operating Systems and Theory of Computation.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Compiler Design by being able to do each of the following:

1. To learn concepts of programming language translation and phases of compiler design
2. To understand the common forms of parsers.
3. To study concept of syntax directed definition and translation scheme for the representation of language.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe the fundamentals of compiler and various phases of compilers.
2. Design and implement LL and LR parsers
3. Solve the various parsing techniques like SLR, CLR, LALR.
4. Examine the concept of Syntax-Directed Definition and translation.
5. Assess the concept of Intermediate-Code Generation and run-time environment
6. Explain the concept code generation and code optimization.

|        | Subject: (5SA03) Compiler Design                                                                                                                                                                                                                                                                                                 | L  |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Introduction to Compilers:</b> Language Processor, The Structure of a Compiler. Lexical Analysis: The role of lexical analyzer, Input Buffering, Specification of tokens, Recognition of tokens, The lexical analyzer generator Lex, Finite Automata, From Regular Expressions to Finite Automata, State minimization of DFA. | 07 |
| Unit-2 | <b>Syntax Analysis:</b> The role of the parser, Review of context free grammar for syntax analysis: Parse Tree and Derivation, Ambiguity in Grammar, Elimination of left recursion and left factoring. Top-down parsing: recursive descent parsing, predictive parsers, Transition diagrams for predictive parsers, FIRST and    | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | FOLLOW, LL (1) Grammars, Construction of predictive parsing tables, Non recursive predictive parsing, Error recovery in predictive parsing.                                                                                                                                                                                                                                                                                                                                               |           |
| <b>Unit-3</b> | <b>Bottom up parsing:</b> Handle pruning, Stack implementation of Shift Reduce Parsing, conflicts during shift reduce parsing Introduction to LR parsing: Simple LR, Items and the LR(0) Automation, The LR-Parsing algorithm, Construction of SLR parsing table, More powerful LR Parsers: canonical LR(1) Items, Constructing LR(1) sets of items and canonical LR(1) parsing tables, Constructing LALR parsing tables, The parser generator Yacc.                                      | <b>07</b> |
| <b>Unit-4</b> | <b>Syntax Directed Translation:</b> Syntax directed definitions, Inherited and synthesized attributes, Evaluation orders of SDD's: Dependency Graphs, S-attributed definitions, L-attributed definition. Application of Syntax-Directed Translation: Construction of syntax trees. Syntax-directed Translation Schemes.                                                                                                                                                                   | <b>07</b> |
| <b>Unit-5</b> | <b>Intermediate-Code Generation:</b> Variants of Syntax Trees: Directed Acyclic Graphs (DAG), Three Address Code.<br><b>Run Time Environments:</b> Storage Organization, Static versus Dynamic Storage Organization, Stack Allocation of Space: Activation trees, Activation Records, Calling Sequences, Variable- Length data on stack. Access to Nonlocal Data on the Stack. Heap Manager: The Memory Manager. Introduction to Garbage Collection: Design Goals for Garbage Collectors. | <b>07</b> |
| <b>Unit-6</b> | <b>Code Generation:</b> Issues in Design of a Code generator, The Target Language, Address in the target code, Basic blocks and flow graphs. Optimization of Basic Blocks, Peephole Optimization and The Principal sources of Optimization.                                                                                                                                                                                                                                               | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>42</b> |

#### Text Book:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: "Principles, Techniques and Tools", Pearson Education Second Edition.

#### Reference Books:

1. D. M. Dhamdhere, Compiler Construction—Principles and Practice, (2/e), Macmillan India.
2. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman Compilers: "Principles, Techniques and Tools", Pearson Education (Low Price Edition).
3. V. Raghavan; Principles of Compiler Design, McGraw Hill Education (India), 2010.
4. Andrew Appel, Modern Compiler Implementation in C, Cambridge University press.
5. K C. Louden "Compiler Construction—Principles and Practice" India Edition, CENGAGE.
6. Bennett J.P., "Introduction to Compiling Techniques", 2/e (TMH).

## B.Tech. Fifth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title               | L  | T  | P  | C  |
|-------------|----------------------------|----|----|----|----|
| 5SA04PE1A   | Data and Internet Security | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Operating Systems, Discrete Mathematics, Data Structures and Fundamentals of Computers.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Data and Internet Security by being able to do each of the following:

1. Understand the foundational concepts and the need for data and internet security, including the principles, processes, and lifecycle of securing information systems.
2. Analyze and apply various cryptographic techniques, hashing methods, and secure communication protocols to ensure data integrity and confidentiality.
3. Evaluate and implement security solutions for email, IP networks, and end-user systems while managing security policies, risks, and governance frameworks.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe the fundamental principles and key components of data and information security.
2. Apply symmetric and asymmetric encryption techniques, hashing algorithms, and cryptographic tools to protect data.
3. Analyze the structure and security requirements of message authentication codes and cryptographic hash functions including HMAC and SHA.
4. Evaluate email security mechanisms to secure digital communication.
5. Assess and implement IP security protocols, intrusion detection systems, firewalls, and countermeasures against network-based threats.
6. Demonstrate the risk management processes and develop security policies, for secure software development and enterprise protection.

|        | Subject: (5SA04PE1A) Data and Internet Security                                                                                                                                                                                                            | L  |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Information Security:</b> Introduction, History of Information security, what is Security, Components of Information System, Balancing Information Security and Access, Approaches to Information Security Implementation, The Systems Development Life | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | Cycle, The Security Systems Development Life Cycle, Security Professionals and the Organization, Communities of Interest, Information Security: Is it an Art or a Science?                                                                                                                                                                                                                                                                                                                                         |           |
| <b>Unit-2</b> | <b>Cryptography:</b> Introduction, Foundations of Cryptology, Cipher Methods: Substitution Cipher, Transposition Cipher, Exclusive OR, Vernam Cipher, Book or Running Key Cipher, Hash Functions. Cryptographic Algorithms: Symmetric Encryption, Asymmetric Encryption, Examples, Encryption Key Size, Cryptographic Tools, Public-Key Infrastructure (PKI), Digital Signatures, Digital Certificates, Hybrid Cryptography Systems, Steganography, Protocols for Secure Communications, Attacks on Cryptosystems. | <b>07</b> |
| <b>Unit-3</b> | <b>Message Authentication and Hash Functions:</b> Message Authentication Codes and Hash Function: Message Authentication Requirements and Functions Requirements for Message Authentication Codes, Security of MACs, MACs Based on Hash Functions (HMAC), Cryptographic Hash Functions, Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Secure Hash Algorithm (SHA).                                                                                           | <b>07</b> |
| <b>Unit-4</b> | <b>Electronic Mail Security:</b> Internet Mail Architecture, Email Formats, Email Threats and Comprehensive Email Security, S/MIME, DNSSEC, DNS-Based Authentication of Named Entities, Sender Policy Framework, DomainKeys Identified Mail, Domain-Based Message Authentication, Reporting, and Conformance.                                                                                                                                                                                                      | <b>07</b> |
| <b>Unit-5</b> | <b>IP Security &amp; Network Endpoint Security:</b> IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange, Firewalls, Intrusion Detection Systems Malicious Software, Distributed Denial of Service Attacks.                                                                                                                                                                                                                            | <b>07</b> |
| <b>Unit-6</b> | <b>The Need for Data and Internet Security:</b> Introduction, Business Needs First, Threats, Attacks, Secure Software Development. Risk Management: Overview, Risk Identification, Risk Assessment, Risk Control Strategies, Selecting a Risk Control Strategy, Quantitative Versus Qualitative Risk Control Practices Recommended Risk Control Practices. Planning for Security, Information Security Planning and Governance, Information Security Policy, Standards, and Practices.                             | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>42</b> |

**Text Book:**

1. Michael E. Whitman, Herbert J. Mattord, "Principles of Information Security", CENGAGE Learning, 4th Edition.
2. William Stallings, "Cryptography and Network Security Principles and Practice" Eighth Edition, Pearson Edn. 2023.

**Reference Books:**

1. C.K.Shyamala, N Harini and, Dr T R Padmanabhan, "Cryptography and Network Security", Wiley India, 1st Edition.
2. Atul Kahate, "Cryptography and Network Security", McGraw Hill, 2nd Edition.
3. W. M. Arthur Conklin, "Principles of Computer Security", Greg White, TMH.

## B.Tech. Fifth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title               | L  | T  | P  | C  |
|-------------|----------------------------|----|----|----|----|
| 5SA04PE1B   | Probability and Statistics | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Applied Mathematics I and II.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Probability and Statistics by being able to do each of the following:

1. Understand the nature of data used for statistical methods and representation of data by various methods.
2. Provide a mathematical framework to access the chances of our predictions coming true.
3. Demonstrate an applicability of test of hypothesis.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe source and type of data in statistics.
2. Explain Data Representation Techniques to real-world example.
3. Apply empirical laws to given data from observation connecting to two variables.
4. Demonstrate the basics concept of probability distributions.
5. Inspect the basics of hypothesis testing.
6. Assess the best possible value of the parameters under specific conditions.

|        | Subject: (5SA04PE1B) Probability and Statistics                                                                                                                                                                                                                                                                                                                                                   | L  |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Introduction to data:</b> Introduction to statistics; sources of data, Types of Data, Concepts of a statistical population and sample from a population, qualitative and quantitative data, nominal and ordinal data, cross sectional and time series data, discrete and continuous data, frequency and non- frequency data. Different types of scales - nominal, ordinal, ratio and interval. | 07 |
| Unit-2 | <b>Data Representations:</b> Different types of presentations of data, data tabulation, describing categorical data, frequency distribution of categorical data, Describing numerical data, frequency table for numerical data, graphical representation, Frequency Distributions and Histograms, Pie Charts, Bar Charts, Pareto Chart, Scatter Plots (Degree of Association), Line Charts.       | 07 |

|               |                                                                                                                                                                                                                                                 |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-3</b> | <b>Analysis of Quantitative Data:</b> Mean, mode, median, standard deviation, coefficient of correlation, Line of regression.                                                                                                                   | <b>07</b> |
| <b>Unit-4</b> | <b>Probability Distribution:</b> Random variables, Continuous random variables, Probability distribution function, Binomial distribution, Poisson distribution, normal distribution.                                                            | <b>07</b> |
| <b>Unit-5</b> | <b>Testing of Hypothesis:</b> Types of errors, power of tests, most powerful tests, Neyman-pearson fundamental lemma and its application, Notion of Uniformly most powerful tests, Likelihood Ratio tests, Description and property of LR test. | <b>07</b> |
| <b>Unit-6</b> | <b>Sampling of Variables:</b> t-distribution, chi-squared distributions, cumulative distribution function, Conditional PDF, Central limit theorem, confidence interval, z-test, t-test, chi-squared test.                                       | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                    | <b>42</b> |

**Text Book:**

1. Ken Black, “Business Statistics for Contemporary Decision Making”, Wiley Student Edition, 2010.
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematics Statistics”, Sultan Chand and Sons, 2001.

