# JAYOTI VIDYAPEETH WOMEN'S UNIVERSITY, JAIPUR

## Faculty of Education and Methodology
## Department of Science & Technology

**SYLLABUS**

# BACHELOR OF TECHNOLOGY (B.TECH.)
## COMPUTER SCIENCE & ENGINEERING(CSE)

**SESSION – 2022-23**

**DURATION – 4 YEARS (8 SEMESTERS)**

# JAYOTI VIDYAPEETH WOMEN'S UNIVERSITY, JAIPUR

## PROGRAM DETAIL

| | |
|---|---|
| **Name of Program** | Bachelor of Technology (B.Tech) |
| **Program Code** | B.Tech |
| **Mode of Program** | Semester |
| **Duration of Program** | 4years/ 8 Semester |
| **Total Credits of Program** | 302 |
| **Curriculum Type and Medium Choice** | English |

## Program Outcomes:

An engineering student to be graduated will learn engineering knowledge, analyzing problems, designing systems and finding solutions, solving complex problems using mathematical and computing methods, using various tools etc. Also, how to communicate and do the teamwork, developing systems and architectures that are sustainable, management of project and finances and learnings that will be life-long.
An Engineering graduate student will able to:

- Apply the knowledge of engineering fundamentals, sciences to solve complex problems.
- Identify the problem, formulate, review previous work if done, analyze the complex problem and find solutions.
- Design solutions for complex engineering problems and design system components
- Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## SYLLABUS OUTLINE

## I Semester

| Nature of Course | Course Name | C | T | P |
|---|---|---|---|---|
| Mathematics | Elementary Mathematics | 6 | 6 | 0 |
| Physics | Elementary Physics | 6 | 4.5 | 1.5 |
| Chemistry | Fundamentals of Chemistry | 6 | 4.5 | 1.5 |
| Core Engineering | Engineering Drawing Lab | 6 | 0 | 6 |
| Core Computer Science | Fundamental of Computers | 6 | 3.5 | 2.5 |
| University Compulsory Course | Language Proficiency (English Communication/ Hindi / Sanskrit / Foreign Language)/Fundamentals of Computer/ Environmental Science & Disaster Management/Cyber Security Applicable :English Communication | 1 | 1 | 0 |
| Academic Exposure | Extra-Curricular Activities(ECA) | 1 | 0 | 1 |
| Academic Exposure | Community Development Activities(CDA) | 1 | 0 | 1 |
| Academic Exposure | Portfolio (Government/Corporate/Entrepreneur) | 1 | 0 | 1 |
| Academic Exposure | Mentorship | 1 | 0 | 1 |
| Co-Curricular Activites | Internship /Industrial Visit /Paper Publication/Conference/Symposium | - | - | - |
| | Total Credits | 35 | 19.5 | 15.5 |

Credits & Hours:

For Theory 1 Credit equal to 10 Hours

For Practical 1 Credit equal to 20 Hours

## Semester- II

| Nature of Course | Course Name | C | T | P |
|---|---|---|---|---|
| **Mathematics** | Mathematics-II | **6** | **6** | **0** |
| **Physics** | Physics-II | **6** | **4.5** | **1.5** |
| **Core Computer Science** | Programming in C | **6** | **4.5** | **1.5** |
| **Electronics and Communication** | Basics of Electronics and Electronic Engineering | **6** | **4.5** | **1.5** |
| **Management** | Entrepreneurship Development | **6** | **6** | **0** |
| **Electronics and Communication** | Digital Electronics | **6** | **6** | **0** |
| **University Compulsory Course** | Language Proficiency (English Communication/ Hindi / Sanskrit / Foreign Language)/ Fundamentals of Computer/ Environmental Science & Disaster Management/ Cyber Security | **0** | **0** | **0** |
| **University Mission Course** | Women's Rights And Law/Self Defence/Help Aid/Yoga & Meditation/Gender Sensitization/My Behaviour & Ethics **Applicable : My Behaviour & Ethics** | **1** | **0.5** | **0.5** |
| **Academic Exposure** | Extra-Curricular Activities | **1** | **0** | **1** |
| **Academic Exposure** | Community Development Activities | **1** | **0** | **1** |
| **Academic Exposure** | Portfolio (Government/Corporate/Entrepreneur) | **1** | **1** | **0** |
| **Academic Exposure** | Mentorship | **-** | **-** | **-** |
| **Co-Curricular Activites** | Internship /Industrial Visit /Paper Publication/Conference/Symposium | **-** | **-** | **-** |
| | **Total Credits** | **40** | **33** | **7** |

**Credits & Hours:**
For Theory 1 Credit equal to 10 Hours
For Practical 1 Credit equal to 20 Hours

# III Semester

| Nature of Course | Course Name | C | T | P |
|---|---|---|---|---|
| **Management** | Economics | **5.5** | **5.5** | **0** |
| **Mathematics** | Engineering Mathematics – III | **6** | **6** | **0** |
| **Electronics and Communication** | Data Communications | **6** | **6** | **0** |
| **Core Computer Science** | Computer System Architecture | **6** | **6** | **0** |
| **Core Computer Science** | Data Structures & Algorithms | **6** | **4.5** | **1.5** |
| **Core Computer Science** | Object Oriented Programming | **6** | **4.5** | **1.5** |
| **University Mission Course** | Women Rights and Law | **1** | **1** | **0** |
| **Professional Development Activity** | Certified Training | **4** | **0** | **4** |
| **University Compulsory Course** | Extra-Curricular Activities | **1*** | **0** | **1** |
| **University Compulsory Course** | Community Development Activities | **1*** | **0** | **1** |
| **Portfolio Development Activity** | Portfolio (Government/Corporate/Entrepreneur) | **0.5** | **0.5** | **0** |
| **University Optional Course** | Professional Activity | **--** | **--** | **--** |
| **Total Credits** | | **43** | **34** | **9** |

**Credits & Hours:**
For Theory 1 Credit equal to 10 Hours
For Practical 1 Credit equal to 20 Hours

**Note**:

- C represents number of Credit per course.
- T represents number of Theory Credit per course.
- P represents number of Seminars, group discussion, workshop
- *Represent as per university norms

# IV Semester

| Nature of Course | Course Name | C | T | P |
|---|---|---|---|---|
| **Management** | Value, Ethics and Governance | **5.5** | **5.5** | **0** |
| **Mathematics** | Engineering Mathematics – IV | **6** | **6** | **0** |
| **Core Computer Science** | Operating Systems | **6** | **4.5** | **1.5** |
| **Core Computer Science** | Relational Database Management Systems | **6** | **4.5** | **1.5** |
| **Core Computer Science** | Computer Organization | **6** | **6** | **0** |
| **Core Computer Science** | Open Elective – I | **6** | **6** | **0** |
| **Core Computer Science** | Web Technology Lab | **2** | **0** | **2** |
| **University Compulsory Course** | Extra-Curricular Activities | **1*** | **0** | **1** |
| **University Compulsory Course** | EVS & DM | **1*** | **0** | **1** |
| **University Compulsory Course** | Community Development Activities | **1** | **0** | **1** |
| **Portfolio Development Activity** | Portfolio (Government/Corporate/Entrepreneur) | **1.5** | **1.5** | **0** |
| **University Optional Course** | Professional Activity | **--** | **--** | **--** |
| **Total Credits** | | **42** | **34** | **8** |

**Credits & Hours:**
For Theory 1 Credit equal to 10 Hours
For Practical 1 Credit equal to 20 Hours

**Open Electives:**

| | |
|---|---|
| 1. | Fundamentals of Databases |
| 2. | Principles of Programming Languages |
| 3. | Enterprise Resource Planning |
| 4. | Principles of Machine Learning |

**Note**:

- C represents number of Credit per course.
- T represents number of Theory Credit per course.
- P represents number of Seminars, group discussion, workshop
- *Represent as per university norms

# V Semester

| Nature of Course | Course Name | C | T | P |
|---|---|---|---|---|
| **Core Computer Science** | Artificial Intelligence & Soft Computing | **6** | **4.5** | **1.5** |
| **Core Computer Science** | Design & Analysis of Algorithms | **6** | **4.5** | **1.5** |
| **Core Computer Science** | Automata Theory & Compiler Design | **6** | **6** | **0** |
| **Core Computer Science** | Computer Networks | **6** | **4.5** | **1.5** |
| **Core Computer Science** | Program Elective – I | **6** | **6** | **0** |
| **Core Computer Science** | Open Elective – II | **6** | **6** | **0** |
| **University Mission Course** | Help Aid | **1** | **1** | **0** |
| **University Compulsory Course** | Extra-Curricular Activities | **1*** | **0** | **1** |
| **University Compulsory Course** | Community Development Activities | **1*** | **0** | **1** |
| **Professional Development Activity** | Industrial Visit | **1** | **1** | **0** |
| **Portfolio Development Activity** | Portfolio (Government/Corporate/Entrepreneur) | **0.5** | **0.5** | **0** |
| **University Optional Course** | Professional Activity | **--** | **--** | **--** |
| **Total Credits** | | **40.5** | **34** | **6.5** |

**Programme Electives:**

| | |
|---|---|
| 1. | Information Retrieval |
| 2. | Computer Graphics & Multimedia |
| 3. | User Interface Design |
| 4. | Digital Image Processing |
| 5. | Internet of Things |
| 6. | Big Data Analytics |
| 7. | Software Defined Networks |
| 8. | Deep Neural Network |
| 9. | Social Network Analysis |
| 10. | Software Testing |
| 11. | Linux System and Shell Programming |
| 12. | Wireless Sensor & Adhoc Network |
| 13. | Mobile Computing |
| 14. | Natural Language Processing |
| 15. | Computer Vision |

**Open Electives:**

| | |
|---|---|
| 1. | Fundamentals of Databases |
| 2. | Principles of Programming Languages |
| 3. | Enterprise Resource Planning |
| 4. | Principles of Machine Learning |

**Credits & Hours:**
For Theory 1 Credit equal to 10 Hours
For Practical 1 Credit equal to 20 Hours

**Note**:

- C represents number of Credit per course.
- T represents number of Theory Credit per course.
- P represents number of Seminars, group discussion, workshop
- *Represent as per university norms

# VI Semester

| Nature of Course | Course Name | C | T | P |
|---|---|---|---|---|
| **Core Computer Science** | Organization and Management | **6** | **6** | **0** |
| **Core Computer Science** | Software Engineering | **6** | **4.5** | **1.5** |
| **Core Computer Science** | Information Systems Security | **6** | **4.5** | **1.5** |
| **Core Computer Science** | Data Science and Machine Learning | **6** | **6** | **0** |
| **Core Computer Science** | Program Elective – II | **6** | **6** | **0** |
| **Core Computer Science** | Open Elective – III | **6** | **6** | **0** |
| **Core Computer Science** | Minor Project | **2** | **0** | **2** |
| **University Mission Course** | Gender Sensitization | **1** | **1** | **0** |
| **University Compulsory Course** | Extra-Curricular Activities | **1*** | **0** | **1** |
| **University Compulsory Course** | Community Development Activities | **1*** | **0** | **1** |
| **Portfolio Development Activity** | Portfolio (Government/Corporate/Entrepreneur) | **1.5** | **1.5** | **0** |
| **University Optional Course** | Professional Activity | **--** | **--** | **--** |
| **Total Credits** | | **42.5** | **35.5** | **7** |

**Programme Electives:**

| | |
|---|---|
| 1. | Information Retrieval |
| 2. | Computer Graphics & Multimedia |
| 3. | User Interface Design |
| 4. | Digital Image Processing |
| 5. | Internet of Things |
| 6. | Big Data Analytics |
| 7. | Software Defined Networks |
| 8. | Deep Neural Network |
| 9. | Social Network Analysis |
| 10. | Software Testing |
| 11. | Linux System and Shell Programming |
| 12. | Wireless Sensor & Adhoc Network |
| 13. | Mobile Computing |
| 14. | Natural Language Processing |
| 15. | Computer Vision |

**Open Electives:**

| | |
|---|---|
| 1. | Fundamentals of Databases |
| 2. | Principles of Programming Languages |
| 3. | Enterprise Resource Planning |
| 4. | Principles of Machine Learning |

**Credits & Hours:**
For Theory 1 Credit equal to 10 Hours
For Practical 1 Credit equal to 20 Hours

**Note**:

- C represents number of Credit per course.
- T represents number of Theory Credit per course.
- P represents number of Seminars, group discussion, workshop
- *Represent as per university norms

# VII Semester

| Nature of Course | Course Name | C | T | P |
|---|---|---|---|---|
| **Core Computer Science** | Program Elective – III | **6** | **6** | **0** |
| **Core Computer Science** | Program Elective – IV | **6** | **6** | **0** |
| **Core Computer Science** | Program Elective – V | **6** | **6** | **0** |
| **Core Computer Science** | Program Elective – VI | **6** | **6** | **0** |
| **Core Computer Science** | Program Elective – VII | **6** | **6** | **0** |
| **Core Computer Science** | Industrial Training | **4** | **0** | **4** |
| **University Mission Course** | Help Aid | **1** | **1** | **0** |
| **University Compulsory Course** | Extra-Curricular Activities | **1*** | **0** | **1** |
| **University Compulsory Course** | Community Development Activities | **1*** | **0** | **1** |
| **Professional Development Activity** | Industrial Visit | **1** | **1** | **0** |
| **Portfolio Development Activity** | Portfolio (Government/Corporate/Entrepreneur) | **0.5** | **0.5** | **0** |
| **University Optional Course** | Professional Activity | **--** | **--** | **--** |
| **Total Credits** | | **38.5** | **32.5** | **6** |

**Program Electives:**

| | |
|---|---|
| 16. | Information Retrieval |
| 17. | Computer Graphics & Multimedia |
| 18. | User Interface Design |
| 19. | Digital Image Processing |
| 20. | Internet of Things |
| 21. | Big Data Analytics |
| 22. | Software Defined Networks |
| 23. | Deep Neural Network |
| 24. | Social Network Analysis |
| 25. | Software Testing |
| 26. | Linux System and Shell Programming |
| 27. | Wireless Sensor & Adhoc Network |
| 28. | Mobile Computing |
| 29. | Natural Language Processing |
| 30. | Computer Vision |

**Credits & Hours:**
For Theory 1 Credit equal to 10 Hours
For Practical 1 Credit equal to 20 Hours
**Note**:

- C represents number of Credit per course.
- T represents number of Theory Credit per course.
- P represents number of Seminars, group discussion, workshop
- *Represent as per university norms

# VIII Semester

| Nature of Course | Course Name | C | T | P |
|---|---|---|---|---|
| **Core Computer Science** | Major Project | **16** | **0** | **16** |
| **University Mission Course** | Help Aid | **1** | **1** | **0** |
| **University Compulsory Course** | Extra-Curricular Activities | **1*** | **0** | **1** |
| **University Compulsory Course** | Community Development Activities | **1*** | **0** | **1** |
| **Professional Development Activity** | Industrial Visit | **1** | **1** | **0** |
| **Portfolio Development Activity** | Portfolio (Government/Corporate/Entrepreneur) | **0.5** | **0.5** | **0** |
| **University Optional Course** | Professional Activity | **--** | **--** | **--** |
| **Total Credits** | | **20.5** | **2.5** | **18** |

**Credits & Hours:**
For Theory 1 Credit equal to 10 Hours
For Practical 1 Credit equal to 20 Hours

**Note**:

- C represents number of Credit per course.
- T represents number of Theory Credit per course.
- P represents number of Seminars, group discussion, workshop
- *Represent as per university norms

******

**Overall Credits: 35+40+43+42+40.5+42.5+38.5+20.5= 302**

******

# I Semester

**COURSE: Elementary Mathematics**

**(Credits: 6)**

**Course Outcomes:** To develop the understanding of basic mathematics i.e. algebra, calculus, trigonometry and statistics. Also, to develop the understanding of measurements. Students will able to perform various mathematical operations using methods.

**Unit-I (Overview of Algebra)**

**(Credits: 2)**

**Theory**

**Set theory**: Classification and types of Finite Set, Venn diagram, Algebra of sets. **Algebra**: Quadratic equation, Nature of roots of quadratic equations, Common Roots. Arithmetic progression, geometric progression and harmonic progression.Determinant of elementary properties of a determinant.Solution of Linear Simultaneous Equations by Cramer's Rule. Adjoin of matrices, Inverse of matrices.

**Unit-II (Overview of calculus and trigonometry)**

**(Credits: 2)**

**Theory**

**Calculus**: Differentiation of Implicit and Explicit Functions. Indefinite integrals of standard functions (simple problems), Methods of integration, **Trigonometry**- Trigonometrically Equations and General Values.

**Unit-III (Overview of statistics)**

**(Credits: 2)**

**Theory**

**Statistics**-Definition and Applications of Statistics in various fields, classification and tabulation of data, graphical representation of data (bar diagram, pie chart, histogram , frequency polygon)**Measure of central tendency**: Mean, mode, median, variance, standard deviation(definition& simple problems).

**Recommended text Books:**

1. Business maths: D.C.sancheti&V.K.kapoor,S.C.chand publications
2. Algebra,Bhargava, saini , agrawal JPH
3. R.D.sharma,12thDhanpat rai publications

**Reference Books:**

1. Elements of statistics,S.C.Gupta&V.K.kapoor,sultanchand& son's publishers.

## COURSE: Elementary Physics

**Course Outcomes:** To impart knowledge of basic concepts in appliedphysics andmake the students familiar with topicslikeinterference,diffraction,polarization,fiberoptics, lasers, wave mechanics, etc. This course isalso aimed at enhancing the analytical capability oftheengineeringstudents.

### UNIT-I (Credits: 2)

**Theory (Credits: 1.5)**

**RELATIVITY**: Review of concepts of frames of reference and Galileantransformationequation,Michelson–Morleyexperimentanditsimplications,Einstein'sspecialtheoryofrelativity,Lorentztransformationequations, Law of addition of velocities, Mass variation with velocity,Conceptofenergyandmomentum,Mass energyrelation.

**OSCILLATIONS&WAVES:**Dampedandforcedoscillations,Resonance(amplitude and power), Q – factor, Sharpness of resonance. Equationsof longitudinal and transverse waves and their solutions, Impedance,Reflectionandtransmissionofwavesataboundary,Impedancematchingbetweentwo medium.

**Practicals: (Credits: 0.5)**

| S.No. | Name of Practical |
|---|---|
| 1 | To determine young's modulus of elasticity of the material of a given wire. |
| 2 | Using a simple pendulum plot L-T graph and hence find the effective length. |

### UNIT-II (Credits: 2)

**Theory (Credits: 1.5)**

**PHYSICALOPTICS:** Interference by division of wave front and amplitude, Multiple beam interference and Fabry-Perot interferometer, Fresnel diffraction through a straight edge, Zone plate, Fraunhofferdiffraction, single slit and N-slit / grating, Resolving power of telescope,prismandgrating.Polarizationbyreflectionandbytransmission,Brewster's law, Double refraction, elliptically and circularly polarized light, Nicolprism,Quarterandhalfwaveplates.

**OPTICAL INSTRUMENTS:** Cardinal points of co-axial lens systems,spherical and chromatic aberrations and their removal, Huygens andRamsden'seyepiece.

**Practicals: (Credits: 0.5)**

| S. No. | Name of Practical |
|---|---|
| 1 | To find the force constant of a helical spring by plotting graph between load and extension. |
| 2 | To find the speed of sound in air at room temperature using a resonance tube by two resonance positions |
| 3 | To study the relation between frequency and length of a given wire under constant tension using Sonometer. |
| 4 | To study the relation between the length of a given wire and tension for constant frequency using Sonometer. |

**UNIT-III** **(Credits: 2)**

**Theory** **(Credits: 1.5)**

**Lasers:**

Coherenceandcoherentpropertiesoflaserbeams,Briefworkingprinciple of lasers, Spontaneous and stimulated Emission, Einstein'sco-efficient,Rubylaser,He-Nelaser.

**Optical Fiber:**

Classification of optical fibers, Refractive index profile, Core-claddingrefractive index difference, Numerical aperture of optical fiber, Pulsedispersioninopticalfiber(ray theory).

**Practical** **(Credits: 0.5)**

| S.No. | Name of Practical |
|---|---|
| 1 | To determine the wave length of sodium light by Newton's ring method. |
| 2 | To determine the height of an object with the help of sextant. |

**Recommended text Books:**

1. Physics text book for class XI, published by NCERT.
2. physics text book for class XII, published by NCERT.

**Reference Books:**

| S.No. | NameofBooks/Authors | YearofPublication/Reprint |
|---|---|---|
| 1. | PhysicsofVibrationsandWaves,byH.J.Pain. | 2005/JohnWiley&SonsLtd |
| 2. | Vibrations andWaves, byA.P.French. | 1971/CRCPress |
| 3. | PerspectiveofModern Physics,byArthurBeiser | 1981/McGraw-Hill |
| 4. | Optics,byA. Ghatak. | 2006/TataMcGraw-Hill |
| 5. | BerkleyPhysicsCourseVol–1. | 2009/TataMcGraw-Hill |

## COURSE: Fundamentals of Chemistry

**Course Outcomes:** To develop the understanding of basic chemistry and its types. To make students understand about the practical aspects of things. Students will able to identify various matters and equipment used in labs, perform some basic experiments.

**UNIT I – (Overview of Physical Chemistry)** **(Credits: 2)**

**Theory** **(Credits: 1.5)**

**Solutions:** Concept of homogeneous and heterogeneous solution, Introduction of the terms, Ionization, acidity, basicity, equivalent weight and gram equivalent weight with suitable example. Preparation of solution, Normality, Molarity, and Molality as applied in relation to a solution. Simple numerical problems related to volumetric analysis. Brief concept of gravimetric analysis.

**Practicals:** **(Credit: 0.5)**

| S.No. | Name of Practical |
|---|---|
| 1 | Preparation of original solution. |
| 2 | Correct group detection |
| 3 | Cu with change in concentration of electrolytes ($CuSO_4$ |
| 4 | Zn with $ZnSO_4$ |

| | |
|---|---|
| **5** | using starch solution as indicator (clock reaction). |

**UNIT II- (Overview of Inorganic chemistry) (Credits: 2)**

**Theory (Credits: 1.5)**

Occurrence and principles of extraction of aluminium, copper, zinc and Iron. position of hydrogen in periodic table, isotopes, preparation, properties and uses of hydrogen; hydrides-ionic, covalent and interstitial; physical and chemical properties of water, heavy water. Hydrogen peroxide-preparation, properties and structure; hydrogen as a fuel.Uses of hydrogen peroxide.

**Practical: (Credit: 0.5)**

| S.No. | Name of Practical |
|---|---|
| **1** | Systematic detection of ion. |
| **2** | Any two confirmatory tests of cation. |
| **3** | Physical nature. |
| **4** | Flame test. |
| **5** | Charcoal cavity test. |

**UNIT III (Overview Organic Chemistry) (Credits: 2)**

**Theory (Credits: 1.5)**

**Stereochemistry of Organic Compounds:** Concept of isomerism. Type of isomerism. **Optical Isomerism -** Elements of symmetry, molecular chirality, enantiomers, stereogeniccentre, optical activity, properties of enantiomers , chiral and acheral molecules and erythrodiastereomers, *, D & L and R & S systems of nomenclature.

**Geometric Isomerism:** Determination of configuration of geometric isomers. E & Z system of nomenclature. **Conformational isomerism:** Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Application of Stereochemistry in biochemistry.

**Practical: (Credit: 0.5)**

| S.No. | Name of Practical |
|---|---|
| **1** | Recrystallization. |
| **2** | Melting points and Boiling point and the identification of an unknown and known compound nepthlene,Benzene |
| **3** | Molecular modelling. |
| **4** | L.S modelling. |
| **5** | Distillation, steam distillation. |

**Recommended text Books:**

1. P.W. Atkins, **Physical Chemistry** (7th Edition), Oxford University Press, 2006.
2. R.T. Morrison and R.N. Boyd, **Organic Chemistry**, Prentice Hall of India Pvt. Ltd., 5th Ed, 1990

**Reference Books:**

1. I. A. Levine, **Physical Chemistry**, McGrawHill, 2009
2. D.A. McQuarrie and J.D. Simon, **Physical Chemistry – a Molecular Approach**, Viva Books Pvt. Ltd., 1998.
3. G. Solomons and C. Fryhle, **Organic Chemistry**, John Wiley & Sons (Asia) Pte Ltd.
4. J.D. Lee, **Concise Inorganic Chemistry**, (5th Edition), ELBS, 1996.

