# DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

## PROGRAMME: B.Tech(CSE): Cloud and Artificial Intelligence

## PROGRAMME OBJECTIVES:

**PEO1**: To impart deep technical knowledge about the field of computer science and engineering.

**PEO2:** To develop an understanding of computer science and engineering at different levels of abstraction including computer architecture and design, operating systems, database management, algorithms and applications.

**PEO3:**To aware students with a strong foundation in the field of Mathematical and basics of engineering fundamentals necessary to analyze and evaluate real world engineering problems and to further prepare them for higher studies, R&D.

**PEO4:**To develop life-long learning attitude among students and to make them aware about professional and social responsibility.

**PEO5:** To inculcate an understanding among the students for utilizing their knowledge of computer engineering and mathematical theory to solve current and future computing problems.

**PEO6:** To inspire leadership and professional values in the students.

## PROGRAMME LEARNING OUTCOMES:

The students of Bachelor of Technology in Computer Science and Engineering will be able to:

1. Apply possessed knowledge of core subjects of production and industrial engineering to solve different problems.
2. **Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

## PROGRAMME SPECIFIC OUTCOMES:

The students upon completion of Programme will be able:

**PSO1**: **Understand and develop** computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics and networking by **identifying**, **demonstrating** and **analyzing** the **knowledge** of engineering in efficient design of computer-based systems of varying complexity.

**PSO2**: **Applying** algorithmic principles, innovative Computer science and engineering **design** and implementation skills to **propose** optimal solutions to complex problems by **choosing** a better platform for research in emerging areas.

**PSO3**: **Identify** standard Software Engineering practices and strategies by **applying** software project development methods using open-source programming environment to **design** and **evaluate** a quality product for business success.

**PSO4**: **Demonstrate** and **examine** basic **understanding** of engineering fundamentals, professional/social ethics and **apply** mathematical foundations to **design** and **solve** computational problems.

# B. Tech.(CSE): Data science and Artificial Intelligence
## I Year: I Semester

| S. No | Course Code | Course Title | Hours Per Week | | | Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1. | -----/ BCY1701 | Physics / Chemistry | 3 | 1 | 3 | 5.5 |
| | BPH1701-CS | Physics (for CS) | | | | |
| | BPH1701-EC | Physics (for EC) | | | | |
| | BPH1701-EE | Physics (for EE) | | | | |
| | BPH1701-CE | Physics (for CE) | | | | |
| | BPH1701-ME | Physics (for ME) | | | | |
| 2. | BMA1001-CS | Mathematics-I (for CS) | 3 | 1 | 0 | 4 |
| | BMA1001-EC | Mathematics-I (for EC) | | | | |
| | BMA1001-EE | Mathematics-I (for EE) | | | | |
| | BMA1001-CE | Mathematics-I (for CE) | | | | |
| | BMA1001-ME | Mathematics-I (for ME) | | | | |
| 3. | BEE1701/ BCS1701 | Basic Electrical Engineering / Programming for Problem Solving | 3 | 1 | 2 | 5 |
| 4. | BME1701/ BME1702 | Engineering Graphics and Design / Workshop Practices | 1 | 0 | 4 | 3 |
| 5. | XESX601/ BHU1701 | Environmental Science* / English | 2/2 | 0/0 | 0/2 | 0/3 |
| | | **Total:** | **12/12** | **3/3** | **9/11** | **17.5/20.5** |
| 6. | **BCS1702** | **Python + Clean Coding** | 2 | 0 | 2 | 3 |

* - Mandatory Non-Credit Course
L - Lecture
T - Tutorial
P - Practical
C -Credit

# B. Tech.(CSE) ::Data science and Artificial Intelligence
## I Year: II Semester

| S. No. | Course Code | Course Title | Hours Per Week | | | Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1. | BCY2701/ ----- | Chemistry/ Physics | 3 | 1 | 3 | 5.5 |
| | BPH2701-CS | Physics (for CS) | | | | |
| | BPH2701-EC | Physics (for EC) | | | | |
| | BPH2701-EE | Physics (for EE) | | | | |
| | BPH2701-CE | Physics (for CE) | | | | |
| | BPH2701-ME | Physics (for ME) | | | | |
| 2. | BMA2001-CS | Mathematics-II (for CS) | 3 | 1 | 0 | 4 |
| | BMA2001-EC | Mathematics-II (for EC) | | | | |
| | BMA2001-EE | Mathematics-II (for EE) | | | | |
| | BMA2001-CE | Mathematics-II (for CE) | | | | |
| | BMA2001-ME | Mathematics-II (for ME) | | | | |
| 3. | BCS2701/ BEE2701 | Programming for Problem Solving / Basic Electrical Engineering | 3 | 1 | 2 | 5 |
| 4. | BME2702/ BME2701 | Workshop Practices / Engineering Graphics and Design | 1 | 0 | 4 | 3 |
| 5. | BHU2701/ XESX601 | English / Environmental Science* | 2/2 | 0/0 | 2/0 | 3/0 |
| | | **Total:** | **12/12** | **3/3** | **11/9** | **20.5/17.5** |
| **6** | **BCS2703** | **Java Fundamental** | **1** | **0** | **2** | **2** |

* - Mandatory Non-Credit Course

L - Lecture

T - Tutorial

P - Practical

C - Credit

# B. Tech.(CSE) ::Data science and Artificial Intelligence
## II Year: III Semester

| S. No. | Subject Code | Subject | L | T | P | CIE | ESE | Total | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | BCS3014 | Data Structures and Algorithms | 3 | 1 | - | 40 | 60 | 100 | 4 |
| 2 | BCS3513 | Data Structures and Algorithms Lab | - | - | 2 | 80 | 20 | 100 | 1 |
| 3 | BCS3015 | Software Engineering | 3 | - | - | 40 | 60 | 100 | 3 |
| 4 | BCS3514 | Software Engineering Lab | - | - | 2 | 80 | 20 | 100 | 1 |
| 5 | BMA3011 | Discrete Mathematics | 3 | 1 | - | 40 | 60 | 100 | 4 |
| 6 | BEC3017 | Digital Electronics | 3 | | - | 40 | 60 | 100 | 3 |
| 7 | BEC3506 | Digital Electronics Lab | - | - | 2 | 80 | 20 | 100 | 1 |
| 8 | BEC3018 | Analog Electronic Circuits | 3 | | - | 40 | 60 | 100 | 3 |
| 9 | BEC3513 | Analog Electronic Circuits Lab | - | - | 2 | 80 | 20 | 100 | 1 |
| 10 | BHU3038 | Effective Technical Communication | 3 | - | - | 40 | 60 | 100 | 3 |
| **Total** | | | **18** | **2** | **8** | **560** | **440** | **1000** | **24** |
| 11 | **BCS3703** | **DevOps and Design Thinking** | 2 | 0 | 2 | 40<br>80 | 60<br>20 | 100<br>100 | 3 |

L - Lecture
T - Tutorial
P - Practical
CIE - Continuous Internal Evaluation
ESE - End Semester Exam
C - Credit

# B. Tech.(CSE) ::Data science and Artificial Intelligence
## II Year: IV Semester

| S. No. | Subject Code | Subject | L | T | P | CIE | ESE | Total | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | BCS4017 | Computer Organization and Architecture | 3 | 1 | - | 40 | 60 | 100 | 4 |
| 2 | BCS4518 | Computer Organization and Architecture Lab | - | - | 2 | 80 | 20 | 100 | 1 |
| 3 | BCS4022 | Operating Systems | 3 | 1 | - | 40 | 60 | 100 | 4 |
| 4 | BCS4519 | Operating Systems Lab | - | - | 2 | 80 | 20 | 100 | 1 |
| 5 | BCS4023 | Formal Language and Automata Theory | 3 | 1 | | 40 | 60 | 100 | 4 |
| 6 | BCS4520 | IT Workshop | 1 | - | 2 | 80 | 20 | 100 | 2 |
| 7 | BMA4012-CS | Mathematics–III | 2 | - | - | 40 | 60 | 100 | 2 |
| 8 | BMG4008 | Organizational Behaviour | 3 | - | - | 40 | 60 | 100 | 3 |
| 9 | XLAX601 | Constitution of India | 2 | - | - | Satisfactory/Unsatisfactory | | | 0 |
| 10 | XCSX601 | Industrial Visit-I | - | - | - | Satisfactory/Unsatisfactory | | | 0 |
| **Total** | | | **17** | **3** | **6** | **440** | **360** | **800** | **21** |
| 11 | **BCS4701** | **Cloud Application Development** | 2 | - | 2 | 40 | 60 | 100 | 3 |
| | | | | | | 80 | 20 | 100 | |

L - Lecture
T - Tutorial
P - Practical
CIE - Continuous Internal Evaluation
ESE - End Semester Exam
C - Credit

# B. Tech.(CSE) ::Data science and Artificial Intelligence
## III Year: V Semester

| S. No. | Subject Code | Subject | L | T | P | CIE | ESE | Total | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | BCS5016 | Database Management Systems | 3 | 1 | - | 40 | 60 | 100 | 4 |
| 2 | BCS5515 | Database Management Systems Lab | - | - | 2 | 80 | 20 | 100 | 1 |
| 3 | BCS5001 | Design and Analysis of Algorithms | 3 | 1 | - | 40 | 60 | 100 | 4 |
| 4 | BCS5501 | Design and Analysis of Algorithms Lab | - | - | 2 | 80 | 20 | 100 | 1 |
| 5 | BCS5017 | Object Oriented Programming | 2 | 1 | - | 40 | 60 | 100 | 3 |
| 6 | BCS5516 | Object Oriented Programming Lab | - | - | 2 | 80 | 20 | 100 | 1 |
| 7 | BEC5015 | Signals and Systems | 3 | - | - | 40 | 60 | 100 | 3 |
| 8 | ---------- | Open Elective-1 | 3 | - | - | 40 | 60 | 100 | 3 |
| 9 | ---------- | Elective-I | 3 | - | - | 40 | 60 | 100 | 3 |
| 10 | XHUX602 | Essence of Indian Traditional Knowledge | 2 | - | - | Satisfactory /Unsatisfactory | | | 0 |
| 11 | BAP5501 | Aptitude and Reasoning and Online Test | - | - | 2 | Satisfactory /Unsatisfactory | | | 0 |
| **Total** | | | **19** | **3** | **8** | **480** | **420** | **900** | **23** |
| 12 | **BCS5701** | **Big Data Analytics** | 2 | 0 | 2 | 40<br>80 | 60<br>20 | 100<br>100 | 3 |

L - Lecture
T - Tutorial
P - Practical
CIE - Continuous Internal Evaluation
ESE - End Semester Exam
C - Credit

# B. Tech.(CSE) ::Data science and Artificial Intelligence
## III Year: VI Semester

| No. | Subject Code | Subject | L | T | P | CIE | ESE | Total | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | BCS6014 | Compiler Design | 3 | 1 | - | 40 | 60 | 100 | 4 |
| 2 | BCS6515 | Compiler Design Lab | - | - | 2 | 80 | 20 | 100 | 1 |
| 3 | BCS6001 | Computer Networks | 3 | 1 | - | 40 | 60 | 100 | 4 |
| 4 | BCS6501 | Computer Networks Lab | - | - | 2 | 80 | 20 | 100 | 1 |
| 5 | ---------- | Elective-II | 3 | - | - | 40 | 60 | 100 | 3 |
| 6 | ---------- | Elective-III | 3 | - | - | 40 | 60 | 100 | 3 |
| 7 | BSS6001 | Soft-skill and Interpersonal Communication | 2 | - | - | 100 | - | 100 | 2 |
| 8 | BCS6516 | Project-I | - | - | 4 | 100 | - | 100 | 2 |
| 9 | BCS6505 | Seminar | - | - | 2 | 100 | - | 100 | 1 |
| 10 | BAP6501 | Aptitude and Reasoning and Online Test | - | - | 2 | Satisfactory /Unsatisfactory | | | 0 |
| **Total** | | | **14** | **2** | **12** | **620** | **280** | **900** | **21** |
| 11 | **BCS6703** | **Data Science** | 2 | 0 | 2 | 40 | 60 | 100 | 3 |
| | | | | | | 80 | 20 | 100 | |

L - Lecture
T - Tutorial
P - Practical
CIE - Continuous Internal Evaluation
ESE - End Semester Exam
C - Credit

**Specialization Streams**

* Big Data Analytics
** Software Engineering
*** Internet of Things
**** Machine Learning

# B. Tech.(CSE) ::Data science and Artificial Intelligence
## IV Year: VII Semester

| S. No. | Subject Code | Subject | L | T | P | CIE | ESE | Total | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ---------- | Elective-IV | 3 | - | - | 40 | 60 | 100 | 3 |
| 2 | ---------- | Elective-V | 3 | - | - | 40 | 60 | 100 | 3 |
| 3 | ---------- | Open Elective-II | 3 | - | - | 40 | 60 | 100 | 3 |
| 4 | BBT7010 | Biology | 2 | - | - | 40 | 60 | 100 | 2 |
| 5 | BCS7507 | Project-II | - | - | 10 | 100 | - | 100 | 5 |
| 6 | BCS7503 | Summer Training | - | - | 2 | 100 | - | 100 | 1 |
| **Total** | | | **11** | **0** | **12** | **360** | **240** | **600** | **17** |
| 7 | **BCS7702** | **Artificial Intelligence and Deep Learning** | 2 | 0 | 2 | 40 | 60 | 100 | 3 |
| | | | | | | 80 | 20 | 100 | |

L - Lecture
T - Tutorial
P - Practical
CIE - Continuous Internal Evaluation
ESE - End Semester Exam

# B. Tech.(CSE) ::Data science and Artificial Intelligence
## IV Year: VIII Semester

| S. No. | Subject Code | Subject | L | T | P | CIE | ESE | Total | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | ---------- | Elective-VI | 3 | - | - | 40 | 60 | 100 | 3 |
| 2 | ---------- | Open Elective-III | 3 | - | - | 40 | 60 | 100 | 3 |
| 3 | ---------- | Open Elective-IV | 3 | - | - | 40 | 60 | 100 | 3 |
| 4 | BCS8503 | Project-III | - | - | 12 | 80 | 20 | 100 | 6 |
| **Total** | | | **9** | **0** | **12** | **200** | **200** | **400** | **15** |

L - Lecture
T - Tutorial
P - Practical
CIE - Continuous Internal Evaluation
ESE - End Semester Exam
C - Credit

# B. Tech.(CSE) ::Data science and Artificial Intelligence

## List of Electives

| | | | |
|---|---|---|---|
| **Elective-I** | | | **V Semester** |
| 1 | BCS5001-DE1 | Ecommerce | |
| 2 | BCS5002-DE1 | Graph Theory | |
| 3 | BCS5003-DE1 | Management Information System | |
| 4 | BCS5004-DE1 | Computer Graphics | |
| **Elective-II** | | | **VI Semester** |
| 1 | BCS6004-DE2 | MOOC: Operations Research | |
| 2 | BCS6001-DE2 | Computer Based Numerical and Statistical Techniques | |
| 3 | BCS6002-DE2 | Geographical Information System | |
| 4 | BCS6003-DE2 | Artificial Intelligence | |
| **Elective-III** | | | **VI Semester** |
| 1 | BCS6001-DE3 | Digital Image Processing | |
| 2 | BCS6002-DE3 | Information Security and Cyber Law | |
| 3 | BCS6003-DE3 | Cryptography and Network Security | |
| 4 | BCS6005-DE3 | MOOC: Cloud Computing | |
| 5 | BCS6004-DE3 | Machine Learning | |
| **Elective-IV** | | | **VII Semester** |
| 1 | BCS7001-DE4 | Mobile Application Development | |
| 2 | BCS7002-DE4 | Parallel Algorithm | |
| 3 | BCS7003-DE4 | Microprocessor | |
| 4 | BCS7005-DE4 | MOOC: Real time Systems | |
| 5 | BCS7004-DE4 | Distributed System | |
| **Elective-V** | | | **VII Semester** |
| 1 | BCS7001-DE5 | Data Mining and Data Warehousing | |
| 2 | BCS7005-DE5 | MOOC: Soft Computing | |

| | | | |
|---|---|---|---|
| 3 | BCS7002-DE5 | Semantic Web and Web Services | |
| 4 | BCS7003-DE5 | Data Compression | |
| 5 | BCS7004-DE5 | Mobile Computing | |

| Elective-VI | | | VIII Semester |
|---|---|---|---|
| 1 | BCS8001-DE6 | Embedded Systems | |
| 2 | BCS8002-DE6 | Neural Networks | |
| 3 | BCS8003-DE6 | Simulation and Modeling | |
| 4 | BCS8005-DE6 | MOOC: Big Data Computing | |
| 5 | BCS8004-DE6 | Information Storage Management | |

# B. Tech.: Computer Science & Engineering

## List of Open Electives

| **Open Elective-I** | | | **Department offered** | **V Semester** |
|---|---|---|---|---|
| 1. | BMG5302 | Principles of Management | MGMT | |
| 2. | BMG5301 | Economics | MGMT | |
| **Open Elective-II** | | | | **VII Semester** |
| 1 | BEC7305 | Satellite Communication | EC | |
| 2 | BME7304 | Total Quality Management | ME | |
| 3 | BCS7305 | MOOC: Blockchain Architecture | CS | |
| **Open Elective-III** | | | | **VIII Semester** |
| 1 | BME8309 | Six Sigma | ME | |
| 2 | BEE8301 | Fuzzy Systems and its Applications | EE | |
| 3 | BBT8301 | Bioinformatics | IBST | |
| **Open Elective-IV** | | | | **VIII Semester** |
| 1 | BEC8304 | Mobile Communications and Networks | EC | |
| 2 | BCS8307 | Green Computing | CS | |
| 3 | BCS8308 | Digital Marketing | CS | |

# CHEMISTRY
# BCY1701/BCY2701

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 3 | 5.5 |

**Course Learning Objectives:** **(40 Hours)**

- To demonstrate major chemical reactions that are used in the synthesis of molecules and their utility
- To distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- To analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- To interpret periodic properties such as ionization potential, electronegativity and oxidation states.

**UNIT – I: Atomic and molecular structure** **(12 Hours)**

Schrodinger equation, particle in one dimensional box and its application (energy and probability density), Forms of the hydrogen atom wave functions, Molecular orbital of diatomic molecules, Equations for atomic and molecular orbitals, Energy level diagrams of diatomic. Pi-molecular orbital of butadiene, benzene and aromaticity, Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties, Band structure of solids and the role of doping on band structures.