**Reference Books:**

1. V.K.Rohatgi, A.K. Md.E.Saleh, “An Introduction to Probability and Statistics”, John Wiley, 2015.
2. R. Shanmugam, R. Chattamvelli, “Statistics for scientists and engineers”, John Wiley, 2015.

## B.Tech. Fifth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title         | L  | T  | P  | C  |
|-------------|----------------------|----|----|----|----|
| 5SA04PE1C   | Expert System Design | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Artificial Intelligence, Discrete Structures and Data Structures.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Expert System Design by being able to do each of the following:

1. To introduce the fundamentals of expert systems, including their architecture, types, and real-world applications.
2. To develop understanding of knowledge representation and inference mechanisms used in expert system design.
3. To familiarize students with methodologies for expert system development and critical issues such as explainability, ethics, and future trends.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe the characteristics, types, advantages, and limitations of expert systems and distinguish between rule-based and model-based systems.
2. Illustrate the architecture of expert systems and explain the role of components such as the inference engine and knowledge base.
3. Apply knowledge representation techniques such as rules, logic, and semantic networks to represent domain knowledge.
4. Analyze inference techniques including forward chaining, backward chaining, and reasoning under uncertainty.
5. Design the structure of a simple expert system using appropriate development methodologies and validation techniques.
6. Evaluate ethical concerns, explainability, and societal impacts related to the deployment of expert systems.

|               |                                                                                                                                                                             |           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | <b>Subject: (5SA04PE1C) Expert System Design</b>                                                                                                                            | <b>L</b>  |
| <b>Unit-1</b> | <b>Introduction to Expert Systems:</b> Overview of Artificial Intelligence and Expert Systems, Characteristics of Expert Systems, Applications of Expert System, Rule-based | <b>07</b> |

|               |                                                                                                                                                                                                                                                                                                                                                       |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | vs. Model-based Systems, Various Tools and Programming Languages use for Expert Systems, Limitations of Expert Systems, Advantages of Expert Systems.                                                                                                                                                                                                 |           |
| <b>Unit-2</b> | <b>Architecture of Expert Systems:</b> Importance of Expert Systems in Decision Making, Characteristics of a Good Expert System Architecture, Expert System Components: Knowledge Base, Inference Engine, User Interface, Forward and Backward Chaining Mechanisms, Types of Expert Systems (Rule-Based, Frame-Based, etc.)                           | <b>07</b> |
| <b>Unit-3</b> | <b>Knowledge Representation:</b> Knowledge Representation Techniques: Production Rules and Semantic Networks, Logic-Based Representation (Propositional and Predicate Logic), Knowledge Acquisition Techniques, Handling Incomplete and Uncertain Knowledge, Challenges in Knowledge Representation.                                                  | <b>07</b> |
| <b>Unit-4</b> | <b>Inference Mechanisms:</b> Role of the Inference Engine in Expert Systems, Decision Trees and Rule Matching in Inference Engines, Inference Techniques: Forward and Backward Chaining, Reasoning with Uncertainty: Bayesian Networks and Dempster-Shafer Theory.                                                                                    | <b>07</b> |
| <b>Unit-5</b> | <b>Expert System Design and Development Methodologies:</b> Principles of Expert System Design, The Role of the Knowledge Engineer, Knowledge Acquisition Strategies and Challenges, Knowledge Base Construction: Structuring Rules and Facts, Validation and Verification of Expert Systems, Purpose of Evaluation and Maintenance of Expert Systems. | <b>07</b> |
| <b>Unit-6</b> | <b>Advanced Topics and Ethical Considerations:</b> Introduction to Explainable AI (XAI) and its application, Ethical Concerns: Bias, Privacy, and Accountability, Societal Impacts of Expert Systems, Regulations and Standards for Expert Systems Deployment, Future Possibilities for Expert System.                                                | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                          | <b>42</b> |

#### **Text Book:**

1. Peter Jackson, " Principles of Expert Systems", Addison Wesley Publication, 2nd Edition, ISBN: 978-0201503725.
2. Ankur Taly and Christoph Molnar, "Explainable Artificial Intelligence: An Introduction to Interpretable Machine Learning", by , Publisher: Springer, 1st Edition (2021), ISBN: 978-3-030-83356-5.

#### **Reference Books:**

1. Frederick Hayes-Roth, Donald A. Waterman, and Douglas B. Lenat, "Building Expert Systems", Addison-Wesley Publication.
2. Bruce G. Buchanan and Edward H. Shortliffe, "Rule-Based Expert Systems: The MYCIN Experiments of the Stanford Heuristic Programming Project", Addison-Wesley Publication.
3. S. Rajasekaran and G. A. Vijayalakshmi Pai, "Knowledge-Based Systems", PHI Learning Publication.

## B.Tech. Fifth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title          | L  | T  | P  | C  |
|-------------|-----------------------|----|----|----|----|
| 5SAOE3B     | Business Intelligence | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Basic Knowledge of Programming.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Business Intelligence by being able to do each of the following:

1. To Study and Explain the Business Intelligence, Analytics and Decision Support system.
2. To study List the technologies for Decision making, automated decision systems.
3. Illustrate multi-criteria Decision-making systems, predictive modelling techniques.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Explain the components and architecture of Business Intelligence systems and their integration with decision support systems.
2. Describe the phases of decision-making to solve business problems using data-driven approaches.
3. Examine data warehousing solutions and use ETL tools effectively for business analytics.
4. Use data mining techniques and sentiment analysis tools to generate actionable insights for business applications.
5. Assess mathematical and spreadsheet-based models for model-driven decision support in uncertain environments.
6. Demonstrate the use of automated decision systems and expert systems in real-world business scenarios, including knowledge representation and inference techniques.

|        | Subject: (5SAOE3B) Business Intelligence                                                                                                                                                                                                                                                                              | L  |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Overview of Business Intelligence and Analytics:</b> Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics. | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                                       |           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-2</b> | <b>Decision Making:</b> Introduction and Definitions, Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components.                                                                          | <b>07</b> |
| <b>Unit-3</b> | <b>Descriptive and Predictive Analytics:</b> Data Warehousing Definitions and Concepts, Process Overview, Architectures, ETL Process, Data Warehouse Development and Implementation Issues. Data Mining Concepts, Applications, Process, Methods.                                                                                                                     | <b>07</b> |
| <b>Unit-4</b> | <b>Business Reporting and Performance Management:</b> Business Reporting Definitions and Concepts, Data and Information Visualization, Different Types of Charts and Graphs, Emergence of Data Visualization and Visual, Performance Dashboards, Business Performance Management and measurement, Balanced Scorecards, Six Sigma as a Performance Measurement System. | <b>07</b> |
| <b>Unit-5</b> | <b>Model-Based Decision Making:</b> Decision Support Systems modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spreadsheets, Decision Analysis with Decision Tables and Decision Trees, Multi-Criteria Decision Making with Pairwise Comparisons.                                             | <b>07</b> |
| <b>Unit-6</b> | <b>Automated Decision Systems and Expert Systems:</b> Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems, Introduction to Knowledge Management.                                                       | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                          | <b>42</b> |

#### **Text Book:**

1. Ramesh Sharda, Dursun Delen, Efraim Turban, J.E. Aronson, Ting-Peng Liang and David King, "Business Intelligence and Analytics: System for Decision Support", 10th Edition, Pearson Global Edition, 2013.

#### **Reference Books:**

1. Edward Mize, "Data Analytics: The Ultimate Beginner's Guide to Data Analytics", Venture Ink Publication, 2017.
2. Rick Sherman, "Business Intelligence Guidebook: From Data Integration to Analytics", Morgan Kaufmann Publication.
3. Ralph Kimball and Margy Ross, "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling", Wiley Publication.
4. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publication.
5. Russell Glass and Sean Callahan, "The Big Data-Driven Business: How to Use Big Data to Win Customers, Beat Competitors, and Boost Profits", Wiley Publication.

## **B.Tech. Fifth Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>       | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------------|---------------------------|----------|----------|----------|----------|
| <b>5SAOE3C</b>     | <b>Project Management</b> | 03       | 00       | 00       | 03       |

**Course Prerequisite: --**

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of the Project Management.