5. D. F. Shriver and P. W. Atkins, **Inorganic Chemistry,** Oxford University Press, 2006.

## COURSE:Fundamentals of Computers

**Course Outcomes:** To develop the understanding of basic computer system, what's inside the hardware and how computer works on machine level.Also, the working and use of Microsoft Office. Students will able to recognize hardware components, working of an operating system and various applications.

**UNIT – I (Basics of computer System and Number System)** **(Credits: 2)**

**Theory** **(Credits: 1.5)**

Introduction to Computer System and functions of its components, evaluation of Computers and their classification, hardware and software; Number System: Decimal, Binary, Octal and Hexadecimal and their inter conversions. Representation of integer and real numbers, characters and codes (BCD, ASCII and EBCDIC), error detecting and correcting codes (Parity, Gray and Hamming codes), binary and floating point arithmetic (addition and subtraction).

**Practical (0.5Credit)**

| S.No. | Name of Practical |
|---|---|
| 1 | Demonstration of different Hardware and software components of computers. |
| 2 | Description of assembly of computer system hardware. |
| 3 | Description of the functionalities of different types of system software and application software. |

**Practice**
Practice of number systems and codes (BCD, ASCII and EBCDIC).

**UNIT – II (Boolean algebra)** **(Credits: 1)**

**Theory (Credits: 1)**

Basic concepts of Boolean algebra and their electronic implementation through various logic gates, simplification of Boolean expressions (Boolean algebra and Karnaugh map method).Hard Devices and software device, CPU, Memory disks and its types.

**UNIT – III (Software and MS office)** **(Credits: 3)**

**Theory (Credits: 1)**
Network Basics and Internet, Concept of System software and application software, Office Automation (MS-Word, Excel and Power Point). Introduction to Data Bases, concept and architecture, Tables, Query and Report generation (MS- Access).

**Practical** **(Credits: 2)**

| S.No. | Name of Practical |
|---|---|
| **1** | Document creation & formatting of that document |
| **2** | Create a word document and grammar & spelling checking in that document |
| **3** | Table creation in a word document and table handling |
| **4** | Find & Replace function in Microsoft word |
| **5** | Mail Merge |
| **6** | Document with multiple columns |

**Spreadsheet:**

| S.No. | Name of Practical |
|---|---|
| **1** | Creation of Workbook, entering data in multiple sheets, Cell referencing, charts, |
| **2** | Functions-Date & Time, Mathematical, Statistical, Look up and text |

**Presentation**:

| S.No. | Name of Practical |
|---|---|
| **1** | Creation of Presentation and formatting, different views of presentation, |
| **2** | layouts and templates, Master slides, Animation, Transition. |

**Recommended text Books:**

1. Computer Fundamentals, Architecture & Organization, B.RAM, New Age International, New Delhi, 2000

**References Books:**

1. Microsoft Office 2000 for Windows, S. Sagman, Berkeley Peachpit Press, 1999
Fundamental of computer, V. Rajaraman, Prentice Hall India Pvt., Limited

# English Communication

**(Credits: 1)**

**Course Outcomes:** To develop the understanding of communication with the practical aspects and real time reading, writing and practicing with other students. Students will able to learn communication techniques and the practice in the course will make them to see the things in real life.

**Theory and Practices:**

1. Greeting and introducing one and others.
2. Practice exercise: practice 15 words each for greeting and describing oneself. Practice How to talk about time and date.
3. Parts Of Speech: noun, pronoun, adjective practice exercise: read a text and identify different parts of speech.
4. Write paragraph about your friend or relative using pronoun and adjective, Modals, Conjunction and Preposition and Prepositional Phrases.
5. Practice exercise: read newspaper or any text to find different common phrases being used remember and practice them in own sentences.
6. Idioms, Other Common Phrases and Confused Words practice exercise: make sentence from confused words to understand the difference of meaning.
7. Read and write the summary of ten news in own words, speaking exercise: describing daily routine, favorite movie, novelist.
8. Write different derivational words of the words commonly used along with meaning.
9. Reading exercise. Show them some passage and ask them to read and summaries orally.
10. Practice exercise: summaries news they hear/watch on TV.
11. Group discussion practice exercise: learn how to agree or disagree with someone. Listening and watching audio visual clips.
12. Practice in language lab. Role play, Revision of all session.

## Engineering Drawing Lab

**(Credits: 6)**

**Course Outcomes:** To develop the understanding of basic things used in measurements, various shapes and projections, and how sections are build and views are created. Students will able to identify the tools used in engineering drawing, use these tools.

**UNIT – I (Introduction)** **(Credits: 2)**

Introduction: Scales, Code of practice for engineering drawing – Drawing sheets and title blocks – Types and sizes of letters – Dimensioning rules – Construction of plane curves like ellipse, parabola, hyperbola, spirals, involutes, trochoids and cycloids. Projection of Points, Lines And Planes: Projection of points – Projection of lines, lines parallel to both reference planes, lines inclined to one of the reference planes, lines inclined to both the reference planes–Projection of planes, planes inclined to one of the reference planes, planes inclined to both the reference planes.

**UNIT – II (Projection of Solids)** **(Credits: 2)**

Projection of Solids: Classification of solids - Projection of solids in simple positions, with axis inclined to one of the reference planes and with axis inclined to both the reference planes. Auxiliary Projection: Introduction– Auxiliary Projection of points, lines and solids - with axis inclined to one of the reference planes and with axis inclined to both the reference planes.

**UNIT – III (Section of Solids and Development of Surfaces)** **(Credits: 2)**

Section of Solids and Development of Surfaces: Sectional views, section planes, perpendicular to VP and inclined to HP, section planes perpendicular to HP and inclined to VP – True shapes of sections, Development of surfaces: Method of development – Parallel line development – radial line development.

**Recommended Text Books:**

1. Machine drawing, P. S. Gill, Delhi : S.K. Kataria& Sons , 2001

**Reference Books:**

1. Engineering drawing [Plane and Solid Geometry in First-Angle Projection Method] by N. D. Bhatt Revised and Enlarged by V. M. Panchal, Charotar Publication, Anand, Gujarat
2. Machine Drawing, by N. D. Bhatt, Charotar Publication, Anand, Gujarat
3. Engineering Graphics, John K.C. and Varghese, Jet Publications, Thrissur, 1998.
4. Engineering Drawing and Graphics +Auto CAD, Venugopal, K., New Age International (P) Ltd., New Delhi, 1998.

## II Semester
## Course: Mathematics-II

**Course Outcomes:** To develop the understanding of algebra and equations to write and understand basic proofs. Develop and maintain problem-solving skills. Use mathematical ideas to model real-world problems. Be able to communicate mathematical ideas with others.

**UNIT-I (Linear Algebra)** **(Credits: 2)**

**Theory** **(Credits: 1.5)**

Vectors in *Rn*, notion of linear independence and dependence, linear span of a set of vectors, vector subspace of *Rn*, basis of vector subspaces. Systems of linear equations, matrices and Gaussian elimination, row space, null space, and column space, rank of a matrix; Determinants and rank of a matrix in terms of determinants. Abstract vector spaces, linear transformations, matrix of a linear transformation, change of basis and similarity, rank-nullity theorem, Inner product spaces.

**Practice (0.5)**

Practice of Vectors, linear Equations, Matrix and Determinants.

**UNIT-II(Abstract Algebra)** **(Credits: 2)**

**Theory** **(Credits: 1.5)**

Basic Knowledge of abstract algebra, Groups, Sub groups, Rings, Fields, Vector Space, Sub space,Eigen values and Eigen vectors, characteristic polynomials, Eigen values of special matrices (orthogonal, unitary, hermitian, symmetric, skew-symmetric, normal). Algebraic and geometric multiplicity, diagonalization by similarity transformations, spectral theorem for real symmetric matrices, application to quadratic forms

**Practice** **(Credits: 0.5)**

Practice of Eigen Values, Polynomials and spectral theorems.

**UNIT-III(Differential Equations)** **(Credits: 2)**

**Theory** **(Credits: 1.5)**

Exact equations, integrating factors and Bernoulli equations.Orthogonal trajectories.Lipchitz condition, Picard's theorem, examples on no uniqueness. Linear differential equations generalities, Linear differential equations and Wornskians Dimensionality of space of solutions, Abel-Lowville formula, Linear ODEs with constant co-efficient, the characteristic equations, Cauchy Euler equations, Method of undetermined coefficients. Method of variation of parameters, Laplace transformation and generalities, shifting theorems, Convolution theorem.

**Practice (Credits: 0.5)**

Practice of bernaullis equations, linear differential equations and Laplace transformations.

**Recommended text Books:**

1. H. Anton, **Elementary Linear Algebra with Applications** (8th Edition), John-Wiley & Sons, 1995.
2. G. Strang, **Linear Algebra and its Applications** (4th edition), Thomson, 2006.

**Reference Books:**

1. S. Kumaresan, **Linear Algebra: a Geometric Approach**, Prentice Hall of India, 2000.
2. E. Kreyszig, **Advanced Engineering Mathematics** (8th Edition), John Wiley & Sons, 1999.
3. W.E. Boyce and R. Diprima, **Elementary Differential Equations** (8th Edition), John Wiley & Sons, 2005.
4. T.M. Apostol, **Calculus, Volume 2** (2nd edition), Wiley-Eastern, 1980.

## COURSE: Physics- II

**Course Outcomes:** Thiscoursegivesabalanceaccountofthefundamentalsof Physicsaswellassomeofrecentdevelopmentsinthisareabestsuitedtothe Engineering applications in different branchesand to provide the knowledge and methodologynecessaryforsolvingproblemsinthefieldofengineering.

**UNIT-I** **(Credits: 2)**
**Theory** **(Credits: 1.5)**

**QuantumPhysics:** Failureofclassicalphysics,Comptoneffect,Pair production, de-broglie relation, wave function, Probability density,Schrodinger wave equation, operators, expectation values and eigen-value equation, particle in a box, simple harmonic oscillator problem,conceptofdegeneracy.
**QuantumStatistics:** Fermi—DiracandBose–EinsteinDistribution,Fermi-Diracprobabilityfunction, Fermienergylevel.

**Practical** **(Credits: 0.5)**

| S.No. | Name of Practical |
|---|---|
| 1 | Study Characteristics of Zener Diode. |
| 2 | Study Characteristics of Semiconductor Diode. |
| 3 | Study the Charging of a Condenser and hence determine time constant. |
| 4 | To deter mine the specific resistance of a material and determine difference between two small resistances using carry foster's bridge. |

**UNIT-II** **(Credits: 2)**
**Theory** **(Credits: 1.5)**

**Classical Statistics:** Microscopic-macroscopic systems, concept ofphasespace,basicpostulatesofstatisticalmechanics,Maxwell—Boltzmanndistributionlaw.
**Electrodynamics:** Maxwell'sequations,conceptofdisplacementcurrent, Derivation of wave equation for plane electromagnetic wave,Poynting vector. Poynting theorem, Energy density, wave equation indielectric& conducting media.

**Practical** **(Credits: 0.5)**

| S.No. | Name of Practical |
|---|---|
| 1 | Study Electromagnetic induction and verify faraday's law. |
| 2 | To convert a galvanometer into an ammeter |

**UNIT-III** **(Credits: 2)**
**Theory** **(Credits: 1.5)**

**NuclearPhysics:**Nuclearproperties,constituentofthenucleus,binding energy, stable nuclei, radioactive decay law (alpha and betaspectrum), Q-value of nuclear reaction , nuclear models:liquid dropandshellmodel,nuclearfissionandfusion,elementaryideasofnuclearreactors.
**SemiconductorPhysics:**Conceptofintrinsicandextrinsicsemiconductors, Fermi level, characteristics of PN Junction, static anddynamicresistance,zenardiodeandLED,diodeasarectifier,transistor(PNPandNPN)characteristics, currentandvoltage gain.

**Practical (Credits: 0.5)**

| S.No. | Name of Practical |
|---|---|
| 1 | To determine modular of rigidity of a wire using Maxwell's needle. |
| 2 | To convert a galvanometer in a voltmeter. |

**Recommended text Books:**

1. Physics text book for class XII, published by NCERT.
2. Satyaprakash, Electricity and Magnetism, Published by PragatiPrakashan (Meerut)

**Reference Books:**

| S.No. | NameofBooks/Authors | YearofPublication/Reprint |
|---|---|---|
| 1. | NuclearPhysics,byErwinKaplan | 2002/Narosa |
| 2. | ConceptofNuclearPhysics,byBernardCohen | 2001/McGraw-Hill |
| 3. | PerspectiveofModern Physics,byArthurBeiser | 1969/McGraw-HillUS |
| 4. | Electrodynamics,byGriffith | 2012/PHILearning |
| 5. | Electricity&magnetism,byRangawala&Mahajan. | 2012/McGraw-Hill |

# COURSE: Programming in C

**Course Outcomes:** The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.

**UNIT – I (Computer programming and Control Statements and Functions) (Credits: 2)**

**Theory (Credits: 1.5)**

Steps involved in computer programming, problem analysis, algorithms & flow charts, High level and low level programming languages. Computer programming (in C): various data types and their representation, constants and variable, arithmetic and logical expressions, data assignments, input and output statement. Programming: Control statement- sequencing, conditional and unconditional branching and looping, single and multi-dimensional arrays. User defined functions, parameter passing, and recursion.

**Practical (Credits: 0.5)**

| S.No. | Name of Practical |
|---|---|
| **1** | Programs based on arithmetic expressions addition, subtraction, |
| **2** | Programs based on arithmetic expressions multiplication, division, |
| **3** | Programs based on swapping the values of variables. |
| **4** | Programs based on area of circle. |
| **5** | Programs based on area of square and rectangle by user defined input |
| **6** | Programs based on area of triangle with the with both float and integer data types. |
| **7** | Programs based on area of cube by user defined input. |
| **8** | Programs based on volume of cylinder by user defined input. |
| **9** | Programs based on logical expressions. |
| **10** | Programs based on conditional statement (if, if…..else) |
| **11** | Programs based on conditional statement nested if…..else). |
| **12** | Programs based on relational operators. |
| **13** | Programs based on looping statement (for loop, |
| **14** | Programs based on looping statement (while loop and do…..while loop). |
| **15** | Programs based on array (1-Dimensional and 2-Dimensional) and array operations. |
| **16** | Programs based on string operations. |
| **17** | Programs based on functions. |
| **18** | Programs based on conditional statement (if, if…..else) |

**UNIT – II (Pointers and Memory Allocation) (Credits: 2)**

**Theory (Credits: 1.5)**

Pointers: Definition and uses of pointers, memory allocation, pointers and array, pointers and functions. Structures, union, pointers to structures, enumeration.String manipulations. Pointers operators, pointer arithmetic, Pointers and function, Array of pointers, Pointer and Strings, Pointer to structure, Pointers within structure, Introduction of Static and Dynamic memory allocation, The process of Dynamic memory allocation, DMA functions Malloc() function, Size of() operator, Function free(), Function realloc()

**Practice (Credits: 0.5)**

| S.No. | Name |
|---|---|
| **1** | Practice of Examples based on Recursion and looping, |
| **2** | Practice of Examples based on operators (Arithmetic, relational and relational). |
| **3** | Practice of Examples based on functions. |
| **4** | Programs based on Pointers. |
| **5** | Programs based on String Operations. |
| **6** | Program based on Structure. |
| **7** | Program based on union. |
| 8 | Write a programs using Pointer Operators |
| 9 | Write a programs using pointer and function |
| 10 | Write a programs using array of Pointer |
| 11 | Write a programs using pointers of pointers |
| 12 | Write a programs execute Malloc(), Malloc(),Realloc(),free()Function. |

**UNIT – III (File Handling and Graphics) (Credits: 2)**

**Theory (Credits: 1.5)**

File structure, File handling function, File types, Streams, Text, Binary, File system basics, The file pointer, Opening a file, Closing a file, Writing a character, Reading a character, Appending a character Working with string fputs() and fgets(),Data files: Opening, closing, creating, processing and unformatted data files. Standard streams in C, Flushing a stream, , Direct access file, random access I/O, fprintf() and fscanf(), getting file name as Command line arguments.

Graphics and Text mode, Video Adapter, Initialize Graphics Mode and resolution, header file graphics.h. Functions used In Graphics – Drawing a Point on Screen, Drawing – lines, rectangle, circles, arcs, polygon. Functions to fill colors. Display Text in Graphics mode, out text (), outtextxy(), justifying text.

**Practical (Credits: 0.5)**

| S.No. | Name of Practical |
|---|---|
| 1 | Write a Program to open a file |
| 2 | Write a Program to Writing a Character in file |
| 3 | Write a Program to Reading a Character in file |
| 4 | Write a Program to appending a Character in file |
| 5 | Write a Program to closing a file |
| 6 | Write a programs using String functions strlen(), strcpy, strcmp(),strlwr(),strupr(), strchr(), strcat(). |
| 7 | Write a programs using fprintf(), fscanf(), getc(), putc(), fgetc(), fputc(), fseek(), feof() functions |
| 8 | Write a Program to Draw a Point on Screen |
| 9 | Write a Program to Draw lines |
| 10 | Write a Program to Draw Rectangle |
| 11 | Write a Program to Draw Circle |
| 12 | Write a Program for Draw Arcs and polygon |

**Recommended text Books:**

1. YashwantKanetkar, **Let us C**. Allied Publishers, 1998.
2. B. Godefriod, "Programming in C ", Schaum Series.

**Reference Books:**

G.Dromey, **How to Solve It by Computer**, Prentice-Hall, Inc., Upper Saddle River, NJ, 1982

## COURSE: Basics of Electrical & Electronics Engineering

**Course Outcomes:** To introduce the students about domestic wiring, the functioning of various electrical apparatus and the safety measures. Emphasize the effects of electric shock and precautionary measures. To impart basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context. To provide knowledge about the basic DC and AC electric circuits and magnetic circuits. To introduce the concepts of generators, motors, transformers and their applications.

**Unit –I – Circuit Theory** **(Credits: 2)**

**Theory** **(Credits: 1.5)**

Introduction to Circuit Theory: Basic physical laws –Ohm's law, Coloumb's Law, Farady's Law. Basic circuit elements –Active Element, Passive Element and its Application. Kirchhoff's voltage law (KVL), Kirchhoff's current law (KCL) .Circuit Theorem: - Superposition Theorem, Thevenin's Theorem, Norton's Theorem and maximum Power Transfer theorem.

**Lab Experiments:** **(Credits: 0.5)**

1. Basic study of symbols used in Electrical Lab.
2. Basic study of tools used in Electrical Lab.
3. Study and verification of Ohm's Law.
4. Study and verification of Kirchhoff's Law.
5. Study and verification of Superposition Theorem.
6. Study and verification of Thevenin's theorem.
7. Study of different types of Passive Components.

**Unit –II– Semiconductors** **(Credits: 2)**

**Theory** **(Credits: 1.5)**

Introduction to Semiconductor Physics:-Insulator, Conductor, Semiconductor, Intrinsic Semiconductor, Extrinsic Semiconductor. Introduction to diodes, types of diode:- P-N Diode, Zener Diode, LED, Photo Diode, Varactor Diode and their applications. Rectifiers, Types of Rectifier: - Half wave Rectifier, full wave Rectifier, Bridge Rectifier.

**Lab Experiments:** **(Credits: 0.5)**

1. Basic study of Domestic house wiring and stair case wiring.
2. Study of different types of lamps.
3. Practice of Soldering
4. Practice of Finding Faults in Equipments

**Unit –III– Transformer** **(Credits: 2)**

**Theory** **(Credits: 1.5)**

Measuring Instruments:-Introduction and working principle and Application of ammeter, voltmeter (shunt and multiplier), Two-wattmeter method, Cathode-ray Oscilloscope.

Transformer: - Introduction, Working Principle, Autotransformer, Losses in Transformer, Phasor Diagram, Equivalent Circuit, Application.

**Lab Experiments: (Credits: 0.5)**

1. Study of Single Phase Transformer.

**Recommended Text Books:**

1. K.A. Krishnamurthy and M.R. Raghuveer, **Electrical and Electronics Engineering for Scientists**, Wiley Eastern Ltd., 1993.

**Reference Books:**

1. L. S. Bobrow, **Fundamentals of Electrical Engineering**(2nd edition), Oxford University Press, New Delhi

2. Vincent Del Toro, **Electrical Engineering Fundamentals**, Prentice Hall, 1989.

## COURSE: Entrepreneurship Development

**Course Outcomes:**The objective of thecourse is, further on, that the students develop the ability of analyzing various aspects ofentrepreneurship – especially of taking over the risk, and the specificities as well as thepattern of entrepreneurship development and, finally, to contribute to theirentrepreneurial and managerial potentials.

**UNIT I (The Entrepreneur)** **(Credits: 2)**

Introduction: The Entrepreneur: Definition, Emergence of Entrepreneurial Class; Theories of Entrepreneurship. Characteristics of an Entrepreneur – Why Start an Enterprise; Entrepreneur as an Inventor, Innovator, and Imitator; Difference Between an Entrepreneur and A Manager; Functions of an Entrepreneur; Types of Entrepreneurs; Entrepreneurial Characteristics & Skills. Disadvantages of Being an Entrepreneur.

**UNIT II (Promotion of Venture &Opportunity Analysis**) **(Credits: 2)**

Promotion of a Venture: Opportunity Analysis; External Environmental Analysis Economic, Social and Technological; Competitive factors; Legal requirements of establishment of a new unit and Raising of Funds; Venture Capital Sources and Documentation Required. Entrepreneurial Behavior: Innovation and Entrepreneur; Entrepreneurial Behaviour and Psycho theories, Social responsibility. Entrepreneurial Development Programmes (EDP): EDP, Their Role, Relevance and Achievements; Role of Government in Organizing EDP's Critical Evaluation.

**UNIT III** **(Credits: 2)**

**Theory** Role of Entrepreneur: Role of an Entrepreneur in Economic Growth as an Innovator, Generation of Employment Opportunities, Complimenting and Supplementing Economic Growth, Bringing about Social Stability and Balanced Regional Development of Industries: Role in Export Promotion and Import Substitution, Forex Earnings.

**Recommended Text Book:**

1. Hisrich, Robert and Peters, Michael, (2002), Entrepreneurship, 5th Edition, McGraw Hill Education.
2. Charantimani, (2006), Entrepreneurship Development and Small Business Enterprise, 1st edition, Pearson Education.

**Reference Books::**

1. Chandra, Ravi, (2003), Entrepreneurial Success: A Psychological Study, Sterling Publication Pvt. Ltd., New Delhi.
2. Balaraju, Theduri, (2004), Entrepreneurship Development: An Analytical Study, Akansha Publishing House, New Delhi.
3. David, Otes, (2004), A Guide to Entrepreneurship, Jaico Books Publishing House, Delhi.
4. Kaulgud, Aruna, (2003), Entrepreneurship Management, Vikas Publishing House, Delhi.

## III Semester

**COURSE: ECONOMICS** **(Credits: 5.5)**

**Course Outcomes:** To develop a theoretical understanding of economics and microeconomics, customer behavior, various laws which are implemented in real life scenario and market situations.

**Unit: I (Introduction to Economics)** **(Credits: 2.5)**

Introduction: Definition, nature and scope of economics, introduction to micro and macroeconomics; Microeconomics: Consumer behavior, cardinal and ordinal approaches of utility, law of diminishing marginal utility, theory of demand and supply, law of demand, exceptions to the law of demand, change in demand and change in quantity demanded, elasticity of demand and supply, Indifference curve, properties, consumer equilibrium, Price and income effect;

**Unit: II (Production and Various laws)**

**(Credits: 1.5)**

Production: Law of production, production function, SR and LR production function, law of returns, Isoquant curve, characteristics, Is cost, producer's equilibrium; Cost and revenue analysis: Cost concepts, short run and long- run cost curves, TR,AR,MR;

**Unit: III (Market Situations)**

**(Credits: 1.5)**

Various market situations: Characteristics and types, Break-even analysis; Macro Economics: National Income, Monetary and Fiscal Policies, Inflation, demand and supply of money, consumption function and business cycle.