**UNIT – II: Spectroscopic techniques and its applications** **(08 Hours)**

Principles of spectroscopy and selection rules, Electronic spectroscopy, Fluorescence and its application in medicine, Vibrational and rotational spectroscopy of diatomic molecules. Nuclear magnetic resonance (NMR) and its application, magnetic resonance imaging.

**UNIT – III: Intermolecular forces and potential energy surfaces** **(04 Hours)**

Ionic, dipolar and van der Waals interactions, equation of state of real gases and critical phenomena.

**UNIT – IV: Use of free energy in chemical equilibrium** **(06 Hours)**

Thermodynamic functions: energy, entropy and free energy. Estimation of entropy and free energies, Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base concept (Arrhenius, Bronsted- Lowry, Lewis concept), Oxidation reduction and solubility equilibria, water chemistry, Corrosion, Use of free energy considerations in metallurgy through Ellingham diagrams.

**UNIT – V:Periodic properties** **(04 Hours)**

Effective nuclear charge, variation of s, p, d and f orbitals energies of atoms in the periodic table, electronic configuration, atomic and ionic sizes, ionization energies, electron affinity, electronegativity, polarizability (Fazan rule), oxidation states, hard soft acid and bases (Pearson concept).

**UNIT – VI:Stereochemistry** **(04 Hours)**

Representation of 3-dimensional structures, structural isomers and stereoisomerism, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configuration and conformational analysis.

**UNIT – VII:Periodic properties** **(04 Hours)**

Introduction to reactions involving substitution (electrophilic and nucleophilic substitution), addition, elimination. Synthesis of some commonly used drug molecules.

**TEXT BOOKS:**

**T1.** University Chemistry, by B. H. Mahan
**T2.** Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
**T3.** Fundamentals of Molecular Spectroscopy, by C. N. Banwell
**T4.** Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishnan
**T5.** Concise Inorganic Chemistry, J.D.Lee, 5th edn. Blackwell Science, London

**REFERENCES BOOKS:**

**R1.** Physical Chemistry, by P. W. Atkins
**R2.** Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5thEditionhttp://bcs.whfreeman.com/vollhardtschore5e/default.asp
**R3.** D. Nasipuri, Stereochemistry of Organic Compounds, 2nd Edition (1994), Wiley Eastern Ltd,New Delhi.

**Course Learning Outcomes:**After completion of this course, students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Explain** and **examine** periodic properties such as ionization potential, electronegativity and oxidation states. | **2, 4** Understanding & Analyzing |
| CLO2 | **Interpret** and **categorize** the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques. | **2, 4** Understanding & Analyzing |
| CLO3 | **Interpret** microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces. | **2, 3** Understanding & Applying |
| CLO4 | **Summarize** chemical reactions that are used in the synthesis of molecules and their utility | **2,5** Understanding & Analyzing |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes (CLOs) | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | L | M | M | M | - | M | L | - | - | - | - | H | M | L | - | M |
| CLO2 | L | M | M | M | - | M | L | - | - | - | - | H | M | L | - | M |
| CLO3 | H | H | M | M | - | M | L | - | - | - | - | H | M | L | - | M |
| CLO4 | H | H | M | M | - | M | L | - | - | - | - | H | M | L | - | M |

**L=Low, M=Medium, H=High**

# CHEMISTRY LAB
# BCY1701/BCY2701

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 5.5 |

**Course Learning Objectives:** **(40 Hours)**

- To examine thin layer chromatography of given organic compounds/extract and determine the R f value.
- To determine of chloride ion content of water.
- To inspect the relative viscosity & relative surface tension.
- To measure equivalent conductance, cell constant, make synthesis polymer and radical (acidic and basic)
- To show potential energy surface & lattice structures.

**List of Experiments:**

1. To perform thin layer chromatography of given organic compounds/extract.
2. Determination of chloride ion content of water.
3. To determine the relative surface tension and viscosity of a liquid with respect to water at room temperature.
4. To determine the molecular mass of a compound using colligative property (freezing point depression).
5. To determine the cell constant of a given conductivity cell & equivalent conductance of KCl solution.
6. Synthesis of a polymer/drug.
7. To determine the saponification value of a given fat/oil.
8. To detect one cation and one anion in the given mixture of salts.
9. To study lattice structures and packing of spheres.
10. Models of potential energy surfaces.

**TEXT BOOKS:**

**T1**. O. P. Pandey, D. N. Bajpai and S. Giri. "Practical Chemistry", S. Chand & Co., 2012.
**T2.** Arun Sethi "Systematic Experiments in Chemistry", New Age International (P) Limited, Publishers, 1st edition, 2009.
**T3.**T2. Arun Sethi, Systematic Lab Experiments in Organic Chemistry", New Age International (P) Limited,Publishers, 1st edition, 2003.

**Course Learning Outcomes:** After completion of this course, students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Determine** and **analyze** $R_f$ value of compound. | **4, 5** Analyzing, Evaluating |
| CLO2 | **Demonstrate** and **interpret** the **s**aponification value of a given fat/oil. | **2, 5** Understanding, Evaluating |
| CLO3 | **Demonstrate** and **analyze** relative density, relative viscosity and surface tension and cell constant of a given conductivity cell & equivalent conductance of KCl solution. | **2, 4** Understanding, Analyzing |
| CLO4 | **Explain** and **classify** lattice structures and packing of spheres. | **2, 4** Understanding, Analyzing |
| CLO5 | **Analyze** cation and one anion in the given mixture of salts. | **4** Analyzing |

| | | |
|---|---|---|
| CLO6 | **Measure** molecular mass of a compound using colligative property (freezing point depression). | **5** Evaluating |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes (CLOs) | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CLO2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CLO3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CLO4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

**L=Low, M=Medium, H=High**

# PHYSICS
# BPH1701-CS/BPH2701-CS

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 3 | 5.5 |

**Course Learning Objectives:** **(40 Hours)**

- To introduce physics of electronic materials.
- To provide understanding of semiconductor materials.
- To gain insight about interaction of light with the semiconductor materials.
- To explore measurement technique to characterize the semiconductor materials.
- To gain insight about low dimension engineered materials.
- To develop the understanding and handling of the physical problems.

**UNIT – I: Electronic Materials** **(10 Hours)**

Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect band gaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.

**UNIT – II: Semiconductors** **(12 Hours)**

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for opto-electronic devices.

**UNIT – III: Light-semiconductor interaction** **(06 Hours)**

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Joint density of states, Density of states for photons, Transition rates (Fermi's golden rule), Optical loss and gain; Photo voltaic effect, Exciton, Drude model.

**UNIT – IV: Measurements** **(06 Hours)**

Four-point probe and van der Pauw measurements for carrier density, resistivity, and hall mobility; Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics, DLTS, band gap by UV-Vis spectroscopy, absorption/transmission.

**UNIT – V: Engineered semiconductor materials** **(06 Hours)**

Density of states in 2D, 1d and 0D (qualitatively). Practical examples of low-dimensional systems such as quantum wells, wires, and dots: design, fabrication, and characterization techniques. Hetero junctions and associated band-diagrams.

**TEXT BOOKS:**

**T1.** S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
**T2.** J. Singh, Semiconductor Optoelectronics: Physics and Technology,McGraw-Hill Inc. (1995).

**REFERENCES BOOKS:**

**R1.**B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
**R2.** A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
**R3.** P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).

**MOOC resource:**
1. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
2. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Guptaon NPTEL

**Course Learning Outcomes:**After completion of this course, students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Define** and **explain** structure and properties of the electronic materials on the basis of band theory. | **1,2** Understanding, Remember |
| CLO2 | **Understand** properties of semiconductor materials for optoelectronic devices. | **2** Understanding |
| CLO3 | **Interpret** the optical properties of semiconductor materials and physics behind it. | **5** Evaluating |
| CLO4 | **Compare** properties of different materials and their suitability to fabricate electronic devices using various measurement techniques. | **4** Evaluating |
| CLO5 | **Develop** low dimensional system for the fabrication of electronic devices. | **6** Creating |
| CLO6 | ***Apply*** *devices to demonstrate and analyze optical, mechanical, electrical and magnetic property of the systems.* | **3** Applying |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes (CLOs) | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | H | M | M | L | L | M | L | M | H | M | H | - | - | - | - |
| **CLO2** | H | H | M | M | L | L | M | L | M | H | M | H | - | - | - | - |
| **CLO3** | H | H | M | M | L | L | M | L | M | H | M | H | - | - | - | - |
| **CLO4** | H | H | M | H | H | L | H | L | H | H | M | H | - | - | - | - |
| **CLO5** | H | H | H | H | H | H | H | L | H | H | H | H | - | - | - | - |
| **CLO6** | H | H | M | H | L | L | M | M | H | M | L | H | - | - | - | - |

L=Low, M=Medium, H=High

# PHYSICS LAB
# BPH1701-CS/BPH2701-CS

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 5.5 |

**Course Learning Objectives:** **(40 Hours)**

- To understand the fundamentals of computers.
- To understand and apply the various steps in program development.
- To examine the syntax and semantics of C programming language.
- To analyze the usage of structured programming approach in solving problems.

**List of Experiments:**

1. To determine the wavelength of the monochromatic light by Newton's Ring.
2. To determine the specific rotation of the cane sugar solution using bi-quartz polarimeter.
3. To determine the wavelengths of any three spectral lines using plane transmission grating.
4. To find the angle of the prism by rotating the telescope method.
5. To verify Inverse Square Law of radiation using a photoelectric cell.
6. To study normal modes of oscillation of two coupled pendulums and to measure the normal mode frequencies.
7. To determine the (a) Hall Coefficient (b) Carrier Charge Concentration and (c) Mobility of charge carriers of a given semiconductor material using the given setup.
8. To find the moment of Inertia of fly wheel.
9. To determine the energy band gap of a semiconductor material.
10. To study variation of magnetic field along the axis of Helmholtz Galvanometer and determine the radius of the Helmholtz coil.
11. To find the vertical distance between two points using a Sextant.

**TEXT BOOKS:**

**T1.** S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
**T2.** J. Singh, Semiconductor Optoelectronics: Physics and Technology,McGraw-Hill Inc. (1995).

**REFERENCES BOOKS:**

**R1.**B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
**R2.** A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
**R3.** P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).

**MOOC resource:**

1. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
2. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Guptaon NPTEL

**Course Learning Outcomes:**After completion of this course, students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Define** and **explain** structure and properties of the electronic materials on the basis of band theory. | **1,2** Understanding, Remember |
| CLO2 | **Understand** properties of semiconductor materials for optoelectronic devices. | **2** |

| | | |
|---|---|---|
| | | Understanding |
| CLO3 | **Interpret** the optical properties of semiconductor materials and physics behind it. | **5** Evaluating |
| CLO4 | **Compare** properties of different materials and their suitability to fabricate electronic devices using various measurement techniques. | **4** Evaluating |
| CLO5 | **Develop** low dimensional system for the fabrication of electronic devices. | **6** Creating |
| CLO6 | ***Apply*** *devices to demonstrate and analyze optical, mechanical, electrical and magnetic property of the systems.* | **3** Applying |

**Mapping of CO-PO/PSO:**

| **Course Learning Outcomes (CLOs)** | **Program Learning Outcomes (PLOs)** | | | | | | | | | | | | **Program Specific Outcomes (PSOs)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PLO1** | **PLO2** | **PLO3** | **PLO4** | **PLO5** | **PLO6** | **PLO7** | **PLO8** | **PLO9** | **PLO10** | **PLO11** | **PLO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CLO1** | H | H | M | M | L | L | M | L | M | H | M | H | - | - | - | - |
| **CLO2** | H | H | M | M | L | L | M | L | M | H | M | H | - | - | - | - |
| **CLO3** | H | H | M | M | L | L | M | L | M | H | M | H | - | - | - | - |
| **CLO4** | H | H | M | H | H | L | H | L | H | H | M | H | - | - | - | - |
| **CLO5** | H | H | H | H | H | H | H | L | H | H | H | H | - | - | - | - |
| **CLO6** | H | H | M | H | L | L | M | M | H | M | L | H | - | - | - | - |

**L=Low, M=Medium, H=High**

# MATHEMATICS – I
# BMA1001-CS/BMA2001-CS

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Learning Objectives:** **(40 Hours)**

- To introduce basic ideas about calculus and its importance.
- To provide some understanding of sequence and series of function.
- To aim at understanding and discussing multivariable and matrices.
- To explore the connection between calculus, matrices and fields of applications of the subject.

**UNIT – I: CALCULUS – I** **(06 Hours)**

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

**UNIT – II: CALCULUS – II** **(06 Hours)**

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

**UNIT – III: SEQUENCES AND SERIES** **(10 Hours)**

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

**UNIT – IV: MULTIVARIABLE CALCULUS: DIFFERENTIATION** **(08 Hours)**

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

**UNIT – V: MATRICES** **(10 Hours)**

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Maxima and minima. Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

**TEXT BOOKS:**

**T1.** E. Kreyszig, "Advanced Engineering Mathematics", 9thEdition, John Wiley and Sons, New York, 2006.
**T2.** G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, 2002.
**T3.** B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2010.
**T4.** B.V. Ramanna, "Higher Engineering Mathematics", Tata Mcgraw Hill Publishing Company Ltd., 2008.

**REFERENCES BOOKS:**

**R1.** Peter V. O' Neil," Advanced Engineering Mathematics", Thomson (Cengage Learning), 2007.
**R2.** R.K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 2008.
**R3.** Veerarajan T., Engineering Mathematics for first year, Tata Mcgraw Hill, New Delhi, 2008.
**R4.** K. Hoffmann and R. Kunze, "Linear Algebra", Prentice Hall of India, New Delhi, 2002.
**R5.** N. Piskunov, "Differential and Integral Calculus", CBS, New Delhi.
**R6.** M.R. Spiegel, "Theory and Problems on Vector Analysis", Mcgraw Hill Publication, New York.

**Course Learning Outcomes:**After completion of this course, students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember**,**understand** and **apply** thedifferential and integral | **1,2,3** |

| | | |
|---|---|---|
| | calculus, Beta and Gamma functions, Taylor's and Maclaurin theorems, Maxima and minima. | Remembering, Understanding Applying |
| CLO2 | **Remember**,**understand**and **analyze** convergence of sequence and series of functions. | **1, 2, 4** Remembering, Understanding analyzing |
| CLO3 | **Understand** and **apply**multivariable calculus. | **2,6** Understanding, Applying |
| CLO4 | **Recall**, **classify**, **solve** and **determine** matrices | **1,2,3,5** Remembering, Understanding Applying Evaluating |

**Mapping of CO-PO/PSO:**

| **Course Learning Outcomes (CLOs)** | **Program Learning Outcomes (PLOs)** | | | | | | | | | | | | **Program Specific Outcomes (PSOs)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PLO1** | **PLO2** | **PLO3** | **PLO4** | **PLO5** | **PLO6** | **PLO7** | **PLO8** | **PLO9** | **PLO10** | **PLO11** | **PLO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CLO1** | H | H | H | H | H | M | L | L | L | M | L | M | - | - | - | - |
| **CLO2** | H | H | M | H | H | L | M | - | - | M | L | M | - | - | - | - |
| **CLO3** | H | H | M | H | H | M | L | - | - | - | L | M | - | - | - | - |
| **CLO4** | H | H | H | H | M | L | L | L | L | L | M | M | - | - | - | - |

**L=Low, M=Medium, H=High**

# BASIC ELECTRICAL ENGINEERING
# BEE1701/BEE2701

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 2 | 5 |

**Course Learning Objectives:** **(40 Hours)**

- Illustrate the 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.
- Analyze basic DC and AC circuits used in electrical devices.
- Explain the working principle, construction, applications of DC machines and AC machines.
- Examine the importance of transformers in transmission and distribution of electric power.

**UNIT I** **(8 Hours)**

**DC Circuits**: Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current andvoltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and NortonTheorems. Time-domain analysis of first-order RL and RC circuits.

**UNIT II** **(8 Hours)**

**AC Circuits**: Representation of sinusoidal waveforms, peak and rms values, phasor representation, realpower, reactive power, apparent power, power factor. Analysis of single-phase ac Circuitsconsisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phasebalanced circuits, voltage and current relations in star and delta connections.

**UNIT III** **(6 Hours)**

**Transformers:**Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, lossesin transformers, regulation and efficiency. Auto-transformer and three-phase transformerconnections.

**UNIT IV** **(8 Hours)**

**Electrical Machines:**Generation of rotating magnetic fields, Construction and working of a three-phase inductionmotor,Significance of torque-slip characteristic. Loss components and efficiency, starting andspeed control of induction motor. Single-phase induction motor. Construction, working, torque speed characteristic and speed control of hunt dc motor. Construction and working ofsynchronous generators.

**UNIT V** **(10 Hours)**

**Power Converters & Electrical Installations:**DC-DC buck and boost converters, duty ratio control. Single-phase voltage source inverters.Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types ofWires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries.Elementary calculations for energy consumption, power factor improvement and batterybackup.

**TEXT BOOKS:**

**T1.** D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
**T2.** D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
**T3.** L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
**T4.** E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
**T5.** V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

**REFERENCES BOOKS:**

**R1.** W. H. Hayt& J. E. Kennedy, "Engineering Circuit Analysis" Tata M.C. Graw Hill.
**R2.** P. S. Bimbhra "Electrical Machinery" Seventh Edition, Khanna Publishers, New Delhi.
**R3.** Vincent Del Toro "Electrical Engineering Fundamentals" Prentice Hall India, 2002.
**R4.** Edward Hughes "Electrical & Electronics Technology" Pearson education Limited, Indian Reprint 2002.

**Course Learning Outcomes:**After completion of this course, students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Illustrate**; **analyze** circuit laws and theorems that **relate** the basic foundation to **solve** dc network problems. | **1,2, 3, 4** Remembering Understanding , Applying, Analyzing |
| CLO2 | **Explain**, **analyze** and **find** the average and root mean square (RMS) values, of alternating or periodic waveforms also, **identify** total power in single phase and three phase system. | **1,2, 3, 4** Remembering Understanding , Applying, Analyzing |
| CLO3 | **Summarize**; **define** and **construct** phasor diagram of transformer both under no load and loaded condition also, **analyze** important and popular connections of 3-phase transformer (such as star/star, star/delta, delta/star etc.). | **1,2, 3, 4** Remembering Understanding , Applying, Analyzing |
| CLO4 | **Explain**; **find** and **analyze** speed torque characteristics of various machines also, **make use of** earthing and power factor improvement. | **1,2, 3, 4** Remembering Understanding , Applying, Analyzing |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes (CLOs) | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | M | L | - | - | - | - | - | - | - | - | M | H | M | L | M |
| **CLO2** | H | M | L | - | - | - | - | - | - | - | - | M | L | L | L | M |
| **CLO3** | H | M | L | M | - | - | - | - | - | - | - | M | H | M | L | M |
| **CLO4** | H | M | L | M | - | - | - | - | - | - | - | M | H | M | L | M |

**L=Low, M=Medium, H=High**

# BASIC ELECTRICAL ENGINEERING LAB
# BEE1701/BEE2701

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 5 |

**Course Learning Objectives:**

- To illustrate about common electrical components and their ratings.
- Make use of electrical connections by wires of appropriate ratings.
- To illustrate the usage of common electrical measuring instruments.
- To explain the basic characteristics of transformers and electrical machines.
- To illustrate the working of power electronic converters.