1. Students should be able to understand Project Life Cycle and Project Development Steps.
2. Student should be able to carry out project planning using tools like BAR chart.
3. Student should be able to carry out project planning using tools Networking methods like CPM, PERT etc.
4. Student should know process and need of PERT.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Apply the knowledge of management functions like planning, scheduling, executing and controlling to construction projects.
2. Solve and apply various planning tools like BAR chart to compare and control the project at the time of execution.
3. Demonstrate their capability for preparing the project networks to work out best possible time for completing the project.
4. To understand the concept of PERT.
5. Develop the various report writing techniques for successful completion of projects.
6. To understand importance and application of project management performance.

|               | <b>Subject: (5SAOE3C) Project Management</b>                                                                                                                                                                                                                           | <b>L</b>  |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-1</b> | <b>Project</b><br>Project, Project life cycle - Conceptual Phase, Planning Phase, Execution Phase, Termination phase, Project Stakeholders. Concept of feasibility study, Project identification considering objectives and SWOT analysis, Screening of Project Ideas. | <b>07</b> |

|               |                                                                                                                                                                                                                                                                                                                                                                                                           |           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-2</b> | <b>Introduction on Bar Chart:</b><br>Work break down structure, Project Monitoring & Controlling, Planning Tools: Basic concept of Bar Chart, their advantage, limitations, Numerical on Bar Chart.<br><br>Technical Feasibility: Process selection, Level of automation, Plant capacity, Acquiring technology, appropriate technology plant location, Equipment selection & procurement, Govt. policies. | <b>07</b> |
| <b>Unit-3</b> | <b>Networking:</b><br>Networking – Activity, Event, Dummy Activity, Fulerson’s numbering rule. Introduction of Critical Path Method four kinds of floats. Numerical on TF, FF, IF.                                                                                                                                                                                                                        | <b>07</b> |
| <b>Unit-4</b> | <b>PERT:</b><br>PERT: Concept, technique, three time estimates, average time, Critical path, slack computation, S.D, Variance, Numerical on PERT.                                                                                                                                                                                                                                                         | <b>07</b> |
| <b>Unit-5</b> | <b>Project Report:</b><br>Preparation of project report, Risk analysis, Sensitivity analysis, Methods of rising capital.                                                                                                                                                                                                                                                                                  | <b>07</b> |
| <b>Unit-6</b> | <b>Introduction to:</b> Projected balance sheet, Projected profit & loss statement, Projected cash flow, Rate of return, Discounted playback period, Return after taxes. Initial review, Performance analysis, Ratio analysis, Sickness, Project revival, Organization aspects.                                                                                                                           | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                              | <b>42</b> |

#### **Text Books:**

1. Kumar Neeraj Jha, “Construction Project Management- Theory and Practice”, Pearson Education, New Delhi ,17.

#### **Reference Books:**

1. K. K. Chitkara, “Construction Project Management- Planning, schedule and controlling”, second edition”, Tata McGraw Hill Education pvt. Ltd, New Delhi.
2. John M. Nicholas and Herman steven, “Project management for engineers, business and technology”, fourth edition, Routledge Publication, New York.
3. Prasanna Chandra, “Projects Planning, analysis, selection, financing, implementation and review”, 7th edition, McGraw Hill Education India Pvt. Ltd., New Delhi.
4. Harold Kerzner, “Project Management system approach to planning, scheduling and controlling, second.

## **B.Tech. Fifth Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>           | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------------|-------------------------------|----------|----------|----------|----------|
| <b>5SAOE3D</b>     | <b>Aptitude for Engineers</b> | 03       | 00       | 00       | 03       |

**Course Prerequisite:** Basic knowledge of Mathematics.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Aptitude for Engineers by being able to do each of the following:

1. To learn the basics of aptitude.
2. To learn the fundamentals of Quantitative Aptitude and Reasoning
3. To learn the simple techniques to solve problems on Aptitude and Reasoning.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Apply the knowledge of calculation speed in aptitude.
2. Understand the basic concepts of Arithmetic ability.
3. Understand the basic concepts of Quantitative ability.
4. Develop the General Mental Ability.
5. Acquire satisfactory competency in Reasoning.
6. Apply the basic concepts of Data Interpretation.

|               | <b>Subject: (5SAOE3D) Aptitude for Engineers</b>                                                                                                                                                     | <b>L</b>  |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-1</b> | <b>Basic of Aptitude:</b> Importance of calculation speed, Multiplication Techniques, Method to find out square and square roots, Cube and Cube roots, Simplification, Basic concepts of Percentage. | <b>07</b> |
| <b>Unit-2</b> | <b>Arithmetic Ability:</b> Basic concepts of Ratio and Proportion, Combination of Ratios, Numericals on ratio and Proportion, Introduction to Average and its numericals, Problems on Ages.          | <b>07</b> |
| <b>Unit-3</b> | <b>Quantitative Ability:</b> Basic concept of Time and work and its Numericals, Numericals on Pipe and Cisterns, Fundamental relationship between time, speed and distance, Problems on Train.       | <b>07</b> |

|               |                                                                                                                                                                                                                                                                                                         |           |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-4</b> | <b>General Mental Ability:</b> Series Completion: Types of Number Series, Alphabet Series, Alphanumeric Series, Continuous pattern series, Introduction to Coding – decoding, Letter coding, Direct letter coding, Number symbol coding, deciphering message word codes, Alpha-Numeric sequence puzzle. | <b>07</b> |
| <b>Unit-5</b> | <b>Reasoning Ability:</b> Basic concepts of Blood Relation, relation puzzle, coded relation, Important fact of a Clock and Calendar and its numericals, Problem on Directional sense.                                                                                                                   | <b>07</b> |
| <b>Unit-6</b> | <b>Data Interpretation:</b> Introduction to Tabulation and its numericals, Basic concepts of Bar Graph and its numericals, Fundamentals of Pie Chart.                                                                                                                                                   | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                            | <b>42</b> |

**Text Book:**

1. Quantitative Aptitude, Dr. R.S. Aggrawal, S. Chand & Company Ltd.
2. A Modern Approach to Verbal and Non Verbal Reasoning, Dr. R.S. Aggrawal, S. Chand & Company Ltd.

**Reference Books:**

1. A New Approach to Reasoning Verbal, Non-Verbal and Analytical, BS Sijwali and Indu Sijwali, Arihant Publication Ltd
2. Complete Mathematics Part-1, Rishikesh Kumar, Lucent Publication Ltd.
3. Quantitative Aptitude, Abhijit Guha, McGraw Hill
4. Quantitative Aptitude for CAT, Trishna, Pearson Publication.

## **B.Tech. Fifth Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>                         | <b>L</b>  | <b>T</b>  | <b>P</b>  | <b>C</b>  |
|--------------------|---------------------------------------------|-----------|-----------|-----------|-----------|
| <b>5SA05</b>       | <b>Data Analytics and Visualization Lab</b> | <b>00</b> | <b>00</b> | <b>02</b> | <b>01</b> |

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Data Analytics and Visualization Lab by being able to do each of the following:

1. To understand Data Analytics Life Cycle and Business Challenges
2. To understand Analytical Techniques and Statically Models
3. To understand Statically Modelling Language.

### **Course Outcomes:**

After successfully completing the course, students will be able to-

1. Use his / her understanding / knowledge of Data Analytics and Visualization so as to design / conduct experimentation related to given aim / objective
2. Use Computer Hardware / Software and other concern resources for conduction of practical.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given practical.

### **List of Experiment:**

*Minimum 8 to 10 practical's are to be conducted based on subject **5SA01 – Data Analytics and Visualization**.*

### **Software Tools:**

Python (Data Analysis and visualization Libraries: Pandas, NumPy, Matplotlib, Seaborn, Plotly, Bokeh) / R (Statistical computing, data visualization Packages: ggplot2, dplyr, Shiny, tidyr) / Tableau  
Microsoft Power BI / Grafana / IBM SPSS / SAS.

## **B.Tech. Fifth Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>         | <b>L</b>  | <b>T</b>  | <b>P</b>  | <b>C</b>  |
|--------------------|-----------------------------|-----------|-----------|-----------|-----------|
| <b>5SA06</b>       | <b>Computer Network Lab</b> | <b>00</b> | <b>00</b> | <b>02</b> | <b>01</b> |

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Computer Network Lab by being able to do each of the following:

1. To understand the working principle of various communication protocols.
2. To analyze error performance of a digital communication system in presence of noise and other interferences.
3. To learn various searching techniques and identify to address a particular problem.

### **Course Outcomes:**

After successfully completing the course, students will be able to-

1. Use his / her understanding / knowledge of Computer Network so as to design / conduct experimentation related to given aim / objective
2. Use Computer Hardware / Software and other concern resources for conduction of practical.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given practical.

### **List of Experiment:**

*Minimum 8 to 10 practical's are to be conducted based on subject 5SA02 – Computer Network.*

### **Software Tools:**

Python / C / C++ / Java / Network Simulator - 3 / Wireshark / Cisco Packet Tracer / GNS3 / NetSim.

## **B.Tech. Fifth Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>        | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------------|----------------------------|----------|----------|----------|----------|
| <b>5SA07</b>       | <b>Compiler Design Lab</b> | 00       | 00       | 02       | 01       |

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Compiler Design Lab by being able to do each of the following:

1. To Know the basic components of a Compiler.
2. To implement Lexical Analyzer and Syntax Analyzer using various compiler Tool.
3. To implement various parsing methods and code optimization techniques.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Use his / her understanding / knowledge of Compiler Design so as to design / conduct experimentation related to given aim / objective
2. Use Computer Hardware / Software and other concern resources for conduction of practical.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given practical.

### **List of Experiment:**

*Minimum 8 to 10 practical's are to be conducted based on subject 5SA03 – Compiler Design Syllabus.*

### **Software Tools:**

C / C++ / Lex / Yacc / Bison / Flex / ANTLR / Online IDEs (GDB / Replit / Ideone).

## **B.Tech. Fifth Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>                  | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------------|--------------------------------------|----------|----------|----------|----------|
| <b>5SA08</b>       | <b>Computer Skill Laboratory - 2</b> | 00       | 00       | 02       | 01       |

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Modern Tools and Technology by being able to do each of the following:

1. To provide practical exposure to the theoretical concepts of the chosen elective subject through hands-on experiments and simulations.
2. To develop the technical skills necessary to apply subject-specific tools, algorithms, and frameworks in real-world problem-solving.
3. To strengthen analytical thinking by engaging students in lab-based assignments, mini-projects, or case studies.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Use his / her understanding / knowledge of Modern Emerging Tools and Technology so as to design / conduct experimentation related to given aim / objective
2. Use Computer Hardware / Software and other concern resources for conduction of practical.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given practical.