**Recommended Books & References:**

1. H.L Ahuja, *Macroeconomics Theory and Policy*, (20e) S. Chand Publication.
2. Peterson H C et.al.,*Managerial Economics*, (9e), Pearson, 2012
3. P L Mehta, *Managerial Economics*, Sultan Chand & Sons, New Delhi, 2012.
4. G J Tuesen & H G Tuesen, *Engineering Economics*, PHI, New Delhi, 2008.
5. J. L. Riggs, D. D. Bedworth, S. U. Randhawa, *Engineering Economics*, Tata McGraw Hill, 2018.

## COURSE: ENGINEERING MATHEMATICS III

**(Credits: 6)**

**Course Outcomes:** To develop the understanding of Boolean algebra, calculus and graph theory and their uses that where we can apply these methods. Students will be able to do mathematical operations.

**Unit: I (Boolean algebra)**

**(Credits: 1)**

Boolean algebra: Partial ordering relations, Poset, Lattices, Basic Properties of Lattices. Distributive and complemented lattices, Boolean lattices and Boolean Algebra.

**Unit: I (Calculus)**

**(Credits: 2.5)**

Propositional and Predicate Calculus: Well-formed formula, connectives, quantifications, Inference theory of propositional and predicate calculus. Elementary configuration: Permutations and Combinations, Generating function, Principle of inclusion and exclusion Partitions, compositions. Ordering of permutations: Lexicographical and Fikes.

**Unit: I (Graph Theory)**

**(Credits: 2.5)**

Graph theory: Basic definitions, Degree, regular graphs, Eulerian and Hamiltonian graphs, Trees and Properties, Centre, radius and diameter of a graph, Rooted and binary trees, Matrices associated with graphs, Algorithms for finding shortest path, Algorithm. Group theory: Semi groups, Monoids, Groups subgroups, Normal Subgroups, Cosets, Lagrange's Theorem, Cyclic groups.

**Recommended Books & References:**

1. C. L. Liu, *Elements of Discrete Mathematics, (2e)*, Mc Graw Hill, New Delhi, 2007.
2. J. P. Trembaly and R. Manohar, *Discrete Mathematics Structures with application to computer science*, Tata Mc Graw Hill, 2012.
3. E. S. Page and L. B. Wilson, *An Introduction to Computational Combinatorics*, Cambridge Univ. Press, 1979.
4. N. Deo, *Graph theory withApplications to computer science*, PHI, 2012.

## COURSE: DATA COMMUNICATIONS

**(Credits: 6)**

**Course Outcomes:** To develop the theoretical understanding of communications and networking, Signal encoding and data link control protocols. Student will able to learn about various applications of communications through the network.

**Unit: I (Introduction)**

**(Credits: 2)**

Introduction: Data communications, Networks, Network types, Standards. Protocol Layering: Protocol, Need for protocol architecture, OSI Model, TCP/IP protocol architecture. Data Transmission: Concepts and terminology, Analog and digital data transmission, Transmission impairments, Channel capacity, Transmission Media: Guided transmission media, Wireless transmission, Wireless propagation, Line-of-Sight transmission.

**Unit: II (Signal Encoding Techniques)**

**(Credits: 2)**

Signal Encoding Techniques: Analog and digital Signals, Digital-to-digital conversion: Line coding schemes, Block coding, scrambling, Analog-To-Digital Conversion: Pulse code modulation, Delta modulation. Digital Data Communication Techniques: asynchronous and synchronous transmission, Types of errors, Error detection, Error correction, Line configurations.

**Unit: III (Data Link Control Protocols)**

**(Credits: 2)**

Data Link Control Protocols: Flow control, Error control, High-level data link control. Multiplexing: Frequency-division multiplexing, Time-division multiplexing, Code-division multiple access.Space division multiplexing. Multiple Accesses: Random access, Aloha, Carrier senses multiple access, Carrier sense multiple access with collision detection, Carrier sense multiple access with collision avoidance, Code-division multiple access.

**References:**

1. B. Forouzan, *Data Communication & Networking,* (5e), McGraw Hill Education, 2013.
2. W. Stallings, *Data and Computer Communications*, (10e), Pearson Education,2018.

## COURSE: COMPUTER SYSTEM ARCHITECTURE

**(Credits: 6)**

**Course Outcomes:** To develop the understanding about the computer architecture, its basic structure and models, working of logical and arithmetic units in the computer system. Students will be able to recognize the devices and able to perform operations on it.

**Unit: I (Digital Logic Circuits)** **(Credits: 2)**

Digital Logic Circuits: Logic Gates, Boolean algebra, Map Simplification, Combinational Circuits, Flip-Flops, Sequential Circuits. Digital Components: Integrated Circuits, Decoders, Multiplexers, Registers, Shift Registers, Binary Counters, Memory Unit.

**Unit: II (Basic Structure of Computers)** **(Credits: 2)**

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Software, Performance. Machine Instructions and Programs: Numbers, Arithmetic Operations and Characters, Memory Locations and Addresses, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Additional Instructions, Encoding of Machine Instructions.

**Unit: III (Arithmetic)** **(Credits: 2)**

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating Point Numbers and Operations.

**Recommended Books & References:**

1. M. Morris Mano, *Computer System Architecture*, (3e), Pearson, 2017.
2. C. Hamacher, Z. Vranesic, S. Zaky, *Computer Organization and Embedded Systems*, (6e), McGraw Hill, 2012.
3. J. P. Hayes, *Computer Architecture and Organization*, (3e), McGraw Hill TMH, 2012.

## COURSE: DATA STRUCTURES & ALGORITHMS

**(Credits: 6)**

**Course Outcomes:** To develop the understanding about the theoretical and practical aspects of various algorithms and data structures used in the computer systems.Also, the relation between data structures and algorithms.

**Theory: (Credits: 4.5)**

**Unit: I (Introduction)**

**(Credits: 1.5)**

Introduction: Data structures classification, time and space complexity, pointers and pointer applications, Accessing variables through pointers, structures, functions. Array: introduction, Linear array, representation of an array in memory, multi-dimensional arrays, pointer arrays, matrix operations.

Linked Lists: Introduction, single linked list, representation of a linked list in memory, Different Operations on a Single linked list, reversing a single linked list, Advantages and disadvantages of single linked list, circular linked list, doubly linked list and Header linked list.

**Unit: II (Applications of Algorithms)**

**(Credits: 1.5)**

Applications: polynomial operations and Josephus problem. Stacks: Basic Stack Operations, implementation of a Stack using Static Array, Dynamic Array and linked list, Multiple stack implementation using single array, Stack Applications, Reversing list, Factorial Calculation, Infix to postfix conversion, evaluation of Arithmetic Expressions and Towers of Hanoi. Queues: Basic Queue Operations, Representation of a Queue using array and linked list, Implementation of Queue Operations using Stack, Applications of Queues, Round Robin Algorithm, Circular Queues, Dequeues, Priority Queues.

**Unit: III (Trees and Graphs)**

**(Credits: 1.5)**

Trees: Definition of tree, Properties of tree, Binary Tree, Representation of Binary trees using arrays and linked lists, Operations on a Binary Tree, threaded binary tree, Binary Tree Traversals (recursive and using stack), Binary search tree, AVL tree, m-way tree, B-tree, B+ tree Graphs: Basic concepts, Different representations of Graphs, Graph Traversals (BFS & DFS), Minimum Spanning Tree (Prims & Kruskal). Searching Techniques: Sequential and binary search. Hashing: Hash function, Address calculation techniques, and Common hashing functions, Collision resolution, Linear and Quadratic probing, Double hashing. Sorting Techniques: Basic concepts, Sorting by: bubble sort, Insertion sort, selection sort, quick sort, heap sort, merge sort, radix sort.

**Practical:**

**(Credits: 1.5)**

1. Implementation of array operations: insertion, deletion, linear search and binary search, matrix operation.
2. Implementation of singly, doubly and circular linked lists: inserting, deleting, and inverting a linked list, Polynomial addition, subtraction and sparse matrix implementation by linked list, Josephus problem.
3. Stacks and Queues: adding, deleting elements.
4. Circular Queue: Adding & deleting elements, conversion of infix to postfix and Evaluation of postfix expressions using stacks & queues, Implementation of stacks & queues using linked lists.
5. Recursive and Non-recursive traversal of Trees: Threaded binary tree traversal, BST and AVL tree implementation.
6. Implementation of sorting and searching algorithms: bubble sort, Insertion sort, selection sort, quick sort, heap sort, merge sort, radix sort, Hash table implementation.

**Recommended Books & References:**

1. A. S. Tannenbaum, J. Augenstein, *Data Structures using C*, Pearson India, 2018.
2. E. Horowitz, S. Sahni, *Fundamentals of Data Structures in C*, (2e), Universities Press, 2008.
3. A. Forouzan, R. F. Gilberg, *A Structured Programming Approach Using C*, (3e), Cengage Learning, 2006.

## COURSE: OBJECT ORIENTED PROGRAMMING

**(Credits: 6)**

**Course Outcomes:** To develop the understanding of object oriented programming with the fundaments and how these work with the input and output flows, exception handling and multithread programming.

**Unit: I (Introduction)** **(Credits: 1.5)**

The History and Evolution of object-oriented technology: benefits of object-oriented programming (OOP), application of object-oriented programming (OOP), introduction to object-oriented programming language like Java, C# and C++.

**Unit: II (Programming Fundamentals)** **(Credits: 2)**

Programming Fundamentals: Control flow statements, operators, datatypes, Type conversion, Wrapper Classes, Arrays. Introduction to classes: Class fundamentals, declaring objects, Assigning Object reference variables, Introduction to methods, Constructors, Method Overloading, objects as parameters, argument passing, returning objects, recursion, access control, final, nested and inner classes.

**Unit: III (I/O Basics)** **(Credits: 2.5)**

I/O Basics: Reading Console Input, Writing Console Output, Files handling. Inheritance: base and derived class, multilevel hierarchy, access modifier in inheritance, method overriding, abstract classes. Exception Handling: Exception types, creating exception, Try Catch construct, Throw and throws keyword. Multithreaded programming: Creating and running threads, synchronise methods, inter thread communication, suspending, resuming and stopping thread.

**Practical:** **(Credits: 1.5)**

1. Introduction to object-oriented programming language: Basic programming construct, flow control, loops, data type and arrays.
2. Introduction to classes and object: creating class and object, using object to access class members, declaring method in class, recursion, argument passing and returning, declaring constructor, constructor overloading and method overloading.
3. Input-output: Basic technique for input and output, type casting, file handling.
4. Inheritance: creating base class and derive class, use of different access modifier, overriding base class methods, creating abstract classes/interfaces.
5. Exception handling: try catch construct, creating own exception, raising exception.
6. Multi thread programming: creating and running thread, stopping thread, use of wait, inter thread communication.

**Recommended Books & References:**


1. M. Weisfeld, *The object-oriented thought process*, (4e), Pearson, 2013.
2. H. Schildt, *The Complete Reference Java*, (10e), Oracle Press, 2018.
3. C. Horstmann, *Core Java Volume I—Fundamentals*, (10e), Prentice Hall, 2006.
4. H. Schildt, *The Complete Reference C++*, (4e), Mcgraw Hill, 2003.

## B.Tech Syllabus – IV Semester

**COURSE: VALUE, ETHICS & GOVERNANCE (Credits: 5.5)**

**Course Outcomes:** To develop the understanding of value education, basic human nature and behaviors, the governance system and roles of particulars, and about corporate social responsibilities.

**Unit-1 (Relevance of Value Education) (Credits: 2)**

Relevance of Value Education in day-to-day life.Mantra for success - Value, Moral and Ethics.Determinants of human nature (Three Gunas) and its impact on human life.Relevance of Personality, Attitude, Behavior, Ego, Character, introspection, Motivation, Leadership and 4 Qs with relevant Case Studies*.

**Unit-2 (Governance) (Credits: 2)**

Governance: Understanding of Public and Private sector Governance systems; Courts & CAG. Public Sector Governance: Need, relevance, stakeholders. Private Sector Governance: Proprietary, Partnership, Company (Pvt Ltd & Ltd), Company' Act 2013, Board of Directors; its Roles and Responsivities.Regulatory bodies; its role in ethical governance.Projects on PPP mode-relevance & prospects.

**Unit-3 Corporate Social Responsibility Credits: 1.5)**

CSR: Relationship with Society, Philanthropy and Business strategy, CSR Policy, Triple Bottom Line. Suggestive Case Studies: Uphar Theatre Tragedy- Engineering Ethics, Bhopal Gas Tragedy- Operational Engineering Ethics, Satyam Case- Financial Reporting Ethics, Enron Case- Business Ethics, Navin Modi Case- Financial Fraudulence.

**Recommended Books & References:**


1. Professional Module of ICSI.
2. Ghosh B.N., *Business Ethics & Corporate Governance*, (1e) McGraw Hill, 2011.
3. Mandal S.K., *Ethics in Business & Corporate Governance*, (2e), McGraw Hill, 2012.
4. Ray C.K., *Corporate Governance, Value & Ethics*, Vaya Education of India, 2012.
5. Chatterjee Abha, *Professional Ethics*, (2e) Oxford Publications.


**COURSE: ENGINEERING MATHEMATICS IV**

**(Credits: 6)**

**Course Outcomes:** To develop the understanding of basic set theory, distributions in mathematics and some tests like Chi square which is used in testing and sampling algorithms.

**Unit-1 (Basic Set theory) (Credits: 2)**

Basic Set theory, Axioms of probability, Sample space, conditional probability, total probability theorem, Baye's theorem. One dimensional and two dimensional random variables, mean and variance, properties,

**Unit-2 (Correlations and Distributions) (Credits: 2)**

Chebyschev's inequality, correlation coefficient,Distributions, Binomial, Poisson, Normal and Chisquare. Functions of random variables: One dimensional and Two dimensional, F & T distributions , Moment generating functions,

**Unit-3 Sampling theory and various tests (Credits: 2)**

Sampling theory, Central limit theorem, Point estimation, MLE, Interval estimation, Test of Hypothesis : significance level, certain best tests; Chi square test.

**Recommended Books & References:**


1. P. L. Meyer, *Introduction to probability and Statistical Applications*, (2e), Oxford and IBH publishing, 1980.
2. Miller, Freund and Johnson, *Probability and Statistics for Engineers*, (8e), PHI, 2011.
3. Hogg and Craig, *Introduction to mathematical statistics*, (6e), Pearson education, 2012.
4. S. M. Ross, *Introduction to Probability and Statistics for Engineers and Scientists*, Elseveir, 2010.

## COURSE: OPERATING SYSTEMS

**(Credits: 6)**

**Course Outcomes:** To develop the understanding of operating systems, processes run in the background, memory management, and scheduling and file management theoretically and practically.

**Theory (Credits: 4.5)**

**Unit-I(Introduction to operating systems)**

**(Credits: 1.5)**

Introduction: Definition of operating systems, Single and multi-processor systems, Operating system Services, System commands and system calls, Interrupt, System boot. OS Structure: Simple, Layered, Microkernel, Hybrid, Modules, Types of OS, Multi-user, Multitasking, Embedded, Real-time, Network, Distributed. Virtualization: Introduction, Hypervisor, Data center, Virtual data center, VMware virtualization products.

**Unit-II(Process and threads)** **(Credits: 1.5)**

Process and Thread: Process concept, Operations on processes, Inter-process communication, UNIX pipes, Multithreading, Multithreaded models, PThread API. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms. Synchronization: Critical section problem, Peterson solution, Synchronization hardware, Semaphores, Classical problems of synchronization, Deadlock, Methods for handling deadlock.

**Unit-III(Memory and File system management)** **(Credits: 1.5)**

Memory Management: Swapping, Contiguous memory allocation, Paging, Structure of Page Table, Segmentation, Demand Paging, Page Replacement Policies, Allocation of Frames, Thrashing. File System Interface and Implementation: File Concept, Access Methods, Directory and Disk Structure, File System Mounting, File System Structure, File System Implementation, Allocation Methods, Free Space Management. Disk Management: Disk Scheduling Algorithms, Disk Management, Swap Space Management.

**Practical** **(Credits: 1.5)**

1. Basic Linux commands: Illustration of shell functions, wild cards, redirection, pipes, sequencing, grouping, background processing, command substitution, sub shells, Shell programming.
2. System Calls: File and process, I/O Redirection, IPC using Pipe and Signals.
3. PThread API: Multithreaded programs, Synchronization programs using PThreads and Semaphores, CPU Scheduling, Deadlock, Memory Management.
4. Creating a Virtual Machine: Virtual Machine Files and Snapshots, Virtual Machine Cloning and Exporting.

**Recommended Books & References:**

1. A. Silberschatz, P. B. Galvin, G. Gagne, *Operating System Concepts*, (9e), Wiley, 2014.
2. A.S. Tanenbaum, H. Bos, *Modern Operating Systems*, (4e), Pearson, 2015.
3. W. Stallings, *Operating Systems: Internals and Design Principles*, (9e), Pearson, 2018.

## COURSE: RELATIONAL DATABASE MANAGEMENT SYSTEMS

**(Credits: 6)**

**Course Outcomes:** To develop the understanding of database management systems, schemas, various models related to relational databases, SQL and designing of relational database systems theoretically and practically.

**Theory (Credits: 4.5)**

**Unit-I(Introduction to Database) (Credits: 1)**

Introduction: Database systems, RDBMS Definition, data models, 3-schema architecture, challenges in building RDBMS, different components of a RDBMS. Relational Data Model: Concept of relations and its characteristics, schema-instance, integrity constraints, E/R Model, Extended E/R Model, converting the database specification in E/R and Extended E/R notation to the relational schema.

**Unit-II(Relational Query Language) (Credits: 1.5)**

Relational Query Language: Relational Algebra operators- selection, projection, cross product, various types of joins, division, example queries, tuple relation calculus, domain relational calculus, introduction to SQL, data definition in SQL, table and different types of constraints definitions, data manipulation in SQL, nested queries, notion of aggregation.

**Unit-III(Relational Database Design) (Credits: 2)**

Relational Database Design: functional dependencies and Normal forms, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, multi-valued dependencies and 4NF. Transaction Processing: concepts of transaction processing, ACID properties, concurrency control, locking based protocols, recovery and logging methods. Data Storage and Indexing: file organizations, primary, secondary index structures, hash-based indexing, dynamic hashing techniques, multi-level indexes, B-tree and B+ trees.

**Practical (Credit: 1.5)**

1. Introduction to SQL and its different command categories i.e. DDL, DML, DQL and DCL,
2. Data Integrity Constraints and Built-in Functions,
3. Design and implementing the data requirements of a simple DB application,
4. Experiments on views, indexing, triggers, stored procedures, transaction.

**Recommended Books & References:**


1. A. Silberschatz, H. F. Korth, S. Sudarshan, *Database System Concepts*, (6e), McGraw Hill, 2013.
2. R. Elmasri, S. B. Navathe, *Fundamentals of Database Systems*, (6e), Addison-Wesley, 2010.
3. R. Ramakrishnan, J. Gehrke, *Database Management Systems*, (3e), McGraw Hill, 2014.
4. I. Bayross, *SQL, PL/SQL The Programming Language of Oracle*, (4e), BPB Publications, 2010.
5. C. J. Date, *An Introduction to Database Systems*, (8e), Prentice Hall of India, 2006.

## COURSE: COMPUTER ORGANIZATION

**(Credits: 6)**

**Course Outcomes:** To develop the understanding of computer organization, processor data path and controls, pipelining and various clustering methods, memory organization and multithreading in hardware.

**Unit-I(Processor datapath and control)**

**(Credits: 1.5)**

Processor Datapath and Control: Logic Design Conventions, Building a Datapath, Implementation Schemes, Exceptions, Microprogramming.

**Unit-II(Pipelining and Memory Hierarchy)**

**(Credits: 2)**

Pipelining: Overview, Pipelined Datapath, Pipelined Control, Data Hazards and Forwarding, Data Hazards and Stalls, Branch Hazards. Memory Hierarchy: Basics of Caches, Measuring and Improving Cache Performance, Virtual Memory, Address Translation.

**Unit-III(Storage and other peripherals)**

**(Credits: 2.5)**

Storage and Other Peripherals: Disk Storage and Dependability, Networks, Connecting I/O Devices to Processor and Memory, Interfacing I/O Devices to the Memory, Processor, and Operating System, I/O Performance Measures, Redundant Array of Inexpensive Disks. Multicores, Multiprocessors and Clusters: Shared Memory Multiprocessors, Clusters and other Message-Passing Multiprocessors, Hardware Multithreading, SISD, MIMD, SIMD, SPMD and Vector Processors.

**Recommended Books & References:**

1. D. A. Patterson, J. L. Hennessy, *Computer Organization and Design: The Hardware and Software Interface*, (5e), Elsevier, 2017.
2. J. L. Hennessy, D. A. Patterson, *Computer Architecture: A Quantitative Approach*, (6e), Morgan Kaufmann Publishers, 2019.
3. W. Stallings, *Computer Organization and Architecture –Designing for Performance*, (9e), Pearson, 2013.

## COURSE: WEB TECHNOLOGY LAB

**(Credits: 6)**

**Course Outcomes:** To develop the understanding of web designing using HTML, CSS and PHP. To develop the understanding of practical implementation of JavaScript for mobile projects.

**Practical**

1. Introduction to WWW: Web Design, Web site design principles, planning the site and navigation.
2. HTML: The development process, html tags, forms, web site structure. XHTML: XML, move to XHTML, meta tags, character entities, frames and frame sets, inside browser.
3. Style Sheets: CSS1, CSS2, CSS3.
4. JavaScript: How to develop javascript, variables, functions, conditions, loops and repetition. Advance Javascript: Javascript and objects, javascript own objects, the DOM and web browser environments, forms and validations.
5. DHTML: Combining HTML, CSS and Javascript, events and buttons, controlling your browser.
6. Ajax: Introduction, advantages, purpose of it, Ajax based web application, alternatives of Ajax.
7. XML: Introduction to XML, DTD and Schemas, Well formed, using XML with application. XSL: Introduction to XSL, XML transformed simple example, XSL elements, transforming with XSLT.
8. PHP: Starting to script on server side, arrays, function and forms, advance PHP. Databases: Connection to server, creating database, performing data and schema related operations, PHP myadmin and database bugs.
9. Advanced topics: E-Commerce models and architecture. m-Commerce: WAP and Mobile agents, search engines and search engine optimization, Introduction to web services and technology.
10. Introduction, pros and cons of the above technology with advance technology: JQuery, WebRTC, Web socks, Angularjs, NodeJS, JSON, Bootstrap.

Note: All above will be facilitated using Web/Mobile application projects assigned to the students.

**Recommended Books & References:**

1. R. Connolly, R. Hoar, *Fundamentals of Web Development,* Pearson Education India, 2015.
2. R. Nixon, *Learning PHP, MySQL & JavaScript with jQuery, CSS and HTML5*, (5e), O'Reilly Publications, 2018.
3. L. Welling, L. Thomson, *PHP and MySQL Web Development*, (5e), Pearson Education, 2017.
4. N. C. Zakas, *Professional JavaScript for Web Developers*, (3e), Wrox/Wiley India, 2019.
5. D. S. Mcfarland, *JavaScript & jQuery: The Missing Manual*, (3e), O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014.
6. Z. R. A. Boehm, *Murach's HTML5 and CSS3*, (4e), Murach's/Shroff Publishers & Distributors Pvt Ltd, 2018.

**Open Electives:**

## COURSE: FUNDAMENTAL OF DATABASES

**(Credits: 6)**

**Course Outcomes:** To develop the understanding of Basics of database and its working concepts using SQL Queries for various operations.

**Unit-I(Introduction to Databases) (Credits: 2)**

Introduction: Database-System Applications, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture.

**Unit-II(File management system) (Credits: 2)**

File Management System: Indexing and Hashing. Relational Algebra: Algebra, Tuple Calculus, Domain Calculus. SQL: Data Definition Language, Data manipulation language, SQL Data Types and Schemas, Integrity Constraints, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null Values, Nested Sub-queries, Correlated queries. Join: Inner, Outer, Left, Right and Natural.