**List of Experiments:**

1. To study Synchronous Machine operating as a generator it's stand-alone operation with a load and control of voltage through field excitation.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-Ccircuits to a step change in voltage.
3. Demonstration of cut-out sections of different machines. dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
4. Demonstration of (a) dc-dc converters (b) dc-ac converters.
5. To study power measurement of 3 phase circuit by two Wattmeter method.
6. Measurement of efficiency of a single-phase transformer by load test.
7. To study Thevenin's theorem.
8. Determine of efficiency of a DC shunt motor by load test.
9. To study speed control of a D.C Shunt motor using:
   (i) Armature voltage control.
   (ii) Field control method.
10. To study running and reversing of a three-phase induction motor.

**Course Learning Outcomes:**After completion of this course, students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Illustrate** and **find** steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage and analyze their characteristics. | **1,2,4** Remembering, Understanding, Analyzing, |
| CLO2 | **Find** and **analyze** cut-out sections of different machines. | **1,4** Remembering, Analyzing |
| CLO3 | **Find** and **analyze** efficiency of a single-phase transformer by load test. | **1,4** Remembering, Analyzing |
| CLO4 | **Illustrate** and **analyse** speed control of a D.C Shunt motor. | **2,4** Understanding, Analyzing, |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes (CLOs) | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | M | - | - | - | - | - | - | - | - | H | H | M | H | M |
| CLO2 | H | H | H | - | - | - | - | - | - | - | - | M | H | M | M | H |
| CLO3 | H | H | M | - | - | - | - | - | - | - | - | H | H | M | H | M |
| CLO4 | H | H | H | - | - | - | - | - | - | - | - | M | H | H | M | M |

**L=Low, M=Medium, H=High**

# PROGRAMMING FOR PROBLEM SOLVING
# BCS1701/BCS2701

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 2 | 5 |

**Course Learning Objectives:** **(40 Hours)**

- To understand the fundamentals of computers.
- To understand and apply the various steps in program development.
- To examine the syntax and semantics of C programming language.
- To analyze the usage of structured programming approach in solving problems.

**UNIT I** **(8 Hours)**

**Computer Fundamentals**: Definition, Block diagram, components, characteristics & classification, Hardware & software, Types of software, Operating System: Types, Functions and Examples. Input and Output devices, Memory: Primary and secondary memory, Types of primary memory, Storage devices. Processor, CPU, Fundamentals of Networks: LAN, MAN, WAN, Topologies.Number Systems: Binary, Octal, Decimal, Hexadecimal.Types of programming, **Algorithm**, Pseudo code, Flow charts.

**UNIT II** **(8 Hours)**

**Introduction to C Language** - History, Structure of C Program, Identifiers, Data Types, Variables, Constants, Input / Output Statements, Compiler, Interpreter and Assembler. Arithmetic **Operators** and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.**Conditional Control Statements**: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: for, while, do-while and Examples. Continue, Break and Goto statements.

**UNIT III** **(8 Hours)**

**Functions:** Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Methods of Parameter Passing. Recursion- Recursive Functions.**Storage Classes**: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.**Arrays** - Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two-Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Insertion, Selection and Bubble Sort. Notion of order of complexity.

**UNIT IV** **(8 Hours)**

**Pointers** – Introduction, declaration, Pointer Arithmetic operations,Pointers and Arrays, Pointers and Functions, Dynamic Memory Allocation, **Strings** - Concepts, C Strings, String Input/output Functions, Arrays of Strings, String Manipulation Functions. **Preprocessors**: Preprocessor Directives, defining and calling macros.

**UNIT V** **(8 Hours)**

**Structures:** Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self-Referential Structures, **Unions**, Type Definition (typedef), Enumerated Types. Input and Output: **Introduction to Files**, Modes of Files, Streams, Standard Library Input/output Functions, Character Input/output Functions.

**TEXT BOOKS:**

**T1**.Schaum's Outline of Programming with C by Byron Gottfried, McGraw-Hill

**T2**.The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education

**T3**. Ashok N Kamthane, ""Programming in C", Pearson Education.

**REFERENCES BOOKS:**

**R1.**Let Us C By Yashwant P. Kanetkar

**R2.** Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman,Pearson Addison-Wesley

**R3.** Computer Fundamentals and Programming in C. Reema Thareja, Oxford Publication.

**Course Learning Outcomes:**After completion of this course, students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** sound problem solving and program design techniques to solve a large, complex problem by decomposing the problem into smaller, more manageable sub-problems | **1,2** Understanding, Remember |
| CLO2 | **Understand** and **apply** arrays, pointers and structures to formulate algorithms and programs. | **2,3** Understanding, Applying |
| CLO3 | **Apply** and **analyze** the programming skills to code and test a given logic in C programming language | **3, 4** Applying, Analyzing |
| CLO4 | **Explain** and **elaborate** the concept of searching and sorting to perform I/O operations. | **5, 6** Evaluating, Creating |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes (CLOs) | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | M | M | L | - | L | L | L | L | M | L | L | H | - | - | M |
| **CLO2** | M | M | H | M | - | L | - | - | - | - | M | M | M | H | - | - |
| **CLO3** | L | H | M | M | M | - | L | - | - | M | M | L | - | H | - | M |
| **CLO4** | H | H | H | M | H | - | - | - | - | - | L | M | M | H | - | - |

**L=Low, M=Medium, H=High**

# PROGRAMMING FOR PROBLEM SOLVING LAB
# BCS1701/BCS2701

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 5 |

**Course Learning Objectives:**

- To elaborate the fundamental concepts and gain a broad understanding ofcomputer software and hardware.
- To design algorithmic solution for simple computing problems.
- To develop problem-solving and empirical skills through the process of designing, implementing, and executing C programs.
- To make studentslearn the basic programming construct so that they can switch over to any other language in future.

**List of Experiments:**

1. Introduction to computer Hardware, Input & Output Device and Operating Systemused in the laboratory.
2. Working with Word Processor,Spread Sheet and Presentation Software, Internetand E-mail.
3. Programs based on Standard Input and Output functions.
4. Programs based on various Operators and Conditional Statements.
5. Programs based on switch, break and continue statement.
6. Programs based on for, while and do- while loops.
7. Implementation of programs related to Functions.
8. Implementation of programs related to One-Dimensional Arrays and Two-Dimensional Arrays and Strings.
9. Implementation of programs related to Structures, Union andPointers.
10. Implementation of programs related to File Handling.

**Other References:**

**1.**C and Cpp online course by *Spoken Tutorial (MOOC)*

**2.** Problem Solving through Programming in C online course by *NPTEL*

**Course Learning Outcomes:**After completion of this course, students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember**and **Understand** basic structure of the C-programming, declaration and usage of variables. | **1,2** Understanding, Remember |
| CLO2 | **Develop** C programs using pointers to access arrays, strings and functions and **understand** the different types of data handled by C language. | **2, 3** Understanding, Applying |
| CLO3 | **Apply** conditional and iterative statements to **analyze** C programs | **3,4** Applying, |

| | | |
|---|---|---|
| | | Analyzing |
| CLO4 | **Create** C programs using operators and **decide** ways to enhance problem solving skills. | **5,6** Evaluating, Creating |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes (CLOs) | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | M | M | - | - | - | L | L | L | M | L | H | H | H | - | M |
| **CLO2** | H | H | H | M | M | - | - | - | L | - | M | H | H | H | L | - |
| **CLO3** | M | H | H | L | L | - | - | - | - | - | M | H | H | M | L | - |
| **CLO4** | M | H | M | L | L | - | - | - | - | M | L | L | M | M | - | M |

**L=Low, M=Medium, H=High**

# ENGINEERING GRAPHICS AND DESIGN
# BME1701/BME2701

| L | T | P | C |
|---|---|---|---|
| 1 | 0 | 4 | 3 |

**Course Learning Objective:**

1. To introduce the concept of graphic communication, develop the drawing skills for communicating concepts, ideas and designs of engineering products.
2. To develop skills in interpreting, and producing engineering drawings accurately.
3. To build skill to use the techniques and modern engineering tools necessary for engineering practice.
4. To develop basic skill of computer-aided geometric design.

**Unit-I: PROJECTION OF POINTS AND STRAIGHT LINES**

Importance of graphics – use of drafting instruments – BIS conventions and specifications – size, layout and folding of drawing sheets – lettering dimensioning and scales - Projection of points, located in all quadrants - projection of straight lines located in the first quadrant, determination of true lengths and true inclinations

**Unit-II: PROJECTION OF PLANES AND SOLIDS**

Projection of polygonal surface and circular lamina located in first quadrant inclined to one or both reference planes-Projection of solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

**Unit-III: SECTION OF SOLIDS**

Section of simple solids like prisms, pyramids, cylinder and cone in vertical position by cutting planes inclined to any one of the reference planes, obtaining true shape of section.

**Unit-IV: DEVELOPMENT OF SURFACES**

Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones

**Unit-V: ORTHOGRAPHIC AND ISOMETRIC PROJECTION**

Orthographic principles – missing view - free hand sketching in first angle projection from pictorial views. Principles of isometric projection – isometric view and projections of simple solids, truncated prisms, pyramids, cylinders and cones. Introduction to CAD software – menus and tools – drafting platform demonstration

**TEXT/ REFERENCE BOOKS:**

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House.
2. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
5. (Corresponding set of) CAD Software Theory and User Manuals

**Course Learning Outcomes:** After completion of this course, students will be able to:

| CLO | Description | Bloom's Taxonomy Level |
|---|---|---|

| | | |
|---|---|---|
| CLO1 | **Create** the projection of points in all quadrants and straight lines | 6<br>Creating |
| CLO2 | **Construct** the projections of planes and solid objects with refer to reference planes | 6<br>Creating |
| CLO3 | **Illustrate** the true shape of truncated solids in both the manual and computerized manner | 2<br>Understanding |
| CLO4 | **Apply** orthographic and isometric projections in both the manual and computerized man | 3<br>Applying, |

Mapping of CLOs with PLOs & PSOs

| **Course Learning Outcomes** | **Program Learning Outcomes (PLOs)** | | | | | | | | | | | | **Program Specific Outcomes(PSOs)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PLO1** | **PLO2** | **PLO3** | **PLO4** | **PLO5** | **PLO6** | **PLO7** | **PLO8** | **PLO9** | **PLO10** | **PLO11** | **PLO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CLO1** | H | | M | | | | | | | | | | L | L | | H |
| **CLO2** | | H | | | | | | | | | | L | L | L | | L |
| **CLO3** | H | | H | | H | | H | | | | | M | H | M | M | M |
| **CLO4** | L | M | | | H | | H | | | | | H | H | M | M | M |

**H: High M: Medium L: Low**

# WORKSHOP PRACTICES
# BME1702/BME2702

L T P C
1 0 4 3

## Course Learning Objectives:

1. To make use of casting, forming, machining, joining, advanced manufacturing methods
2. To demonstrate CNC machining, Additive manufacturing, fitting operations & power tools.
3. To experiment with carpentry, plastic mounding, glass cutting and metal casting.
4. To build welding (arc welding & gas welding) and brazing.

**Lectures:** **(10 hours)**

**Detailed contents**

**1.**Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lectures)**

**2.** CNC machining, Additive manufacturing **(1 lecture)**

**3.** Fitting operations & power tools **(1 lecture)**

**4.** Electrical &Electronics **(1 lecture)**

**5.** Carpentry **(1 lecture)**

**6.** Plastic moulding, glass cutting **(1 lecture)**

**7.** Metal casting **(1 lecture)**

**8.** Welding (arc welding & gas welding), brazing **(1 lecture)**

**Workshop Practice:** **(60 hours)**

**1.** Machine shop **(10 hours)**

**2.** Fitting shop **(8 hours)**

**3.** Carpentry **(6 hours)**

**4.** Electrical & Electronics **(8 hours)**

**5.** Welding shop (Arc welding 4 hrs + gas welding 4 hrs) **(8 hours)**

**6.** Casting **(8 hours)**

**7.** Smithy **(6 hours)**

**8.** Plastic moulding& Glass Cutting **(6 hours)**

**Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.**

**Text Books**

**T1.**Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India Edition, 2006

**T2.** S. Gowri P. Hariharan,A.Suresh Babu, Manufacturing Technology I, Pearson Education, 2008.

**References**

**R1.** Roy. A. Lindberg, Processes and materials of manufacture, PHI / Pearson education, 2006.

**R2.** P.N. Rao, Manufacturing Technology Foundry, Forming and Welding, TMH-2003; 2 nd Edition, 2003

**R3.**HajraChouldhary S.K and Hajra Choudhury. AK., Elements of workshop Technology, volume I and II, Media promoters and Publishers Private Limited, Mumbai, 1997.

**Course Learning Outcomes(CLO):**On completion of this course, the students will be able **to :**

| CLO | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Create** knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate. | 6 Creating |
| CLO2 | **Build** components with their own hands. | 3,6 Applying, Creating |
| CLO3 | **Develop** practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes. | 3,6 Applying, Creating |
| CLO4 | **Demonstrate** small devices of their interest by assembling different components | 2 Understanding |
| CLO5 | **Experiment with** carpentry, plastic mounding, glass cutting and metal casting. | 3 Applying |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | | H | | | H | | | | | L | H | M | M | M |
| CLO2 | H | H | | H | | | M | | | | | L | H | M | M | M |
| CLO3 | H | H | | H | M | L | L | | | | | L | H | M | M | M |
| CLO4 | H | H | | H | | | M | | | | | L | H | M | M | M |
| CLO5 | H | L | | H | | | H | | | | | L | H | L | M | L |

**H: High M: Medium L: Low**

# ENVIRONMENTAL SCIENCE
# XESX601

**L T P C**
**2 0 0 0**

**Course Learning Objectives:** **(40 Hours)**

- To tell some introductory knowledge on concepts and general principles regarding environment.
- To illustrate role of education, religions, cultures, movements and sustainable developmental activities in ecological preservation.
- To aim at understanding the sources, effects and control measures of pollution of air, water, land, noise, solid wastes and also creating awareness on globally recognized environmental challenges.
- To examine the role of ways, legal methods and accountabilities in safeguarding environment.

**UNIT I** **(8 Hours)**

**Basics of Environment and Natural Resources:**Components of the environment (atmosphere, hydrosphere, lithosphere and biosphere), types of environment (micro-level, macro-level, natural and man-made), concept of ecology. Importance and multidisciplinary nature of environmental studies.Ecosystem: Structure and functions (energy flow, food chains and food webs).Biodiversity: importance, threats and conservation.Land resources: Land use change; land degradation, soil erosion and desertification.Deforestation: Causes (mining, dam construction and u1banization) and impacts on environment.Water resources: Use and over-exploitation of surface and ground water, floods, droughts, droughts, conflicts over water (international & inter-state).Energy resources: Renewable and nonrenewable, alternate resources, growing energy needs, case studies.

**UNIT II** **(7 Hours)**

**Ecological Behavior and Knowledge Management:**Ethics and ecological wisdom: Role of Indian and other religions and cultures in environmental conservation, ecological world view.Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi), recycling, energy, water conservation, political activism, consumerism, commitment to environmental organizations. Globalization and environmental issues.Environment, ecology and quality of life. Ideologies of environmentalismAwareness, appropriate technology and scientific conservation. Sustainable Development and Agenda 21.Training for environmental mental set- The issue of altering habits. Managing Environmental challenges for future.

**UNIT III** **(6 Hours)**

**Environmental Pollution and Remediation:**Environmental pollution: Air, water, land, noise, and nuclear hazards. solid waste management (municipal, industrial, commercial and hazardous) and traffic management.An understanding of environmental issues: Climate change, global warming, ozone layer depict ion, acid rain, natural disasters and human population growth.

**UNIT IV** **(4 Hours)**

**Environmental Laws and Regulations:**Policy consideration: Environmental (Protection), Act, 1986; Hazardous Wastes (Management and Handling) Rules, 1989; Noise Pollution (Regulation and Control)) Rules, 2000; Bio-Medical Waste (Management and Handling) Rules, 1998. Role of different agencies in promoting environmental protection: Role of magistracy, higher courts and police.International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).Corporate Social responsibility (CSR).

**TEXT BOOKS:**

**T1**. Environmental Science and Engineering by Benny Joseph (Tata Mc Graw Hill Publishing Company, New Delhi).
**T2.** Environmental Studies by R.C. Sharma and D. Gurbir Sangha (Kalani Publishers, cw Delhi).
**T3.** Introduction to Environmental Science by Anjaneyalu. Y. (B.S. Publications, Hyderabad).
**T4.** Environmental Pollution Control Engineering by C.S. Rao (New Age International Pub.).

**REFERENCES BOOKS:**

**R1.**Text book of Environmental Studies for undergraduate courses by E. Bharu cha (University Press Publication).
**R2.** Environmental Studies: From Crisis to Cure by R. Rajagopalan (Ox ford University Press).