### **List of Experiment:**

*Minimum 8 to 10 practical's are to be conducted based on subject 5SA04PE1A / B / C – Program Elective Course – 1 Syllabus or Modern Emerging Tools and Technology.*

### **Software Tools:**

NodeJS / Python / R / Brup Suite Community Edition / Wireshark / Kali Linux / Nmap / Open SSL / CLIPS / Drools / GNU Prolog / SWI Prolog / VSCode / Django / Flask

## **B.Tech. Fifth Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>                        | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------------|--------------------------------------------|----------|----------|----------|----------|
| <b>5SAH</b>        | <b>Advanced Data Science and Analytics</b> | 03       | 00       | 00       | 03       |

**Course Prerequisite:** Introduction to Python, Data Structures, Programming Methodology and Advanced Programming for Data Science.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Advanced Data Science and Analytics by being able to do each of the following:

1. To introduce foundational concepts and tools in data science, including Python programming and key libraries for analytics.
2. To equip students with techniques in data wrangling, machine learning (supervised & unsupervised), deep learning, and NLP for solving practical problems.
3. To develop an understanding of real-world data science applications, ethical implications, and emerging technologies like big data systems and recommender systems.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Recall the fundamental concepts of data science, including its life cycle, evolution, and essential Python libraries.
2. Explain data wrangling techniques and preprocessing methods such as handling missing data, feature scaling, and encoding in data pipelines.
3. Apply supervised machine learning algorithms like regression, decision trees, and SVM to real-world datasets using model evaluation techniques.
4. Analyze unsupervised learning models like clustering, dimensionality reduction (PCA, t-SNE), and association rules to uncover hidden patterns in datasets.
5. Evaluate the performance of deep learning and NLP models using various metrics and select appropriate models for sentiment analysis and text classification.
6. Design and develop a capstone mini-project by integrating concepts of time series forecasting, recommender systems, and ethical data practices using different tools.

|               |                                                                                                                                                                                                                                                                                                                                         |           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | <b>Subject: (5SAH) Advanced Data Science and Analytics</b>                                                                                                                                                                                                                                                                              | <b>L</b>  |
| <b>Unit-1</b> | Foundations of Data Science and Python for Analytics: Introduction to Data Science: Key concepts and evolution, Data Science life cycle and workflows, Python essentials for data science, Libraries: NumPy, Pandas, Matplotlib, Seaborn.                                                                                               | <b>07</b> |
| <b>Unit-2</b> | Data Wrangling and Preprocessing: Data collection, data cleaning and manipulation, Handling missing data, outliers, and categorical variables, Feature scaling, encoding, binning, and transformation, Feature engineering and dimensionality reduction (PCA).                                                                          | <b>07</b> |
| <b>Unit-3</b> | Supervised Learning Techniques: Linear and Logistic Regression, Decision Trees and Random Forests, Support Vector Machines (SVM), Model validation: k-Fold Cross Validation, Confusion Matrix, AUC-ROC.                                                                                                                                 | <b>07</b> |
| <b>Unit-4</b> | Unsupervised Learning and Clustering: Clustering methods: K-means, Hierarchical, DBSCAN, Association Rule Mining: Apriori and FP-Growth, Dimensionality Reduction: t-SNE, PCA revisited, Applications of unsupervised learning in customer segmentation.                                                                                | <b>07</b> |
| <b>Unit-5</b> | Deep Learning and NLP: Fundamentals of Neural Networks and Backpropagation, Introduction to Keras and TensorFlow, NLP basics: tokenization, stemming, lemmatization, Applications: Sentiment analysis, Text classification, Word embeddings.                                                                                            | <b>07</b> |
| <b>Unit-6</b> | Capstone Applications and Ethics in Data Science: Time Series Forecasting (ARIMA, LSTM overview), Recommender Systems: Collaborative Filtering and Content-Based, Big Data ecosystem overview (Hadoop, Spark basics), Data privacy, bias in AI, and ethical considerations, Capstone Mini-Project / Case Studies in various industries. | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                            | <b>42</b> |

**Text Book:**

1. Sebastian Raschka and Vahid Mirjalili, "Python Machine Learning", Packt Publishing, 3rd Edition, 2019, ISBN: 978-1789955750.

**Reference Books:**

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media Publishing, 2nd Edition, 2019, ISBN: 978-1492041139.
2. Nathan Marz and James Warren, "Big Data: Principles and Best Practices of Scalable Real-Time Data Systems", Manning Publications, 2015, ISBN: 9781617290343.
3. Rajkumar Buyya, Rodrigo N. Calheiros and Amir Vahid Dastjerdi, "Big Data: Principles and Paradigms", Publisher: Morgan Kaufmann.

## B.Tech. Sixth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title | L  | T  | P  | C  |
|-------------|--------------|----|----|----|----|
| 6SA01       | Data Science | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Discrete Mathematics, Data Structures, Programming Methodology and Introduction to Python.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Data Science by being able to do each of the following:

1. To understand the need of data science and Statistics
2. To understand and apply the different data modelling strategies.
3. To apply the learned concept for the skillful data management.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Explain basics and need of data science
2. Describe proficiency with statistical analysis of data.
3. Demonstrate loading of data and its manipulation for data science
4. Perform linear and multiple linear regression analysis.
5. Develop the ability to build and assess classification-based models
6. Evaluate outcomes and make decisions based on data.

|        | Subject: (6SA01) Data Science                                                                                                                                                                                                     | L  |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | Data Science, Relation with other fields, Computational Thinking, Skills for Data Science, Tools for Data Science, Issues of Ethics, Bias, and Privacy in Data Science<br>Data: Data types, Data Collection, Data Pre-processing. | 07 |
| Unit-2 | Techniques: Introduction, Data Analysis and Data Analytics, Descriptive Analysis, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics, Exploratory Analysis, Mechanistic Analysis                                  | 07 |

|               |                                                                                                                                                                                        |           |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-3</b> | Python: Introduction, Getting Access to Python, Basic Examples, Control Structures, Statistics Essentials: Importing Data, Plotting the Data, Correlation                              | <b>07</b> |
| <b>Unit-4</b> | Introduction: Machine Learning, Classification (Supervised Learning), Clustering (Unsupervised Learning), Regression, Gradient Descent, Linear Regression, Multiple Linear Regression. | <b>07</b> |
| <b>Unit-5</b> | Supervised Learning: Introduction, Logistic Regression, KNN, Decision Tree, Random Forest.                                                                                             | <b>07</b> |
| <b>Unit-6</b> | Unsupervised Learning: Introduction, Agglomerative Clustering, Divisive Clustering, Expectation Maximization (EM), Introduction to Reinforcement Learning.                             | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                           | <b>42</b> |

**Text Book:**

1. Chirag Shah," A Hands-on Introduction to Data Science ", Cambridge University Press (2020)  
ISBN:978- 1-108-47244-9.

**Reference Books:**

1. Foster Provost & Tom Fawcett, "Data Science for Business", O'Reilly Media Publication, 1st Edition, 2013, ISBN-13: 978-1449361327.
2. Foster Provost & Tom Fawcett, "Data Science for Business", O'Reilly Media Publication, 1st Edition, 2013, ISBN-13: 978-1449361327.
3. Rafael A. Irizarry, Introduction to Data Science: A Python Approach to Concepts, Techniques, and Applications" by CRC Press, 1st Edition, 2016, ISBN-13: 978-1491901415.
4. Joel Grus, "Data Science from Scratch: First Principles with Python" O'Reilly Media Publication, 1st Edition, 2019, ISBN: 978-1492041139.
5. Peter Bruce and Andrew Bruce, "Practical Statistics for Data Scientists" O'Reilly Media Publication, 2nd Edition, 2017, ISBN: 978-1491952962.

## B.Tech. Sixth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                      | L  | T  | P  | C  |
|-------------|-----------------------------------|----|----|----|----|
| 6SA02       | Design and Analysis of Algorithms | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Discrete Mathematics, Data Structures, Theory of Computations and Programming Methodology.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms by being able to do each of the following:

1. Understand algorithmic techniques and efficiency analysis.
2. Apply algorithm design techniques to solve computational problems.
3. Analyze algorithm efficiency using complexity measures.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe fundamental algorithmic concepts and asymptotic analysis.
2. Explain analysis techniques to control structures, loops, recursion, and solve recurrences.
3. Analyze advanced data structures and apply greedy algorithms to solve optimization problems.
4. Apply divide-and-conquer strategies to solve problems like sorting and matrix multiplication.
5. Evaluate graph algorithms like DFS, BFS, and hashing for different problem domains.
6. Create dynamic programming solutions and inspect NP-completeness concepts.

|        | Subject: (6SA02) Design and Analysis of Algorithms                                                                                                                                                                            | L  |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | Introduction to elementary algorithmic, problems & instances, Efficiency of algorithms, Average & worst-case analysis, Efficiency considerations. Elementary operations. Asymptotic notation, conditional asymptotic notation | 07 |
| Unit-2 | <b>Analysis of algorithms:</b> Control structures analysis; sequencing, 'for' loops, recursive calls, while & repeat loops, Average-case analysis, amortized analysis. Solving recurrences.                                   | 07 |

|               |                                                                                                                                                                                                                           |           |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-3</b> | <b>Advanced data structures:</b> Heap, Binomial heaps, disjoint structures. Greedy algorithms: general characteristics. Graphs: minimum spanning trees, Kruskals' algorithm, Shortest-path algorithms, Knapsack Problem.  | <b>07</b> |
| <b>Unit-4</b> | <b>Divide-and-Conquer:</b> Introduction, Multiplying integers, general template, binary search, Sorting: Merge-sort, Quicksort. Insertion sort, Heap sort, Finding median, Matrix multiplication, Cryptography.           | <b>07</b> |
| <b>Unit-5</b> | <b>Exploring Graphs:</b> Traversing trees; Depth-first search for undirected & directed graphs. Breadth-first search. Branch-and-bound. The minimax problem, Hashing.                                                     | <b>07</b> |
| <b>Unit-6</b> | <b>Dynamic programming:</b> Binomial coefficients & world series examples. Principle of optimality, Knapsack problem, Shortest-paths, Memory functions. Introduction to Completeness; class N & NP. Polynomial reduction. | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                              | <b>42</b> |

**Text Book:**

1. Aho, Hopcroft & Ullman "The Design & Analysis of Computer Algorithms' (Addison-Wesley).

**Reference Books:**

1. E. Horowitz and S. Sahani, "Fundamental Algorithms", Galgotia Publication, 2nd Edition, 2007.
2. T. H. Cormen, C. E. Leiserson and R. L. Rivest, "Introduction to Algorithms", McGraw-Hill Publication, 3rd Edition, 2009.
3. D. E. Knuth, "Fundamental Algorithms", Addison-Wesley Publication, 1st Edition, 1997.
4. G. Brassard and P. Bratley, "Fundamentals of Algorithmics", PHI Publication, 1st Edition, 1996.