**Unit-III(The Entity Relationship Model) (Credits: 2)**

The Entity-Relationship Model: Constraints, Entity-Relationship Diagrams, Entity-Relationship Design Issues, Weak Entity Sets, Extended E-R Features. Normalization: Normal Forms, BCNF.

**Recommended Books & References:**

1. R. Elmasri, S. B. Navathe, *Fundamentals of Database Systems*, (6e), Addison-Wesley, 2010.
2. R. Ramakrishnan, J. Gehrke, *Database Management Systems*, (3e), McGraw Hill, 2014.

## COURSE: PRINCIPLES OF PROGRAMMING LANGUAGES

**(Credits: 6)**

**Course Outcomes:** To develop the understanding of programming language in context of syntax and semantics, data types, and concepts of object oriented programming in various programming languages.

**Unit-I(Preliminary Concepts of Programming Languages) (Credits: 2)**

Preliminary Concepts: Concepts of programming languages. Syntax and Semantics: general Problem of describing Syntax and Semantics. Data types: Primitive, character, user defined, array, associative record, union, pointer and reference types.

**Unit-II(Expressions and Statements) (Credits: 2)**

Expressions and Statements: Assignment Statements, Control Structures. Subprograms and Blocks: Fundamentals of sub-programs, Scope of life time of variables, static and dynamic scope, design issues of sub-programs and operations. Abstract Data types: Abstractions and encapsulation, introductions to data abstraction, design issues, language examples.

**Unit-III(Concurrency and exception handling) (Credits: 2)**

Concurrency: Subprogram level concurrency, semaphores, monitors, massage passing, Java threads, C# threads. Exception handling: Exceptions, exception Propagation, Exception handler in Ada, C++ and Java, Logic Programming Language: Introduction and overview of logic programming.

**Recommended Books & References:**

1. R. W. Sebesta, *Concepts of Programming Languages*, (10e), Pearson Education, 2008.
2. D. A. Watt, *Programming Language Design Concepts*, Wiley, (2e), 2007.
3. B. Tucker, R. E. Noonan, *Programming Languages*, (2e), TMH, 2007.
4. K. C. Louden, *Programming Languages*, (2e), Thomson, 2003.
5. T. W. Pratt, M. V. Zelkowitz, T. V. Gopal, *Programming Languages: Design and Implementation*, (4e), PHI, 2006

## COURSE: ENTERPRISE RESOURCE PLANNING

**(Credits: 6)**

**Course Outcomes:** To develop the understanding of enterprise resource planning and how engineering works in the businesses. Also, the understanding of software development life cycle in nutshell.

**Unit-I(ERP Overview) (Credits: 2)**

ERP Overview: ERP Components, ERP Benefits. Business Process Reengineering (BPA): BPA life cycle, BPA components. Data warehousing, Data mining, Supply chain Management; ERP: evolution, a Manufacturing Perspective, ERP Module, ERP Market, ERP implementation life cycle, Options of various paradigms, Identification of suitable platforms.

**Unit-II(SDLC/SSAD) (Credits: 2)**

SDLC/SSAD: Role of SDLC/SSAD, Object oriented architecture. ERP Implementation: introduction, pre evaluation screening, package evaluation, project planning phase, Gap analysis, Hidden costs, Major Vendors, Consultant Employees, Human Resource.

**Unit-III(ERP & E-Commerce) (Credits: 2)**

ERP & E-Commerce: Future Directives- in ERP, ERP and Internet, Critical Factors guiding selection and evaluation of ERP, Strategies for its successful implementation, Impediments and initiatives to achieve success, Critical success and failure factors, Integrating of ERP into organizational culture. Using ERP tool: Case study of a system using SAP or ORACLE or open source ERP.

**Recommended Books & References:**

1. S. R. Magal, J. Word, *Integrated Business Processes with ERP Systems*, (2e), John Wiley & Sons, 2011.
2. M. Sumner, *Enterprise Resource Planning*, Pearson Education, (2e), 2006.
3. E. Monk, B. Wagner, *Concepts in Enterprise Resource Planning*, (3e), Thomson Course Technology, 2006.

## COURSE: PRINCIPLES OF MACHINE LEARNING

**(Credits: 6)**

**Course Outcomes:** To develop the understanding of artificial intelligence and basics of data mining, roles and uses of data mining and various algorithms theoretically. Also, the uses of neural networks and its types.

**Unit-I(Introduction to Artificial Intelligence) (Credits: 2)**

Introduction to Artificial Intelligence: Foundations, scope, problems. Problem-solving through Searching: forward and backward, state-space, blind, heuristic, problem-reduction, minimax.
Supervised Learning: Process for feature selection, over-parameterization and the curse of dimensionality, regularization, cross validation.

**Unit-II (Classification and Regression) (Credits: 2)**

Classification: operation of classifiers, regression as a classifier, metrics used to evaluate classifiers, SVM, Naïve Bayes, KNN. Regression: operation of regression models, prediction and forecasting, metrics used to evaluate regression models.

**Unit-III(Neural Networks) (Credits: 2)**

Neural networks: Feed forward NN, Feed backward NN, Convolutional Neural network. Unsupervised Learning: K-mean clustering. Algorithmic Learning Theory and Applications: Mistake bound model, PAC Model.

**Recommended Books & References:**

1. G. F. Luger, W. A. Stubblefield, *Artificial Intelligence - Structures and Strategies for Complex Problem Solving.* (5e), Addison Wesley, 2005.
2. P Baldi, S Brunak, *Bioinformatics: A Machine Learning Approach*, (2e) MIT Press, 2002.
3. T. M. Mitchell, *Machine Learning*, McGraw-Hill Education, 2017.
4. Y Abu-Mostafa, M. Magdon-Ismail, H.T. Lin, H-T. *Learning from Data*. AML Book, 2012.

# V Semester

## COURSE: ARTIFICIAL INTELLIGENCE AND SOFT COMPUTING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of fundamental concepts of artificial intelligence, search techniques and soft computing in detail. Student will be able to understand the concepts of artificial applications and soft computing.

**Unit: I (Fundamental Concepts)** **(Credit: 1.5)**

Fundamental Concepts: Agents, environments, general model, Problem solving techniques. Search Techniques: Uninformed search, heuristic search, adversarial search and game trees, Solution of constraint satisfaction problems using search.

**Unit: II (Knowledge representation)** **(Credit: 1.5)**

Knowledge Representation: Propositional and predicate calculus, semantics for predicate calculus, inference rules, unification, Resolution, semantic networks, conceptual graphs/Dependency, structured representation. Learning: Inductive learning, decision tree learning. Natural language processing: introduction, parsing using context free grammars, Chomsky hierarchy, case grammar.

**Unit: III (Soft Computing)** **(Credit: 1.5)**

Soft computing: Fuzzy set theory, Fuzzy sets, set-theoretic operations, membership functions, Union, intersection and complement, fuzzy rules, reasoning and interference. Neural networks: Perception, Back Propagation. Evolutionary techniques: genetic algorithms, Swarm Algorithm, ant colony optimization.

**Practical** **(Credit: 1.5)**

1. Introduction to Python: basic variable declaration, loops, inbuilt functions.
2. Basic Programming using Python for AI techniques: global and local heuristics, Crypt arithmetic, Python syntax, Constraint satisfaction Problem, Preposition and inference.
3. Travelling Salesman Problem using Branch & Bound /Nearest Neighbour.
4. Character recognition using Neural Networks.
5. Optimization using Genetic Algorithms.
6. Mini-Projects & Case Studies.

**Recommended Books & References:**

1. S. Russell, P. Norvig, *Artificial Intelligence: A Modern Approach,*(3e) PHI, 2011.
2. E. Rich, K. Knight, S. B. Nair, *Artificial Intelligence,* (3e), Tata McGraw Hill, 2009.
3. G. F. Luger, *Artificial Intelligence-Structures and Strategies for Complex Problem Solving*, (6e), Addison-Wesley Pearson Education, 2012.

## COURSE: DESIGN & ANALYSIS OF ALGORITHMS

**(Credit: 6)**

**Course Outcome:** To develop the understanding of fundamental concepts of algorithms, framework analysis, and dynamic programming concepts. Students will be able to perform dynamic programming to solve some complex problems using optimized solutions.

**Theory (Credit: 4.5)**

**Unit: I (Introduction to algorithms) (Credits: 1.5)**

Introduction: Fundamentals of Algorithms, Important Problem Types, Analysis of algorithm efficiency. Analysis Framework: Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Nonrecursive and Recursive Algorithms, Brute force Techniques, Divide and Conquer.

**Unit: II (Searching and Sorting) (Credits: 1.5)**

Decrease and Conquer: Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting. Transform and Conquer: Presorting, BST, Heapsort. Space and Time tradeoffs: Input Enhancement in String Matching.

**Unit: III (Dynamic Programming (Credits: 1.5)**

Dynamic Programming: Warshall's and Floyd's Algorithms, The Knapsack Problem. Greedy Techniques: Prim's, Kruskal's and Dijkstra's Algorithm, Huffman Trees, Coping with limitations of algorithmic power. Backtracking: nQueens problem, Hamiltonian Circuit Problem, SubsetSum Problem. BranchandBound: Assignment Problem, Knapsack Problem, TSP. Complexity Clasess: P, NP,and NP-complete Problems.

**Practical (Credit: 1.5)**

1. Sorting & Searching Algorithm: insertion sort, selection sort, binary search.
2. Basic data structures: stacks and queues, graphs and trees, binary trees.
3. Algorithmic paradigms: Recursion, divide-and-conquer, Merge sort, Quick sort.
4. Greedy: Knapsack, Huffman encoding, dynamic programming, lower bounds and optimal algorithms.
5. Heaps: Heaps, priority queues, min-max heaps, heap sort.
6. Dynamic search structures: Binary search trees, height balancing, B-trees.
7. Algorithms on arrays: Linear-time median finding, sorting in linear time (counting sort, radix sort, bucket sort), String matching (Rabin-Karp and Knuth-Morris-Pratt algorithms).
8. Graph algorithms Traversal: (BFS, DFS, topological sort), Minimum spanning trees (Prim and Kruskal algorithms), shortest paths (Dijkstra's and Floyd-Warshal algorithms).
9. Mini-Projects & Case Studies.

**Recommended Books & References:**

1. E. Horowitz, S. Sahni, S. Rajasekaran, *Fundamental of Computer Algorithms*, (2e), Universities Press, 2007.
2. T. H. Cormen, C. E. Leiserson, R.L. Rivest and C. Stein, *Introduction to Algorithms*, (3e), MIT press, 2009.

## COURSE: AUTOMATA THEORY & COMPILER DESIGN

**(Credit: 6)**

**Course Outcome:** To develop the understanding of automata theory, Mealy and Moore machines, hierarchy in grammars and the compiler design techniques. Students will learn about the theoretical and practical aspects of machines.

**Unit: I (Introduction to automata)**

**(Credits: 2)**

Introduction: Automata Theory, Mathematical Preliminaries and Notation, Review of set theory, function, relation. Finite Automata: Deterministic and Non Deterministic Finite Automata (FA), Regular languages, Mealy and Moore machine;

**Unit: II (Regular Sets and Regular Grammars)**

**(Credits: 2)**

Regular Sets and Regular Grammars: Chomsky Hierarchy, Regular Expressions, Regular Grammar and FA, Pumping Lemma for Regular Languages**;** Context Free Languages (CFL) and Grammars: Ambiguity, Methods for Transforming Grammars**;** Push Down Automata: Nondeterministic Pushdown Automata (NPDA), Design of NPDA, PDA and CFLs**;** Introduction to Turing machine;

**Unit: III (Compiler Design)**

**(Credits: 2)**

Introduction to Compiler Design: Structure of a Compiler, Lexical Analysis, Recognition of Tokens**;** Introduction to LR Parsing: Simple LR, More Powerful LR Parsers**,** Parser Generators; Syntax Directed Translations; Type Checking: Rules for Type Checking; Storage Organization.

**Recommended Books & References:**


1. P. Linz, *An Introduction to Formal Languages and Automata*, (6e), Jones and Bartlett Student Edition, 2016.
2. A. V. Aho, J. Ullman, M. S. Lam, R. Sethi, *Compilers: Principles, Techniques and Tools*, (2e), Pearson Education, 2015.
3. M. Sipser, *Introduction to the Theory of Computation*, (3e), Cengage Learning, 2014.
4. J. C. Martin, *Introduction to Languages and the Theory of Computation*, (4e), McGraw Hill, 2010.

## COURSE: COMPUTER NETWORKS

**(Credit: 6)**

**Course Outcome:** To develop the understanding of networking and its concepts, some dynamic routing protocols and applications and protocols at application layer theoretically and practically. Students will be able to learn and perform the virtual network simulation and also, the real time traffic monitoring.

**Unit: I (Network Layer and protocols)** **(Credits: 1.5)**

Network Layer: Network layer design issues, routing algorithms, congestion control algorithms, Quality of service, MPLS, Classful addressing, Sub-netting, Classless addressing. Protocols: ARP & DHCP, Introduction, Packet Format, message types, IPV4 header format, fragmentation, options, checksum. ICMP: Message format, message types.

**Unit: II (Dynamic Routing Protocols)** **(Credits: 1.5)**

Dynamic routing protocols: RIP, OSPF & BGP. Multicasting Protocol: IGMP, Introduction to IPV6. Transport Layer: Transport services, state diagram, Elements of Transport Protocols, addressing, Connection establishment, connection release, Error control and Flow Control, Multiplexing. Congestion Control: Bandwidth allocation, regulating the sending rate, UDP, TCP.

**Unit: III (Application Layer)** **(Credits: 1.5)**

Application Layer: DNS, Name space, domain resource records. Electronic Mail: SMTP, POP, IMAP, MIME, HTTP, HTTPS, SNMP. Network Security: Security Goals, Attacks, Attack prevention techniques, Firewall, IDS, DMZ, IPsec.

**Practical** **(Credit: 1.5)**

1. Cisco Packet Tracer: Introduction to packet tracer and networking device components, Router mode, Switch/Router basic commands; designing of star topology using HUB and Switch,
2. IP configuration of end devices,
3. Configuring DHCP server, Static routing, RIP, OSPF, VLAN and NAT.
4. Network programming: Transmission control protocol and User datagram protocol.
5. Network Utilities: PING, NETSTAT, IPCONFIG, IFCONFIG, ARP, TRACE-ROUTE

**Recommended Books & References:**

1. B. A. Forouzan, *TCP/IP Protocol Suite*, (4e), TMH, 2010.
2. A. S. Tanenbaum, *Computer Networks*, (5e), Pearson, 2010.

## Open Electives:

### COURSE: FUNDAMENTAL OF DATABASES

**(Credits: 6)**

**Course Outcome:** To develop the understanding of Basics of database and its working concepts using SQL Queries for various operations. Students will learn about database systems and, manage the data.

**Unit-I(Introduction to Databases) (Credits: 2)**

Introduction: Database-System Applications, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture.

**Unit-II(File management system) (Credits: 2)**

File Management System: Indexing and Hashing. Relational Algebra: Algebra, Tuple Calculus, Domain Calculus. SQL: Data Definition Language, Data manipulation language, SQL Data Types and Schemas, Integrity Constraints, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null Values, Nested Sub-queries, Correlated queries. Join: Inner, Outer, Left, Right and Natural.

**Unit-III(The Entity Relationship Model) (Credits: 2)**

The Entity-Relationship Model: Constraints, Entity-Relationship Diagrams, Entity-Relationship Design Issues, Weak Entity Sets, Extended E-R Features. Normalization: Normal Forms, BCNF.

**Recommended Books & References:**

3. R. Elmasri, S. B. Navathe, *Fundamentals of Database Systems*, (6e), Addison-Wesley, 2010.
4. R. Ramakrishnan, J. Gehrke, *Database Management Systems*, (3e), McGraw Hill, 2014.

## COURSE: PRINCIPLES OF PROGRAMMING LANGUAGES

**(Credits: 6)**

**Course Outcome:** To develop the understanding of programming language in context of syntax and semantics, data types, and concepts of object oriented programming in various programming languages.

**Unit-I(Preliminary Concepts of Programming Languages)**

**(Credits: 2)**

Preliminary Concepts: Concepts of programming languages. Syntax and Semantics: general Problem of describing Syntax and Semantics. Data types: Primitive, character, user defined, array, associative record, union, pointer and reference types.

**Unit-II(Expressions and Statements)**

**(Credits: 2)**

Expressions and Statements: Assignment Statements, Control Structures. Subprograms and Blocks: Fundamentals of sub-programs, Scope of life time of variables, static and dynamic scope, design issues of sub-programs and operations. Abstract Data types: Abstractions and encapsulation, introductions to data abstraction, design issues, language examples.

**Unit-III(Concurrency and exception handling)**

**(Credits: 2)**

Concurrency: Subprogram level concurrency, semaphores, monitors, massage passing, Java threads, C# threads. Exception handling: Exceptions, exception Propagation, Exception handler in Ada, C++ and Java, Logic Programming Language: Introduction and overview of logic programming.

**Recommended Books & References:**

1. R. W. Sebesta, *Concepts of Programming Languages*, (10e), Pearson Education, 2008.
2. D. A. Watt, *Programming Language Design Concepts*, Wiley, (2e), 2007.
3. B. Tucker, R. E. Noonan, *Programming Languages*, (2e), TMH, 2007.
4. K. C. Louden, *Programming Languages*, (2e), Thomson, 2003.
5. T. W. Pratt, M. V. Zelkowitz, T. V. Gopal, *Programming Languages: Design and Implementation*, (4e), PHI, 2006

## COURSE: ENTERPRISE RESOURCE PLANNING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of enterprise resource planning and how engineering works in the businesses. Also, the understanding of software development life cycle in nutshell.

**Unit-I(ERP Overview)** **(Credits: 2)**

ERP Overview: ERP Components, ERP Benefits. Business Process Reengineering (BPA): BPA life cycle, BPA components. Data warehousing, Datamining, Supply chain Management; ERP: evolution, a Manufacturing Perspective, ERP Module, ERP Market, ERP implementation life cycle, Options of various paradigms, Identification of suitable platforms.

**Unit-II(SDLC/SSAD)** **(Credits: 2)**

SDLC/SSAD: Role of SDLC/SSAD, Object oriented architecture. ERP Implementation: introduction, pre evaluation screening, package evaluation, project planning phase, Gap analysis, Hidden costs, Major Vendors, Consultant Employees, Human Resource.

**Unit-III(ERP & E-Commerce)** **(Credits: 2)**

ERP & E-Commerce: Future Directives- in ERP, ERP and Internet, Critical Factors guiding selection and evaluation of ERP, Strategies for its successful implementation, Impediments and initiatives to achieve success, Critical success and failure factors, Integrating of ERP into organizational culture. Using ERP tool: Case study of a system using SAP or ORACLE or open source ERP.

**Recommended Books & References:**

1. S. R. Magal, J. Word, *Integrated Business Processes with ERP Systems*, (2e), John Wiley & Sons, 2011.
2. M. Sumner, *Enterprise Resource Planning*, Pearson Education, (2e), 2006.
3. E. Monk, B. Wagner, *Concepts in Enterprise Resource Planning*, (3e), Thomson Course Technology, 2006.

## COURSE: PRINCIPLES OF MACHINE LEARNING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of artificial intelligence and basics of data mining, roles and uses of data mining and various algorithms theoretically. Also, the uses of neural networks and its types.

### Unit-I(Introduction to Artificial Intelligence)

**(Credits: 2)**

Introduction to Artificial Intelligence: Foundations, scope, problems. Problem-solving through Searching: forward and backward, state-space, blind, heuristic, problem-reduction, minimax.
Supervised Learning: Process for feature selection, over-parameterization and the curse of dimensionality, regularization, cross validation.

### Unit-II(Classification and Regression)

**(Credits: 2)**

Classification: operation of classifiers, regression as a classifier, metrics used to evaluate classifiers, SVM, Naïve Bayes, KNN. Regression: operation of regression models, prediction and forecasting, metrics used to evaluate regression models.

### Unit-III(Neural Networks)

**(Credits: 2)**

Neural networks: Feed forward NN, Feed backward NN, Convolutional Neural network. Unsupervised Learning: K-mean clustering. Algorithmic Learning Theory and Applications: Mistake bound model, PAC Model.

### Recommended Books & References:

1. G. F. Luger, W. A. Stubblefield, *Artificial Intelligence - Structures and Strategies for Complex Problem Solving.* (5e), Addison Wesley, 2005.
2. P Baldi, S Brunak, *Bioinformatics: A Machine Learning Approach,* (2e) MIT Press, 2002.
3. T. M. Mitchell, *Machine Learning*, McGraw-Hill Education, 2017.
4. Y Abu-Mostafa, M. Magdon-Ismail, H.T. Lin, H-T. *Learning from Data*. AML Book, 2012.

## Programme Electives:

### COURSE: INFORMATION RETRIEVAL

**(Credits: 6)**

**Course Outcome:** To develop the understanding of information retrieval using some terminologies and the concepts behind the search engines.

**Unit-I(Introduction to IR)**

**(Credits: 2)**

Introduction to IR: IR Concepts, Boolean Retrievals- An Example Information Retrieval Problem, A First Take at Building an Inverted Index, Processing Boolean Queries. The Term Vocabulary and Postings Lists: Document Delineation and Character Sequence Decoding, Determining the Vocabulary of Terms. Dictionaries and Tolerant Retrieval: Search Structures for Dictionaries, Wildcard Queries, Spelling Correction, Phonetic Correction.

**Unit-II(Index Construction and Information retrieval)**

**(Credits: 2)**

Index Construction: Hardware Basics Blocked Sort-Based Indexing. Scoring, Term Weighting and the Vector Space Model: Parametric and Zone Indexes, Term Frequency and Weighting, The Vector Space Model for Scoring. Evaluation in Information Retrieval: Information Retrieval System Evaluation, Standard Test Collections, Evaluation of Unranked Retrieval Sets, Evaluation of Ranked Retrieval Results.

**Unit-III(XML and Web search)**

**(Credits: 2)**

XML Retrieval: Basic XML Concepts, Challenges in XML Retrieval, A Vector Space Model for XML Retrieval, Evaluation of XML Retrieval, Text-Centric vs. Data-Centric XML Retrieval. Web Search Basics: Web Characteristics, Advertising as the Economic Model, The Search User Experience, Index Size and Estimation, Near-Duplicates and Shingling. Web Crawling and Indexes: Overview, Crawling, Distributing Indexes, Connectivity Servers. Link Analysis: The Web as a Graph, Page Rank, Hubs and Authorities.

**Recommended Books & References:**

1. C. Manning, P. Raghavan, H. Schütze, *Introduction to Information Retrieval,* Cambridge University Press, 2009.
2. R. Baeza-Yate, B. Ribeiro-Neto, *Modern Information Retrieval,* (2e), Addison Wesley, 2012.
3. S. Chakrabarti, *Mining the Web: discovering knowledge from hypertext data,* (2e), Morgan Kaufmann, 2002.
4. D. A. Grossman , O. Frieder, *Information Retrieval: Algorithms, and Heuristics, (2e),* Springer, 2004.

## COURSE: COMPUTER GRAPHICS & MULTIMEDIA

**(Credit: 6)**

**Course Outcome:** To develop the understanding of computer graphics, algorithms behind the graphics, and how multimedia systems work practically and theoretically both.

### Unit-I(Introduction to Computer Graphics)

**(Credits: 2)**

Basics of Computer Graphics: Pixel, Frame buffer, Application of computer graphics. Graphic Display Devices: Cathode Ray Tube, Light emitting diode, DVST, Random and Raster Scan displays. Scan Conversion: Line Generation using digital differential analyzer (DDA), bresenham's Algorithm, Circle generation algorithm, Ellipse generation algorithm, Polygon generation and filling algorithms.

### Unit-II(Transformations of images)

**(Credits: 2)**

Two Dimensional Transformations: Introduction, homogeneous representation of points, basic transformation like Translation, Rotation, Scaling, Reflection, Shear. Clipping and Windowing: Cohen Sutherland Algorithm, liang Barsky algorithm, Sutherland Hodgman Algorithm. Three dimensional transformation: Translation, Rotation, Scaling and Reflection. Projection: Introduction, Types of projection. Hidden Surface elimination: Depth comparison, Back face detection algorithm, Painter's Algorithm, Z-Buffer Algorithm. Basic Illumination Model: Diffuse reflection, Specular reflection, Phong and Gouraud shading.