**R3.** Environmental Science by S.C. Santra (New Central Book Agency (P) Ltd., Kolkata).

**OTHER REFERENCES:**
http://nptcl. ac. in/courses/122102006/
https://www.youtube.com/watch?v=jXAilwKkzhk
https:// www.youtube.com/watch?v=201RvxfOg
https:// www.youtube.com/watch?v=IizVLnq01114A
https:// www.youtube.com/watch?v=IDrGTnTuBI
https:// www.youtube.com/watch?v=QFluIRVurhY

**Course Learning Outcomes:** After completion of this course, students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Recall, understand** and respond on the basic understanding of their environmental complexes. | **1, 2** Remembering, Understanding |
| CLO2 | **Understand** and **analyze** the ways education, social movements and fair developmental practices help in maintaining ecological balance. | **2, 4** Understanding, Analyzing |
| CLO3 | **Apply** and **analyze** various aspects of deteriorating environmental components and also prevailing environmental threats. | **3, 4** Applying, Analyzing |
| CLO4 | **Interpret** and **elaborate** various tools viz. policies, rules/acts, mechanisms, compliances, institutions/agencies in securing the planet. | **5, 6** Evaluating, Creating |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes (CLOs) | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | M | M | | M | L | M | | M | - | M | - | M | M | - | - | M |
| CLO2 | M | H | | M | L | | H | L | | M | M | - | - | H | M | M |
| CLO3 | M | | H | - | - | H | | L | M | | | M | M | H | M | M |
| CLO4 | - | - | L | | H | - | H | - | M | H | M | | - | - | H | - |

**L=Low, M=Medium, H=High**

# ENGLISH
# BHU1701/BHU2701

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 2 | 3 |

**Course Learning Objectives:** **(40 Hours)**

- To define and explain various techniques of word formation; and develop skills of sensible writing andvocabulary building.
- To illustrate and elaborate fundamental techniques and features of writing skills.
- To demonstrate and discuss various types of common errors committed by users of English and solve exercises to develop their understanding in use of grammatically correct sentences.
- To organize language lab activities and workshops to develop oral communication skills.

**UNIT I** **(4 Hours)**

**Vocabulary Building**: The concept of word formation. Root words from foreign languages and their use in English. acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. synonyms, antonyms, and standard abbreviations.

**UNIT II** **(6 Hours)**

**Basic Writing Skills:**Sentence Structures. Use of phrases and clauses in sentences. Importance of proper punctuation. Creating coherence. Organizing principles of paragraphs in documents. Techniques for writing precisely.

**UNIT III** **(10 Hours)**

**Identifying Common Errors in Writing:**Subject-verb agreement. Noun-pronoun agreement. Misplaced modifiers, Articles, Prepositions, Redundancies and Clichés.

**UNIT IV** **(8 Hours)**

**Nature and Style of sensible Writing:**Describing, Defining, Classifying, providing examples or evidence, Writing introduction and conclusion, Comprehension, Précis Writing, Essay Writing.

**UNIT V** **(2 Hours)**

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

**TEXT BOOKS:**

**T1**. Beebe, S.A. et al. "Communication: Principles for Lifetime" (3rd edition), Pearson
**T2.**Raman, M. and Sharma, S. "Technical Communication: Principles and Practice" OxfordUniversity Press
**T3.**Sethi, J. and Dhamija, P.V. "A Course in Phonetics and Spoken English" (2nd Ed.), PHI Learning Pvt. Ltd.

**REFERENCES BOOKS:**

**R1.**Hencock, M. "English Pronunciation in Use", Cambridge University Press.
**R2.**Carter, R. "Seeing Through Language: A Guide to Styles of English Writing", Blackwell Publications,
**R3.**Balasubramanian, T. "A Textbook of Phonetics for Indian Students", Macmillan
**R4.**Humes, J.C. "Speak Like Churchill, Stand Like Lincoln: 21 Powerful Secrets of History's Greatest Speakers", Three Rivers Press.

**Course Learning Outcomes:** After completion of this course, students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Recall** and **explain** different techniques of word formation; and **demonstrate** knowledge of synonyms, antonyms and skills of sensible writing. | **1, 2** Remembering, Understanding |
| CLO2 | **Illustrate** essential techniques and features of effective writing and **make use of** them in written communication. | **2, 3** Understanding, Applying |
| CLO3 | **Identify** and **analyze** common errors in English and **solve** exercises based on them; **apply** acquired knowledge and skills of oral and written communication in personal and professional life. | **3, 4** Applying, Analyzing |
| CLO4 | **Take part in** individual and group communication activities; and **determine** and **invent** new forms and methods of communication to as per the situation. | **4, 5, 6** Analyzing, Evaluating, Creating |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes (CLOs) | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | - | - | - | - | - | L | L | L | M | H | L | L | - | - | - | L |
| **CLO2** | - | - | - | L | - | L | L | L | M | H | L | M | - | - | - | L |
| **CLO3** | - | - | - | L | L | L | L | M | M | H | M | M | - | - | - | L |
| **CLO4** | - | - | - | L | L | L | L | M | H | H | M | M | - | - | - | L |

**L=Low, M=Medium, H=High**

# ENGLISH LAB
# BHU1701/BHU2701

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 3 |

**Course Learning Objectives:**

- To define and explain various techniques of word formation; and develop skills of sensible writing andvocabulary building.
- To illustrate and elaborate fundamental techniques and features of writing skills.
- To demonstrate and discuss various types of common errors committed by users of English and solve exercises to develop their understanding in use of grammatically correct sentences.
- To organize language lab activities and workshops to develop oral communication skills.

**List of Activities:**

**1. PRONUNCIATION PRACTICE (2 lab days)**

i. Sounds of English
ii. Syllable
iii. Accent
iv. Intonation
v. Common Errors in Pronunciation
vi. Pronunciation Practice

**2. SPEAKING PRACTICE (2 lab days)**

i. Phenomenon Description
ii. Live commentary
iii. Process Description
iv. Routine and Properties
v. Future Plans
vi. Story Telling

**3. PRESENTATION (2 lab days)**

i. Use of Power Point Presentation
ii. Salient Features of Effective PPT
iii. Slide Making
iv. Delivery
v. Practice

**4. PUBLIC SPEECH (1 lab day)**

i. Use of Public Speech
ii. Salient Features of an Effective Speech
iii. General Challenges
iv. Audience Analysis
v. Persuasion Techniques: Ethos, Pathos, Logos
vi. Body Language, Tone, and Delivery
vii. Speech Practice

5. INTERVIEW (1 lab day)

i. Making an Effective CV
ii. Preparation for an Interview
iii. Interview Etiquettes
iv. Most Common Interview Questions
v. Mock Interview

**6. GROUP DISCUSSION** **(2 lab days)**
i. Purpose
ii. GD Etiquettes
iii. Rules and Techniques
iv. GD Practice

**7. DEBATE** **(1 lab day)**
i. Purpose
ii. Rules and Techniques
iii. Debate Practice

**8. SITUATIONAL CONVERSATION** **(2 lab days)**
i. At Hotel
ii. At the Air-Port
iii. At Bank
iv. At Shop
v. At Workplace

**OTHER REFERNCES:**

**R1**. Practical English Usage. Michael Swan. OUP. 1995.
**R2.** Remedial English Grammar. F.T. Wood. Macmillan.2007 (iii)On Writing Well. William Zinsser. Harper Resource Book. 2001
**R3.** Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
**R4.** Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
**R5.** Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

**Course Learning Outcomes:** After completion of this course, students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Recall** and **explain** different techniques of word formation; and **demonstrate** knowledge of synonyms, antonyms and skills of sensible writing. | **1, 2** Remembering, Understanding |
| CLO2 | **Illustrate** essential techniques and features of effective writing and **make use of** them in written communication. | **2, 3** Understanding, Applying |
| CLO3 | **Identify** and **analyze** common errors in English and **solve** exercises based on them; **apply** acquired knowledge and skills of oral and written communication in personal and professional life. | **3, 4** Applying, Analyzing |
| CLO4 | **Take part in** individual and group communication activities; and **determine** and **invent** new forms and methods of communication to as per the situation. | **4, 5, 6** Analyzing, Evaluating, Creating |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes (CLOs) | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | - | - | - | - | - | L | L | L | M | H | L | L | - | - | - | L |
| CLO2 | - | - | - | L | - | L | L | L | M | H | L | M | - | - | - | L |
| CLO3 | - | - | - | L | L | L | L | M | M | H | M | M | - | - | - | L |
| CLO4 | - | - | - | L | L | L | L | M | H | H | M | M | - | - | - | L |

**L=Low, M=Medium, H=High**

# PYTHON +CLEAN CODING
# BCS1702

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 3 |

## Course Learning Objectives:

- To understand why Python is a useful scripting language for developers.
- To learn how to design and program Python applications.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to identify Python object types.
- UNIT I: Introduction to Clean Code
- What is Bad Code? Example 1: Avoid ,Example 2: for each code, What is Clean Code?
- Purpose of Clean Code, Thought of experienced programmers, Intention Revealing Names, Example 1: Poor Variable Names, Example 2: Poor Method Names, Example 3: Variable Name, Make Meaningful Distinctions, Example 1: Usage of Different Words, Example 2: Distinct Names ,Use Pronounceable Names, Example 1: Vocal Names, Example 2: Short Form Names, Example 3: Non-Pronounceable Names, Example 4: Compare, Avoid Encodings and Mental Mappings, Difference between smart and professional programmer, Class and Method Names
- **UNIT II: Functions**
- Function Size Matters, Blocks and Indenting, Do only one thing within a function, One level of abstraction per function, Use Descriptive Names, Example 1: Verbal Names, Function Arguments, Advantages of Having Less Arguments, Command Query Separation, Prefer Exceptions to Returning Error Codes, Extract Try/Catch Blocks, Error Handling Is One Thing
- **UNIT III: Comments and Formatting**
- Good Comments ,Good Names Can Obviate Comments, Types of Good Comments, Legal Comment, Informative Comment, Explanation of Intent Comment, Clarification Comment, Warning of Consequences Comment, TODO Comments, Amplification Comment, Bad Comments ,Mumbling Comments, Redundant Comments, Misleading Comments, Mandated Comments, Journal Comments,

  Noise Comments, Scary Noise, Commented-Out Code, Too Much Information, The Purpose of Formatting, Vertical Formatting, Horizontal Formatting, Exercise 1: Comments and Formatting, Data Abstraction, Example 1: Concrete Point, Example 2: Abstract Point, Data/Object Antisymmetry, Law of Demeter, Data Transfer Objects

- **UNIT IV: Python Basics**
- What is Python?, Advantages and disadvantages, Downloading and installing, Which version of Python, Running Python Scripts, Using the interpreter interactively, Using variables, String types: normal, raw and Unicode, String operators and expressions, Math operators and expressions, Writing to the screen, Reading from the keyboard, Indenting is significant, The if and elif statements,, While Loops, Using List, Dictionaries, Using the for statement, Opening, reading and writing a text file, Using Pandas, the python data analysis library and data frames
- **UNIT V: Advanced Concepts in Python**
- RE Pattern Matching,Parsing Data,Introduction to Regression,Types of Regression, Use Cases,Exploratory data analysis, Correlation Matrix, Visualization using Metplotlib, Implementing linear regression, Machine Learning – Algorithm,Algorithms – Random forest,Super vector Machine,Random Forest,Build your own model in python,Comparison between random forest and decision tree

**Text Book:**

- 1.Python Cookbook, Third edition, by David Beazley and Brian K. Jones
- **Reference book:**
- 1.Natural Language Processing With Python, by Steven Bird, Ewan Klein, and Edward Loper.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | Remember and Understand indexing and slicing to access data in Python programs | Remembering, Understanding **1,2** |
| CLO2 | Remember and Understand how to write functions and pass arguments in Python | Remembering, Understanding **1,2** |
| CLO3 | Understand package by applying Python modules for reusability. | 2,3 **Understand, Apply** |
| CLO4 | Analyze and Evaluate exception handling in Python applications for error handling. | Evaluating, Analyze **4,5** |

**Mapping of CLOs with PLOs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO1 | PLO1 | PLO1 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | H | L | | | | L | M | H | H | M | M | H |
| CLO2 | H | H | H | M | H | L | | | | L | M | H | H | H | H | H |
| CLO3 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |
| CLO4 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |

**H: High** **M: Medium** **L: Low**

# PYTHON + CLEAN CODING LAB
# BCS1702

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 3 |

**Course Learning Objectives:**

- To elaborate the fundamental concepts and gain a broad understanding of computer software and hardware.
- To design algorithmic solution for simple computing problems.
- To develop problem-solving and empirical skills through the process of designing, implementing, and executing C programs.
- To make students learn the basic programming construct of python language so that they can switch over to any other language in future.

**List of Experiments:**

1. WAP to design and program Python applications.
2. WAP to use indexing and slicing to access data in Python programs
3. To define the structure and components of a Python program
4. To learn how to write loops and decision statements in Python
5. To learn how to write functions and pass arguments in Python
6. To learn how to build and package Python modules for reusability
7. WAP to read and write files in Python.
8. WAP to design object-oriented programs with Python classes.
9. To learn data handling and use cases diagrams.
10. WAP to use class inheritance in Python for reusability.
11. WAP to use exception handling in Python applications for error handling.

**Text Book:**

1.Python Cookbook, Third edition, by David Beazley and Brian K. Jones

**Reference book:**

1.Natural Language Processing With Python, by Steven Bird, Ewan Klein, and Edward Loper.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | Remember and Understand basics Python programming application. | Remembering, Understanding 1,2 |
| CLO2 | Remember and understand function, indexing and slicing. | Remembering, Understanding 1,2 |

| | | |
|---|---|---|
| CLO3 | Understand package by applying Python modules for reusability. | 2,3 **Understand, Apply** |
| CLO4 | Analyze and Evaluate exception handling in Python applications for error handling. | Evaluating, Analyze **4,5** |

**Mapping of CLOs with PLOs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO1 | PLO1 | PLO1 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | H | L | | | | L | M | H | H | M | M | H |
| CLO2 | H | H | H | M | H | L | | | | L | M | H | H | H | H | H |
| CLO3 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |
| CLO4 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |

**H: High** **M: Medium** **L: Low**

# JAVA FUNDAMENTAL
# BCS2703

| L | T | P | C |
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| 1 | 0 | 0 | 2 |

## Course Learning Objectives:

- To understand why Java is a useful language for developers.
- To learn how to design and program Java applications.
- To learn how to debug Java programs.
- To learn the understanding of java server pages and database connectivity.

**UNIT I: Introduction to OBJECT ORIENTED PROGRAMMING**

Introduction to object-oriented programming, Object concept, Key principles of object-oriented programming Development project life cycle Introduction to UML :Static UML Diagrams – Class, Object, Component, Deployment Dynamic UML Diagrams – Use Case, Sequence, Activity, State Chart

**UNIT II: Introduction to Java Development Environment**

Introduction to the Java programming language, Introduction to the Java development and Productivity tools ,Object-oriented programming,Java syntax basics - Part 1 ,Java syntax basics - Part 2

**Unit III: CONCEPTS OF CORE JAVA**

Writing simple Java code using the IDE ,Building classes ,Debug applications ,Inheritance ,Design patterns and refactoring ,Interfaces ,Collections ,Generics ,Threads and synchronization ,Utility classes

**Unit IV: Exception Handling and Netbeans**

Exceptions and exception handling, I/O and serialization , JavaBeans, Introduction to Java EE Web Component ,Overview of Servlets ,Java EE Container Services Overview ,Servlet API

**Unit V: JAVA SERVER PAGES**

Overview of JavaServer Pages, JavaServer Pages Specification and Syntax,Create and Edit HTML and JSPs,Debugging Web Applications, Web Archive Deployment Descriptor,Session State Storage Issues,Cookie API, HttpSession: Management of Application Data ,URL Rewriting,Best Practices for Session Management, JSP Expression Language, JSP Custom Tags, JSP Tag Files ,Create and Edit Servlets,

Filters, and Listeners ,XDoclet and Annotations ,Connecting to a database ,Web Application Security,Java EE Packaging and Deployment ,Best Practices for Server-Side Application Development

**TEXT BOOKS:**

**T1.** Herbert Schildt, The Complete Reference, Java 2 (Fourth Edition) TMH.
**T2.** Michael R Blaha, James R Rambaugh, Object Oriented Design and Modeling with UML, (Second Edition) Pearson

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | Remember and Understand object oriented programming. | Remembering, Understanding **1,2** |
| CLO2 | Remember and Understand Java development environment and core concepts of Java. | Remembering, Understanding **1,2** |
| CLO3 | Understand exception handling and develop an understanding of Netbeans. | 2,3 **Understand, Apply** |
| CLO4 | Analyze and Evaluate applications using JSP. | Evaluating, Analyze **4,5** |

**Mapping of CLOs with PLOs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO1 | PLO1 | PLO1 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | H | L | | | | L | M | H | H | M | M | H |
| CLO2 | H | H | H | M | H | L | | | | L | M | H | H | H | H | H |
| CLO3 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |
| CLO4 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |

**H: High** **M: Medium** **L: Low**

# JAVA FUNDAMENTAL LAB
# BCS2703

| L | T | P | C |
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**Course Learning Objectives:**

- To elaborate the fundamental concepts and gain a broad understanding of computer software and hardware.
- To design algorithmic solution for simple computing problems.
- To develop problem-solving and empirical skills through the process of designing, implementing, and executing C programs.
- To make students learn the basic programming construct of python language so that they can switch over to any other language in future.

**List of Experiments:**

1) Create Java classes that implement an object-oriented design
2) Apply Java language constructs that enable and enforce OO-related concepts such as data encapsulation, strict typing and type conversion, inheritance, and polymorphism
3) Use Java syntax to develop applications in Java
4) Use inheritance and interfaces in Java applications
5) Refactor Java code Debug Java programs
6) Describe Java EE component model and its use in building server-side applications
7) Develop, debug, and test server-side applications
8) Develop and test servlets
9) Develop and test JSP pages
10) Learn how to use JSPs and servlets in accordance with the Model/View/Controller(MVC) programming model
11) Develop, test, and use JSP custom tags.

**Text Book:**

**T1.** Herbert Schildt, The Complete Reference, Java 2 (Fourth Edition) TMH.
**T2.** Michael R Blaha, James R Rambaugh, Object Oriented Design and Modeling with UML, (Second Edition) Pearson.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | Remember and Understand object oriented programming. | Remembering, Understanding **1,2** |

| | | |
|---|---|---|
| CLO2 | Remember and Understand Java development environment and core concepts of Java. | Remembering, Understanding **1,2** |
| CLO3 | Understand exception handling and develop an understanding of Netbeans. | 2,3 **Understand, Apply** |
| CLO4 | Analyze and Evaluate applications using JSP. | Evaluating, Analyze 4,5 |

**Mapping of CLOs with PLOs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO1 | PLO1 | PLO1 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | H | L | | | | L | M | H | H | M | M | H |
| CLO2 | H | H | H | M | H | L | | | | L | M | H | H | H | H | H |
| CLO3 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |
| CLO4 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |

H: High M: Medium L: Low

# DATA STRUCTURES AND ALGORITHMS

## BCS3014

| L | T | P | C |
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**(40 Hours)**

**Course Learning Objectives:**

- To develop student's knowledge in data structures and its associated algorithms.
- To introduce the concepts and techniques of structuring and operating on abstract data types in problem solving.
- To discuss common sorting, searching and graph algorithms, and to study the complexity and comparisons among these various techniques.