## B.Tech. Sixth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                | L  | T  | P  | C  |
|-------------|-----------------------------|----|----|----|----|
| 6SA03       | Database Management Systems | 02 | 00 | 00 | 02 |

**Course Prerequisite:** Discrete Mathematics, Data Structures, Programming Methodology and Basic Knowledge of Programming.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Database Management Systems by being able to do each of the following:

1. Understand the fundamental concepts of databases and database management systems
2. Master relational database operations and SQL query language
3. Apply principles of database design, normalization, and transaction management.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe Database Management Systems architecture and its components.
2. Discuss relational operations using relational algebra and SQL.
3. Develop normalized databases to reduce redundancy and improve integrity.
4. Analyze queries for better performance.
5. Inspect database transaction management with ACID properties.
6. Design concurrency control and recovery techniques.

|        | Subject: (6SA03) Database Management Systems                                                                                                                                                                                       | L  |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Introduction to DBMSs:</b> Databases and Database Users, Characteristics of the Database Approach, Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence, Database Languages.                    | 05 |
| Unit-2 | <b>Relational Algebra, SQL:</b> Relational query languages, relational operators, The Relational Algebra, Overview of SQL query language, Basic Structure of SQL queries, Set Operations, Null Values, Aggregate Functions, Views. | 05 |

|               |                                                                                                                                                                                                                                            |           |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-3</b> | <b>Normalization:</b> Database Design and Normalization Functional Dependencies, Properties of Relational Decomposition, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form. | <b>05</b> |
| <b>Unit-4</b> | <b>Query Processing and Query Optimization:</b> Overview, Measures of Query Cost, Query Optimization: Overview, Transformation of Relational Expressions, Choice of Evaluation Plans, Materialized Views.                                  | <b>05</b> |
| <b>Unit-5</b> | <b>Transaction Management:</b> Transaction Concept, Simple transaction model, Storage structure, Transaction Atomicity and Durability, transaction isolation, Serializability, transaction isolation and atomicity                         | <b>05</b> |
| <b>Unit-6</b> | <b>Concurrency Control and Recovery System:</b> Lock-Based Protocols, Deadlock Handling, Multiple Granularities, Timestamp- Based Protocols, Validation-Based Protocols                                                                    | <b>05</b> |
|               | <b>Total</b>                                                                                                                                                                                                                               | <b>30</b> |

**Text Book:**

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, Sixth Edition, McGraw Hill.

**Reference Books:**

1. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill
2. Shamkant B. Navathe, RamezElmasri, Database Systems, Pearson Higher Education
3. Garcia-Molina, Ullman, Widom: Database System Implementation, Pearson education.
4. S. K. Singh: Database Systems, Concepts, Design and Applications, Pearson Education.
5. G.K. Gupta: Database Management Systems, McGraw Hill.
6. Toledo and Cushman: Database Management Systems, (Schaum 's Outlines).

## B.Tech. Sixth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title   | L  | T  | P  | C  |
|-------------|----------------|----|----|----|----|
| 6SA04PE2A   | Cyber Security | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Computer Network and Data and Internet Security.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Cyber Security by being able to do each of the following:

1. Introduce the fundamental concepts of cyber security, including types of cybercrimes, cyber laws, and ethical considerations.
2. Familiarize students with common cyber threats, vulnerabilities, attack methods, and security challenges in both wired and wireless environments.
3. Provide knowledge and skills in cyber forensic tools and techniques for investigating and analyzing cyber incidents across different platforms and devices.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe the nature and scope of cybercrimes and interpret key legal frameworks such as the IT Act 2000 and international cyber laws.
2. Explain various cyber offenses including social engineering, cyberstalking, botnets, and cloud-based attacks.
3. Analyze security vulnerabilities and threats related to mobile and wireless devices.
4. Identify and evaluate the tools and techniques used in cyber-attacks.
5. Apply knowledge of computer forensics to conduct digital investigations.
6. Examine forensic challenges in handheld and mobile devices and demonstrate the use of forensic tools for data extraction, preservation, and analysis.

|        | Subject: (6SA04PE2A) Cyber Security                                                                                                                                                                                                                                                                         | L  |
|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | Introduction to Cybercrime: Introduction, Cybercrime, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era. | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-2</b> | Cyber Offenses: Introduction, Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrime, Botnets, Attack Vector, Cloud Computing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>07</b> |
| <b>Unit-3</b> | Cybercrime: Mobile and Wireless Devices Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Cards Frauds in Mobile and Wireless Computing, Security Challenges posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implementations for Organizations, Organizational Measures for Handling Mobile, Devices Related Security Issues Organizational Security Policies and Measures in Mobile Computing, Laptops.                                                                                                                                                              | <b>07</b> |
| <b>Unit-4</b> | Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>07</b> |
| <b>Unit-5</b> | Computer Forensics: Introduction, Historical Background of Cyberforensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, · Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography.                                                                                                                                                                                                                                                           | <b>07</b> |
| <b>Unit-6</b> | Forensics of Hand-Held Devices: Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics, Introduction to Forensics of Hand-Held Devices, Understanding Cell Phone Working Characteristics, Hand-Held Devices and Digital Forensics, Toolkits for Hand-Held Device Forensics, Forensics of iPods and Digital Music Devices, An Illustration on Real Life Use of Forensics, Techno-Legal Challenges with Evidence from Hand-Held Devices, Organizational Guidelines on Cell Phone Forensics | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>42</b> |

**Text Book:**

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley India Pvt Ltd.

**Reference Books:**

1. Nina Godbole, “Information Systems Security”, Wiley India, New Delhi.
2. Kenneth J. Knapp, “Cyber Security & Global Information Assurance”, Information Science Publishing.
3. James Graham, Richard Howard, Ryan Olson, “Cyber Security Essentials” CRC Press.
4. Jeetendra Pande, “Introduction to Cyber Security” Uttarakhand Open University, 2017.

## B.Tech. Sixth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                   | L  | T  | P  | C  |
|-------------|--------------------------------|----|----|----|----|
| 6SA04PE2B   | Programming with Large Dataset | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Discrete Mathematics, Data Structures, Programming Methodology, Python Programming and Probability and Statistics.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Programming with Large Datasets by being able to do each of the following:

1. Understand the fundamental concepts of big data and distributed computing frameworks.
2. Develop proficiency in programming and data processing using Python and scalable tools.
3. Apply scalable machine learning techniques and data storage solutions for large datasets.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe the challenges and solutions for processing large datasets.
2. Explain with distributed computing frameworks for big data processing.
3. Illustrate data preprocessing, cleaning, and visualization for large datasets.
4. Examine scalable machine learning algorithms for large datasets.
5. Inspect data storage, query performance, and indexing for large datasets.
6. Design big data tools and techniques to real-world case studies and industry applications.

|        | Subject: (6SA04PE2B) Programming with Large Dataset                                                                                                                                                                                                                         | L  |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Introduction to Big Data and Programming for Large Datasets:</b> Introduction to Big Data, Challenges of processing large datasets, Overview of tools and frameworks (Hadoop, Spark, etc.), Introduction to MapReduce programming, Data preprocessing for large datasets | 07 |
| Unit-2 | <b>Distributed Computing Frameworks:</b> Introduction to distributed computing, Hadoop ecosystem (HDFS, YARN, Hive, Pig), Introduction to Apache Spark, Data partitioning and shuffling in distributed systems, Data storage formats for large datasets (Parquet, Avro)     | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                    |           |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-3</b> | <b>Data Processing Using Python:</b> Python for data processing (Pandas, NumPy) Introduction to Dask for parallel computing in Python, Handling missing and noisy data, Visualizing large datasets using Matplotlib and Seaborn.                                                                                                                   | <b>07</b> |
| <b>Unit-4</b> | <b>Scalable Machine Learning with Large Datasets:</b> Challenges in machine learning with large datasets, Introduction to scalable ML libraries (MLlib, H2O.ai, TensorFlow), Dimensionality reduction techniques (PCA, t-SNE), Distributed model training and evaluation.                                                                          | <b>07</b> |
| <b>Unit-5</b> | <b>Data Storage and Query Optimization:</b> Overview of databases for large-scale data (NoSQL, SQL), Introduction to MongoDB and Cassandra, Query optimization techniques for large datasets, Indexing and partitioning for faster queries                                                                                                         | <b>07</b> |
| <b>Unit-6</b> | <b>Case Studies and Industry Applications:</b> Case studies on large-scale data Processing in real-world applications (e.g., e-commerce, healthcare, finance). Real-time data streaming with Kafka and Spark Streaming, Introduction to cloud services for big data (AWS, Google Cloud, Azure), Ethics and challenges in large-scale data handling | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                       | <b>42</b> |

#### **Text Book:**

1. Foster Provost and Tom Fawcett, Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking", O'Reilly Media Publication, 2013, ISBN: 978-1449361327.
2. Nathan Marz, "Big Data: Principles and Best Practices of Scalable Real-Time Data Systems", Manning Publications, 2015, ISBN: 9781617290343.