### Unit-III(Introduction to Multimedia)

**(Credits: 2)**

Introduction to Multimedia: Concepts and uses, hypertext and hypermedia, image, video and audio standards, text compression algorithm. Animation: types, techniques, key frame animation, utility, morphing.

**Recommended Books & References:**


1. D. Hearn, M. P. Baker, *Computer Graphics with OpenGL*, (4e), Pearson Education, 2014.
2. R. Steinmetz, K. Nahrstedt, *Multimedia Systems*, Springer, 2004
3. J. F. Hughes, J. D. Foley, *Computer graphics Principles and Practice*,(3e), Pearson Education, 2014.
4. R. Steinmetz, K. Nahrstedt, *Multimedia Fundamentals: Media Coding and Content Processing*, (2e), Pearson Education, 2004

## COURSE: USER INTERFACE DESIGN

**(Credit: 6)**

**Course Outcome:** To develop the understanding of user interface and its designing principals, models and use cases with real life projects.

**Unit-I(UI Design Process)**

**(Credits: 2)**

UI Design Process: Design Process Introduction, Designing to Address a Problem w/o Solution Ideas, Designing for a known solution direction, Designing to iterate on/improve an existing solution, Common Elements: Usability, Engineering and Task-Centered Approaches, Use Cases, Personas, Tasks, and Scenarios, Design-Centered Methods & When They Work Best, Pulling it all Together, Psychology and Human Factors for User Interface Design: Introduction, Fitts' Law, Short- and long-term memory, attention, Perception and visualization, hierarchy, Mistakes, Errors, and Slips, Conceptual models, The Gulf of Execution and the Gulf of Evaluation,

**Unit-II(Designing Principals and personas)**

**(Credits: 2)**

Design Principles: Visibility, Feedback, Mappings, Constraints, Interacting beyond individuals (social psychology), High-Level Models: Distributed Cognition, Activity Theory, Situated Action, User Research Methods: User Research to Design, Introduction to User Research, Interview and Focus Groups, Observations, Contextual Inquiry, Ethics and Consent, Design a User Research Protocol, Log Analysis, Surveys and Questionnaires, Analyzing and Delivering User Research: Introduction: Translating User Research to Support Design, Qualitative Analysis, Quantitative Analysis, Personas I: What They Are; How They're Used, Personas II: Walking Through Examples, Use Cases, Tasks and Walkthrough Scenarios, Implications for Design,

**Unit-III(Ideation and Idea selection)**

**(Credits: 2)**

Ideation and Idea Selection: rom Research to Ideas, Ideation, Idea Selection, Communicating Ideas to Stakeholders, Good User Interfaces principles: learnability, visibility, error prevention, efficiency, and graphic design) and the human capabilities that motivate them (including perception, motor skills, color vision, attention, and human error), Implementation of UI: building user interfaces, including low-fidelity prototypes, etc Empirical research involving novel user interfaces.

**Recommended Books & References:**

1.Norman, A. Donald, *The Design of Everyday Things.*MIT Press, 2014.
2.Coursera platform and internet resources

## COURSE: DIGITAL IMAGE PROCESSING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of image processing, its types and various uses, and the use of image are processing in the authentication.

### Unit-I(Introduction to Image Processing)

**(Credits: 2)**

Introduction to image processing: steps in image processing, Image file formats, Basic relationships between pixels, Colour Models. Image Enhancement and Restoration: Image histogram, Spatial domain enhancement, point operations, Log transformation, Power-law transformation.

### Unit-II(Image transformations)

**(Credits: 2)**

Frequency domain enhancement: introduction to image transforms, Fourier transform, 2D-DFT. Restoration: Noise models, Restoration using inverse filtering and Wiener filtering. Image Coding and Compression: Lossless compression, Lossy compression, JPEG, MPEG.

### Unit-III(Image Segmentation and Representation)

**(Credits: 2)**

Image Segmentation and Representation: Grey level features, edges and lines, similarity, correlation, template matching, edge detection using templates, Representation scheme, boundary descriptors, regional descriptors, Image Morphology. Biometric Authentication, Object Detection.

### Recommended Books & References:


1. K. R. Castleman, *Digital Image Processing*, (2e), Pearson Education, 2011.
2. R. C. Gonzalez, R. E. Woods, *Digital Image Processing*, (4e), Pearson Education, 2018.
3. A. K. Jain, *Fundamentals of Digital Image Processing*, Pearson Education, Reprint 2015.
4. S. Jayaraman, S. Esakkirajan, T Veerakumar, *Digital Image Processing*, Tata McGraw Hill Education, 2009.
5. R. C. Gonzalez, R. E. Woods, S. Eddins, *Digital Image Processing using MATLAB*, (2e), Pearson Education.
6. A. McAndrew, *Introduction to Image processing using MATLAB*, Cengage Learning Publisher, 2007.
7. Prateek Joshi, *OpenCV with Python By Example*, (1e) PACKT Publishing, 2018.

**COURSE: INTERNET OF THINGS(Credit: 6)**

**Course Outcome:** To develop the understanding of fundamental concepts of Internet of Things and its applications, working of IoT system and protocols related to it.

**Unit-I(Introduction) (Credits: 2)**

Introduction: Analog and digital signals, serial communication, RF and sensors; Introduction to JSON/XML. Programming on Development Boards: Understanding of the board, tool chain and development environment setup; Sensors and Actuators: Understanding and using analog, digital, SPI, UART, I2C.

**Unit-II(Nodes and Communications) (Credits: 2)**

Nodes and communication protocols: Understanding usage of nodes and gateways for sensor communication and external communication, RF, Zigbee, BT, WI-FI, GSM.

**Unit-III(IoT and Cloud) (Credits: 2)**

IoT Cloud Platform, Cloud using Web Services, Cloud Computing Services for Sensor Management, Python Script; Data Analytics: Mongo DB, Map Reduce, Using cloud APIs for analytics, Visualization, NVD3, Mobile interfacing.

**Recommended Books & References:**

1. V. Madisetti, A. Bahga, *Internet of Things: A Hands-On- Approach*, VPT, 2014.
2. R. Buyya, A. V. Dastjerdi, *Internet of Things Principles and Paradigms*, 2016.
3. H. Geng, *Internet of Things Principles and Data Analytics Handbook*, Wiley, 2017.
4. P. Raj, A. C. Raman, *The Internet of Things Enabling Technologies, Platforms, and Use Cases*, CRC Press, 2017.

**COURSE: BIG DATA ANALYTICS (Credit: 6)**

**Course Outcome:** To develop the understanding of Big Data and its management, Advanced analytics algorithms, and file systems used to manage the big data.

**Unit-I(Introduction to Big Data) (Credits: 2)**

INTRODUCTION: Introduction to big data, definition, need and evolution of BDA, Applications of Big Data. Analysing big data: Sources of big data, Characteristics of Big Data(4 V's), Drivers of BDA, Structured vs. Unstructured data, Data Marts, Differences between traditional DWDM and BDA. Data Processing: Data Wrangling, Data Munging, Data Jujitsu. Data Visualisation: Why to visualize data. Data Analytics Life Cycle.

**Unit-II(Advanced Analytics Algorithms) (Credits: 2)**

Advanced Analytics Algorithms: Introduction using R – Theory and Methods Overview: K-means clustering, Association Rules, Linear Regression, Logistic Regression, Naïve Bayesian Classifiers, Decision Trees, Time Series Analysis, Text Analytics; Statistics for Model Building and Evaluation: Statistics in the Analytic Lifecycle, Hypothesis Testing, Difference of means.

**Unit-III(HADOOP Framework) (Credits: 2)**

Hadoop Framework: Introduction to Hadoop, HDFS - Hadoop Distributed File system, Map Reduce Programming, Pig. ETL & Batch Processing with Hadoop: ETL & Data Warehousing, Ingesting data into Big Data Platforms using Apache Sqoop & Flume, Big Data Analytics using Apache Hive, NoSQL databases for Big Data Storage Applications (HBase), Workflow management for Hadoop using Oozie Spark: Introduction to Spark, SparkSQL, MLLib: Regression, Clustering & Classification using Spark MLLib.

**Recommended Books & References:**

1. B. Schmarzo, *Big Data: Understanding How Data Powers Big Business,* Wiley.2013
2. A. Jorgensen, J. Rowland-Jones, J. Welch, *Microsoft Big Data Solutions,* Wiley.,2014
3. J. Thompson, S. P. Rogers, *Analytics: How to Win with Intelligence, Technics, LLC Publications ,* 2017

## COURSE: SOFTWARE DEFINED NETWORKS

**(Credit: 6)**

**Course Outcome:** To develop the understanding of working of software defined working, programming behind this and network function virtualization.

**Unit-I(Software Defined Networking) (Credits: 2)**

Software Defined Networking (SDN): Separation of control plane and data plane, IETF forces, Active networking. Control and Data Plane Separation: Concepts, Advantages and disadvantages, the Open flow protocol.

**Unit-II(Control Plane and SDN Programming) (Credits: 2)**

Control Plane: Overview, Existing SDN controllers including floodlight and open daylight projects. Customization of Control Plane: Switching and firewall implementation using SDN concepts. Data Plane: Software-based and Hardware-based, Programmable network, Mininet based examples. Programming SDNs: Northbound application programming interface, current languages and tools, Composition of SDNs.

**Unit-III(Network Functions Virtualization) (Credits: 2)**

Network Functions Virtualization (NFV): Concepts, Implementation, Applications. Use Cases of SDNs: Data Centers, Internet exchange points, Backbone networks, Home networks, Traffic engineering. Programming Assignments for implementing some of the theoretical concepts listed above.

**Recommended Books & References:**

1. T. D. Nadeau, K. Gray, *SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies,* (1e) O'Reilly Media, 2013.
2. P. Goransson, C. Black, *Software Defined Networks: A Comprehensive Approach*, (2e) Morgan Kaufmann, 2016.
3. F. Hu, *Network Innovation through Open Flow and SDN: Principles and Design*, CRC Press, 2014.
4. V. Tiwari, *SDN and Open Flow for Beginners, Amazon Digital Services, Inc.,* ASIN, 2013.
5. S Subramanian, *Software Defined Networking with OpenStack,* Packt Publishing, 2016.

## COURSE: DEEP NEURAL NETWORK

**(Credit: 6)**

**Course Outcome:** To develop the understanding of neural networks using advanced methods in neural networks and the working of the neural networks.

**Unit-*I*(Introduction) (Credits: 2)**

Introduction of Deep Learning, Basics of Machine Learning, Neural Network, Activation function, Gradient Descent, Stochastic Gradient Descent, backpropagation, Deep Convolution Neural network: convolution operation, ReLU Layer, Pooling Layer, Flattening, fully connected layer, softmax and cross entropy,

**Unit-II(Recurrent Neural networks) (Credits: 2)**

Recurrent Neural network: Vanishing Gradient Problem, LSTMs, LSTM variations, Self-organizing Map (SOM), K-means clustering, Boltzmann Machine, Energy-based Models, Contrastive Divergence,

**Unit-III(Deep Belief Networks) (Credits: 2)**

Deep Belief Networks, autoencoders, training of auto encode, over complete hidden layers, sparse autoencoders, denoising autoencoders, contractive autoencoders, stacked autoencoders, deep autoencoders.

**Recommended Books & References:**

1. I. Goodfellow, Y. Bengio , A. Courville, *Deep Learning*, MIT Press 2016.
2. S. Haykin, *Neural Networks and Learning Machines*, (3e), PHI, 2008.

## COURSE: SOCIAL NETWORK ANALYSIS

**(Credit: 6)**

**Course Outcome:** To develop the understanding of social web and working of different models used in the social network analysis.

**Unit-I(Introduction to Social Web) (Credits: 2)**

Introduction to Social Web: Nodes, Edges and Network measures, Describing Nodes and Edges, Describing Networks, Layouts. Visualizing Network features: The role of Tie Strength, Measuring Tie Strength, Tie Strength and Network Structure, Tie Strength and Network Propagation, Link Prediction, Entity Resolution. Link Prediction: Case Study Friend recommendation.

**Unit-II(Communities) (Credits: 2.5)**

Communities: Introduction, Communities in Context, Quality Functions. Algorithms: Clustering-based, Newman and Girvan- Divisive clustering, Newman-Modularity maximization, Clauset-Greedy optimization of modularity, Louvain Method-Hierarchical clustering, Agglomerative clustering, Falkowski (DENGRAPH)-Density-based clustering, Nikolaev-Entropy centrality-based clustering, Clique-based Methods for Overlapping Community Detection, Palla- Clique percolation method, Lancichinetti-Fitness function, Du-Kernels-based clustering, Shen-Agglomerative hierarchical clustering, Evans-Line graph, clique graph, Label Propagation-based Community Detection.

**Unit-III(Introduction to social influence) (Credits: 1.5)**

Introduction to Social Influence: Influence Related Statistics, Social Similarity and Influence, Homophile, Existential Test for Social Influence, Influence and Actions, Influence and Interaction, Influence Maximization in Viral Marketing.

**Recommended Books & References:**

1. J. Goldbeck, *Analyzing the Social Web*, Morgan Kaufmann Publications, 2013.
2. C. C. Aggarwal, *Social Network Data Analytics*, Springer Publications, 2011.
3. J. Scott, *Social Network Analysis*, (3e), SAGE Publications Limited, 2013.
4. J. Goldman, *Facebook Cookbook*, O'Reilly, 2009.
5. S. Kumar, F. Morstatter, H. Liu, *Twitter Data Analytics*, Springer Publications, 2013.

## COURSE: SOFTWARE TESTING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of fundamentals of software testing, various techniques of testing like manual and automated testing.

**Unit-I(Introduction) (Credits: 2)**

Introduction and concept learning: Basic definitions, Testing axioms, Purpose of Software Testing, Software Testing Principles, The Tester's Role in a Software Development Organization, Origins of Defects, Cost of defects, Defect Classes, Defect Prevention strategies, Defect Repository, Strategies for Software Testing, Testing Activities, Mistakes, Faults & Failures, Verification and Formal Methods, Planning for Verification and Validation.

**Unit-II(Manual Testing Methods) (Credits: 2.5)**

White-Box Testing: Test Adequacy Criteria, Static Testing, Structural Testing, Code Complexity Testing, Mutation Testing, Data Flow Testing. Black-Box Testing: Test Case Design Criteria, Requirement Based Testing, Positive and Negative Testing, Boundary Value Analysis, Equivalence Partitioning State Based Testing, Domain Testing. Functional Testing: Test Plan, Test Management, Test Execution and Reporting, Test Specialist Skills, Tester's Workbench and Tool Categories, Debugging, Test Bed, Traceability and Testability, Attributes of Testable Requirements, Test Matrix, Types of Testing Documentation, Verification Testing, Validation Testing, Integration Testing, System and Acceptance Testing, GUI Testing, Regression Testing, Selection, Minimization and Prioritization of Test Cases for Regression Testing, Creating Test Cases from Requirements and Use cases, Test Design.

**Unit-III(Test Automation) (Credits: 1.5)**

Test Automation: Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

**Recommended Books & References:**

1. W. E. Perry, *Effective Methods for Software Testing*, John Wiley and Sons, 2000.
2. R. Patton, *Software Testing*, Sams Publishing, 2005.
3. A. P. Mathur, *Foundations of Software Testing*, Pearson Education, 2013.
4. J. L. Mitchell, R. Black, *Advanced Software Testing—Vol. 3*, Rocky Nook, 2015.

## COURSE: LINUX SYSTEM AND SHELL PROGRAMMING

**(Credit: 6)**

**Course Outcomes:** To develop the understanding of Linux operating system and its operations. The main objective is to develop the understanding of various operating systems and working on them as per requirements, practically.

**Unit-I(Introduction to Linux)**

**(Credits: 2)**

Fundamentals: Processes in Linux, I/O system calls, select and poll functions, Filters and redirection, Linux file system navigation, Directory access, File system implementation, Hard links and symbolic links. Asynchronous Events: Manipulating signal masks and signal sets, Catching and ignoring signals, waiting for signals.

**Unit-II(Inter-Process Communication)**

**(Credits: 2)**

Inter-Process Communication: Sockets, Remote procedure calls, Network file system. Concurrency: POSIX thread attributes, Synchronization functions, Mutex locks, Condition variables, Signal handling and threads. Character Device Driver Development: Driver concepts, Writing character drivers, Interrupt handling, Interfacing with hardware. Shell Scripting: Loops, Conditional statements, Command line arguments, test command, expr command.

**Unit-III(Advanced Scripting Techniques)**

**(Credits: 2)**

Advanced Scripting Techniques: Providing command line options to scripts, exporting variables, Arrays, Remote shell execution, connecting to MySQL using shell, Essential system administration.

**Recommended Books & References:**


1. W. R. Stevens, S. A. Rago, *Advanced Programming in the UNIX Environment*, (3e), Addison-Wesley, 2013.
2. R. Love, *Linux System Programming: Talking Directly to the Kernel and C Library*, O'Reilly, 2007.
3. S. Das, *Unix Concepts and Applications*, (4e), McGraw Hill, 2006.
2. W. R. Stevens, B. Fenner, *UNIX Network Programming, Volume 1: The Sockets Networking API*, (3e), Pearson, 2003.
3. K. A. Robbins, S. Robbins, *Unix Systems Programming: Communication, Concurrency, and Threads*, (2e), Prentice Hall, 2004.

## COURSE: WIRELESS SENSOR & ADHOC NETWORK

**(Credit: 6)**

**Course Outcome:** To develop the understanding of adhoc networks, standards and benefits of using sensors for smart devices used in daily life.

**Unit-I(Introduction to ad-hoc networks)**

**(Credits: 2)**

Introduction to ad-hoc networks: Definition, characteristics features, applications. Characteristics of Wireless channel, Ad-hoc Mobility Models: Indoor and outdoor models. MAC Protocols: design issues, goals and classification. Contention based protocols with reservation, scheduling algorithms, protocols using directional antennas.

**Unit-II(IEEE standards, protocols and security)**

**(Credits: 2)**

IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.Routing Protocols: Design issues, goals and classification.Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Energy aware routing algorithm, Hierarchical Routing, QoS aware routing. Transport layer: Issues in designing- Transport layer classification, ad-hoc transport protocols. Security issues in ad-hoc networks: issues and challenges, network security attacks, secure routing protocols. Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary perspective. Integration of ad-hoc with Mobile IP networks. Mesh Networks, Vehicular Area Networks, and Mobile Ad Hoc Networks (MANETs).

**Unit-III(Introduction to sensor networks and its applications)**

**(Credits: 2)**

Introduction to sensor networks and its applications: Architecture and factors influencing the sensor network design. Routing protocols- data centric routing protocols, hierarchical routing protocols, location based routing, energy efficient routing etc. Node Scheduling and coverage issues, topology control.Querying, data collection and processing.

**Recommended Books & References:**

1. S. K. Sarkar, T G Basavaraju, C Puttamadappa, *Ad Hoc Mobile Wireless Networks: Principles, Protocols, and Applications,* (2e), CRC Press,2016.
2. C. D. Morais Cordeiro, D. P. Agrawal, *Ad Hoc and Sensor Networks: Theory and Applications,* (2e), World Scientific Publishing, 2011.
3. H. Karl, A. Willing, *Protocols and Architectures for Wireless Sensor Networks,* John Wiley & Sons, 2007.
4. R. Jurdak, *Wireless Ad Hoc and Sensor Networks: A Cross-Layer Design Perspective,* Springer Publications, 2007.
5. S R Murthy, B. S. Manoj, *Ad Hoc Wireless Networks Architectures and Protocols,* Pearson Education, 2008.

## COURSE: MOBILE COMPUTING(Credit: 6)

**Course Outcome:** To develop the understanding of wireless communications, telecommunication systems and the working of wireless networks using some security aspects.

**Unit-I(Wireless Communication Fundamentals) (Credits: 2)**

Wireless Communication Fundamentals: Introduction wireless transmission, Frequencies for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulations spread spectrum, MAC, SDMA, FDMA, TDMA, CDMA, Cellular wireless networks.

**Unit-II(Telecommunications Systems) (Credits: 2)**

Telecommunications Systems: GSM, System architecture protocols, Connection establishment, Frequency alocation, Routing, handover, Security, GPRS. Wireless Networks: Wireless LAN-IEEE 802.11 Standards, Architecture, Services HIPERLAN, AdHoc Network, Bluetooth mobile network layer: Mobile IP, Dynamic host configuration protocol.

**Unit-III(Routing) (Credits: 2)**

Routing: DSDV, DSR, Alternative metrics, Wireless application protocol. Mobile Ad hoc Networks: Overview, Properties of a MANET, Spectrum of MANET applications, Routing and various routing algorithms, Security in MANET.

**Recommended Books & References:**

1. W. Stallings, *Wireless Communications and Networks*, (2e)Pearson Education, 2018.
2. J. Schiller, *Mobile Communications*, (2e), *Pearson Education*, 2009.
3. K. Garg, *Mobile Computing: Theory and Practice*, (1e) Pearson Education India, 2010.

## COURSE: NATURAL LANGUAGE PROCESSING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of various language formats used in computer systems and how these languages processed in the computer systems.

**Unit-I(Introduction) (Credits: 2)**

Introduction: Ambiguity and uncertainty in language, processing paradigms, phases in natural language processing. Text representation in computers: encoding schemes. Linguistics resources: Introduction to corpus, elements in balanced corpus, WordNet, VerbNet. Part of Speech tagging: Stochastic POS tagging, HMM, Transformation based tagging (TBL), handling of unknown words, named entities, multi word expressions.

**Unit-II(Natural language grammars) (Credits: 2)**

Natural language grammars: lexeme, phonemes, phrases and idioms, word order, agreement, tense, aspect and mood and agreement, context free grammar, spoken language syntax. Parsing-unification, probabilistic parsing, tree-bank. Semantics: meaning representation, semantic analysis, and lexical semantics.

**Unit-III(Word Sense Disambiguation) (Credits: 2)**

Word Sense Disambiguation: selection restriction, machine learning approaches, dictionary based approaches. Discourse: Reference resolution, constraints on co-reference, algorithm for pronoun resolution, text coherence, discourse structure. Real time Applications of NLP: text to speech, text summarization, information retrieval, sentiment analysis, machine translation.

**Recommended Books & References:**

1. D. Jurafsky, J. H. Martin, *Speech and Language Processing*, (2e), Pearson Education, 2009.
2. T. Siddiqui, U. S. Tiwary, *Natural language processing and Information retrieval*, Oxford University Press, 2008.

## COURSE: COMPUTER VISION

**(Credit: 6)**

**Course Outcome:** To develop the understanding of a computer system which uses various algorithms and methods to enhance images, graphics, and use of neural networks.

### Unit-I(Introduction)

**(Credits: 2)**

Introduction to computer vision and its applications, Geometric Image Features: Differential Geometry, Contour Geometry, analytical image features: Euclidean geometry, Geometric Camera Parameters, Calibration methods, Image formation, Liner Filtering: Linear filters and convolution, shift invariant linear systems, spatial frequency and Fourier transforms,

### Unit-II(Image Properties)

**(Credits: 2)**

Image transformations and Colour models, Edge Detection methods (Laplacian detectors and Canny edge detector), Points and patches, Harris corner detector, Histogram of Gradients, Difference of Gaussian detector, SIFT, Colour and Texture, Feature based alignment, least squares and RANSAC, Camera models, Camera calibration,

### Unit-III(Methods and properties)

**(Credits: 2)**

Stereo vision, Stereo correspondence, Epipolar geometry Optical flow, Lucas Kanade method, KLT tracking method, Mean shift method, Dense motion estimation, Support Vector Machines, Face detection and recognition, Bag of words, Deep convolution neural network.

### Recommended Books & References:

1. R. Szeliski, *Computer Vision: Algorithms and Applications*, Springer 2011.
2. D. A. Forsyth, J. Ponce, *Computer Vision: A Modern Approach*, (2e), PHI learning, 2012
3. J. E. Solem, *Programming Computer Vision with Python*, O'Reilly, 2012.