**Unit- I** **[8 Hours]**

**Introduction:** Basic Terminology, Elementary Data Organization, Data Structures, Operations on data structures, Algorithm, Complexity, **Analysis of algorithm, Asymptotic Notation.**
**Arrays:** Definition, Single and Multidimensional Arrays, Representation of Arrays, Operations on an array, Application of arrays, Sparse Matrices and their representations.
Sorting and Searching: Insertion Sort, Selection Sort, Bubble Sort, Merge Sort, Radix Sort, Linear Search, Binary Search, Hash Function, Collision Resolution Strategies.

**Unit- II** **[8 Hours]**

**Pointers:** Definition and declaration, Pointer variables, Pointer arithmetic, Pointer Arrays, Pointer to structure, Dynamic Memory Allocation, Garbage collection.
**Linked lists:** Array Implementation and Dynamic Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List**, Complexity analysis of linked list**; Operations on a Linked List: Insertion, Deletion, Traversal; Polynomial Representation and Addition, Generalized Linked List.

**Unit- III** **[8 Hours]**

**Stacks:** Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, **Complexity analysis,** Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Recursion, Tower of Hanoi Problem, Tail recursion, Removal of recursion.
**Queues:** Operations on Queue: Create, Add, Delete, Full and Empty; Array and linked implementation of queues in C, Circular queues, Dequeue and Priority Queue,**Complexity analysis.**

**Unit- IV** **[8 Hours]**

**Trees**: Basic terminology, Binary Trees, Complete Binary Tree, Extended Binary Trees, Algebraic Expressions, Array and Linked Representation of Binary trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Binary Search Trees (BST), Insertion and Deletion in BST, Threaded Binary trees, Traversing in Threaded Binary Trees, AVL trees, Heap Creation, Heap Sort, Huffman algorithm, General Tree, B Trees & B+ Trees.

**Unit- V** **[8 Hours]**

**Graphs:** Terminology, Sequential and linked Representations of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi list; Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm.

**TEXT BOOKS:**

**T1.** Lipschutz, "Data Structures" Schaum's Outline Series, TMH.

**REFERENCE BOOKS:**

**R1.** A.K. Sharma, "Data Structure using C", Pearson Education.
**R2**. Kamthane, "Data Structure using C", Pearson Education.
**R3**. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++" , PHI.
**R4**. S.K. Srivastava, "Data Structures Through C in Depth", BPB Publication

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** the basic terminologies and concepts used in data structures and different sorting techniques. | **1,2** Remembering Understanding, |
| CLO2 | **Understand** the basic data structures and algorithms for autonomous realization of simple programs or partial programs by **applying** linked list's on various operations. | **2, 3** Understanding, Applying |
| CLO3 | Create new solutions for programming problems or improve existing code using learned algorithms and data structures by **analyzing** and **applying,** stack and queue operations. | **3,4** Analyzing, Applying |
| CLO4 | **Evaluate** the hash function and concepts of collision and its resolution methods, **construct** graphs, trees and heaps. | **5, 6** Evaluating, Creating |

**Mapping of CLO-PLO/PSO**

| Course Learning Outcomes (CLOs) | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 | PLO 8 | PLO 9 | PLO 10 | PLO 11 | PLO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| CLO1 | H | H | H | H | M | L | - | - | - | - | L | H | M | H | H | H |
| CLO2 | H | H | H | H | M | L | L | - | - | - | L | L | M | H | H | H |
| CLO3 | H | H | H | H | M | L | L | - | - | - | M | M | M | H | H | H |
| CLO4 | H | H | H | H | H | L | - | - | - | - | L | M | M | H | H | H |

**H: High M: Medium L:Low**

# DATA STRUCTURE AND ALGORITHMS LAB

## BCS3513

| L | T | P | C |
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**Course Learning Objectives:**

- To implement linear and non-linear linked data structures such as linked lists, queues, trees and graphs and to get a good understanding of applications of data structures.
- To understand basic data structures such as arrays, linked lists, stacks and queues.
- To solve problem involving graphs, trees and heaps
- To apply algorithms for solving problems like sorting, searching, insertion and deletion of data

**List of Experiments:**

1. Implement basic operations on Array.
2. Sort the given list of numbers using Insertion Sort, Selection Sort and Bubble Sort.
3. Implement the basic operations on Singly Linked List.
4. Represent the given sparse matrix using Arrays and Linked List.
5. Implement the basic operations on Doubly Linked List and Circular Linked List.
6. Create a Stack and do the basic operations using Arrays and Linked List.
7. Create a Queue and do the basic operations using Arrays and Linked List.
8. Binary Search Tree implementation.
9. Sort the given list of numbers using Heap Sort and Quick Sort.
10. Implement Depth First Search and Breadth First Search.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Understand** and **remember** algorithms and its analysis procedure. | **1,2** Remembering, Understanding |
| CLO2 | **Apply** and **analyze** various data structure algorithms. | **3,4** Applying, Analyzing |
| CLO3 | **Develop** an application by **analyzing** various data structure algorithms. | **3, 4** Applying, Analyzing |
| CLO4 | **Estimate** and **formulate** various techniques for the representation of data in the real world. | **5,6** Evaluating, creating |

**Mapping of CLOs with PLOs & PSOs**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | M | L | L | | L | L | L | H | M | H | H | H |
| CLO2 | H | H | H | H | M | L | L | | L | L | L | L | M | H | H | H |
| CLO3 | H | H | H | H | M | L | L | | L | L | L | L | M | H | H | H |
| CLO4 | H | H | H | H | H | L | L | | L | L | L | M | M | H | H | H |

**H: High** **M: Medium** **L: Low**

# SOFTWARE ENGINEERING

## BCS3015

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Learning Objectives:** **(40 Hours)**

- To understand the concepts of software development process models and analyze different design approaches.
- To understand the quality concepts for software development.
- To understand the project management concepts along with monitoring, planning, scheduling and risk management.

**Unit– I** **[08 Hours]**

Introduction to Software Engineering: Software Components, Software Characteristics, Software Crisis, Software Engineering Processes.
Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.

**Unit– II** **[08 Hours]**

Software Requirement Specifications (SRS): Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. Software Quality Attributes, Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.

**Unit-III** **[08 Hours]**

Software Design: Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.

**Unit-IV** **[08 Hours]**

Software Testing: Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards.

**Unit-V** **[08 Hours]**

Software Maintenance and Software Project Management: Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.

**TEXT BOOK:**

T1. R. S. Pressman: Software Engineering: A Practiioners Approach, 7th Edn. TMH, 2010

**REFERENCE BOOK:**

R1. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI, 2006
R2. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers. R3. Pankaj Jalote, "Software Engineering: A Precise Approach", Wiley
R4. Sommerville, "Software Engineering", 9th Edition, Pearson

R5. W.S. Jawadekar: Software Engineering Principles and Practice, 2nd ed, TMH R6. J.Mishra, A.Mohanty, "Software Engineering", First Edition, Pearson, 2012

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Blooms Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** the issues in engineering that summarizes the background to develop complex systems. | **1,2** Remembering, Understanding |
| CLO2 | **Understand** and **apply** group working skills - including general organization, planning and time management, inter-group negotiation, etc. | **2,3** Understanding, Applying |
| CLO3 | **Apply** and **Analyze** the knowledge of software engineering context, software engineering processes and their applicability. | **3,4** Applying, Analyzing |
| CLO4 | **Analyze** the concepts and techniques to **model** a small-scale **design** project. | **3,4** Applying, Analyzing |

**Mapping of CLO-PLO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | H | L | L | | | | M | H | M | H | H | H |
| CLO2 | H | H | H | H | H | L | L | | | | M | H | M | H | H | H |
| CLO3 | H | H | H | H | H | | | | | | M | H | M | H | H | H |
| CLO4 | H | H | H | H | H | | | | | | M | H | M | H | H | H |

**H: High M: Medium L: Low**

# SOFTWARE ENGINEERING LAB

# BCS3514

**L T P C**
**0 0 2 1**

**Course Learning Objectives:**

- To understand the discipline of project management as it applies to using a project management tool.
- To create a work breakdown structure, identify task relationships, and define resources within the tool.
- To set project baselines and use them to measure progress and integrate multiple projects.

**List of Experiments:**

1. Introduction to the project management tool.
2. Basic steps required to create project and prepare it for data entry (project tasks, sequence the tasks and estimate task duration).
3. Setting up a project [Eating Breakfast] and establish the basic constraints that project will use for its calculation. Analyze the project from different view [Gantt Chart, Network Diagram]
4. Setting up a project [Refurbishment of Workshop] and identifying relationship among the different task and subtask.
5. Setting up a project [Exam Cell Activities] and explain how to enter resources and specific information in the tool and resources to specific tasks.
6. Case Study: Project Windows 8 (Module works on windows Vista and now transform the module to work on Window 8).

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Blooms Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** basic steps required to create a project. | **1,2** Remembering, Understanding |
| CLO 2 | **Demonstrate** a project by **applying** relationship among the task and subtasks. | **2,3** Understanding, Applying |
| CLO 3 | **Analyze** and **determine** necessary project parameters from different perspective. | **4,5** Analyzing, Evaluating |
| CLO 4 | **Construct** the system to analyze specific information fed into the tool and resources for specific tasks. | **6** Creating |

**Mapping of CLO-PLO/PSO**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PLO1 | PLO2 | PLO1 | PLO2 |
| CLO1 | H | H | H | H | H | L | L | | L | L | M | H | M | H | H | H |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLO2 | H | H | H | H | H | L | L | | L | L | M | H | M | H | H | H |
| CLO3 | H | H | H | H | H | L | L | | L | L | M | H | M | H | H | H |
| CLO4 | H | H | H | H | H | L | L | | L | L | M | H | M | H | H | H |

**H: High M: Medium L: Low**

# DISCRETE MATHEMATICS

## BMA3011

**L T P C**
**3 1 0 4**

**(40 Hours)**

**Course Learning Objectives:**

- To introduce general techniques of problem solving, and explore the creation of mathematical logic, set theory, algebraic structure and combinatory.
- To study methods for finding explicit formulas for the sequence terms that satisfy certain types of recurrence relations.
- To aim for understanding the concept of a logical approach in decision making and problem solving of Boolean algebra.
- To explore a logical approach to decision making and problem solving of graph theory.

**UNIT I: PROPOSITIONAL LOGICS** **(07 Hours)**

Proposition, well formed formula, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, quantifiers, Inference theory of predicate logic, Notion of Proofs, First order predicate, well formed formula of predicate.

**UNIT II: SETS, RELATIONS & FUNCTIONS** **(07 Hours)**

Definition of sets, Venn diagrams, complements, Cartesian products, power sets, proofs of some general identities on sets, Relations, Equivalence relation, composition of relations, domain & range of a relation, Definition & types of function, composition of functions.

**UNIT III: ALGEBRAIC STRUCTURES** **(10 Hours)**

Groups, Subgroup, Cyclic groups, Permutation groups, Cosets, Lagrange's theorem, Normal subgroup, Homomorphism and isomorphism of Groups, Definition and elementary properties of Rings and Fields.

**UNIT IV: POSET, LATTICES AND BOOLEAN ALGEBRA** **(08 Hours)**

Definition, partial order sets, Hasse diagram, Definition and properties of Lattices- Bounded, Complemented, complete lattice, Introduction, Axioms and theorems of Boolean algebra, Boolean function, Algebraic manipulation of Boolean expressions. Simplification of Boolean Functions, Karnaugh maps.

**UNIT V: COMBINATORICS AND GRAPH THEORY** **(08 Hours)**

Recurrence relation ($n^{th}$ order recurrence relation with constant coefficient, Homogenous and non-homogenous),Graphs, some basic properties, various operations on graphs, Hamiltonian paths and circuits, Euler graphs, Planner graphs, coloring of graph, Tree, spanning trees, finding spanning trees of weighted graph .

**TEXT BOOKS**

**T1**. Babu Ram, "Discrete Mathematics", Pearson
**T2**. Lipschutz& Lipson, "Discrete Mathematics", TMH
**T3.** E.R. Scheinerman, "Mathematics: A Discrete Introduction", Brooks/Cole, 2000.
**T4.** Krishnamurthy, V., "Combinatorics Theory & Application", East-West Press Pvt. Ltd., New

**REFERENCE BOOKS**

**R1**. Tremblay & Manohar, "Discrete Mathematical structure with Applications to computer science" TMH

**R2.** Rosen, **"**Discrete Mathematics & its Application", TMH.

**R3.** Narsingh, "Graph Theory with Application to Engineering and Computer Science.", PHI.

**R4.** R.P. Grimaldi, Discrete and Combinatorial Mathematics, 5/e, Addison Wesley, 2004

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Understand** and **explain** the foundation of mathematical and scientific theories and able to apply as diagnostic tool for detecting errors in formal reasoning arise in their fields. | **1, 2** Remembering, Understanding, |
| CLO2 | **Construct** and **analyze** various algebraic structures that arises in their fields. | **3, 4** Applying, Analyzing |
| CLO3 | The student will be able to **interpret** various problems on combinatorics and logics. | **5** Evaluating |
| CLO4 | **Construct** a logical approach to decision making and problem solving of graph theory. | **6** Creating |

**Mapping of CLO-PLO/PSO:**

| `Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PLO1** | **PLO2** | **PLO3** | **PLO4** | **PLO5** | **PLO6** | **PLO7** | **PLO8** | **PLO9** | **PLO10** | **PLO11** | **PLO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO1** | H | H | H | L | M | M | L | | H | M | M | M | M | H | H | H |
| **CO2** | H | H | H | L | M | M | L | | H | M | M | M | M | H | H | H |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | H | M | L | H | L | H | L | | H | H | L | M | M | H | H | H |
| **CO4** | H | L | L | H | L | M | L | | H | L | L | M | M | H | H | H |

**L=Low, M=Medium, H=High**

# DIGITAL ELECTRONICS

## BEC3017

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Learning Objectives:** **(35 hours)**

- To understand Boolean function minimization and application of the concept for design of digital circuits like adder, subtractor etc.; flip- flops; counters and registers.
- To understand the differences between combinational and sequential logic.
- To develop the basic understanding of types of data storage memories and the formation of memory banks.
- To study about the logic families and their specifications.
- To study VLSI design flow.

**Unit 1 :** **(7Hours)**

Fundamentals of Digital Systems and logic families Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic

.

**Unit 2:** **(7Hours)**

Combinational Digital Circuits Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

**Unit 3:** **(7Hours)**

Sequential circuits and systems A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

**Unit 4:** **(7Hours)**

A/D and D/A Converters (7Hours) Digital to analog converters: weighted resistor/converter, R-2R

Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs

**Unit 5:** **(7Hours)**

Semiconductor memories and Programmable logic devices. (7Hours) Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

**Text/References:**

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Understand** and **recall** the process of minimization through K-mapping and tabular method. | **1, 2** Remembering, Understanding, |
| CLO2 | **Analyze** and **construct** combinational circuits and sequential circuits using flip flops. | **3, 4** Applying, Analyzing |
| CLO3 | **Explain** and **Examine** memory elements using circuits. | **4, 5** Analyzing, Evaluating |
| CLO4 | **Construct** combinational and sequential circuits through VHDL by understanding dataflow, behavioral and structural modeling, synthesis and simulation of both circuits. | **6** Creating |

**Mapping of CLO-PLO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | H | H | H | H | L | L | | | | | | L | H | M | M | M |
| CO2 | H | H | H | H | M | L | | | | | | L | H | M | M | M |
| CO3 | H | H | H | H | H | L | L | | | | | L | H | M | M | M |
| CO4 | H | H | H | H | H | L | | | | | | L | H | M | M | M |

**H: High M: Medium L: Low**

# DIGITAL ELECTRONICS
# LAB BEC3506

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**20 Hours**

**Course Learning Objectives:**

- To design (build/simulate) digital logic gates, experiments and show the truth table.
- To design (build/simulate), experiment & demonstrate the operation of combinational and sequential circuits.
- To design (simulate), and demonstrate the working of arithmetic logic unit (ALU).

**List of experiments:**

| S.No. | Name of the |
|---|---|
| 1. | Simulate all basic and universal gates. |
| 2. | Design of Comparator. |
| 3. | Design of D Flip-Flop. |
| 4. | Design 4:1 multiplexer and 4:1 de-multiplexer. |
| 5. | Design half adder and full Adder Circuit, check the wave forms and hardware |
| 6. | Design 4-bit synchronous counter. |
| 7. | Design 4-bit asynchronous counter. |
| 8. | Design parallel in parallel out shift register. |
| 9. | Design of JK and T flip-flops using. |
| 10. | BCD to Seven Segment Decoder. |
| 11. | Design of ALU. |

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcome | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Define** and **demonstrate** digital logic gates to analyze its operational behavior and truth table. | 1, 2 Remembering, Understanding |
| CLO2 | To **construct** the combinational circuits and **analyze** its working operation. | 3, 4 Applying, Analyzing |
| CLO3 | To **construct** the sequential circuits and **analyze** its working operation. | 3, 4 Applying, Analyzing |
| CLO4 | **Determine** the operation and working of an arithmetic logic unit (ALU). | 5 Evaluating |

**Mapping of CLOs with POs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | H | H | H | H | M | | | | | | L | H | M | M | M |
| **CLO2** | H | H | H | H | H | M | | | | | | L | H | M | M | M |
| **CLO3** | H | H | H | H | H | M | | | | | | L | H | M | M | M |
| **CLO4** | H | H | H | H | H | M | | | | | | L | H | M | M | M |

**H: High** **M: Medium** **L: Low**

# ANALOG ELECTRONIC CIRCUITS
# BEC3018

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**(40 Hours)**

**Course Learning Objectives:**

- To develop understanding of low frequency transistor models biasing, small signal analysis, frequency domain analysis and design of BJT & MOSFET amplifiers.
- To understand the high frequency transistor models, multistage amplifiers and concept applications of positive and negative feedback in electronic circuits.
- To develop theoretical concepts regarding working and construction of different Oscillator circuits.
- To understand the various practical (linear and non-linear) applications of Op-Amp.

**Unit 1**:
Diode circuits P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

**Unit 2:**
BJT circuits Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

**Unit 3:**
MOSFET circuits MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, transconductance, high frequency equivalent circuit.

**Unit 4:**
Differential, multi-stage and operational amplifiers Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

**Unit 5:**
Linear applications of op-amp ,Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion. Nonlinear applications of op-amp (6 Hours) Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot.