#### **Reference Books:**

1. Tom White, "Hadoop: The Definitive Guide", O'Reilly Media, 2015, ISBN: 9781491901632
2. Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia, "Learning Spark: Lightning-Fast Data Analytics", O'Reilly Media, 2015, ISBN: 9781449358624
3. Wes McKinney, "Python for Data Analysis", O'Reilly Media, 2017 (2nd Edition), ISBN: 9781491957660
4. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", O'Reilly Media, 2019 (2nd Edition), ISBN: 9781492032649
5. Martin Kleppmann, "Designing Data-Intensive Applications", O'Reilly Media, 2017, ISBN: 9781449373320
6. Tyler Akidau, Slava Chernyak, Reuven Lax, "Streaming Systems: The What, Where, When, and How of Large-Scale Data Processing", O'Reilly Media, 2018, ISBN: 9781491983874.

## B.Tech. Sixth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                    | L  | T  | P  | C  |
|-------------|---------------------------------|----|----|----|----|
| 6SA04PE2C   | Applied Artificial Intelligence | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Basic Programming Knowledge, Artificial Intelligence and Data Structures.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Applied Artificial Intelligence by being able to do each of the following:

1. To apply AI techniques to solve real-world problems.
2. To integrate AI models into practical applications such as natural language processing (NLP), computer vision, and robotics.
3. To evaluate the ethical implications and societal impact of AI technologies.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe the evolution of AI and explain basic search strategies and intelligent agent behaviors.
2. Explain machine learning techniques including classification, regression, clustering, and reinforcement learning.
3. Examine deep learning models using neural networks and pre-trained architectures like CNNs.
4. Investigate NLP techniques such as text classification, sentiment analysis, and sequence modeling using LSTM or Transformers.
5. Recommend AI applications in key industries and formulate planning problems with classical and real-world techniques.
6. Evaluate ethical considerations and the societal impact of AI technologies and propose strategies for responsible AI use.

|        | Subject: (6SA04PE2C) Applied Artificial Intelligence                                                                                                                                                                                              | L  |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Introduction to Artificial Intelligence:</b> Definition and History of AI, Machine Learning vs Deep Learning, Applications of AI in the Modern World, Problem Solving Agents, Search Strategies: Depth-first, Breadth-first, Heuristic Search. | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-2</b> | <b>Machine Learning Fundamentals:</b> Supervised Learning (Regression, Classification), Unsupervised Learning (Clustering, Association), Reinforcement Learning, Evaluation Metrics: Accuracy, Precision, Recall, F1-Score, ROC-AUC, Overfitting and Underfitting, Cross-Validation.                                                                                                                                                      | <b>07</b> |
| <b>Unit-3</b> | <b>Deep Learning and Neural Networks:</b> Basics of Neural Networks and Deep Learning, Backpropagation, Convolutional Neural Networks (CNN) for Image Recognition, Transfer Learning and Pre-trained Models, Introduction to Tools and Libraries for Deep Learning.                                                                                                                                                                       | <b>07</b> |
| <b>Unit-4</b> | <b>Natural Language Processing (NLP):</b> Text Preprocessing and Tokenization, Sentiment Analysis and Text Classification, Named Entity Recognition (NER), Sequence Models for NLP (LSTM, Transformers), NLP Applications: Chatbots, Machine Translation, and Text Summarization.                                                                                                                                                         | <b>07</b> |
| <b>Unit-5</b> | <b>AI in Real-world Applications and Planning:</b> AI in Healthcare: (Diagnosis, Drug Discovery, and Personalized Medicine), AI in Finance: (Fraud Detection, Algorithmic Trading, Credit Scoring), AI in Agriculture: (Crop Monitoring, Precision Farming, Pest Detection)<br>Planning Problem Formulation, Classical Planning Techniques (STRIPS, Partial Order Planning), Planning and Acting in the Real World (Uncertainty Handling) | <b>07</b> |
| <b>Unit-6</b> | <b>AI Ethics and Future Trends:</b> Ethical Issues in AI: Bias, Privacy, and Accountability, Social and Economic Impact of AI Technologies, Autonomous Systems and Decision-Making, AI in Governance, Security, and Privacy, Future Directions in AI: AGI, AI in Robotics, AI for Sustainability.                                                                                                                                         | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>42</b> |

#### **Text Book:**

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education / Prentice Hall Publication, 2020, ISBN: 978-0134610993.
2. François Chollet, "Deep Learning with Python" (Second Edition), Publisher: Manning Publications, Publication Year: 2021, ISBN: 978-1617296864.

#### **Reference Books:**

1. Melanie Mitchell, Artificial Intelligence: A Guide for Thinking Humans, Farrar, Straus and Giroux Macmillan Publication, 1st Edition, 2019, ISBN: 978-0374257835
2. Mariya Yao, Adelyn Zhou and Marlene Jia, "Applied Artificial Intelligence: A Handbook for Business Leaders", TOPBOTS Publication, 1st Edition, 2018.
3. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Media, Inc. Publication, 2019.

## B.Tech. Sixth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title     | L  | T  | P  | C  |
|-------------|------------------|----|----|----|----|
| 6SA05PE3A   | Network Security | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Discrete Mathematics, Data and Internet Security, Basic Knowledge of Programming and Programming Methodology.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Network Security by being able to do each of the following

1. To understand the fundamental principles of network security, cryptography, and classical encryption techniques in the context of secure communication systems.
2. To analyze and apply symmetric and asymmetric encryption algorithms, digital signature schemes, and security protocols to protect data and communication.
3. To explore and evaluate the security challenges and solutions in modern networking environments, including web, wireless, cloud, and IoT infrastructures.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Explain the core concepts of computer and network security, including OSI security architecture, security services, mechanisms, and classical encryption techniques.
2. Apply basic and advanced cryptographic techniques such as substitution, transposition, symmetric and asymmetric key encryption, and steganography to secure information.
3. Analyze and compare symmetric key encryption algorithms like DES and AES, and their principles, structures, and operations including block and stream ciphers.
4. Evaluate the working and security of asymmetric encryption algorithms such as RSA, ElGamal, Diffie-Hellman, and ECC, along with digital signature schemes.
5. Assess network and internet security mechanisms such as SSL, TLS, HTTPS, SSH, and wireless network protocols including IEEE 802.11 standards.
6. Identify and address security risks in cloud and IoT systems using appropriate security models.

|               |                                                                                                                                                                                                                                                                                   |    |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|               | <b>Subject: (6SA05PE3A) Network Security</b>                                                                                                                                                                                                                                      | L  |
| <b>Unit-1</b> | <b>Introduction to Network Security:</b> Computer Security Concepts, The OSI Security Architecture- Security Services, Security Mechanisms and Security attacks, A Model for Network Security – Classical Encryption Technique – Symmetric Cipher Model – Substitution Technique. | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                             |           |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-2</b> | <b>Cryptography Concepts and Techniques:</b> Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.                                     | 07        |
| <b>Unit-3</b> | <b>Symmetric key Ciphers:</b> Traditional Block Cipher Structures, Data Encryption Standard (DES), DES Example, Block Cipher Principles, Advanced Encryption Standard (AES), AES Structure, AES Transformation Function, AES Example, Block cipher operation, Stream ciphers.                                                                               | 07        |
| <b>Unit-4</b> | <b>Asymmetric key Ciphers:</b> Principles of public key cryptosystems, RSA Algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, and Elliptic Curve Cryptography, Digital Signatures, Schnorr and NIST Digital Signature Scheme.                                                                                                                    | 07        |
| <b>Unit-5</b> | <b>Network and Internet Security:</b> Transport-level Security: Web security considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell (SSH). Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security.                                        | 07        |
| <b>Unit-6</b> | <b>Cloud and IoT Security:</b> Cloud Security and IoT Security: Cloud Computing, Cloud Security Concepts, Cloud Security Risks and Countermeasures, Cloud Security as a Service, An Open-Source Cloud Security Module. Internet of Things (IoT) Security: The Internet of Things, IoT Security Concepts and Objectives, An Open-Source IoT Security Module. | 07        |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                | <b>42</b> |

#### Text Books:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6<sup>th</sup> and 8<sup>th</sup> Edition.
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition.