# VI Semester

## COURSE: ORGANISATION AND MANAGEMENT

**(Credit: 6)**

**Course Outcome:** To develop the understanding of management in organizations, personal management and entrepreneurship.

**Unit-I(Introduction) (Credits: 2)**

Meaning and definition of an organization, Necessity of Organization, Principles of Organization, Formal and Informal Organizations. Management: Functions of Management, Levels of Management, Managerial Skills, Importance of Management, Models of Management, Scientific Management, Forms of Ownership, Organizational Structures, Purchasing and Marketing Management, Functions of Purchasing Department, Methods of Purchasing, Marketing, Functions of Marketing, Advertising.

**Unit-II(Personal Management) (Credits: 2)**

Introduction, Functions of Personal Management, Development of Personal Policy, Manpower Planning, Recruitment and Selection of manpower**.**Motivation – Introduction, Human needs, Maslow's Hierarchy of needs, Types of Motivation, Techniques of Motivation, Motivation Theories, McGregor's Theory, Herzberg's Hygiene Maintenance Theory. Leadership - Introduction Qualities of a good Leader, Leadership Styles, Leadership Approach, Leadership Theories.

**Unit-III(Entrepreneurship) (Credits: 2)**

Entrepreneurship-Introduction, Entrepreneurship Development, Entrepreneurial Characteristics, Need for Promotion of Entrepreneurship, Steps for establishing small scale unit**.**Data and Information; Need, function and Importance of MIS; Evolution of MIS; Organizational Structure and MIS, Computers and MIS, Classification of Information Systems, Information Support for functional areas of management.

**Recommended Books & References:**

1.Koontz, Harold, Cyril O'Donnell, and Heinz Weihrich, *Essentials of Management*,(1e) Tata McGraw-Hill, New Delhi, 1978.

2. Robbins, Stephen P, and Mary Coulter, *Management, Prentice Hall*, (2e) New Delhi, 1997.

3. E. S. Buffa and R. K. Sarin, *Modern Production / Operations Management*, (8e), Wiley, 1987

4.H. J. Arnold and D. C. Feldman, *Organizational Behavior*, McGraw – Hill, 1986.

5. Aswathappa K, *Human Resource and Personnel Management*, Tata McGraw Hill, 2005.

6. William Wether & Keith Davis, *Human Resource and Personnel Management*, McGraw Hill, 1986.

## COURSE: SOFTWARE ENGINEERING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of software, models for software management, development and product engineering.

**Theory (Credit: 4.5)**

**Unit-I(Introduction)** **(Credits: 1.5)**

Introduction: The Evolving Role of Software, The changing nature of software, Legacy software, Software Myths. Software Engineering: A Layered Technology, a Process Framework, the Capability Maturity Model Integration (CMMI), Specialized Process Models, and the Unified Process.

**Unit-II(Agile Development)**

**(Credits: 1.5)**

Agile development: Agile Process Models Software Engineering Practice, Communication Practice, Planning Practices, Modeling Practices, Construction Practice, Deployment Computer–Based Systems, The System Engineering Hierarchy, Business Process Engineering: An Overview.

**Unit-III(Product Engineering)**

**(Credits: 1.5)**

Product Engineering: An Overview, Data Modeling Concepts, Object Oriented Analysis, Flow-Oriented Modeling, Taxonomy of Quality Attributes, Perspectives of Quality, Quality System, Software Quality Assurance, Capability Maturity Model Observation on Estimation, The Project Planning Process, Software Scope and Feasibility, Human Resources, Empirical Estimation Model, Introduction To DevOps, Cloud Computing And Virtualization, Migration to DevOps, DevOps Tools.

**Practical**

**(Credit: 1.5)**

1. Introduction: Agile development: Agile Process Models Software, Communication Practice, Planning Practices, Modeling Practices, Construction Practice, Deployment of Computer–Based Systems, The System Engineering Hierarchy.
2. Business Process Engineering: An Overview,
3. Product Engineering: An Overview, Data Modelling Concepts, Object Oriented Analysis, Flow-Oriented Modeling, Taxonomy of Quality Attributes, Perspectives of Quality, Quality System, Software Quality Assurance, Capability Maturity Model Observation on Estimation using Projects,
4. The Project Planning Process, Software Scope and Feasibility, Human Resources, Empirical Estimation Model ,
5. Introduction To DevOps, Cloud Computing And Virtualization,
6. Migration to DevOps, DevOps Tools,

Note: All above will be facilitated using Software Projects assigned to the students.

**Recommended Books & References:**

1. R. Pressman, *Software Engineering: A Practitioners Approach*, (8e), McGrawHill Pubs, 2019.
2. M. Walls, *Building a Dev Ops Culture*, O'Reilly Publications, 2013.
3. J. Joyner, *Dev Ops for Beginners, Dev Ops Software Development Method guide for software developers and IT professionals*, Mihails Konoplovs, 2015.

## COURSE: INFORMATION SYSTEMS SECURITY

**(Credit: 6)**

**Course Outcome:** To develop the understanding of security and its concepts, techniques used in security, some problems with live solutions and the usage of security theoretically and practically.

**Unit-I(Introduction)**

**(Credits: 1.5)**

Introduction: Basic objectives of cryptography, Secret-key and public-key cryptography, One-way trapdoor one-way functions, Cryptanalysis, Attack models, Classical cryptography. Block ciphers: Modes of operation, DES and its variants, AES, Linear and differential cryptanalysis. Message digest: Properties of hash functions, MD2, MD5 and SHA-1, Keyed hash functions, Attacks on hash functions.

**Unit-II(Public key Infrastructure)**

**(Credits: 1.5)**

Public-key parameters: Modular arithmetic, Primality testing, Chinese remainder theorem, Modular square roots, Finite field. Intractable problems: Integer factorization problem, RSA problem, Modular square root problem, Discrete logarithm problem, Diffie-Hellman problem, Known algorithms for solving the intractable problems. Public-key encryption: RSA, Rabin and EIGamal schemes, Elliptic and hyper-elliptic curve cryptography, Side channel attacks, Diffie-Hellman and MQV key exchange.

**Unit-III(Digital signatures and authentication)**

**(Credits: 1.5)**

Digital signatures: RSA, DSA and NR signature schemes, blind and undeniable signatures. Entity authentication: Passwords, Challenge-response algorithms, Zero-knowledge protocols. Network security: Certification, public-key infrastructure (PKI), secure socket layer (SSL), Kerberos.

**Practical (Credits: 1.5).**

1. Substitution and Transposition Cipher Implementation: Caesar Cipher, Playfair Cipher, Hill Cipher, Vigenere Cipher, Rail fence.
2. Symmetric and Asymmetric Cipher Implementation: DES, RSA, Diffie-Hellman, MD5, SHA-1.
3. Signature Schemes Implementation: Digital Signature Standard, GnuPG API.
4. Demonstration of secure data storage: Setup of honey pot and monitoring on network using KF sensors.
5. Installation of rootkits.
6. Wireless audit on an access point or a router, WEP and WPA (Net Stumbler).
7. Intrusion detection system using snort.

**Recommended Books & References:**

1. B. A. Forouzan, D. Mukhopadhyay, *Cryptography and Network Security*, (2e), Mc-Graw Hill, , 2008.
2. W. Stallings, *Cryptography and Network Security: Principles and Practice*, (5e),Prentice Hall, 2010.
3. J. Pieprzyk, T. Hardjono, J. Seberry, *Fundamentals of Computer Security*, Springer International Edition, 2003.
4. A. J. Menezes, P. C. V. Oorschot ,S. A. Vanstone, *Handbook of Applied Cryptography*, CRC Press.

## COURSE: DATA SCIENCE AND MACHINE LEARNING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of innovative ideas using machine learning and data science. A better understanding of various algorithms and rules included in the emerging technologies.

**Unit-I(Data Science)**

**(Credits: 2)**

Data Science: Descriptive Statistics, Probability Distribution, regression analysis, ANOVA. Machine Learning: Goals, Applications of ML, developing a learning system, training data, concept representation, function approximation. Decision Tree Learning: Representing concepts as decision trees, Recursive induction of decision trees, best splitting attribute, entropy, information gain., Occam's razor, Overfitting, noisy data, and pruning.

**Unit-II(Artificial Neural Networks)**

**(Credits: 2)**

Artificial Neural Networks: Neurons and biological motivation. Linear threshold units, Perceptron, representational limitation and gradient descent training, Multilayer networks and backpropagation. Hidden layers and constructing intermediate, distributed representations, Overfitting, learning network structure, recurrent networks.Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing. Support Vector Machines: Maximum margin linear separators. Kernels for learning non-linear functions.

**Unit-III(Bayesian Learning)**

**(Credits: 2)**

Bayesian Learning: Probability theory and Bayes rule. Naive Bayes learning algorithm, Logistic regression, Bayes nets and Markov nets for representing dependencies. Instance-Based Learning: k-Nearest-neighbor algorithm, Case-based learning, Relevance feedback and Rocchio algorithm. Naive Bayes for text. Clustering and Unsupervised Learning: Hierarchical Agglomerative Clustering, k-means partitioned clustering, expectation maximization (EM) for soft clustering. Ensemble Learning: Bagging, boosting, and Decorate. Active learning with ensembles.

**Recommended Books & References:**


1. G. James, D. Witten, T Hastie, R Tibshirani, *An introduction to statistical learning with applications in R*, Springer, 2013.
2. J. Han, M. Kamber, J. Pei, *Data Mining concepts and techniques, (2e)*, Morgan Kaufmann-Elsevier, 2011.
3. T. Hastie, R. Tibshirani, J. Friedman, *The Elements of Statistical Learning*, (2e), Springer, 2009.
4. K. Murphy, *Machine Learning: A Probabilistic Perspective*, MIT Press, 2012.
5. T. M. Mitchell, *Machine Learning*, (Indian Edition), MacGraw Hill, 2017.
6. C. Bishop, *Neural Networks for Pattern Recognition*, Oxford University Press, 2019


## Subject: MINOR PROJECT (Credit: 2)

In this course student has to select a project work based on a topic of interest. Periodically the supervisor will evaluate the implementation. This work, started in eighth semester of which, the student will be evaluated internally and externally.

## Open Electives:

### COURSE: FUNDAMENTAL OF DATABASES

**(Credits: 6)**

**Course Outcome:** To develop the understanding of Basics of database and its working concepts using SQL Queries for various operations.

**Unit-I(Introduction to Databases)**

**(Credits: 2)**

Introduction: Database-System Applications, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture.

**Unit-II(File management system)**

**(Credits: 2)**

File Management System: Indexing and Hashing. Relational Algebra: Algebra, Tuple Calculus, Domain Calculus. SQL: Data Definition Language, Data manipulation language, SQL Data Types and Schemas, Integrity Constraints, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null Values, Nested Sub-queries, Correlated queries. Join: Inner, Outer, Left, Right and Natural.

**Unit-III(The Entity Relationship Model)**

**(Credits: 2)**

The Entity-Relationship Model: Constraints, Entity-Relationship Diagrams, Entity-Relationship Design Issues, Weak Entity Sets, Extended E-R Features. Normalization: Normal Forms, BCNF.

**Recommended Books & References:**

1. R. Elmasri, S. B. Navathe, *Fundamentals of Database Systems*, (6e), Addison-Wesley, 2010.
2. R. Ramakrishnan, J. Gehrke, *Database Management Systems*, (3e), McGraw Hill, 2014.

## COURSE: PRINCIPLES OF PROGRAMMING LANGUAGES

**(Credits: 6)**

**Course Outcome:** To develop the understanding of programming language in context of syntax and semantics, data types, and concepts of object oriented programming in various programming languages.

**Unit-I(Preliminary Concepts of Programming Languages)**

**(Credits: 2)**

Preliminary Concepts: Concepts of programming languages. Syntax and Semantics: general Problem of describing Syntax and Semantics. Data types: Primitive, character, user defined, array, associative record, union, pointer and reference types.

**Unit-II(Expressions and Statements)**

**(Credits: 2)**

Expressions and Statements: Assignment Statements, Control Structures. Subprograms and Blocks: Fundamentals of sub-programs, Scope of life time of variables, static and dynamic scope, design issues of sub-programs and operations. Abstract Data types: Abstractions and encapsulation, introductions to data abstraction, design issues, language examples.

**Unit-III(Concurrency and exception handling)**

**(Credits: 2)**

Concurrency: Subprogram level concurrency, semaphores, monitors, massage passing, Java threads, C# threads. Exception handling: Exceptions, exception Propagation, Exception handler in Ada, C++ and Java, Logic Programming Language: Introduction and overview of logic programming.

**Recommended Books & References:**

1. R. W. Sebesta, *Concepts of Programming Languages*, (10e), Pearson Education, 2008.
2. D. A. Watt, *Programming Language Design Concepts*, Wiley, (2e), 2007.
3. B. Tucker, R. E. Noonan, *Programming Languages*, (2e), TMH, 2007.
4. K. C. Louden, *Programming Languages*, (2e), Thomson, 2003.
5. T. W. Pratt, M. V. Zelkowitz, T. V. Gopal, *Programming Languages: Design and Implementation*, (4e), PHI, 2006

## COURSE: ENTERPRISE RESOURCE PLANNING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of enterprise resource planning and how engineering works in the businesses. Also, the understanding of software development life cycle in nutshell.

**Unit-I(ERP Overview)**

**(Credits: 2)**

ERP Overview: ERP Components, ERP Benefits. Business Process Reengineering (BPA): BPA life cycle, BPA components. Data warehousing, Datamining, Supply chain Management; ERP: evolution, a Manufacturing Perspective, ERP Module, ERP Market, ERP implementation life cycle, Options of various paradigms, Identification of suitable platforms.

**Unit-II(SDLC/SSAD)**

**(Credits: 2)**

SDLC/SSAD: Role of SDLC/SSAD, Object oriented architecture. ERP Implementation: introduction, pre evaluation screening, package evaluation, project planning phase, Gap analysis, Hidden costs, Major Vendors, Consultant Employees, Human Resource.

**Unit-III(ERP & E-Commerce)**

**(Credits: 2)**

ERP & E-Commerce: Future Directives- in ERP, ERP and Internet, Critical Factors guiding selection and evaluation of ERP, Strategies for its successful implementation, Impediments and initiatives to achieve success, Critical success and failure factors, Integrating of ERP into organizational culture. Using ERP tool: Case study of a system using SAP or ORACLE or open source ERP.

**Recommended Books & References:**

1. S. R. Magal, J. Word, *Integrated Business Processes with ERP Systems*, (2e), John Wiley & Sons, 2011.
2. M. Sumner, *Enterprise Resource Planning*, Pearson Education, (2e), 2006.
3. E. Monk, B. Wagner, *Concepts in Enterprise Resource Planning*, (3e), Thomson Course Technology, 2006.

## COURSE: PRINCIPLES OF MACHINE LEARNING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of artificial intelligence and basics of data mining, roles and uses of data mining and various algorithms theoretically. Also, the uses of neural networks and its types.

**Unit-I(Introduction to Artificial Intelligence) (Credits: 2)**

Introduction to Artificial Intelligence: Foundations, scope, problems. Problem-solving through Searching: forward and backward, state-space, blind, heuristic, problem-reduction, minimax.
Supervised Learning: Process for feature selection, over-parameterization and the curse of dimensionality, regularization, cross validation.

**Unit-II(Classification and Regression) (Credits: 2)**

Classification: operation of classifiers, regression as a classifier, metrics used to evaluate classifiers, SVM, Naïve Bayes, KNN. Regression: operation of regression models, prediction and forecasting, metrics used to evaluate regression models.

**Unit-III(Neural Networks) (Credits: 2)**

Neural networks: Feed forward NN, Feed backward NN, Convolutional Neural network. Unsupervised Learning: K-mean clustering. Algorithmic Learning Theory and Applications: Mistake bound model, PAC Model.

**Recommended Books & References:**

1. G. F. Luger, W. A. Stubblefield, *Artificial Intelligence - Structures and Strategies for Complex Problem Solving.* (5e), Addison Wesley, 2005.
2. P Baldi, S Brunak, *Bioinformatics: A Machine Learning Approach*, (2e) MIT Press, 2002.
3. T. M. Mitchell, *Machine Learning*, McGraw-Hill Education, 2017.
4. Y Abu-Mostafa, M. Magdon-Ismail, H.T. Lin, H-T. *Learning from Data*. AML Book, 2012.

## Programme Electives:

### COURSE: INFORMATION RETRIEVAL

**(Credits: 6)**

**Course Outcome:** To develop the understanding of information retrieval using some terminologies and the concepts behind the search engines.

**Unit-I(Introduction to IR)**

**(Credits: 2)**

Introduction to IR: IR Concepts, Boolean Retrievals- An Example Information Retrieval Problem, A First Take at Building an Inverted Index, Processing Boolean Queries. The Term Vocabulary and Postings Lists: Document Delineation and Character Sequence Decoding, Determining the Vocabulary of Terms. Dictionaries and Tolerant Retrieval: Search Structures for Dictionaries, Wildcard Queries, Spelling Correction, Phonetic Correction.

**Unit-II(Index Construction and Information retrieval)**

**(Credits: 2)**

Index Construction: Hardware Basics Blocked Sort-Based Indexing. Scoring, Term Weighting and the Vector Space Model: Parametric and Zone Indexes, Term Frequency and Weighting, The Vector Space Model for Scoring. Evaluation in Information Retrieval: Information Retrieval System Evaluation, Standard Test Collections, Evaluation of Unranked Retrieval Sets, Evaluation of Ranked Retrieval Results.

**Unit-III(XML and Web search)**

**(Credits: 2)**

XML Retrieval: Basic XML Concepts, Challenges in XML Retrieval, A Vector Space Model for XML Retrieval, Evaluation of XML Retrieval, Text-Centric vs. Data-Centric XML Retrieval. Web Search Basics: Web Characteristics, Advertising as the Economic Model, The Search User Experience, Index Size and Estimation, Near-Duplicates and Shingling. Web Crawling and Indexes: Overview, Crawling, Distributing Indexes, Connectivity Servers. Link Analysis: The Web as a Graph, Page Rank, Hubs and Authorities.

**Recommended Books & References:**

1. C. Manning, P. Raghavan, H. Schütze, *Introduction to Information Retrieval,* Cambridge University Press, 2009.
2. R. Baeza-Yate, B. Ribeiro-Neto, *Modern Information Retrieval,* (2e), Addison Wesley, 2012.
3. S. Chakrabarti, *Mining the Web: discovering knowledge from hypertext data,* (2e), Morgan Kaufmann, 2002.
4. D. A. Grossman , O. Frieder, *Information Retrieval: Algorithms, and Heuristics, (2e),* Springer, 2004.

## COURSE: COMPUTER GRAPHICS & MULTIMEDIA

**(Credit: 6)**

**Course Outcome:** To develop the understanding of computer graphics, algorithms behind the graphics, and how multimedia systems work practically and theoretically both.

### Unit-I(Introduction to Computer Graphics)

**(Credits: 2)**

Basics of Computer Graphics: Pixel, Frame buffer, Application of computer graphics. Graphic Display Devices: Cathode Ray Tube, Light emitting diode, DVST, Random and Raster Scan displays. Scan Conversion: Line Generation using digital differential analyzer (DDA), bresenham's Algorithm, Circle generation algorithm, Ellipse generation algorithm, Polygon generation and filling algorithms.

### Unit-II(Transformations of images)

**(Credits: 2)**

Two Dimensional Transformations: Introduction, homogeneous representation of points, basic transformation like Translation, Rotation, Scaling, Reflection, Shear. Clipping and Windowing: Cohen Sutherland Algorithm, liang Barsky algorithm, Sutherland Hodgman Algorithm. Three dimensional transformation: Translation, Rotation, Scaling and Reflection. Projection: Introduction, Types of projection. Hidden Surface elimination: Depth comparison, Back face detection algorithm, Painter's Algorithm, Z-Buffer Algorithm. Basic Illumination Model: Diffuse reflection, Specular reflection, Phong and Gouraud shading.

### Unit-III(Introduction to Multimedia)

**(Credits: 2)**

Introduction to Multimedia: Concepts and uses, hypertext and hypermedia, image, video and audio standards, text compression algorithm. Animation: types, techniques, key frame animation, utility, morphing.

**Recommended Books & References:**


1. D. Hearn, M. P. Baker, *Computer Graphics with OpenGL*, (4e), Pearson Education, 2014.
2. R. Steinmetz, K. Nahrstedt, *Multimedia Systems*, Springer, 2004
3. J. F. Hughes, J. D. Foley, *Computer graphics Principles and Practice*,(3e), Pearson Education, 2014.
4. R. Steinmetz, K. Nahrstedt, *Multimedia Fundamentals: Media Coding and Content Processing*, (2e), Pearson Education, 2004

## COURSE: USER INTERFACE DESIGN

**(Credit: 6)**

**Course Outcome:** To develop the understanding of user interface and its designing principals, models and use cases with real life projects.

**Unit-I(UI Design Process)**

**(Credits: 2)**

UI Design Process: Design Process Introduction, Designing to Address a Problem w/o Solution Ideas, Designing for a known solution direction, Designing to iterate on/improve an existing solution, Common Elements: Usability, Engineering and Task-Centered Approaches, Use Cases, Personas, Tasks, and Scenarios, Design-Centered Methods & When They Work Best, Pulling it all Together, Psychology and Human Factors for User Interface Design: Introduction, Fitts' Law, Short- and long-term memory, attention, Perception and visualization, hierarchy, Mistakes, Errors, and Slips, Conceptual models, The Gulf of Execution and the Gulf of Evaluation,

**Unit-II(Designing Principals and personas)**

**(Credits: 2)**

Design Principles: Visibility, Feedback, Mappings, Constraints, Interacting beyond individuals (social psychology), High-Level Models: Distributed Cognition, Activity Theory, Situated Action, User Research Methods: User Research to Design, Introduction to User Research, Interview and Focus Groups, Observations, Contextual Inquiry, Ethics and Consent, Design a User Research Protocol, Log Analysis, Surveys and Questionnaires, Analyzing and Delivering User Research: Introduction: Translating User Research to Support Design, Qualitative Analysis, Quantitative Analysis, Personas I: What They Are; How They're Used, Personas II: Walking Through Examples, Use Cases, Tasks and Walkthrough Scenarios, Implications for Design,

**Unit-III(Ideation and Idea selection)**

**(Credits: 2)**

Ideation and Idea Selection: rom Research to Ideas, Ideation, Idea Selection, Communicating Ideas to Stakeholders, Good User Interfaces principles: learnability, visibility, error prevention, efficiency, and graphic design) and the human capabilities that motivate them (including perception, motor skills, color vision, attention, and human error), Implementation of UI: building user interfaces, including low-fidelity prototypes, etc Empirical research involving novel user interfaces.

**Recommended Books & References:**

1.Norman, A. Donald, *The Design of Everyday Things.*MIT Press, 2014.
2.Coursera platform and internet resources

## COURSE: DIGITAL IMAGE PROCESSING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of image processing, its types and various uses, and the use of image are processing in the authentication.

**Unit-I(Introduction to Image Processing)**

**(Credits: 2)**

Introduction to image processing: steps in image processing, Image file formats, Basic relationships between pixels, Colour Models. Image Enhancement and Restoration: Image histogram, Spatial domain enhancement, point operations, Log transformation, Power-law transformation.

**Unit-II(Image transformations)**

**(Credits: 2)**

Frequency domain enhancement: introduction to image transforms, Fourier transform, 2D-DFT. Restoration: Noise models, Restoration using inverse filtering and Wiener filtering. Image Coding and Compression: Lossless compression, Lossy compression, JPEG, MPEG.

**Unit-III(Image Segmentation and Representation)**

**(Credits: 2)**

Image Segmentation and Representation: Grey level features, edges and lines, similarity, correlation, template matching, edge detection using templates, Representation scheme, boundary descriptors, regional descriptors, Image Morphology. Biometric Authentication, Object Detection.