**Text/References:**

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
4. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989. 5. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Define** and **classify** the amplifiers, develop the low frequency transistor models, understand the biasing, small signal & frequency domain analysis, design and comparison of BJT & MOSFET amplifiers. | **1, 2** Remembering, Understanding |
| CLO2 | Understand the high frequency transistor models, **apply** to analysis & design of multistage amplifiers, define, classify and compare the feedback topologies and their applications. | **3** Applying |
| CLO3 | Define and classify the Oscillators, explain their operation, and understand the basic structure & operation of differential amplifiers, **analyze** and solve their parameters. | **4** Analyzing |
| CLO4 | **Explain** the various applications of Op-Amp, make use of Op-Amp to design circuits for practical applications, define and **classify** the filters their analysis and design. | **4,5** Analyzing, Evaluating |
| CLO5 | **Discuss** the operation of DAC, their classification, analysis & design, and explain the basic concept of switched capacitor circuits and apply in ADC, etc. | **6** Creating |

**Mapping of CLOs with PLOs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | L | L | L | | | | | | | M | H | M | M | M |
| CLO2 | H | H | L | L | L | | | | | | | M | H | M | M | M |
| CLO3 | H | H | L | L | L | | | | | | | M | H | M | M | M |
| CLO4 | H | H | L | L | L | | L | | L | | | M | H | M | M | M |
| CLO5 | H | H | L | L | L | | | | | | | M | H | M | M | M |

**H: High M: Medium L: Low**

# ANALOG ELECTRONIC CIRCUITS LAB
## BEC3513

| L | T | P | C |
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| 0 | 0 | 2 | 1 |

**20 Hours**

**Course Learning Objectives:**

**1.** To experiment, measure and show the frequency response of single stage amplifiers.

**2.** To simulate (build), measure and show the frequency response of single stage amplifiers.

**3.** To experiment, measure, show and compare the parameters of Op-Amp and oscillators.

**List of experiments:**

**S. No.**

1. To plot gain in dB v/s frequency, for a Single stage Common source FET amplifier, measurement of bandwidth.
2. To Plot frequency v/s gain in dB for a single stage RC coupled amplifier and Measurement of bandwidth of an amplifier.
3. To measure gain of a Push pull amplifier in class B mode of operation.
4. To calculate the frequency of operation of: (a) Wein bridge, (b) Phase shift oscillator.
5. To calculate gain of Op-amp as summing amplifier, Difference amplifier and output waveforms of Integrator and differentiator.
6. To Calculate CMRR of an Op-Amplifier.
7. To simulate and verify gain v/s frequency plot and bandwidth for a Single stage
8. To simulate and verify gain v/s frequency plot and bandwidth for a Single stage RC
9. To Calculate Common Mode Gain, Differential Mode Gain, CMRR of an Op-Amplifier using simulation software P-Spice.
10. Functional verification of weighted resistor D/A converter.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | To experiment, measure, and **relate** the frequency response of single stage amplifiers calculated value. and **compare** it with | 1, 2 Remembering, Understanding |
| CLO2 | **Make use of** P-Spice to simulate and show the frequency response of single stage amplifiers and **compare** with calculated value. | 3, 4 Applying, Analyzing |

| | | |
|---|---|---|
| CLO3 | To **experiment with** Op-Amp and Oscillators and **analyze** its parameters. | 3, 4<br>Applying, Analyzing |
| CLO4 | To **evaluate** the parameters of Op- Amp and functional verification of DAC. | 5<br>Evaluating |

**Mapping of CLOs with POs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | L | L | L | L | | | | L | | L | H | M | M | M |
| CLO2 | H | H | L | L | L | | | | | | | L | H | M | M | L |
| CLO3 | H | H | L | L | L | L | L | | | | | L | H | M | L | L |
| CLO4 | H | H | L | L | L | | | | | | | L | M | L | L | L |

**H: High** **M: Medium** **L: Low**

# EFFECTIVE TECHNICAL COMMUNICATION

## BHU3038

L T P C
3 0 0 3

**Course Learning Objectives:**

- To define information design, technical terminology, forms of technical writing, semantic and syntactic usage and ethics of business correspondence; and develop the competency in writing and formatting of business documents.
- To illustrate and explain different aspects of technical communication and apply them in business correspondence.
- To improve writing, drafting, designing, editing technical documents over all communication skills.
- To assess the grammatical and technical accuracy of all the technical drafts/ documents and develop new models/ formats of technical communication while keeping in mind the business ethics.

**Unit 1: Information Design and Development-** Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media. **[08 Lectures]**

**Unit 2: Technical Writing, Grammar and Editing-** Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style; Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization. **[10 Lectures]**

**Unit 3: Business Ethics-** Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs; **Self Development and Assessment-** Self assessment,

Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem, Managing Time, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity. **[12 lectures]**

**Unit 4: Communication and Technical Writing-** Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report. **[08 lectures]**

**Text/ Books:**

**T1.** David F. Beer and David McMurrey. *Guide to Writing as an Engineer*. John Willey: New York, 2004.

**T2.** Diane Hacker. *Pocket Style Manual*. Bedford Publication: New York, 2003. (ISBN-0312406843).

**T3.** Shiv Khera. *You Can Win.* Macmillan Books: New York, 2003.

**Reference Books:**

**R1.** Raman, Meenakshi and Sharma, Sangeeta. *Technical Communication: Principles and Practice.* New Delhi: OUP, 2016.

**R2.** Sinha, R.P. *Current English Grammar and Usage with composition*. New Delhi: OUP, 20015.

**R3.** Lesiker, R.V. et al. *Business Communication*. Tata Mc-Graw Hill, 2014.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| **CLO1** | **Show** acquaintance with the information design, technical terminology, forms of technical writing, semantic and syntactic usage and ethics of business correspondence; and **explain** them properly. | **1,2** Remembering, Understanding |
| **CLO2** | **Identify** different aspects of technical communication and | **3** Applying |
| **CLO3** | **Categorize** different types of communication strategies and information design; **analyze** them in drafting the different technical documents. | **4** Analyzing |
| **CLO4** | **Assess** the grammatical and technical accuracy of various types of technical documents and **formulate** new models/ formats of technical communication as | **5, 6** Evaluating, Creating |

**Mapping of CLOs with PLOs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 |
| CLO1 | H | L | M | M | H | M | H | M | M | M | M | M | H | M | M |
| CLO2 | H | L | M | M | H | M | H | M | M | M | M | M | H | M | M |
| CLO3 | H | L | M | M | H | M | H | M | M | M | M | M | H | M | M |
| CLO4 | H | L | M | M | H | M | H | M | M | M | M | M | H | M | M |

**H: High M: Medium L: Low**

# DEVOPS AND DESIGN THINKING
# BCS3702

**L T P C**
**2 0 0 3**

**Course Learning Objectives:**

- To explain the importance of Design Thinking and Use of IBM Design Thinking Framework.
- To learn the use of Agile Methodology and Agile Frameworks.
- Be able to use DevOps tools and understand cloud computing features and applications.

**UNIT I: Design Thinking Methodology**

Introduction to Design Thinking; Importance of Design Thinking; History of Design Thinking; IBM Design Thinking Framework, Introduction; Focus on user outcomes; Relentless invention; Diverse empowered teams,

Introduction; Empathy Map; As-Is Scenario; Big Idea Vignettes; Prioritization Grid; Need Statements; Ideation Activity; Story boards, Crafting Hill; To be Scenario Map; Sponsor Users

UNIT II: **Agile Methodology**

Definition of Project; Project vs Operations; Relationship between Project; Program and Portfolio; Features of Project; Measuring Project Success Phases of a Project, Waterfall Model; How does Waterfall work Advantages -Disadvantages of Waterfall Model; V-Model; How does V-Model work; Advantages Disadvantages of V-Model; Advantages-Disadvantages of Agile, Methodology Overview; Introduction to Agile Manifesto & Guiding Principles; Agile vs Waterfall; Agile Frameworks; Extreme Programming (XP); Rational Unified Process (RUP); Feature Drive Development (FDD); Test Driven Development (TDD); Scrum; Kanban

**UNIT III: SCRUM**

Foundation of Scrum; Scrum Team; Roles in Scrum Team; Sprints; Definition of Ready, Product backlog; Sprint Backlog; Sprint Burndown; Impediments list, Sprint Planning; Daily Scrum Meeting; Purpose of daily scrum; Daily Stand up Characteristics; Product Backlog Refinement; Sprint Review Meeting; Sprint Retrospective, Sprint Goal; User Stories; Story Point; Definition of Done,Sprint Goal Success; Team Velocity; Sprint Burndown Chart; Defect Density

**UNIT IV: DevOps**

Introduction to DevOps; Agile Vs DevOps; DevOps Principles; Introduction to CI/CD; Hands-on GIT; Build Automation - Maven; Configuration Management - Puppet; Continuous Deployment - Docker; Continuous Integration - Jenkins; Continuous Testing - Junit; Continuous Monitoring - Nagios; Continuous Monitoring - Graphite/Grafana,

Introduction of a Use case for CI/CD Pipeline; DevOps in Mobile Application; DevOps in Web Application; DevOps in Internet of Things

**UNIT V: Advanced DevOPS**

Automatic Rollback; Provisioning; Infrastructure as a Code; Scalability and Clustering, Introduction to IBM Cloud; DevOps on Cloud; Cloud Services (Toolchain and DevOps).

- **Text Book:**

1. Hands -On Devops, Sricharan vadapalli, Packt ,2017.
2. Design Thinking Methodology Book,Emrah Yaiyici, 2016.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | is will help them in remembering and understanding the basics of Design Thinking, how IBM Design Thinking Frame work is different from this while explaining the various components of IBM Design Thinking Framework. | Remembering, Understanding **1,2** |
| CLO2 | This will help in understanding the basics of Agile Approaches, how Agile way of project Management is differed from other project management approaches like water fall model or V model. | Remembering, Understanding **1,2** |
| CLO3 | This will help in understanding and applying the basics of DevOps, how it is different from Agile, CI/CD pipeline, different tools used in DevOps, advanced DevOps concepts and DevOps in IBM. Cloud. | 2,3 Understand, Apply |
| CLO4 | Analyze and Evaluate DevOps with advanced concept. | Evaluating, Analyze **4,5** |

**Mapping of CLOs with PLOs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | H | L | | | | L | M | H | H | M | M | H |
| CLO2 | H | H | H | M | H | L | | | | L | M | H | H | H | H | H |
| CLO3 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |
| CLO4 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |

**H: High M: Medium L: Low**

# DEVOPS AND DESIGN THINKING LAB
# BCS3702

**L T P C**
**0 0 2 3**

**Course Learning Objectives:**

- To explain the importance of Design Thinking and Use of IBM Design Thinking Framework.
- To learn the use of Agile Methodology and Agile Frameworks.
- Be able to use DevOps tools and understand cloud computing features and applications.

**List of Experiments:**

1. Introduction to CI/CD; Hands-on GIT
2. Continuous Testing - Junit
3. Continuous Monitoring - Nagios
4. Continuous Monitoring - Graphite/Grafana
5. Designing Use case for CI/CD Pipeline
6. Sprint Burndown Chart
7. DevOps on Cloud
8. Sprint Planning.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | will help them in remembering and understanding the basics of Design Thinking. | Remembering, Understanding **1,2** |
| CLO2 | This will help in remembering and understanding the basics of Agile Approaches. | Remembering, Understanding **1,2** |
| CLO3 | This will help in understanding and applying the basics of DevOps. | 2,3 **Understand, Apply** |
| CLO4 | Analyze and Evaluate DevOps with advanced concept. | Evaluating, Analyze **4,5** |

**Mapping of CLOs with PLOs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO1 | PLO1 | PLO1 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | H | L | | | | L | M | H | H | M | M | H |
| CLO2 | H | H | H | M | H | L | | | | L | M | H | H | H | H | H |
| CLO3 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |
| CLO4 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |

**H: High M: Medium L: Low**

# COMPUTER ORGANIZATIONAND ARCHITECTURE
# BCS4017

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Learning Objectives:** **(40 Hours)**

- To have a thorough understanding of the basic structure and operation of a digital computer.
- To discuss in detail the operations of the arithmetic unit including the algorithms & implementation of fixed-point and floating-point addition, subtraction, multiplication & division.
- To identify the different ways of communicating with I/O devices and standard I/O interfaces.
- To discuss the hierarchical memory system including cache memories and virtual memory.
- To **explain addressing modes, instruction formats and program control statements.**

**UNIT-I** **(8 Hours)**

**Circuit Design:** Register transfer language, Bus and Memory transfers, Tristate and multiplexed bus architecture, arithmetic, logic & shift μ-Operations, ALU design, Arithmetic algorithms (addition, subtraction, Booth multiplication),IEEE754 standard for Floating point numbers, 8085 micro-processor architecture, assembly & machine language.

**UNIT-II** **(8 Hours)**

**Control Design:** Hardwired: Fundamental Concepts: Register Transfers, performing of arithmetic or logical operations, fetching a word from memory, storing a word in memory, Execution of branch instructions, Execution of complete instruction, Micro Programmed: Microinstruction, Micro program sequencing, Microinstruction with Next-address field, Wide-Branch addressing, Pre fetching Microinstruction, Pipelining.

**UNIT-III** **(8 Hours)**

**Processor Design:** Processor Organization: General register organization, Stack organization, Instruction format (zero address, 1 address, 2 address and 3 address fields), Addressing mode, Data transfer & manipulations, Program Control, Micro instructions, Reduced Instruction Set Computer.

**UNIT -IV** **(8 Hours)**

**(Input-Output Organization:** I/O devices and Interface, Input-Output Processor, Modes of transfer, Interrupts, their types & Interrupt handling, Direct Memory Access, Synchronous Serial Communication, Asynchronous Parallel Communication (Strobe Control and Handshaking Methods), Asynchronous Serial Communication.

**UNIT-V** **(8 Hours)**

**Memory Organization:** Memory Hierarchy, Locality, inclusion & coherence properties, Main Memory (RAM/ROM), Associative memory, Speed Size and Cost, Cache Memories, Performance Considerations, Cache memory mapping, Auxiliary memory, Virtual Memory (paging and segmentation), Page fault, Memory management, Secondary Storage.

**TEXT BOOKS:**

**T1.** Computer System Architecture, M. Mano, (PHI).
**T2.** Digital Logic and Computer Organization, V. Rajaraman &T.Radhakrishnan, (PHI).
**T3.** Digital design, M Mano (PHI).

**REFERENCE BOOKS:**

**R1.** Computer Architecture: A Quantitative Approach (Morgan Kaufmann Series in Computer Architecture and Design), John L Hennessy
**R2.** Computer Organization, Stallings(PHI)
**R3.** Structured Computer Organization, Tannenbaum(PHI)

**R4.** Computer Organization, Vravice, Zaky&Hamacher (TMH Publication)

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and**understand** thebasic organization of a computer by defining the architecture of 8086 microprocessor and, also implement the assembly language program for 8086 microprocessors. | **1,2 Remembering, understanding** |
| CLO2 | **Understand** and**apply**computer arithmetic operations on integer and real numbers. | **2,3 Understanding, Applying** |
| CLO3 | **Classify**different methods for computer I/O mechanisms | **4 Analyzing** |
| CLO4 | **Evaluate**the key performance drivers and their physical limits by **analyzing** the effect of a cache of given specs on the system's performance. | **4,5 Analyzing, Evaluating** |
| CLO5 | **Elaborate**memory organization to**explain** the function of each element in memory hierarchy. | **5,6 Evaluating, Creating** |

**Mapping of CLOs with PLOs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | H | M | H | M | M | L | | | | | H | H | | H | |
| **CLO2** | H | H | M | M | L | M | L | | | | | H | | M | | H |
| **CLO3** | H | H | M | H | L | M | L | | | | | H | H | | | |
| **CLO4** | H | H | M | H | L | L | L | | | | | H | | | L | |
| **CLO5** | H | H | M | H | L | L | L | | | | | H | | L | | H |

**H: High M: Medium L: Low**

# COMPUTER ORGANIZATION AND ARCHITECTURE LAB
# BCS4518

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Learning Objectives:**

- To develop assembly language programming skills.
- To explain working of the basic operational units of a computer system architecture.
- To d**escribe the fundamental organization of a computer system.**
- To **compare thesystem memory hierarchy with various levels of 8085 organization.**

**List of Experiments:**

1. To design TTL NAND and NOR Gate and verify its operation.
2. To Design CMOS Inverter Gate and verify its operation.
3. Implementation of a 3-bit SIPO and SISO shift registers using flip-flops.
4. Design of Seven-segment display driver for BCD codes.
5. BCD Adder & Subtractor.
6. To verify the A L U operations.
7. 8085 Assembly Language Programming
8. 8085 Assembly Language Programming
9. 8085 Assembly Language Programming

**Course Learning Outcomes (CLO):**After completion of this course, the students will be able to**:**

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** fundamentals of digital design to extend the learning to design sequential circuits. | **1 Remembering** |
| CLO2 | **Remember** and **understand**thebasic logic gates of IC chips. | **2 Remembering, Understanding** |
| CLO3 | **Understand** and**apply**dynamic scheduling methods and their adaptation to contemporary microprocessor design. | **2,3 Understanding, Applying** |
| CLO4 | **Discover**and**interpret** the theory of 8085 organization with its hardware. | **4,5 Analyzing, Evaluating** |

**Mapping of CLOs with PLOs &PSOs :**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | M | H | M | M | L | | | | | H | H | | H | |
| CLO2 | H | H | M | M | L | M | L | | | | | H | | M | | H |
| CLO3 | H | H | M | H | L | M | L | | | | | H | H | | | |
| CLO4 | H | H | M | H | L | L | L | | | | | H | | | L | |
| CLO5 | H | H | M | H | L | L | L | | | | | H | | L | | H |

**H: High M: Medium L: Low**

# OPERATING SYSTEMS
## BCS4022

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Learning Objectives:** **(40 Hours)**

- To understand the concepts of an operating system (OS).
- To infer the different issues in the management of resources like processor, input-output and memory.
- To apply and analyze the mechanisms of an OS to handle processes and threads in communication.
- To build updistributed operating system concepts that includes architecture, mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.

**Unit- I** **(8 Hours)**

Introduction to Operating Systems: Operating System Services, Classification of Operatingsystems, Operating System Structure, System Calls.

**Unit- II** **(8 Hours)**

Process vs. Program, Process States, Process Transition Diagram, Process ControlBlock, Process Address Space, Schedulers, Scheduling Concepts, Performance Criteria, SchedulingAlgorithms, Real time Scheduling: RM and EDF,Threads, Deadlock Problem, Deadlock Characterization, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from
Deadlock, Methods for Deadlock Handling.