#### Reference Books:

1. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
2. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
3. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
4. Introduction to Network Security: Neal Krawetz, CENGAGE Learning
5. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

## B.Tech. Sixth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                     | L  | T  | P  | C  |
|-------------|----------------------------------|----|----|----|----|
| 6SA05PE3B   | Data Mining and Data Warehousing | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Discrete Mathematics, Data Structures, Programming Methodology, Data Analytics and Visualization and Business Intelligence.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Data Mining and Data Warehousing by being able to do each of the following:

1. To introduce fundamental concepts, methodologies, and applications of data mining and its role in extracting knowledge from large datasets.
2. To enable students to understand the architecture, modeling, and design strategies of data warehouses for analytical processing.
3. To provide knowledge of advanced techniques and design aspects of conceptual, logical, and physical data warehouse modeling including OLAP operations and performance optimization.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe the need, applications, and challenges of data mining and data mining techniques.
2. Discuss data preprocessing techniques such as data cleaning, integration, transformation.
3. Examine the core architecture and components of a data warehousing, and OLAP operations using multidimensional models.
4. Illustrate conceptual models for data warehouse design.
5. Inspect logical models of data warehouse design.
6. Evaluate physical data warehouse design such as materialized views, indexing strategies and data cube computation.

|        | Subject: (6SA05PE3B) Data Mining and Data Warehousing                                                                                                                                                                             | L  |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Introduction to Data Mining:</b> Data Mining, Need of Data Mining? What Kinds of Data Can Be Mined? What Kinds of Patterns Can Be Mined? Which Technologies Are Used? Applications of data mining, Major Issues in Data Mining | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-2</b> | <b>Introduction to Data &amp; Data Preprocessing:</b> Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.                                                                                                                         | <b>07</b> |
| <b>Unit-3</b> | <b>Introduction To Data Warehousing:</b> A Historical Overview of Data Warehousing, Spatial and Spatiotemporal Data Warehouses, New Domains and Challenges, Data Warehouse Concepts: Multidimensional Model, OLAP Operations, Data Warehouse Architecture, Data Warehouse Design, Business Intelligence Tools.                                                                                                                                          | <b>07</b> |
| <b>Unit-4</b> | <b>Conceptual Data Warehouse Design:</b> Conceptual Modeling of Data Warehouses, Hierarchies, Balanced Hierarchies, Unbalanced Hierarchies, Generalized Hierarchies, Alternative Hierarchies, Parallel Hierarchies, Nonstrict Hierarchies, Advanced Modeling Aspects, Facts with Multiple Granularities, Many-to-Many Dimensions.                                                                                                                       | <b>07</b> |
| <b>Unit-5</b> | <b>Logical Data Warehouse Design:</b> Logical Modeling of Data Warehouses, Relational Data Warehouse Design, Time Dimension, Logical Representation of Hierarchies, Balanced Hierarchies, Unbalanced Hierarchies, Generalized Hierarchies, Alternative Hierarchies, Parallel Hierarchies, Nonstrict Hierarchies, Advanced Modeling Aspects, Facts with Multiple Granularities, Manyto-Many Dimensions, Slowly Changing Dimensions, SQL/OLAP Operations. | <b>07</b> |
| <b>Unit-6</b> | <b>Physical Data Warehouse Design:</b> Physical Modeling of Data Warehouses, Materialized Views, Algorithms Using Full Information, Algorithms Using Partial Information, Data Cube Maintenance, Computation of a Data Cube, PipeSort Algorithm, Indexes for Data Warehouses, Bitmap Indexes, Bitmap Compression, Join Indexes, Evaluation of Star Queries.                                                                                             | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>42</b> |

**Text Book:**

1. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, Elsevier, 3rd Edition, 2006, ISBN: 9780123814791
2. Alejandro Vaisman and Esteban Zimányi, "Data Warehouse Systems: Design and Implementation", Springer-Verlag Berlin Heidelberg, 2014, ISBN: 9783642546556.

**Reference Books:**

1. Arun K. Pujari, "Data Mining Techniques", Orient BlackSwan/Universities Press, 3rd Edition, 2013, ISBN: 9788173718126
2. Paulraj Ponniah, "Data Warehousing Fundamentals", John Wiley & Sons, 2001, ISBN: 9780471412540
3. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw-Hill, 35th Reprint, 2016, ISBN: 9780070587410.

**B.Tech Sixth Semester (Artificial Intelligence and Data Science)**

| Course Code | Course Title              | L  | T  | P  | C  |
|-------------|---------------------------|----|----|----|----|
| 6SA05PE3C   | Artificial Neural Network | 03 | 00 | 00 | 03 |

**Course Prerequisite:** Discrete Mathematics, Data Structures, Artificial Intelligence and Expert System Design.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Artificial Neural Network by being able to do each of the following:

1. To introduce the structure and functioning of biological and artificial neurons, and the foundational architectures and models in neural networks.
2. To develop an understanding of supervised and unsupervised learning algorithms, including back propagation, Hopfield networks, and adaptive resonance theory.
3. To explore advanced neural network models such as deep learning, CNNs, auto encoders, and generative models, and their applications in real-world AI systems.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Explain basics and need of data science
2. Describe proficiency with statistical analysis of data.
3. Demonstrate loading of data and its manipulation for data science
4. Perform linear and multiple linear regression analysis.
5. Develop the ability to build and assess classification-based models
6. Evaluate outcomes and make decisions based on data.

|        | Subject: (6SA05PE3C) Artificial Neural Network                                                                                                                                                                                                                                                                            | L  |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit-1 | <b>Foundations of Neural Networks:</b><br>Human Brain and Nervous System, Introduction to Artificial Neural Network, Model of an Artificial Neuron, Early Neural Networks, Activation function, Mculloch Pitts neuron model, ADALINE, MADALINE, Learning methods for Neural Networks, Fixed Increment Learning Algorithm. | 07 |

|               |                                                                                                                                                                                                                                                                                                                                                                                   |           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Unit-2</b> | <b>Backpropagation:</b><br>Architecture of Backpropagation Network, perceptron model, Single layer Artificial Neural Network, Model for Multilayer Perceptron, Back propagation algorithm, Back Propagation learning, training of network, calculation of error, Method of steepest descent algorithm, effect of learning rate, adding momentum term.                             | <b>07</b> |
| <b>Unit-3</b> | <b>Associative Memory:</b><br>Autocorrelation, Hetro correlation, multiple training encoding strategy, Hopfield Network, error performance of Hopfield network, Exponential BAM, Associative memory for real coded pattern pairs, character recognition application.                                                                                                              | <b>07</b> |
| <b>Unit-4</b> | <b>Adaptive Resonance Theory:</b><br>Cluster structure, vector quantization, classical ART network, simplifier ART architecture, ART1: architecture, Special features and algorithm, ART2: architecture, Special features and algorithm, character recognition using ART1                                                                                                         | <b>07</b> |
| <b>Unit-5</b> | <b>Rectified Linear Unit :</b><br>Machine Learning and Deep Learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Deep Learning Applications.                                                                                                 | <b>07</b> |
| <b>Unit-6</b> | <b>Convolutional Networks:</b><br>Convolutional Neural Network (CNN) architectures, different types of CNN, pooling operation in CNN, Under complete Autoencoders, Denoising Autoencoder, Encoder–Decoder model, Bidirectional Recurrent Neural Networks (Bi-RNNs) architecture, Long short-term memory (LSTM), Deep Belief Network working, Directed Generative Network working. | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                      | <b>42</b> |

#### **Text Book:**

1. S. Rajasekaran and G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications", PHI Learning, 2003, ISBN: 9788120321860.
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", MIT Press, 2017, ISBN: 9780262035613.

#### **Reference Books:**

1. Satish Kumar, "Neural Networks: A Classroom Approach", Tata McGraw-Hill, 2004, ISBN: 9780070482920.
2. Simon Haykin, "Neural Networks and Learning Machines", Pearson Education, 3rd Edition, 2009, ISBN: 9780131471399.

## B.Tech. Sixth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title     | L  | T  | P  | C  |
|-------------|------------------|----|----|----|----|
| 6SA06       | Data Science Lab | 00 | 00 | 02 | 01 |

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Data Science Lab by being able to do each of the following:

1. To learn how to handle and clean real-world data using Python.
2. To explore and visualize data using basic tools and libraries.
3. To apply simple machine learning techniques to solve problems.

### Course Outcomes:

After successfully completing the course, students will be able to-

1. Use his / her understanding / knowledge of Data Science so as to design / conduct experimentation related to given aim / objective
2. Use Computer Hardware / Software and other concern resources for conduction of practical.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given practical.

### List of Experiment:

*Minimum 8 to 10 practical's are to be conducted based on subject 6SA01 – Data Science Syllabus.*

### Software Tools:

Apache Hadoop / Tableau / Google COLAB / Python / Online IDE's / Jupyter notebook / Anaconda / Orange Data Mining Tool, KNIME Analytics Platform / R-Studio / R-Programming / RapidMiner Studio / WEKA / VS Code.

## B.Tech. Sixth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                          | L  | T  | P  | C  |
|-------------|---------------------------------------|----|----|----|----|
| 6SA07       | Design and Analysis of Algorithms Lab | 00 | 00 | 02 | 01 |

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Design and Analysis of Algorithms Lab by being able to do each of the following:

1. The principal objective of this course is to build solid foundation in algorithms and their applications.
2. To understand the importance of algorithm and its complexities.
3. To provide a practical exposure of all algorithms.

### Course Outcomes:

After successfully completing the course, students will be able to-

1. Develop programs for sorting a given set of elements and analyze its time complexity.
2. Solve and analyze the problems using greedy methods, dynamic programming, backtracking method to solve various problems.
3. Choose appropriate algorithms techniques to solve computational problems.

### List of Experiment:

*Minimum 8 to 10 practical's are to be conducted based on subject 6SA02 Design and Analysis of Algorithms.*

### Software Tools:

C / C++ / JAVA / Jupyter Notebook / Eclipse / NetBeans / VS Code / Python / ALGOX / Code Chef IDE / Online IDE's / Hacker Rank / Leet Code / ALGO Lab.

## B.Tech. Sixth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                    | L  | T  | P  | C  |
|-------------|---------------------------------|----|----|----|----|
| 6SA08       | Database Management Systems Lab | 00 | 00 | 02 | 01 |

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Database Management Systems Lab by being able to do each of the following:

1. To Understand difference of SQL and NoSQL Database.
2. To construct simple and advanced database queries using a data language.
3. To recognize the need for transaction management and query processing.

### Course Outcomes:

After successfully completing the course, students will be able to-

1. Create Database applications using Query Languages like SQL.
2. Model, design and normalize databases for real life applications.
3. Design and develop transaction processing approach for relational databases.

### List of Experiment:

*Minimum 8 to 10 practical's are to be conducted based on subject **6SA03 Database Management Systems**.*

### Software Tools:

SQL / MYSQL / Oracle / SQL Server / POSTGRESS SQL / SQLite / MONGO DB / Cassandra / CouchDB / Redis / ER-Studio / Microsoft Visio / Lucidchart / DbSchema / PHP MySQL Admin / DB Browser / SQL Lite / XAMPP - WAMPP / SQL FIDDLE / Vertabelo / SolarWinds Database Performance Analyzer / Nagios / Prometheus & Grafana / Amazon RDS / Google Cloud SQL / Azure SQL Database / Google BigQuery / SQL Workbench / DBeaver.