**Recommended Books & References:**


1. K. R. Castleman, *Digital Image Processing*, (2e), Pearson Education, 2011.
2. R. C. Gonzalez, R. E. Woods, *Digital Image Processing*, (4e), Pearson Education, 2018.
3. A. K. Jain, *Fundamentals of Digital Image Processing*, Pearson Education, Reprint 2015.
4. S. Jayaraman, S. Esakkirajan, T Veerakumar, *Digital Image Processing*, Tata McGraw Hill Education, 2009.
5. R. C. Gonzalez, R. E. Woods, S. Eddins, *Digital Image Processing using MATLAB*, (2e), Pearson Education.
6. A. McAndrew, *Introduction to Image processing using MATLAB*, Cengage Learning Publisher, 2007.
7. Prateek Joshi, *OpenCV with Python By Example*, (1e) PACKT Publishing, 2018.

## COURSE: INTERNET OF THINGS

**(Credit: 6)**

**Course Outcome:** To develop the understanding of fundamental concepts of Internet of Things and its applications, working of IoT system and protocols related to it.

**Unit-I(Introduction) (Credits: 2)**

Introduction: Analog and digital signals, serial communication, RF and sensors; Introduction to JSON/XML. Programming on Development Boards: Understanding of the board, tool chain and development environment setup; Sensors and Actuators: Understanding and using analog, digital, SPI, UART, I2C.

**Unit-II(Nodes and Communications) (Credits: 2)**

Nodes and communication protocols: Understanding usage of nodes and gateways for sensor communication and external communication, RF, Zigbee, BT, WI-FI, GSM.

**Unit-III(IoT and Cloud) (Credits: 2)**

IoT Cloud Platform, Cloud using Web Services, Cloud Computing Services for Sensor Management, Python Script; Data Analytics: Mongo DB, Map Reduce, Using cloud APIs for analytics, Visualization, NVD3, Mobile interfacing.

**Recommended Books & References:**

1. V. Madisetti, A. Bahga, *Internet of Things: A Hands-On- Approach*, VPT, 2014.
2. R. Buyya, A. V. Dastjerdi, *Internet of Things Principles and Paradigms*, 2016.
3. H. Geng, *Internet of Things Principles and Data Analytics Handbook*, Wiley, 2017.
4. P. Raj, A. C. Raman, *The Internet of Things Enabling Technologies, Platforms, and Use Cases*, CRC Press, 2017.

## COURSE: BIG DATA ANALYTICS(Credit: 6)

**Course Outcome:** To develop the understanding of Big Data and its management, Advanced analytics algorithms, and file systems used to manage the big data.

**Unit-I(Introduction to Big Data) (Credits: 2)**

INTRODUCTION: Introduction to big data, definition, need and evolution of BDA, Applications of Big Data. Analysing big data: Sources of big data, Characteristics of Big Data(4 V's), Drivers of BDA, Structured vs. Unstructured data, Data Marts, Differences between traditional DWDM and BDA. Data Processing: Data Wrangling, Data Munging, Data Jujitsu. Data Visualisation: Why to visualize data. Data Analytics Life Cycle.

**Unit-II(Advanced Analytics Algorithms) (Credits: 2)**

Advanced Analytics Algorithms: Introduction using R – Theory and Methods Overview: K-means clustering, Association Rules, Linear Regression, Logistic Regression, Naïve Bayesian Classifiers, Decision Trees, Time Series Analysis, Text Analytics; Statistics for Model Building and Evaluation: Statistics in the Analytic Lifecycle, Hypothesis Testing, Difference of means.

**Unit-III(HADOOP Framework) (Credits: 2)**

Hadoop Framework: Introduction to Hadoop, HDFS - Hadoop Distributed File system, Map Reduce Programming, Pig. ETL & Batch Processing with Hadoop: ETL & Data Warehousing, Ingesting data into Big Data Platforms using Apache Sqoop & Flume, Big Data Analytics using Apache Hive, NoSQL databases for Big Data Storage Applications (HBase), Workflow management for Hadoop using Oozie Spark: Introduction to Spark, SparkSQL, MLLib: Regression, Clustering & Classification using Spark MLLib.

**Recommended Books & References:**

1. B. Schmarzo, *Big Data: Understanding How Data Powers Big Business,* Wiley.2013
2. A. Jorgensen, J. Rowland-Jones, J. Welch, *Microsoft Big Data Solutions,* Wiley.,2014
3. J. Thompson, S. P. Rogers, *Analytics: How to Win with Intelligence, Technics, LLC Publications* , 2017

## COURSE: SOFTWARE DEFINED NETWORKS

**(Credit: 6)**

**Course Outcome:** To develop the understanding of working of software defined working, programming behind this and network function virtualization.

**Unit-I(Software Defined Networking) (Credits: 2)**

Software Defined Networking (SDN): Separation of control plane and data plane, IETF forces, Active networking. Control and Data Plane Separation: Concepts, Advantages and disadvantages, the Open flow protocol.

**Unit-II(Control Plane and SDN Programming) (Credits: 2)**

Control Plane: Overview, Existing SDN controllers including floodlight and open daylight projects. Customization of Control Plane: Switching and firewall implementation using SDN concepts. Data Plane: Software-based and Hardware-based, Programmable network, Mininet based examples. Programming SDNs: Northbound application programming interface, current languages and tools, Composition of SDNs.

**Unit-III(Network Functions Virtualization) (Credits: 2)**

Network Functions Virtualization (NFV): Concepts, Implementation, Applications. Use Cases of SDNs: Data Centers, Internet exchange points, Backbone networks, Home networks, Traffic engineering. Programming Assignments for implementing some of the theoretical concepts listed above.

**Recommended Books & References:**

1. T. D. Nadeau, K. Gray, *SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies*, (1e) O'Reilly Media, 2013.
2. P. Goransson, C. Black, *Software Defined Networks: A Comprehensive Approach*, (2e) Morgan Kaufmann, 2016.
3. F. Hu, *Network Innovation through Open Flow and SDN: Principles and Design*, CRC Press, 2014.
4. V. Tiwari, *SDN and Open Flow for Beginners, Amazon Digital Services, Inc.*, ASIN, 2013.
5. S Subramanian, *Software Defined Networking with OpenStack,* Packt Publishing, 2016.

## COURSE: DEEP NEURAL NETWORK (Credit: 6)

**Course Outcome:** To develop the understanding of neural networks using advanced methods in neural networks and the working of the neural networks.

**Unit-*I*(Introduction) (Credits: 2)**

Introduction of Deep Learning, Basics of Machine Learning, Neural Network, Activation function, Gradient Descent, Stochastic Gradient Descent, backpropagation, Deep Convolution Neural network: convolution operation, ReLU Layer, Pooling Layer, Flattening, fully connected layer, softmax and cross entropy,

**Unit-II(Recurrent Neural networks) (Credits: 2)**

Recurrent Neural network: Vanishing Gradient Problem, LSTMs, LSTM variations, Self-organizing Map (SOM), K-means clustering, Boltzmann Machine, Energy-based Models, Contrastive Divergence,

**Unit-III(Deep Belief Networks) (Credits: 2)**

Deep Belief Networks, autoencoders, training of auto encode, over complete hidden layers, sparse autoencoders, denoising autoencoders, contractive autoencoders, stacked autoencoders, deep autoencoders.

**Recommended Books & References:**

1. I. Goodfellow, Y. Bengio , A. Courville, *Deep Learning*, MIT Press 2016.
2. S. Haykin, *Neural Networks and Learning Machines*, (3e), PHI, 2008.

## COURSE: SOCIAL NETWORK ANALYSIS

**(Credit: 6)**

**Course Outcome:** To develop the understanding of social web and working of different models used in the social network analysis.

**Unit-I(Introduction to Social Web) (Credits: 2)**

Introduction to Social Web: Nodes, Edges and Network measures, Describing Nodes and Edges, Describing Networks, Layouts. Visualizing Network features: The role of Tie Strength, Measuring Tie Strength, Tie Strength and Network Structure, Tie Strength and Network Propagation, Link Prediction, Entity Resolution. Link Prediction: Case Study Friend recommendation.

**Unit-II(Communities) (Credits: 2.5)**

Communities: Introduction, Communities in Context, Quality Functions. Algorithms: Clustering-based, Newman and Girvan- Divisive clustering, Newman-Modularity maximization, Clauset-Greedy optimization of modularity, Louvain Method-Hierarchical clustering, Agglomerative clustering, Falkowski(DENGRAPH)-Density-based clustering, Nikolaev-Entropy centrality-based clustering, Clique-based Methods for Overlapping Community Detection, Palla- Clique percolation method, Lancichinetti-Fitness function, Du-Kernels-based clustering, Shen-Agglomerative hierarchical clustering, Evans-Line graph, clique graph, Label Propagation-based Community Detection.

**Unit-III(Introduction to social influence) (Credits: 1.5)**

Introduction to Social Influence: Influence Related Statistics, Social Similarity and Influence, Homophile, Existential Test for Social Influence, Influence and Actions, Influence and Interaction, Influence Maximization in Viral Marketing.

**Recommended Books & References:**

1. J. Goldbeck, *Analyzing the Social Web*, Morgan Kaufmann Publications, 2013.
2. C. C. Aggarwal, *Social Network Data Analytics*, Springer Publications, 2011.
3. J. Scott, *Social Network Analysis*, (3e), SAGE Publications Limited, 2013.
4. J. Goldman, *Facebook Cookbook*, O'Reilly, 2009.
5. S. Kumar, F. Morstatter, H. Liu, *Twitter Data Analytics*, Springer Publications, 2013.

## COURSE: SOFTWARE TESTING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of fundamentals of software testing, various techniques of testing like manual and automated testing.

### Unit-I(Introduction)

**(Credits: 2)**

Introduction and concept learning: Basic definitions, Testing axioms, Purpose of Software Testing, Software Testing Principles, The Tester's Role in a Software Development Organization, Origins of Defects, Cost of defects, Defect Classes, Defect Prevention strategies, Defect Repository, Strategies for Software Testing, Testing Activities, Mistakes, Faults & Failures, Verification and Formal Methods, Planning for Verification and Validation.

### Unit-II(Manual Testing Methods)

**(Credits: 2.5)**

White-Box Testing: Test Adequacy Criteria, Static Testing, Structural Testing, Code Complexity Testing, Mutation Testing, Data Flow Testing. Black-Box Testing: Test Case Design Criteria, Requirement Based Testing, Positive and Negative Testing, Boundary Value Analysis, Equivalence Partitioning State Based Testing, Domain Testing. Functional Testing: Test Plan, Test Management, Test Execution and Reporting, Test Specialist Skills, Tester's Workbench and Tool Categories, Debugging, Test Bed, Traceability and Testability, Attributes of Testable Requirements, Test Matrix, Types of Testing Documentation, Verification Testing, Validation Testing, Integration Testing, System and Acceptance Testing, GUI Testing, Regression Testing, Selection, Minimization and Prioritization of Test Cases for Regression Testing, Creating Test Cases from Requirements and Use cases, Test Design.

### Unit-III(Test Automation)

**(Credits: 1.5)**

Test Automation: Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

**Recommended Books & References:**

1. W. E. Perry, *Effective Methods for Software Testing*, John Wiley and Sons, 2000.
2. R. Patton, *Software Testing*, Sams Publishing, 2005.
3. A. P. Mathur, *Foundations of Software Testing*, Pearson Education, 2013.
4. J. L. Mitchell, R. Black, *Advanced Software Testing—Vol. 3*, Rocky Nook, 2015.

## COURSE: LINUX SYSTEM AND SHELL PROGRAMMING

**(Credit: 6)**

**Course Outcomes:** To develop the understanding of Linux operating system and its operations. The main objective is to develop the understanding of various operating systems and working on them as per requirements, practically.

**Unit-I(Introduction to Linux) (Credits: 2)**

Fundamentals: Processes in Linux, I/O system calls, select and poll functions, Filters and redirection, Linux file system navigation, Directory access, File system implementation, Hard links and symbolic links. Asynchronous Events: Manipulating signal masks and signal sets, Catching and ignoring signals, waiting for signals.

**Unit-II(Inter-Process Communication) (Credits: 2)**

Inter-Process Communication: Sockets, Remote procedure calls, Network file system. Concurrency: POSIX thread attributes, Synchronization functions, Mutex locks, Condition variables, Signal handling and threads. Character Device Driver Development: Driver concepts, Writing character drivers, Interrupt handling, Interfacing with hardware. Shell Scripting: Loops, Conditional statements, Command line arguments, test command, expr command.

**Unit-III(Advanced Scripting Techniques) (Credits: 2)**

Advanced Scripting Techniques: Providing command line options to scripts, exporting variables, Arrays, Remote shell execution, connecting to MySQL using shell, Essential system administration.

**Recommended Books & References:**


1. W. R. Stevens, S. A. Rago, *Advanced Programming in the UNIX Environment*, (3e), Addison-Wesley, 2013.
2. R. Love, *Linux System Programming: Talking Directly to the Kernel and C Library*, O'Reilly, 2007.
3. S. Das, *Unix Concepts and Applications*, (4e), McGraw Hill, 2006.
4. W. R. Stevens, B. Fenner, *UNIX Network Programming, Volume 1: The Sockets Networking API*, (3e), Pearson, 2003.
5. K. A. Robbins, S. Robbins, *Unix Systems Programming: Communication, Concurrency, and Threads*, (2e), Prentice Hall, 2004.

## COURSE: WIRELESS SENSOR & ADHOC NETWORK

**(Credit: 6)**

**Course Outcome:** To develop the understanding of adhoc networks, standards and benefits of using sensors for smart devices used in daily life.

**Unit-I(Introduction to ad-hoc networks)**

**(Credits: 2)**

Introduction to ad-hoc networks: Definition, characteristics features, applications. Characteristics of Wireless channel, Ad-hoc Mobility Models: Indoor and outdoor models. MAC Protocols: design issues, goals and classification. Contention based protocols with reservation, scheduling algorithms, protocols using directional antennas.

**Unit-II(IEEE standards, protocols and security)**

**(Credits: 2)**

IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.Routing Protocols: Design issues, goals and classification.Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Energy aware routing algorithm, Hierarchical Routing, QoS aware routing. Transport layer: Issues in designing- Transport layer classification, ad-hoc transport protocols. Security issues in ad-hoc networks: issues and challenges, network security attacks, secure routing protocols. Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary perspective. Integration of ad-hoc with Mobile IP networks. Mesh Networks, Vehicular Area Networks, and Mobile Ad Hoc Networks (MANETs).

**Unit-III(Introduction to sensor networks and its applications)**

**(Credits: 2)**

Introduction to sensor networks and its applications: Architecture and factors influencing the sensor network design. Routing protocols- data centric routing protocols, hierarchical routing protocols, location based routing, energy efficient routing etc. Node Scheduling and coverage issues, topology control.Querying, data collection and processing.

**Recommended Books & References:**


1. S. K. Sarkar, T G Basavaraju, C Puttamadappa, *Ad Hoc Mobile Wireless Networks: Principles, Protocols, and Applications*, (2e), CRC Press,2016.
2. C. D. Morais Cordeiro, D. P. Agrawal, *Ad Hoc and Sensor Networks: Theory and Applications*, (2e), World Scientific Publishing, 2011.
3. H. Karl, A. Willing, *Protocols and Architectures for Wireless Sensor Networks*, John Wiley & Sons, 2007.
4. R. Jurdak, *Wireless Ad Hoc and Sensor Networks: A Cross-Layer Design Perspective*, Springer Publications, 2007.
5. S R Murthy, B. S. Manoj, *Ad Hoc Wireless Networks Architectures and Protocols*, Pearson Education, 2008.

## COURSE: MOBILE COMPUTING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of wireless communications, telecommunication systems and the working of wireless networks using some security aspects.

**Unit-I(Wireless Communication Fundamentals) (Credits: 2)**

Wireless Communication Fundamentals: Introduction wireless transmission, Frequencies for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulations spread spectrum, MAC, SDMA, FDMA, TDMA, CDMA, Cellular wireless networks.

**Unit-II(Telecommunications Systems) Credits: 2)**

Telecommunications Systems: GSM, System architecture protocols, Connection establishment, Frequency alocation, Routing, handover, Security, GPRS. Wireless Networks: Wireless LAN-IEEE 802.11 Standards, Architecture, Services HIPERLAN, AdHoc Network, Bluetooth mobile network layer: Mobile IP, Dynamic host configuration protocol.

**Unit-III(Routing) (Credits: 2)**

Routing: DSDV, DSR, Alternative metrics, Wireless application protocol. Mobile Ad hoc Networks: Overview, Properties of a MANET, Spectrum of MANET applications, Routing and various routing algorithms, Security in MANET.

**Recommended Books & References:**

1. W. Stallings, *Wireless Communications and Networks*, (2e)Pearson Education, 2018.
2. J. Schiller, *Mobile Communications*, (2e), *Pearson Education*, 2009.
3. K. Garg, *Mobile Computing: Theory and Practice*, (1e) Pearson Education India, 2010.

## COURSE: NATURAL LANGUAGE PROCESSING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of various language formats used in computer systems and how these languages processed in the computer systems.

**Unit-I(Introduction) (Credits: 2)**

Introduction: Ambiguity and uncertainty in language, processing paradigms, phases in natural language processing. Text representation in computers: encoding schemes. Linguistics resources: Introduction to corpus, elements in balanced corpus, WordNet, VerbNet. Part of Speech tagging: Stochastic POS tagging, HMM, Transformation based tagging (TBL), handling of unknown words, named entities, multi word expressions.

**Unit-II(Natural language grammars) (Credits: 2)**

Natural language grammars: lexeme, phonemes, phrases and idioms, word order, agreement, tense, aspect and mood and agreement, context free grammar, spoken language syntax. Parsing-unification, probabilistic parsing, tree-bank. Semantics: meaning representation, semantic analysis, and lexical semantics.

**Unit-III(Word Sense Disambiguation) (Credits: 2)**

Word Sense Disambiguation: selection restriction, machine learning approaches, dictionary based approaches. Discourse: Reference resolution, constraints on co-reference, algorithm for pronoun resolution, text coherence, discourse structure. Real time Applications of NLP: text to speech, text summarization, information retrieval, sentiment analysis, machine translation.

**Recommended Books & References:**

1. D. Jurafsky, J. H. Martin, *Speech and Language Processing*, (2e), Pearson Education, 2009.
2. T. Siddiqui, U. S. Tiwary, *Natural language processing and Information retrieval*, Oxford University Press, 2008.

## COURSE: COMPUTER VISION

**(Credit: 6)**

**Course Outcome:** To develop the understanding of a computer system which uses various algorithms and methods to enhance images, graphics, and use of neural networks.

**Unit-I(Introduction)**

**(Credits: 2)**

Introduction to computer vision and its applications, Geometric Image Features: Differential Geometry, Contour Geometry, analytical image features: Euclidean geometry, Geometric Camera Parameters, Calibration methods, Image formation, Liner Filtering: Linear filters and convolution, shift invariant linear systems, spatial frequency and Fourier transforms,

**Unit-II(Image Properties)**

**(Credits: 2)**

Image transformations and Colour models, Edge Detection methods (Laplacian detectors and Canny edge detector), Points and patches, Harris corner detector, Histogram of Gradients, Difference of Gaussian detector, SIFT, Colour and Texture, Feature based alignment, least squares and RANSAC, Camera models, Camera calibration,

**Unit-III(Methods and properties)**

**(Credits: 2)**

Stereo vision, Stereo correspondence, Epipolar geometry Optical flow, Lucas Kanade method, KLT tracking method, Mean shift method, Dense motion estimation, Support Vector Machines, Face detection and recognition, Bag of words, Deep convolution neural network.

**Recommended Books & References:**

1. R. Szeliski, *Computer Vision: Algorithms and Applications*, Springer 2011.
2. D. A. Forsyth, J. Ponce, *Computer Vision: A Modern Approach*, (2e), PHI learning, 2012
3. J. E. Solem, *Programming Computer Vision with Python*, O'Reilly, 2012.

## VII Semester

### COURSE: INDUSTRIAL TRAINING

In this course the student, undergo in reputed Private / Public Sector / Government organization / companies as industrial training for minimum 45 days to be undergone by the student in the summer vacation of the VI semester.

**Outcome of this course:**

To expose students to the 'real' working environment and be acquainted with the organization structure, business operations and administrative functions.

To have hands-on experience in the students' related field so that they can relate and reinforce what has been taught at the university.

To promote cooperation and to develop synergetic collaboration between industry and the university in promoting a knowledgeable society & to set the stage for future recruitment by potential employers.

## Programme Electives:

### COURSE: INFORMATION RETRIEVAL

**(Credits: 6)**

**Course Outcome:** To develop the understanding of information retrieval using some terminologies and the concepts behind the search engines.

**Unit-I (Introduction to IR)** **(Credits: 2)**

Introduction to IR: IR Concepts, Boolean Retrievals- An Example Information Retrieval Problem, A First Take at Building an Inverted Index, Processing Boolean Queries. The Term Vocabulary and Postings Lists: Document Delineation and Character Sequence Decoding, Determining the Vocabulary of Terms. Dictionaries and Tolerant Retrieval: Search Structures for Dictionaries, Wildcard Queries, Spelling Correction, Phonetic Correction.

**Unit-II (Index Construction and Information retrieval)** **(Credits: 2)**

Index Construction: Hardware Basics Blocked Sort-Based Indexing. Scoring, Term Weighting and the Vector Space Model: Parametric and Zone Indexes, Term Frequency and Weighting, The Vector Space Model for Scoring. Evaluation in Information Retrieval: Information Retrieval System Evaluation, Standard Test Collections, Evaluation of Unranked Retrieval Sets, Evaluation of Ranked Retrieval Results.

**Unit-III (XML and Web search)** **(Credits: 2)**

XML Retrieval: Basic XML Concepts, Challenges in XML Retrieval, A Vector Space Model for XML Retrieval, Evaluation of XML Retrieval, Text-Centric vs. Data-Centric XML Retrieval. Web Search Basics: Web Characteristics, Advertising as the Economic Model, The Search User Experience, Index Size and Estimation, Near-Duplicates and Shingling. Web Crawling and Indexes: Overview, Crawling, Distributing Indexes, Connectivity Servers. Link Analysis: The Web as a Graph, Page Rank, Hubs and Authorities.

**Recommended Books & References:**

1. C. Manning, P. Raghavan, H. Schütze, *Introduction to Information Retrieval,* Cambridge University Press, 2009.
2. R. Baeza-Yate, B. Ribeiro-Neto, *Modern Information Retrieval,* (2e), Addison Wesley, 2012.
3. S. Chakrabarti, *Mining the Web: discovering knowledge from hypertext data,* (2e), Morgan Kaufmann, 2002.
4. D. A. Grossman , O. Frieder, *Information Retrieval: Algorithms, and Heuristics, (2e),* Springer, 2004.

## COURSE: COMPUTER GRAPHICS & MULTIMEDIA

**(Credit: 6)**

**Course Outcome:** To develop the understanding of computer graphics, algorithms behind the graphics, and how multimedia systems work practically and theoretically both.

**Unit-I (Introduction to Computer Graphics)** **(Credits: 2)**

Basics of Computer Graphics: Pixel, Frame buffer, Application of computer graphics. Graphic Display Devices: Cathode Ray Tube, Light emitting diode, DVST, Random and Raster Scan displays. Scan Conversion: Line Generation using digital differential analyzer (DDA), bresenham's Algorithm, Circle generation algorithm, Ellipse generation algorithm, Polygon generation and filling algorithms.

**Unit-II (Transformations of images)**

**(Credits: 2)**

Two Dimensional Transformations: Introduction, homogeneous representation of points, basic transformation like Translation, Rotation, Scaling, Reflection, Shear. Clipping and Windowing: Cohen Sutherland Algorithm, liang Barsky algorithm, Sutherland Hodgman Algorithm. Three dimensional transformation: Translation, Rotation, Scaling and Reflection. Projection: Introduction, Types of projection. Hidden Surface elimination: Depth comparison, Back face detection algorithm, Painter's Algorithm, Z-Buffer Algorithm. Basic Illumination Model: Diffuse reflection, Specular reflection, Phong and Gouraud shading.

**Unit-III (Introduction to Multimedia)** **(Credits: 2)**

Introduction to Multimedia: Concepts and uses, hypertext and hypermedia, image, video and audio standards, text compression algorithm. Animation: types, techniques, key frame animation, utility, morphing.