**Unit- III** **(8 Hours)**

Inter-process Communication: Race conditions, Critical sections, Mutual exclusion, Critical-section problem, Algorithmic approach to implementing critical sections, Hardware support forprocess synchronization, Semaphores, Mutexes, Monitors.Classic Problems of Synchronization: Producers-consumers with bounded buffers problem,Readers-writers problem, Dining-philosophers problem

**Unit- IV** **(8 Hours)**

Memory Management: Introduction, Logical and Physical Address Space, Swapping, ContiguousMemory Allocation, Fragmentation, Paging, Structure of Page Table, Segmentation, Segmentationwith Paging. Virtual Memory: Demand Paging, Performance of Demand Paging, Page ReplacementAlgorithms, Allocation of Frames, Thrashing,Second chance(SC)

**Unit- V** **(8 Hours)**

File system: File Concept, Access Methods, Directories, Mounting of File-System, File-SystemStructure, File-System Implementation, Allocation Methods. I/O Devices, and I/O Subsystems, I/OBuffering, Disk Storage and Disk Scheduling, Disk Management, RAID.

**TEXT BOOKS:**

T1 “Operating System Concepts”, Abraham Siberschatz and Peter Baer Galvin, Ninth Edition, Addision-Wesley
T2 “Operating System”, William Stallings, Prentice Hall of India, 5th Edition.

**REFERENCE BOOKS:**

R1 “Modern Operating”, Andrew Tanenbaum, Systems, Prentice Hall
R2 Milan Milankovic, “Operating Systems, Concepts and Design”, McGraw-Hill.
R3 Harvey M Deital; Operating Systems;, Addison Wesley
R4 Richard Peterson, “Linux: The Complete Reference”, Osborne McGraw-Hill.
R5 A.M. Lister, Fundamentals of Operating System. Macmillan
R6 Douglas , Operating System Design- The XINU Approach. Prentice – Hall
R7 Pramod Chandra P. Bhatt.- “ An Introduction of Operating Systems, Concepts and Practice,PHI

**Course Learning Outcomes:** After completion of this course, the students will be able to:

| S.No. | Description | Blooms Taxonomy Level |
|---|---|---|
| **1.** | **Define** and **classify** the different structures of the operating systems. | **1,2 Remembering, Understanding** |
| **2.** | **Develop** an **understanding** of process synchronization and analyzing the memory management and its allocation policies. | **2,3 Understanding, Applying** |
| **3.** | **Analyze** the important computer system resources by **identifying** the role of operating system in their management policies and algorithms. | **3,4 Applying, Analyzing** |
| **4.** | **Discuss**and **assess**the implementation of processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files. | **5,6 Evaluating, Creating** |

**Mapping of CO-PO/PSOs:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CO1** | H | L | M | L | - | L | L | L | M | M | L | L | L | - | - | M |
| **CO2** | L | H | M | - | M | - | L | - | - | M | M | L | - | - | H | - |
| **CO3** | L | H | H | L | - | - | - | - | - | - | - | L | H | M | - | - |
| **CO4** | M | M | H | M | - | - | L | - | - | - | L | M | - | H | M | |

**H: High M: Medium L: Low**

# OPERATING SYSTEMS LAB
# BCS4519

**L T P C**
**0 0 2 1**

**Course Learning Objectives:**

- To create a process and child process, synchronization between processes, implementing various scheduling algorithms, page replacement algorithms.
- To learn programmatically to examine simple OS mechanisms.

**List of Experiments:**

1. Write a program to implement fork system call.
2. Write a program to implement critical section problems.
3. Write a program to implement classical problems of process synchronization.
4. Write a program to implement non-preemptive scheduling algorithm
5. Write a Program to implement preemptive scheduling algorithm.
6. Write a program to Implement Banker's algorithm.
7. Write a program to implement page replacement algorithms.
8. Write a program to implement Disk Scheduling algorithms.
9. Write a Program to implement file allocation methods.
10. Write a Program for MFT and MVT first fit and best fit.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| **CLO1** | **Remember** and **understand** C program for process and file system management using system calls. | **1,2 Understanding, Remembering** |
| **CLO2** | **Choose** and **analyze** the best CPU scheduling algorithm for a given problem instance. | **3, 4 Analyzing, Applying** |
| **CLO3** | **Compare** and **contrast** the performance of various page replacement algorithms. | **4,5 Analyzing, Evaluating** |
| **CLO4** | **Discuss** the algorithm for deadlock avoidance, detection and file allocation strategies. | **6 Creating** |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | H | L | M | H | H | - | - | - | - | - | - | L | H | M | M | - |
| CO2 | H | H | M | M | M | - | - | - | - | - | - | L | M | H | M | - |
| CO3 | H | H | M | H | H | - | - | - | - | - | - | L | M | H | M | - |
| CO4 | H | M | H | M | M | - | - | - | - | - | - | L | H | H | M | - |

**H: High M: Medium L: Low**

# FORMAL LANGUAGE AND AUTOMATA THEORY

## BCS4023

**L T P C**

**3 1 0 4**

**Course Learning Objectives:** **(40Hours)**

- To introduce abstract models of computation, their properties, computability and complexity theory.
- To make students able to answer, whether a problem can or cannot be computed, and if it can, how efficiently.
- To make students acquire insights into the relationship among formal languages, formal grammars and automata.

**Unit- I** **(8 Hours)**

**Introduction:** Alphabets, Strings and Languages; Automata and Grammars, Chomsky's classification. Finite Automata: Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem.

**Unit- II** **(8 Hours)**

**Regular Expression:** Regular expression (RE), Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem,

Regular Languages and Its Properties: Non Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages,

FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

**Unit- III** **(8 Hours)**

Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness , Pumping lemma for CFLs,Context sensitive languages:Context-Sensitive grammars(CSG) and languages,Linear bounded Automata and equivalence with CSG.

**Unit- IV** **(8 Hours)**

Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA.

**Unit- V** **(8 Hours)**

Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis. Recursive and Recursively Enumerable languages.

Undecidability: Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.

**TEXT BOOKS:**

**T1.** K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", PHI.

**T2.** Peter Linz,"An Introduction to Formal Languages and Automata", Jones & Bartlett Learning.

**REFERENCE BOOKS:**

**R1.** Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education.
**R2.** Kirthivasan, "Introduction to formal languages", Pearson Education.
**R3.** Martin J. C., "Introduction to Languages and Theory of Computations", TMH.
**R4.** Papadimitrou, C. and Lewis, C.L., "Elements of the Theory of Computation", PHI.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Understand**, **define**, analyze and interpret regular languages, expression and Grammars. | **1,2 Understanding, Remembering** |
| CLO2 | **Construct** and **classify** different types of finite automata and machines as acceptor, verifier and translator. | **3, 4 Analyzing, Applying** |
| CLO3 | Design, **analyze** and interpret context free languages, expression and grammars. | **4 Analyzing** |
| CLO4 | **Explain** different types of push down automata as simple parser. | **5 Evaluating** |
| CLO5 | **Discuss** and analyze different languages, grammars, automata and machines to **determine** conversion of automata to programs and functions. | **5,6 Evaluating, Creating** |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO1 | H | H | H | M | M | | | | M | H | H | H | H | H | | L |
| CO2 | H | H | H | M | M | | | | | H | H | H | H | | H | |
| CO3 | H | H | H | M | M | | | | | H | H | H | H | | M | |
| CO4 | H | H | H | H | M | | | | | H | H | H | | | H | H |
| CO5 | H | H | H | H | M | | | | H | H | H | H | M | M | H | H |

**H: High M: Medium L: Low**

# IT WORKSHOP
# BCS4520

**L T P C**
**1 0 2 2**

**Course Learning Objectives:**

- To perform programming in MATLAB language to solve various problems.
- To make students understand the practical applications of machine learning techniques on dataset.
- To train studentsusing the tools and information necessary to develop curriculum using mathematical formulas.
- To discuss diverse techniques and methods to deliver course content using various datasets.

**List of Experiments:**

1. Write commands to declare variables, seek workspace variables and keyword.
2. Write commands to perform basic operations of MATLAB tool.
3. Write commands to create matrix, manipulate them by addition subtraction and multiplication.
4. Write a program to perform if, for, while operations.
5. Write a program to calculate factorial using function.
6. Write a program to read and write data from excel file.
7. Write a program to plot the data.
8. Write a program to vectorization.
9. Write a program to implement Bayes classifier.
10. Write a program to implement supervised learning on IRIS Dataset using Naïve-Bayes classifier.
11. Write a program to implement Nearest Neighbour classification technique.
12. Write a program to implement k-means clustering on IRIS Dataset.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and**explain**the need for simulation/implementation required for the verification of mathematical functions. | **1,2**<br>**Understanding, Remembering,** |
| CLO2 | **pply** the main features of the MATLAB program development environment to enable their usage in the higher learning. | **3**<br>**Applying** |
| CLO3 | **Analyze** and**evaluate** simple mathematical functions/equations required in numerical computing environment such as MATLAB. | **4,5**<br>**Analyzing**<br>**Evaluating** |

| | | |
|---|---|---|
| CLO4 | **Discuss** simple mathematical functions and operationtheorem using plots/display. | **6 Creating** |

**Mapping of CO-PO/PSO :**

| **Course Learning Outcomes** | **Program Learning Outcomes (PLOs)** | | | | | | | | | | | | **Program Specific Outcomes (PSOs)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO1** | **H** | **H** | **H** | **H** | **H** | **L** | **-** | **L** | **H** | **M** | **L** | **H** | **H** | **-** | **-** | **M** |
| **CO2** | **H** | **H** | **H** | **H** | **H** | **L** | **-** | **L** | **H** | **M** | **M** | **H** | **-** | **H** | **-** | **M** |
| **CO3** | **H** | **H** | **H** | **H** | **H** | **L** | **-** | **L** | **H** | **M** | **M** | **H** | **H** | **H** | **-** | **H** |
| **CO4** | **H** | **H** | **H** | **H** | **H** | **L** | **-** | **L** | **H** | **M** | **L** | **H** | **H** | **H** | **-** | **-** |

**H: High M: Medium L: Low**

# MATHEMATICS – III
# BMA4012-CS

**L T P C**
**2 0 0 2**
**(32 Hours)**

**Course Learning Objectives:**

- To introduce basic ideas about the basic techniques and theories of complex analysisand numerical analysis.
- To provide some understanding of various concepts and principles of differentiation of functions of complex variable that is used in various techniques dealing engineering problems**.**
- To aim at understanding and debating to develop the essential tools of solution of algebraic and transcendental equation and also to solve ODEs which are generated by physical phenomena.
- To explore the connection between history, mathematics and current fields of applications of the subject.

**UNIT I: Complex Variable - Differentiation (08 Hours)**

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties, Conformal mappings, Mobius transformations and their properties.

**UNIT II: Complex Variable - Integration (08 Hours)**

Contour integrals, Cauchy – Goursat theorem, Cauchy Integral formula (without proof), Liouville's theorem and Maximum modulus theorem; Taylor's series, Laurent's series, zeros of analytic functions, singularities, Residues, Cauchy Residue theorem, Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals.

**UNIT III: Numerical Methods-1 (08 Hours)**

Solution of polynomial and transcendental equations: Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae, Numerical Differentiation.

**UNIT IV: Numerical Methods-2 (08 Hours)**

Numerical integration: Trapezoidal rule and Simpson's $1/3^{rd}$ and 3/8 rules. Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations.

**TEXT BOOKS:**

**T1.** E. Kreyszig, "Advanced Engineering Mathematics", $9^{th}$ Edition, John Wiley and Sons, New York, 2006.
**T2.** N.P.Bali and Manish Goyal, "A text book of Engineering Mathematics III", Laxmi Publications., 2010.
**T3.** B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2010.
**T4.** B.V. Ramanna, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Ltd., 2008.

**REFERENCE BOOKS:**

**R1.** Peter V. O' Neil, "Advanced Engineering Mathematics", Thomson (Cengage Learning), 2007.
**R2.** R.K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 2008.
**R3.** Veerarajan T., "Engineering Mathematics for second year", Tata Mcgraw Hill, New Delhi, 2010.

**Course Learning Outcomes:** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Recall,** comprehendand **explain** the complex variable and numericalanalysis with its need and importance. | **1, 2**<br>**Remembering, Understanding** |
| CLO2 | **Apply** and **analyze** function of several complex variable solutionsof polynomial/ transcendental equations, interpolation and numerical differential techniques. | **3,4**<br>**Applying, Analyzing,** |
| CLO3 | **Analyze**and **interpret** numerical integral function and its properties. . | **4,5**<br>**Analyzing, Evaluating** |
| CLO4 | **Discuss**the ordinary differential equations with its need and importance. | **6**<br>**Creating** |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | H | H | H | M | M | M | | M | M | H | M | H | L | L | M |
| **CLO2** | H | H | H | H | M | M | H | | H | H | L | H | H | M | H | M |
| **CLO3** | H | M | M | H | M | H | L | | L | M | M | M | H | M | H | M |
| **CLO4** | H | L | M | H | M | M | M | | H | H | L | M | M | L | H | H |

**H: High M: Medium L: Low**

# ORGANIZATIONAL BEHAVIOR
# BMG4008

L T P C
3 0 0 3

**Course Learning Objectives:** **(40 Hours)**

- To aim at imparting an understanding of self and the process of self-awareness.
- To help the students understand the importance of group behavior and the impact of organizational change and development.
- To make students understand the fundamental and basic concepts of OB.
- To make students able to apply their understanding in real life situations.

**UNIT-I** **(10 Hours)**

**Introduction to Organizational Behavior:** Organizational Behavior-Concept and importance of Organizational Behavior.O.B and the Behavioral sciences contributing to O.B, Future trends in O.B, Model of O.B.

**UNIT-II** **(10 Hours)**

**Individual Behavior:** Overview of individual behavior, Models of human behavior, Assumption About human behavior, Determinants of individual behavior, Personality, Factors and personality traits influencing O.B, Perception-process and errors, Attitude and values.

**UNIT-III(10 Hours)**

**Group Behavior:** Group Dynamics and behavior-Concept, types and development, Power and Politics, Conflicts and Negotiation, Leadership behavior.

**UNIT-IV(10 Hours)**

Organizational culture, change and development, Organizational culture-concept, significance and types of organizational culture, Organizational change, Nature, forces, types and level to change, strategies to overcome resistance to change, Organizational development-process and technique of O.D. Suggested Reading.

**TEXT BOOKS:**

**T1.**Singh,Dalip, "Emotional intelligence at work" ,Response books , Sage Publication ,Delhi Chakroborty S.K. , Management by values ,Oxford university press ,1991.

**REFERENCE BOOKS:**

**R1.**Luthans ,Fred , "Organization behavior" ,Tata McGraw Hill, New Delhi Dressler David and Cans, Donald, "The study of Human interaction", U.S.

**R2.**Lindzey G. and Borgatta E, Sociometric measurement in the handbook of social psychology, Addison welsey, U.S.Preffer& company, "Theories and models in applied behavioral sciences", Vol -2 (1996).

Course Learning Outcomes(CLO):**After completion of this course, the students will be able to:**

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Understand** the concept involved in the study of human behavior, classify models of human behavior, evaluatingthe emerging trends of organizational behavior**.** | **1, 2 Remembering, Understanding** |

| | | |
|---|---|---|
| CLO2 | Understandthe component of attitude, perception and personality in understanding individual behavior. **Analyzing** individual behavior models to**identify**various personality traits which effect business decision making. | **3, 4**<br>**Applying, Analyzing** |
| CLO3 | **Analyze** various motivation techniques used in business organizations, understandingof group behavior mechanism and **evaluating**its implications in business management and problem solving. | **4, 5**<br>**Analyzing,**<br>**Evaluating** |
| CLO4 | Understandthe concept of organizational culture and **discuss** how organizational changes effects organizational development. | **6**<br>**Creating** |

Mapping of CLOs with PLOs & PSOs:

| **Course Learning Outcomes** | **Program Learning Outcomes (PLOs)** | | | | | | | | | | | | **Program Specific Outcomes(PSOs)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PLO1** | **PLO2** | **PLO3** | **PLO4** | **PLO5** | **PLO6** | **PLO7** | **PLO8** | **PLO9** | **PLO10** | **PLO11** | **PLO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CLO1** | H | | | | | | | | | H | | | H | M | | |
| **CLO2** | H | | | | | | M | | | H | | | H | M | | |
| **CLO3** | H | | | H | M | L | H | | | H | | M | H | M | L | L |
| **CLO4** | H | | | H | | | L | | | M | M | | H | M | | |

**H: High M: Medium L: Low**

# CONSTITUTION OF INDIA
# XLAX601

L T P C
2 0 0 0

**Course Learning Objectives:** **(24 Hours)**

- To remember making of Indian constitution and understand its nature and special features, apply importance of schedules, preamble and to analyze the state under article 12.
- To understand fundamental rights, analyze fundamental duties and relation and distinction between fundamental rights and DPSP, applying remedies Public Interest Litigation and Judicial Activism.
- To know structure and hierarchy of courts, analyze their powers and understand the election, qualification and powers of president of India and governor and differences and apply the position of prime minister.
- To understand the power and function of UPSC and examine functions of election commission, analyze the meaning and scope of emergency and to determine the Constitutional Amendment.

**UNIT- I** **(06 Hours)**

Making of Indian Constitution, Nature and special features of the Constitution of India, Importance of schedules in Indian Constitution, Preamble, State under Article 12 of the Constitution

**UNIT- II** **(06 Hours)**

Fundamental rights**,** Fundamental Duties (Article 51-A)**,** Fundamental Rights and Directive Principles of State Policy, inter-relationship, judicial balancing**,** Remedies for enforcement of rights contained in Constitution**,** Public Interest Litigation Judicial activism

**UNIT-III** **(06 Hours)**

Structure and Hierarchy of Courts and their powers **,**President of India- election, qualification, powers-legislative, executive and discretionary **,** Position of the Prime Minister**,** Governor**.**

**UNIT- IV** **(06 Hours)**

Union public service commission**,** Election commission**,** Emergency- Meaning and Scope, Constitutional Amendment

**TEXT BOOKS:**

**T1.** D.D.Basu, Shorter Constitution of India, 15th Edition 2018, LexisNexis, Nagpur
**T2.** Shukla V.N., Constitution of India, Lucknow: Eastern Book Co.,
**T3.** B.K.Sharma, Introduction to Constitution of India, Prentice Hall.
**T4.** J.N. Pandey ,Constitution of India.,47th ed., Central Law Agency, 2014.
**T5.** P.M. Bakshi. Constitution of India..12th ed., Universal Publication, 2013
**T6.** M.V.Pylee, Constitutional Government in India, Asia Publishing House
**T7.**R.C.Agarwal, National Movement & Constitutional Development, S.Chand Publishing Company
**T8.** Prof. Uday Raj Rai, Constitutional Law -1, Eastern Book Company, 2016.