## B.Tech. Sixth Semester (Artificial Intelligence and Data Science)

| Course Code | Course Title                  | L  | T  | P  | C  |
|-------------|-------------------------------|----|----|----|----|
| 6SA09       | Computer Skill Laboratory - 3 | 00 | 00 | 04 | 02 |

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Modern Tools and Technology by being able to do each of the following:

1. To provide practical exposure to the theoretical concepts of the chosen elective subject through hands-on experiments and simulations.
2. To develop the technical skills necessary to apply subject-specific tools, algorithms, and frameworks in real-world problem-solving.
3. To strengthen analytical thinking by engaging students in lab-based assignments, mini-projects, or case studies.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Use his / her understanding / knowledge of Modern Emerging Tools and Technology so as to design / conduct experimentation related to given aim / objective
2. Use Computer Hardware / Software and other concern resources for conduction of practical.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given practical.

### List of Experiment:

*Minimum 8 to 10 practical's are to be conducted based on subject **6SA04PE2 A / B / C – Program Elective Course – 2** or **6SA04PE3 A / B / C – Program Elective Course – 3 Syllabus** or **Modern Emerging Tools and Technology** with One Mini Project have to be submitted by students.*

### Software Tools:

Emerging Latest Software Tools and Technology to be used for Practical's and Minor Project.

## **B.Tech. Sixth Semester (Artificial Intelligence and Data Science)**

| <b>Course Code</b> | <b>Course Title</b>               | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|--------------------|-----------------------------------|----------|----------|----------|----------|
| <b>6SAH</b>        | <b>Business and Web Analytics</b> | 03       | 00       | 00       | 03       |

**Course Prerequisite:** Discrete Mathematics, Data Structures, Programming Methodology, Python Programming and Data Analytics and Visualization.

**Course Learning Objectives:** Throughout the course, students will be expected to demonstrate their understanding of Business and Web Analytics by being able to do each of the following:

1. To introduce students to the foundations of business analytics, including descriptive, predictive, and prescriptive analytics and their role in data-driven decision-making.
2. To develop analytical skills in data visualization, sampling, estimation, and statistical interpretation relevant to business and web analytics.
3. To equip students with the knowledge of web analytics tools, techniques, and methods for analyzing user behavior, traffic, and optimizing website performance.

**Course Outcomes:** After Successful completion of this course, the student will be able to:

1. Describe the role of business analytics in modern decision-making using descriptive, predictive, and prescriptive analytics techniques.
2. Predict statistical measures and visualization methods for understanding and interpreting business data.
3. Analyze data using sampling techniques and estimate population parameters.
4. Apply web analytics methodologies including log file analysis, goal setting, and performance metrics using tools like Google Analytics.
5. Inspect visitor, traffic, and content analysis of web to understand user behavior through segmentation and search analysis.
6. Design A/B testing, usability evaluation, and in-page behavior analysis to improve web design and user engagement.

|               |                                                                                                                                                                                                                                                                                                                                                                                                                       |           |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|               | <b>Subject: (6SAH) Business and Web Analytics</b>                                                                                                                                                                                                                                                                                                                                                                     | <b>L</b>  |
| <b>Unit-1</b> | <b>Introduction to Business Analytics:</b> Analytics Landscape, Why Analytics, Business Analytics-The Science of Data-Driven Decision Making, Descriptive Analytics, Predictive Analytics, Prescriptive Analytics, Descriptive, Predictive, and Prescriptive Analytics Techniques, Big Data Analytics, Web and Social Media Analytics.                                                                                | <b>07</b> |
| <b>Unit-2</b> | <b>Descriptive Analytics:</b> Data Types and Scales, Types of Data Measurement Scales, Population and Sample, Measures of Central Tendency, Percentile, Decile and Quartile, Measures of Variation, Measures of Shape – Skewness and Kurtosis, Data Visualization.                                                                                                                                                    | <b>07</b> |
| <b>Unit-3</b> | <b>Sampling and Estimation:</b> Population Parameters and Sample Statistic, Sampling, Probabilistic Sampling, Non-probability Sampling, Sampling Distribution, Central Limit Theorem (CLT), Sample Size Estimation for Mean of the population, Estimation of Population Parameters, Method of Moments, Estimation of Parameters Using Method of Moments, Estimation of Parameters Using Maximum Likelihood Estimation | <b>07</b> |
| <b>Unit-4</b> | <b>Introduction to Web Analytics:</b> Web Analytics Approach, A Model of Analysis, Context Matters, Log File Analysis, Page Tagging, Metrics and Dimensions, Goals, Conversion Rate, Goal Reports in Google Analytics, Performance Indicators, Going Beyond the Website                                                                                                                                               | <b>07</b> |
| <b>Unit-5</b> | <b>Learning about Users through Web Analytics:</b> Visitor Analysis, Traffic Analysis, Organic Search, Search Query Analysis, Website Content Reports, Click-Path Analysis, Segmentation - Why & How Segment Data, Segmenting According to page, User Traits, Information Need.                                                                                                                                       | <b>07</b> |
| <b>Unit-6</b> | <b>Pairing Analytics Data:</b> Personas, Usability Testing & Inspection, Design Objectives, Measuring the Effects of Changes, Measuring Behavior within Pages, Google Analytics In-Page Analytics, Analytics Tools, Analyzing Event Data, A/B Testing, Designing an Experiment.                                                                                                                                       | <b>07</b> |
|               | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                          | <b>42</b> |

**Text Book:**

1. U. Dinesh Kumar, "Business Analytics: The Science of Data-Driven Decision Making", Wiley, 2017, ISBN: 9788126569378.
2. Michael Beasley, "Practical Web Analytics for User Experience: UX Designer", Morgan Kaufmann, 2013, ISBN: 9780124046944.

**Reference Books:**

1. Ger Koole, "An Introduction to Business Analytics", Lulu.com, 2019, ISBN: 9780244442398.
2. Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity", John Wiley & Sons, 2009, ISBN: 9780470529393.
3. Eric T. Peterson, "Web Analytics Demystified: A Marketer's Guide to Understanding How Your Website Affects Your Business", Celilo Group Media & Jim Sterne, 2004, ISBN: 9780974358422.

### B.Tech Sixth Semester

| Course Code | Course Title                         | L  | T  | P  | C  |
|-------------|--------------------------------------|----|----|----|----|
| 6SDMP       | Disaster Management and Preparedness | 02 | 00 | 00 | 00 |

**Course Prerequisites:** Environmental Science

**Course Learning Objectives:**

1. Basic concepts of disasters, hazards, vulnerability, risk, and disaster management.
2. Knowledge of disaster management principles, frameworks, policies, and mitigation strategies.
3. The role of science and technology in disaster risk reduction and sustainable disaster management.

**Course Outcomes:**

Students will be able to –

1. Define and explain concepts of disaster, hazard, vulnerability, risk, and capacity.
2. Classify and describe different types of disasters, their causes, consequences, and control measures.
3. Apply disaster management cycle approaches including preparedness, response, recovery, and rehabilitation strategies.
4. Analyze disaster management policies, acts, guidelines, and institutional mechanisms in India.
5. Evaluate the applications of GIS, GPS, Remote Sensing, early warning systems, and mitigation technologies in disaster management.

| UNIT    | Subject: Disaster Management and Preparedness.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | L |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| UNIT I  | Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2 |
| UNIT II | Geological Disasters (earthquakes, landslides, tsunami, mining);<br>Hydro-Meteorological Disasters (floods, cyclones, lightning, thunderstorms, hail storms, avalanches, droughts, cold and heat waves)<br>Biological Disasters (epidemics, pest attacks, forest fire);<br>Technological Disasters (chemical, industrial, radiological, nuclear) and<br>Man-made Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters)<br>Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters | 8 |

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |     |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>UNIT III</b> | Disaster Management Cycle – Paradigm Shift in Disaster Management<br>Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness<br>During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation –<br>Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action | 8   |
| <b>UNIT IV</b>  | Disaster Profile of India – Mega Disasters of India and Lessons Learnt<br>Disaster Management Act 2005 – Institutional and Financial Mechanism<br>National Policy on Disaster Management,<br>National Guidelines and Plans on Disaster Management;<br>Role of Government (local, state and national), Non-Government and Inter-Governmental Agencies                                                                                                                                                                                                                                                                                      | 7   |
| <b>UNIT V</b>   | Geo-informatics in Disaster Management (RS, GIS, GPS and RS)<br>Disaster Communication System (Early Warning and Its Dissemination)<br>Land Use Planning and Development Regulations<br>Disaster Safe Designs and Constructions<br>Structural and Non Structural Mitigation of Disasters<br>S&T Institutions for Disaster Management in India                                                                                                                                                                                                                                                                                             | 7   |
| <b>UNIT VI</b>  | Study of Recent Disasters (at local, state and national level)<br>And Preparation of Disaster Risk Management Plan of an Area or Sector<br>Role of Engineers in Disaster Management                                                                                                                                                                                                                                                                                                                                                                                                                                                       | --- |
|                 | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 32  |

#### **Course Marking Scheme (50 Marks)**

1. Classroom activeness – 5 Marks;
2. Assignment submission and evaluation – 10 Marks;
3. Class Test/Internal Assessment – 25 Marks;
4. Report Writing on Disaster Management topic – 10 Marks.

#### **Performance Evaluation Criteria:**

The Performance of Student securing 25 marks or above will be considered Satisfactory, while students securing below will be considered Unsatisfactory.

#### **Text Books:**

1. Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
3. An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi.

#### **Reference Books:**

1. World Disasters Report, 2009. International Federation of Red Cross and Red Crescent, Switzerland
2. Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur
3. Disaster Preparedness Kit, American Red Cross