**Recommended Books & References:**


1. D. Hearn, M. P. Baker, *Computer Graphics with OpenGL*, (4e), Pearson Education, 2014.
2. R. Steinmetz, K. Nahrstedt, *Multimedia Systems*, Springer, 2004
3. J. F. Hughes, J. D. Foley, *Computer graphics Principles and Practice*,(3e), Pearson Education, 2014.
4. R. Steinmetz, K. Nahrstedt, *Multimedia Fundamentals: Media Coding and Content Processing*, (2e), Pearson Education, 2004

## COURSE: USER INTERFACE DESIGN

**(Credit: 6)**

**Course Outcome:** To develop the understanding of user interface and its designing principals, models and use cases with real life projects.

**Unit-I (UI Design Process)** **(Credits: 2)**

UI Design Process: Design Process Introduction, Designing to Address a Problem w/o Solution Ideas, Designing for a known solution direction, Designing to iterate on/improve an existing solution, Common Elements: Usability, Engineering and Task-Centered Approaches, Use Cases, Personas, Tasks, and Scenarios, Design-Centered Methods & When They Work Best, Pulling it all Together, Psychology and Human Factors for User Interface Design: Introduction, Fitts' Law, Short- and long-term memory, attention, Perception and visualization, hierarchy, Mistakes, Errors, and Slips, Conceptual models, The Gulf of Execution and the Gulf of Evaluation,

**Unit-II (Designing Principals and personas)** **(Credits: 2)**

Design Principles: Visibility, Feedback, Mappings, Constraints, Interacting beyond individuals (social psychology), High-Level Models: Distributed Cognition, Activity Theory, Situated Action, User Research Methods: User Research to Design, Introduction to User Research, Interview and Focus Groups, Observations, Contextual Inquiry, Ethics and Consent, Design a User Research Protocol, Log Analysis, Surveys and Questionnaires, Analyzing and Delivering User Research: Introduction: Translating User Research to Support Design, Qualitative Analysis, Quantitative Analysis, Personas I: What They Are; How They're Used, Personas II: Walking Through Examples, Use Cases, Tasks and Walkthrough Scenarios, Implications for Design,

**Unit-III (Ideation and Idea selection)** **(Credits: 2)**

Ideation and Idea Selection: rom Research to Ideas, Ideation, Idea Selection, Communicating Ideas to Stakeholders, Good User Interfaces principles: learnability, visibility, error prevention, efficiency, and graphic design) and the human capabilities that motivate them (including perception, motor skills, color vision, attention, and human error), Implementation of UI: building user interfaces, including low-fidelity prototypes, etc Empirical research involving novel user interfaces.

**Recommended Books & References:**

1.Norman, A. Donald, *The Design of Everyday Things.*MIT Press, 2014.
2.Coursera platform and internet resources

## COURSE: DIGITAL IMAGE PROCESSING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of image processing, its types and various uses, and the use of image are processing in the authentication.

**Unit-I (Introduction to Image Processing)**

**(Credits: 2)**

Introduction to image processing: steps in image processing, Image file formats, Basic relationships between pixels, Colour Models. Image Enhancement and Restoration: Image histogram, Spatial domain enhancement, point operations, Log transformation, Power-law transformation.

**Unit-II (Image transformations)**

**(Credits: 2)**

Frequency domain enhancement: introduction to image transforms, Fourier transform, 2D-DFT. Restoration: Noise models, Restoration using inverse filtering and Wiener filtering. Image Coding and Compression: Lossless compression, Lossy compression, JPEG, MPEG.

**Unit-III (Image Segmentation and Representation)**

**(Credits: 2)**

Image Segmentation and Representation: Grey level features, edges and lines, similarity, correlation, template matching, edge detection using templates, Representation scheme, boundary descriptors, regional descriptors, Image Morphology. Biometric Authentication, Object Detection.

**Recommended Books & References:**


1. K. R. Castleman, *Digital Image Processing*, (2e), Pearson Education, 2011.
2. R. C. Gonzalez, R. E. Woods, *Digital Image Processing*, (4e), Pearson Education, 2018.
3. A. K. Jain, *Fundamentals of Digital Image Processing*, Pearson Education, Reprint 2015.
4. S. Jayaraman, S. Esakkirajan, T Veerakumar, *Digital Image Processing*, Tata McGraw Hill Education, 2009.
5. R. C. Gonzalez, R. E. Woods, S. Eddins, *Digital Image Processing using MATLAB*, (2e), Pearson Education.
6. A. McAndrew, *Introduction to Image processing using MATLAB*, Cengage Learning Publisher, 2007.
7. Prateek Joshi, *OpenCV with Python By Example*, (1e) PACKT Publishing, 2018.

## COURSE: INTERNET OF THINGS

**(Credit: 6)**

**Course Outcome:** To develop the understanding of fundamental concepts of Internet of Things and its applications, working of IoT system and protocols related to it.

**Unit-I (Introduction)** **(Credits: 2)**

Introduction: Analog and digital signals, serial communication, RF and sensors; Introduction to JSON/XML. Programming on Development Boards: Understanding of the board, tool chain and development environment setup; Sensors and Actuators: Understanding and using analog, digital, SPI, UART, I2C.

**Unit-II (Nodes and Communications)** **(Credits: 2)**

Nodes and communication protocols: Understanding usage of nodes and gateways for sensor communication and external communication, RF, Zigbee, BT, WI-FI, GSM.

**Unit-III (IoT and Cloud)** **(Credits: 2)**

IoT Cloud Platform, Cloud using Web Services, Cloud Computing Services for Sensor Management, Python Script; Data Analytics: Mongo DB, Map Reduce, Using cloud APIs for analytics, Visualization, NVD3, Mobile interfacing.

**Recommended Books & References:**

1. V. Madisetti, A. Bahga, *Internet of Things: A Hands-On- Approach*, VPT, 2014.
2. R. Buyya, A. V. Dastjerdi, *Internet of Things Principles and Paradigms*, 2016.
3. H. Geng, *Internet of Things Principles and Data Analytics Handbook*, Wiley, 2017.
4. P. Raj, A. C. Raman, *The Internet of Things Enabling Technologies, Platforms, and Use Cases*, CRC Press, 2017.

## COURSE: BIG DATA ANALYTICS

**(Credit: 6)**

**Course Outcome:** To develop the understanding of Big Data and its management, Advanced analytics algorithms, and file systems used to manage the big data.

**Unit-I (Introduction to Big Data)** **(Credits: 2)**

INTRODUCTION: Introduction to big data, definition, need and evolution of BDA, Applications of Big Data. Analysing big data: Sources of big data, Characteristics of Big Data(4 V's), Drivers of BDA, Structured vs. Unstructured data, Data Marts, Differences between traditional DWDM and BDA. Data Processing: Data Wrangling, Data Munging, Data Jujitsu. Data Visualisation: Why to visualize data. Data Analytics Life Cycle.

**Unit-II (Advanced Analytics Algorithms)** **(Credits: 2)**

Advanced Analytics Algorithms: Introduction using R – Theory and Methods Overview: K-means clustering, Association Rules, Linear Regression, Logistic Regression, Naïve Bayesian Classifiers, Decision Trees, Time Series Analysis, Text Analytics; Statistics for Model Building and Evaluation: Statistics in the Analytic Lifecycle, Hypothesis Testing, Difference of means.

**Unit-III (HADOOP Framework)** **(Credits: 2)**

Hadoop Framework: Introduction to Hadoop, HDFS - Hadoop Distributed File system, Map Reduce Programming, Pig. ETL & Batch Processing with Hadoop: ETL & Data Warehousing, Ingesting data into Big Data Platforms using Apache Sqoop & Flume, Big Data Analytics using Apache Hive, NoSQL databases for Big Data Storage Applications (HBase), Workflow management for Hadoop using Oozie Spark: Introduction to Spark, SparkSQL, MLLib: Regression, Clustering & Classification using Spark MLLib.

**Recommended Books & References:**

1. B. Schmarzo, *Big Data: Understanding How Data Powers Big Business,* Wiley.2013
2. A. Jorgensen, J. Rowland-Jones, J. Welch, *Microsoft Big Data Solutions,* Wiley.,2014
3. J. Thompson, S. P. Rogers, *Analytics: How to Win with Intelligence, Technics, LLC Publications* , 2017

## COURSE: SOFTWARE DEFINED NETWORKS

**(Credit: 6)**

**Course Outcome:** To develop the understanding of working of software defined working, programming behind this and network function virtualization.

**Unit-I (Software Defined Networking)** **(Credits: 2)**

Software Defined Networking (SDN): Separation of control plane and data plane, IETF forces, Active networking. Control and Data Plane Separation: Concepts, Advantages and disadvantages, the Open flow protocol.

**Unit-II (Control Plane and SDN Programming)** **(Credits: 2)**

Control Plane: Overview, Existing SDN controllers including floodlight and open daylight projects. Customization of Control Plane: Switching and firewall implementation using SDN concepts. Data Plane: Software-based and Hardware-based, Programmable network, Mininet based examples. Programming SDNs: Northbound application programming interface, current languages and tools, Composition of SDNs.

**Unit-III (Network Functions Virtualization)** **(Credits: 2)**

Network Functions Virtualization (NFV): Concepts, Implementation, Applications. Use Cases of SDNs: Data Centers, Internet exchange points, Backbone networks, Home networks, Traffic engineering. Programming Assignments for implementing some of the theoretical concepts listed above.

**Recommended Books & References:**

1. T. D. Nadeau, K. Gray, *SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies,* (1e) O'Reilly Media, 2013.
2. P. Goransson, C. Black, *Software Defined Networks: A Comprehensive Approach,* (2e) Morgan Kaufmann, 2016.
3. F. Hu, *Network Innovation through Open Flow and SDN: Principles and Design*, CRC Press, 2014.
4. V. Tiwari, *SDN and Open Flow for Beginners, Amazon Digital Services, Inc.,* ASIN, 2013.
5. S Subramanian, *Software Defined Networking with OpenStack,* Packt Publishing, 2016.

## COURSE: DEEP NEURAL NETWORK

**(Credit: 6)**

**Course Outcome:** To develop the understanding of neural networks using advanced methods in neural networks and the working of the neural networks.

**Unit-*I* (Introduction)** **(Credits: 2)**

Introduction of Deep Learning, Basics of Machine Learning, Neural Network, Activation function, Gradient Descent, Stochastic Gradient Descent, backpropagation, Deep Convolution Neural network: convolution operation, ReLU Layer, Pooling Layer, Flattening, fully connected layer, softmax and cross entropy,

**Unit-II (Recurrent Neural networks)** **(Credits: 2)**

Recurrent Neural network: Vanishing Gradient Problem, LSTMs, LSTM variations, Self-organizing Map (SOM), K-means clustering, Boltzmann Machine, Energy-based Models, Contrastive Divergence,

**Unit-III (Deep Belief Networks)** **(Credits: 2)**

Deep Belief Networks, autoencoders, training of auto encode, over complete hidden layers, sparse autoencoders, denoising autoencoders, contractive autoencoders, stacked autoencoders, deep autoencoders.

**Recommended Books & References:**

1. I. Goodfellow, Y. Bengio , A. Courville, *Deep Learning*, MIT Press 2016.
2. S. Haykin, *Neural Networks and Learning Machines*, (3e), PHI, 2008.

## COURSE: SOCIAL NETWORK ANALYSIS

**(Credit: 6)**

**Course Outcome:** To develop the understanding of social web and working of different models used in the social network analysis.

**Unit-I (Introduction to Social Web)**

**(Credits: 2)**

Introduction to Social Web: Nodes, Edges and Network measures, Describing Nodes and Edges, Describing Networks, Layouts. Visualizing Network features: The role of Tie Strength, Measuring Tie Strength, Tie Strength and Network Structure, Tie Strength and Network Propagation, Link Prediction, Entity Resolution. Link Prediction: Case Study Friend recommendation.

**Unit-II (Communities)**

**(Credits: 2.5)**

Communities: Introduction, Communities in Context, Quality Functions. Algorithms: Clustering-based, Newman and Girvan- Divisive clustering, Newman-Modularity maximization, Clauset-Greedy optimization of modularity, Louvain Method-Hierarchical clustering, Agglomerative clustering, Falkowski (DENGRAPH)-Density-based clustering, Nikolaev-Entropy centrality-based clustering, Clique-based Methods for Overlapping Community Detection, Palla- Clique percolation method, Lancichinetti-Fitness function, Du-Kernels-based clustering, Shen-Agglomerative hierarchical clustering, Evans-Line graph, clique graph, Label Propagation-based Community Detection.

**Unit-III (Introduction to social influence)**

**(Credits: 1.5)**

Introduction to Social Influence: Influence Related Statistics, Social Similarity and Influence, Homophile, Existential Test for Social Influence, Influence and Actions, Influence and Interaction, Influence Maximization in Viral Marketing.

**Recommended Books & References:**

1. J. Goldbeck, *Analyzing the Social Web*, Morgan Kaufmann Publications, 2013.
2. C. C. Aggarwal, *Social Network Data Analytics*, Springer Publications, 2011.
3. J. Scott, *Social Network Analysis*, (3e), SAGE Publications Limited, 2013.
4. J. Goldman, *Facebook Cookbook*, O'Reilly, 2009.
5. S. Kumar, F. Morstatter, H. Liu, *Twitter Data Analytics*, Springer Publications, 2013.

## COURSE: SOFTWARE TESTING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of fundamentals of software testing, various techniques of testing like manual and automated testing.

### Unit-I (Introduction)

**(Credits: 2)**

Introduction and concept learning: Basic definitions, Testing axioms, Purpose of Software Testing, Software Testing Principles, The Tester's Role in a Software Development Organization, Origins of Defects, Cost of defects, Defect Classes, Defect Prevention strategies, Defect Repository, Strategies for Software Testing, Testing Activities, Mistakes, Faults & Failures, Verification and Formal Methods, Planning for Verification and Validation.

### Unit-II (Manual Testing Methods)

**(Credits: 2.5)**

White-Box Testing: Test Adequacy Criteria, Static Testing, Structural Testing, Code Complexity Testing, Mutation Testing, Data Flow Testing. Black-Box Testing: Test Case Design Criteria, Requirement Based Testing, Positive and Negative Testing, Boundary Value Analysis, Equivalence Partitioning State Based Testing, Domain Testing. Functional Testing: Test Plan, Test Management, Test Execution and Reporting, Test Specialist Skills, Tester's Workbench and Tool Categories, Debugging, Test Bed, Traceability and Testability, Attributes of Testable Requirements, Test Matrix, Types of Testing Documentation, Verification Testing, Validation Testing, Integration Testing, System and Acceptance Testing, GUI Testing, Regression Testing, Selection, Minimization and Prioritization of Test Cases for Regression Testing, Creating Test Cases from Requirements and Use cases, Test Design.

### Unit-III (Test Automation)

**(Credits: 1.5)**

Test Automation: Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

### Recommended Books & References:

1. W. E. Perry, *Effective Methods for Software Testing*, John Wiley and Sons, 2000.
2. R. Patton, *Software Testing*, Sams Publishing, 2005.
3. A. P. Mathur, *Foundations of Software Testing*, Pearson Education, 2013.
4. J. L. Mitchell, R. Black, *Advanced Software Testing—Vol. 3*, Rocky Nook, 2015.

## COURSE: LINUX SYSTEM AND SHELL PROGRAMMING

**(Credit: 6)**

**Course Outcomes:** To develop the understanding of Linux operating system and its operations. The main objective is to develop the understanding of various operating systems and working on them as per requirements, practically.

**Unit-I (Introduction to Linux)**

**(Credits: 2)**

Fundamentals: Processes in Linux, I/O system calls, select and poll functions, Filters and redirection, Linux file system navigation, Directory access, File system implementation, Hard links and symbolic links. Asynchronous Events: Manipulating signal masks and signal sets, Catching and ignoring signals, waiting for signals.

**Unit-II (Inter-Process Communication)**

**(Credits: 2)**

Inter-Process Communication: Sockets, Remote procedure calls, Network file system. Concurrency: POSIX thread attributes, Synchronization functions, Mutex locks, Condition variables, Signal handling and threads. Character Device Driver Development: Driver concepts, Writing character drivers, Interrupt handling, Interfacing with hardware. Shell Scripting: Loops, Conditional statements, Command line arguments, test command, expr command.

**Unit-III (Advanced Scripting Techniques)**

**(Credits: 2)**

Advanced Scripting Techniques: Providing command line options to scripts, exporting variables, Arrays, Remote shell execution, connecting to MySQL using shell, Essential system administration.

**Recommended Books & References:**


1. W. R. Stevens, S. A. Rago, *Advanced Programming in the UNIX Environment*, (3e), Addison-Wesley, 2013.
2. R. Love, *Linux System Programming: Talking Directly to the Kernel and C Library*, O'Reilly, 2007.
3. S. Das, *Unix Concepts and Applications*, (4e), McGraw Hill, 2006.
4. W. R. Stevens, B. Fenner, *UNIX Network Programming, Volume 1: The Sockets Networking API*, (3e), Pearson, 2003.
5. K. A. Robbins, S. Robbins, *Unix Systems Programming: Communication, Concurrency, and Threads*, (2e), Prentice Hall, 2004.

## COURSE: WIRELESS SENSOR & ADHOC NETWORK

**(Credit: 6)**

**Course Outcome:** To develop the understanding of adhoc networks, standards and benefits of using sensors for smart devices used in daily life.

**Unit-I (Introduction to ad-hoc networks)**

**(Credits: 2)**

Introduction to ad-hoc networks: Definition, characteristics features, applications. Characteristics of Wireless channel, Ad-hoc Mobility Models: Indoor and outdoor models. MAC Protocols: design issues, goals and classification. Contention based protocols with reservation, scheduling algorithms, protocols using directional antennas.

**Unit-II (IEEE standards, protocols and security)**

**(Credits: 2)**

IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.Routing Protocols: Design issues, goals and classification.Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Energy aware routing algorithm, Hierarchical Routing, QoS aware routing. Transport layer: Issues in designing- Transport layer classification, ad-hoc transport protocols. Security issues in ad-hoc networks: issues and challenges, network security attacks, secure routing protocols. Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary perspective. Integration of ad-hoc with Mobile IP networks. Mesh Networks, Vehicular Area Networks, and Mobile Ad Hoc Networks (MANETs).

**Unit-III (Introduction to sensor networks and its applications)**

**(Credits: 2)**

Introduction to sensor networks and its applications: Architecture and factors influencing the sensor network design. Routing protocols- data centric routing protocols, hierarchical routing protocols, location based routing, energy efficient routing etc. Node Scheduling and coverage issues, topology control.Querying, data collection and processing.

**Recommended Books & References:**

1. S. K. Sarkar, T G Basavaraju, C Puttamadappa, *Ad Hoc Mobile Wireless Networks: Principles, Protocols, and Applications,* (2e), CRC Press,2016.
2. C. D. Morais Cordeiro, D. P. Agrawal, *Ad Hoc and Sensor Networks: Theory and Applications,* (2e), World Scientific Publishing, 2011.
3. H. Karl, A. Willing, *Protocols and Architectures for Wireless Sensor Networks,* John Wiley & Sons, 2007.
4. R. Jurdak, *Wireless Ad Hoc and Sensor Networks: A Cross-Layer Design Perspective,* Springer Publications, 2007.
5. S R Murthy, B. S. Manoj, *Ad Hoc Wireless Networks Architectures and Protocols,* Pearson Education, 2008.

## COURSE: MOBILE COMPUTING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of wireless communications, telecommunication systems and the working of wireless networks using some security aspects.

**Unit-I (Wireless Communication Fundamentals)** **(Credits: 2)**

Wireless Communication Fundamentals: Introduction wireless transmission, Frequencies for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulations spread spectrum, MAC, SDMA, FDMA, TDMA, CDMA, Cellular wireless networks.

**Unit-II (Telecommunications Systems)** **(Credits: 2)**

Telecommunications Systems: GSM, System architecture protocols, Connection establishment, Frequency alocation, Routing, handover, Security, GPRS. Wireless Networks: Wireless LAN-IEEE 802.11 Standards, Architecture, Services HIPERLAN, AdHoc Network, Bluetooth mobile network layer: Mobile IP, Dynamic host configuration protocol.

**Unit-III (Routing)** **(Credits: 2)**

Routing: DSDV, DSR, Alternative metrics, Wireless application protocol. Mobile Ad hoc Networks: Overview, Properties of a MANET, Spectrum of MANET applications, Routing and various routing algorithms, Security in MANET.

**Recommended Books & References:**

1. W. Stallings, *Wireless Communications and Networks*, (2e)Pearson Education, 2018.
2. J. Schiller, *Mobile Communications*, (2e), *Pearson Education*, 2009.
3. K. Garg, *Mobile Computing: Theory and Practice*, (1e) Pearson Education India, 2010.

## COURSE: NATURAL LANGUAGE PROCESSING

**(Credit: 6)**

**Course Outcome:** To develop the understanding of various language formats used in computer systems and how these languages processed in the computer systems.

**Unit-I (Introduction)** **(Credits: 2)**

Introduction: Ambiguity and uncertainty in language, processing paradigms, phases in natural language processing. Text representation in computers: encoding schemes. Linguistics resources: Introduction to corpus, elements in balanced corpus, WordNet, VerbNet. Part of Speech tagging: Stochastic POS tagging, HMM, Transformation based tagging (TBL), handling of unknown words, named entities, multi word expressions.

**Unit-II (Natural language grammars)** **(Credits: 2)**

Natural language grammars: lexeme, phonemes, phrases and idioms, word order, agreement, tense, aspect and mood and agreement, context free grammar, spoken language syntax. Parsing-unification, probabilistic parsing, tree-bank. Semantics: meaning representation, semantic analysis, and lexical semantics.

**Unit-III (Word Sense Disambiguation)** **(Credits: 2)**

Word Sense Disambiguation: selection restriction, machine learning approaches, dictionary based approaches. Discourse: Reference resolution, constraints on co-reference, algorithm for pronoun resolution, text coherence, discourse structure. Real time Applications of NLP: text to speech, text summarization, information retrieval, sentiment analysis, machine translation.

**Recommended Books & References:**

1. D. Jurafsky, J. H. Martin, *Speech and Language Processing*, (2e), Pearson Education, 2009.
2. T. Siddiqui, U. S. Tiwary, *Natural language processing and Information retrieval*, Oxford University Press, 2008.

## COURSE: COMPUTER VISION

**(Credit: 6)**

**Course Outcome:** To develop the understanding of a computer system which uses various algorithms and methods to enhance images, graphics, and use of neural networks.

### Unit-I (Introduction)

**(Credits: 2)**

Introduction to computer vision and its applications, Geometric Image Features: Differential Geometry, Contour Geometry, analytical image features: Euclidean geometry, Geometric Camera Parameters, Calibration methods, Image formation, Liner Filtering: Linear filters and convolution, shift invariant linear systems, spatial frequency and Fourier transforms,

### Unit-II (Image Properties)

**(Credits: 2)**

Image transformations and Colour models, Edge Detection methods (Laplacian detectors and Canny edge detector), Points and patches, Harris corner detector, Histogram of Gradients, Difference of Gaussian detector, SIFT, Colour and Texture, Feature based alignment, least squares and RANSAC, Camera models, Camera calibration,

### Unit-III (Methods and properties)

**(Credits: 2)**

Stereo vision, Stereo correspondence, Epipolar geometry Optical flow, Lucas Kanade method, KLT tracking method, Mean shift method, Dense motion estimation, Support Vector Machines, Face detection and recognition, Bag of words, Deep convolution neural network.

**Recommended Books & References:**

1. R. Szeliski, *Computer Vision: Algorithms and Applications*, Springer 2011.
2. D. A. Forsyth, J. Ponce, *Computer Vision: A Modern Approach*, (2e), PHI learning, 2012
3. J. E. Solem, *Programming Computer Vision with Python*, O'Reilly, 2012.

# VIII Semester

**MAJOR PROJECT:**

In this course student has to select a project work based on a topic of interest. Periodically the supervisor will evaluate the implementation. This work, started in eighth semester of which, the student will be evaluated internally and externally.

**Outcome of the course:**

Investigating professional topics, including ethical, legal and security issues, related to computing projects.

Design and develop the software with Software Engineering practices and standards

Apply prior knowledge to design and implement solutions for computational problems while considering numerous realistic restraints.

******