**REFERENCE BOOKS:**

**R1.** Seervai H.M. Constitutional Law of India.
**R2.**M.P.Jain, Constitution of India, Wadhwa Nagpur

**Course Learning Outcomes:**After completion of this course, the students will be able to

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|

| | | |
|---|---|---|
| CLO1 | **Remember** and **understand** the historical background of The Constitution of India, its features and the concept of state under Indian Constitution. | **1, 2**<br>**Remembering, Understanding** |
| CLO2 | **Develop** an **understanding** about the concept of Fundamental Rights and Duties, Directive Principles of State Policy and role of Judiciary. | **2,3**<br>**Understanding, Applying** |
| CLO3 | **Apply** the concepts to know the functional authorities and organs under the Indian Constitution. | **3**<br>**Applying** |
| CLO4 | **Analyze** and **evaluate** the grounds of emergency and constitutional amendments. | **4,5**<br>**Analyzing, Evaluating** |

**Mapping of CO-PO/PSO:**

| **Course Learning Outcomes** | **Program Learning Outcomes PLOs)** | | | | | | | | | | | | **Program Specific Outcomes (PSOs)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PLO1** | **PLO2** | **PLO3** | **PLO4** | **PLO5** | **PLO6** | **PLO7** | **PLO8** | **PLO9** | **PLO10** | **PLO11** | **PLO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CLO1** | - | - | L | - | - | M | M | M | L | L | - | M | - | - | - | L |
| **CLO2** | - | - | L | - | - | M | M | M | L | L | - | M | - | - | - | L |
| **CLO3** | - | - | L | - | - | M | M | M | L | L | - | M | - | - | - | L |
| **CLO4** | - | - | L | - | - | M | M | M | L | L | - | M | - | - | - | L |

**H: High M: Medium L: Low**

# INDUSTRIAL VISIT-I
# XCSX601

L T P C
0 0 0 0

**Course Learning Objectives:**

- To inspect students about current industry practices.
- To motive practical awareness of various industrial vectors.
- To create an opportunity of having face to face session with technical and administrative experts of the organization to ask question and clarify doubts.
- To explain students with interesting facts and newer technologies.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** the trends, techniques and advanced areas of computer science and engineering. | **1,2 Remember Understanding,** |
| CLO2 | **)evelop** an **understanding** about real time applications in various industries. | **2, 3 Understanding, Applying** |
| CLO3 | **nalyze** and applyvarious scenarios for software creatior and implementation. | **4 Analyzing** |
| CLO4 | **termine** and **analyze** the software development )duct development strategies. | **4, 5 Analyzing, Evaluating** |

**Mapping of CLOs with PLO& PSO:**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | H | M | | M | L | | | | L | L | L | H | M | M | H |
| **CLO2** | H | H | M | | M | L | | | | L | L | L | H | M | M | H |
| **CLO3** | H | H | M | | M | L | | | | L | L | L | H | M | M | H |
| **CLO4** | H | H | M | | M | L | | | | L | L | L | H | M | M | H |

**H: High M: Medium L:Low**

# HUMAN VALUES AND ETHICS
# XHUX601

**Course Learning Objectives:**

| L | T | P | C |
|---|---|---|---|
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- To make students recall and apply the basic human values.
- To recommend them a training in human relationship for appreciating family and society.
- To organize and prioritize them in a manner in which they can be adaptable to the nature.
- To develop the skills to identify the characteristics of people and the eco-friendly production system.

**UNIT-I** **(06 Hours)**

**Requirement of Value Education, Fundamental Guidelines, Content and Methodology for Value Education**

Appreciating the need, Fundamental Guidelines, Content and Methodology for Value Education, Self-Investigation: Methodology and Content. Fundamental Human Aspirations: Uninterrupted Happiness and Prosperity. A Critical Evaluation of the present situation: Understanding Happiness and Prosperity rightly, Harmonious Living at all levels.

**UNIT-II** **(04 Hours)**

**Understanding Harmony in the Individual - Harmony within Self**

An individual as Co-existence of Sentient Self ('I') and Physical Body, Learning by distinguishing the needs of Self ('I') and 'Body' - Happiness and Prosperity, Problems related to identity crisis, depression,lack of motivation, traumatic childhood. Harmony of Self ('I') with the physical Body: Self-control and Health; Understanding Physical Needs. Understanding suicide and psychosomatic problems.

**UNIT– III** **(06 Hours)**

**Human Relationship: Appreciating Harmony in Family and Society**

Fundamentals for Harmony in Family as basic unit of human interaction Understanding values in human to human relationship. Family problems, domestic violence, relationship issues among youth. Understanding society as an extension of Family; Social crimes; causes, factors leading to such.

**UNIT- IV** **(06 Hours)**

**Existence as Co-existence; Understanding Harmony in the Nature and Existence**, Harmony in Nature and its critical appraisal in the present scenario.

**UNIT– V** **(06 Hours)**

**Positive Psychology & Professional Ethics**

**Competence in Professional Ethics:**

**a)**Capacity to utilize the professional competence for expanding Universal Human Order
**b)** Skill to identify the scope and characteristics of people-friendly and eco-friendly production systems
**c)**Ability to identify and develop appropriate technologies and management Patterns for above production systems

**Text Books:**

**T1.** Gaur, R.R.,Sangal, R., and Bagaria, G.P. (2009) "A Foundation Course in Human Values and Professional Ethics" Excel Books Private Limited. New Delhi.

**Reference Books:**

**R1.**Illich, I.(1974) "Energy & Equity" The Trinity Press, Worcester and Harper Collins,USA.

**R2.**Schumacher, E.F. (1973) "Small is Beautiful: A Study of Economics as if People Mattered" Blond & Briggs, Britain

**R3.**Sussan, G.(1976) "How the Other Half Dies", Penguin Press, Reprinted 1991.

**R4.**Meadows, D.H.,Meadows, D.L. Randers, J., Bchrens, W.W.III (1972) "Limits lo Growth — Club of Rome's report", Universe Books.

**R5.**Nagraj, A. (1998) "JeevanVidyaekParichay" Divya Path Sans than, Amarkantak.

**R6.**SeebauerE.G. and Berry, R.L. (2000) "Fundamentals of Ethics for Scientists &Engineers" Oxford University Press.

**R7.**Govindrajran, M.,Natrajan, S. and Kumar, V.S.S. "Engineering Ethics "Prentice Hall of India Ltd

**R8.**Banerjee, B.P. (2005) "Foundations of Ethics and Management" Excel Books.

Course Learning Outcomes (CLO):**After completion of this course, the students will be able to:**

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Requirement of Value Education, Fundamental Guidelines, Content, and Methodology for Value Education-** Explain the need, Fundamental Guidelines, Content and Methodology for Value Education, Self-Inspect: Methodology and Content. Fundamental Human Aspirations: Uninterrupted Happiness and Prosperity. A Critical Evaluation of the present situation: Understanding Happiness and Prosperity rightly, Harmonious Living at all levels. | **2, 4, 6 Understanding Analyzing, Evaluating** |
| CLO2 | **Outlining Harmony in the Individual -Harmony within Self** -An individual as Co-existence of Sentient Self ('I') and Physical Body. Learning by distinguishing the needs of Self ('I') and 'Body' - Happiness and Prosperity Problems related to identity crisis, depression, lack of motivation, traumatic childhood. Harmony of Self ('I') with the physical Body: Self-control and Health; Interpret Physical Needs. Understanding suicide and psychosomatic problems. | **2,5, 4, Understanding, Evaluating Analyzing** |
| CLO3 | **Human Relationship: Demonstrating Harmony in Family and Society** Fundamentals for Harmony in Family as basic unit of human interaction Identifying values in human to human relationship. Family problems, domestic violence, relationship issues among youth. Understanding society as an extension of Family; Social crimes; causes, and determining factors leading to such problems. | **2,3, 5, Understanding, Applying Evaluating** |
| CLO4 | **Existence as Co-existence; Understanding Harmony in the Nature and Existence** Harmony in Nature and its critical **appraisal** in the present scenario. **Demonstrate** the relationship between man and nature. **Evaluating** the harmony of man and nature in the present scenario. | **2,5,5 Understanding, Evaluating Evaluating** |

| | | |
|---|---|---|
| CLO5 | **Positive Psychology & Professional Ethics**<br>**Competence in Professional Ethics:**<br>**a)** Capacity to utilize the professional competence for expanding Universal Human Order.<br>**b)** Skill to prioritize the scope and characteristics of people-friendly and Eco-friendly production systems.<br>**c)** Ability to Examine and develop appropriate technologies and management Patterns for above production systems. | **2,5,4**<br>**Understanding Evaluating, Analyzing** |

**Mapping of CLOs with PLOs & PSOs**

| **Course Learning Outcomes CLOs** | **Program Learning Outcomes (PLOs)** | | | | | | | | | | | | **Program Specific Outcomes (PSOs)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PLO1** | **PLO2** | **PLO3** | **PLO4** | **PLO5** | **PLO6** | **PLO7** | **PLO8** | **PLO9** | **PLO10** | **PLO11** | **PLO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CLO1** | - | **H** | **M** | **M** | **L** | **M** | **H** | **M** | **M** | **M** | - | **H** | - | **M** | **M** | **M** |
| **CLO2** | - | **M** | **M** | **M** | **L** | **H** | **H** | **H** | **M** | - | - | **H** | - | **M** | **M** | **M** |
| **CLO3** | - | **H** | **H** | **L** | **L** | **H** | **H** | **M** | **M** | **M** | - | **H** | - | **M** | **M** | **M** |
| **CLO4** | - | **H** | **M** | **M** | **L** | **M** | **H** | **H** | **M** | **L** | - | **H** | - | **M** | **M** | **M** |
| **CLO5** | **L** | **H** | **H** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | - | **H** | - | **M** | **M** | **M** |

**H: HighM: Medium L: Low**

# CLOUD APPLICATION DEVELOPMENT
## BCS4701

**L T P C**
**2 0 0 3**

**(40 Hours)**

**Course Learning Objectives:**

- Understand the evolution and impact of cloud computing in the world today
- Understand the evolution and impact of cloud computing in the world today
- Explore end-to-end case studies for every key cloud industry and identify common patterns: public cloud, private cloud, hybrid cloud
- Understand technical aspects of cloud solutions: software as a service, platform as services and infrastructure as a service

**UNIT I CLOUD COMPUTING LANDSCAPE**
Cloud impact in our lives,Cloud enterprise adoption,Cloud services, Summary & resources

**UNIT II CLOUD INDUSTRY ADOPTION**
Drivers for Digital Transformation, Cloud Impact in Banking, Cloud Impact in Education**,** Cloud Culture of Change
API Platforms Landscape,APIs driving the Cloud platform revolution,Summary & resources

**UNIT III DATA IN THE CLOUD**
Where and how will data be used?Why use No SQL? Attributes of No SQL databases, AI Industry Adoption, AI Evolution, Empowered Cloud Apps with AI, Summary & resources

**UNIT IV: CLOUD FOR MULTI-CHANNEL**
The Need for a Multi-channel platform, Multi-channel platform characteristics, Rapid and Intelligent, Cloud Security landscape, Security concerns in micro-services, OAuth protocol, Summary & resources

**UNIT V:DEVOPS FRAMEWORK**
What is DevOps?, DevOps Agile Culture, DevOps Lifecycle, Summary & resources

**Reference Book:**

IBM Skills Academy.

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | Remember and understandthe evolution and impact of cloud computing in the world today. | **1,2**<br>**Remembering, Understanding** |
| CLO2 | Understand and Explore end-to-end case studies for every key cloud industry and identify common patterns: public cloud, private cloud, hybrid cloud | **2,3**<br>**Understanding** |

| | | |
|---|---|---|
| | | **Applying** |
| CLO3 | Underst and and analyze the industry practices to design and build agile cloud solutions, using the cloud Garage methodology | **2,4 Understand, Analyzing,** |
| CLO4 | Analyze and evaluate teamwork agile industrypractices using Devops framework. | **4,5 Analyzing Evaluating,** |

Mapping of CLOs with PLOs & PSOs:

| **Course Learning Outcomes** | **Program Learning Outcomes (PLOs)** | | | | | | | | | | | | **Program Specific Outcomes(PSOs)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PLO1** | **PLO2** | **PLO3** | **PLO4** | **PLO5** | **PLO6** | **PLO7** | **PLO8** | **PLO9** | **PLO10** | **PLO11** | **PLO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CLO1** | H | H | H | H | H | L | | | | L | | H | M | M | M | M |
| **CLO2** | H | H | H | H | H | | | | | L | | H | H | H | H | H |
| **CLO3** | H | H | H | H | H | | | | | L | | H | L | L | H | M |
| **CLO4** | H | H | M | M | H | | | | | M | | H | M | M | H | H |

**H: High M: Medium L: Low**

# CLOUD APPLICATION DEVELOPMENT LAB
## BCS4701

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 3 |

**CourseLearning Objectives:**

- Understand the evolution and impact of cloud computing in the world today
- Understand the evolution and impact of cloud computing in the world today
- Explore end-to-end case studies for every key cloud industry and identify common patterns: public cloud, private cloud, hybrid cloud
- Understand technical aspects of cloud solutions: software as a service, platform as services and infrastructure as a service.

**List of Experiments:**

- Create an IBM Cloud Account

**ACME AIRLINE CLOUD ADOPTION**

- Prepare your Environment
- Creating an APP
- Developing an App
- Acme Business Case- Preparing the APP
- Prepare Your Environment
- Creating an App
- Developing an App
- Acme Business Case – Preparing the App

**MAINTENANCE CREW CLOUD APP**

- Digital App Builder Data Sets
- Cloud Management
- Return to the Digital App Builder
- Preview Dataset in Action

**ADD AI TO MAINTENANCE CREW APP**

- Create Cloud Cognitive Services
- Connect Services to your App
- Train and Implement Cognitive Services

**ADD MULTI-CHANNEL SUPPORT**

- Android Studio
- Enabling Android in Digital App Builder
- Preview your APP in Android Device

**SECURE THE MAINTENANCE CREW APP**

- Login Security
- Mobile Phone Authorization
- Test new security functionality

**EXPLORE TOOLCHAINS**

- Enable Toolchains
- Create and Explore the Garage Method
- Finalize the Creation of Toolchain
- Agile Planning
- Continuous Integration and Delivery

- Manage IBM Cloud Apps
- Manage App Using New Relic & PagerDuty
- Slack and PagerDuty Integration
- Learn from Users

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | Remember and understand the evolution and impact of cloud computing in the world today. | **1,2 Remembering, Understanding** |
| CLO2 | Understand and Explore end-to-end case studies for every key cloud industry and identify common patterns: public cloud, private cloud, hybrid cloud | **2,3 Understanding Applying** |
| CLO3 | Understand and analyze the industry practices to design and build agile cloud solutions, using the cloud Garage methodology | **2,4 Understand, Analyzing,** |
| CLO4 | Analyze and evaluate teamwork agile industrypractices using Devops framework. | **4,5 Analyzing Evaluating,** |

**Mapping of CLOs with PLOs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | H | H | H | H | L | | | | L | | H | M | M | M | M |
| **CLO2** | H | H | H | H | H | | | | | L | | H | H | H | H | H |
| **CLO3** | H | H | H | H | H | | | | | L | | H | L | L | H | M |
| **CLO4** | H | H | M | M | H | | | | | M | | H | M | M | H | H |

**H: High M: Medium L: Low**

# DATABASE MANAGEMENT SYSTEMS
# BCS5016

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Learning Objectives:** **(40 Hours)**

- To remember and understand relational database system.
- To analyse database requirements and determine the entities involved in the system and their relationship to one another.
- To develop the logical design of the database using data modelling concepts such as entity-relationship diagrams.
- To create and manipulate a relational database using a relational database package like SQL.

**Unit- I** **(08 Hours)**

**Introduction:** An overview of database management system, database system vs. file system, Database system concept and architecture, data model schema and instances, data independence and database language and interfaces, data definitions language, DML, Overall Database Structure.

**Data modeling using the Entity Relationship Model:** ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationship of higher degree.

**Unit- II**

**(08 Hours)**

**Relational data Model and Language:** Relational data model concepts, integrity constraints, entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, and tuple and domain calculus.

**Introduction on SQL:** Characteristics of SQL, advantage of SQL. SQL data type and literals, Types of SQL commands, SQL operators and their procedure, Tables, views and indexes, Queries and sub queries, Aggregate functions. Insert, update and delete operations, Joins, Unions, Intersection, Minus, Cursors, Triggers and Procedures in SQL/PLSQL.

**Unit- III**

**08 Hours)**

**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.

**Unit- IV** **(08 Hours)**

**Transaction Processing Concept:** Transaction system, Testing of serializability, serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling.

**Unit- V**

**(08 Hours)**

**Distributed Database:** distributed data storage, Concurrency Control Techniques: Concurrency control, Locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi version schemes, Recovery with concurrent transaction, case study of Oracle.

**TEXT BOOKS:**

**T1.** Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill

**T2.** Elmasri, Navathe, " Fudamentals of Database Systems", Pearson Education

**REFERENCE BOOKS:**

**R1**. Shio Kumar Singh, "Database Systems", Pearson

**R2**. Date C.J., "An Introduction to Database Systems", Addision Wesley Leon & Leon,"Database Management Systems", Vikas Publishing House

**R3**. Bipin C. Desai, "An Introduction to Database Systems", Gagotia Publications Majumdar & Bhattacharya, "Database Management System", TMH

**Course Learning Outcomes (CLO):** On completion of the course students will be able to

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember and Understand** the basic concepts of Database Management Systems and E-R modelling. | 1, 2 **Remembering, Understanding** |
| CLO2 | **Develop** an **understanding** about the concept of relational data model and various integrity constraints and write SQL queries. | 2,3 **Understanding, Applying** |
| CLO3 | **Apply** the concepts of normalization techniques for the given database application. | 3 **Applying** |
| CLO4 | **Analyze and evaluate** transaction, concurrency and recovery techniques in data bases and distributed data storage. | 4,5 **Analyzing, Evaluating** |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO1 | PLO1 | PLO1 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | L | M | | | | | | | | H | H | M | M | M |
| CLO2 | H | H | L | M | | | | | | | | H | H | M | M | M |
| CLO3 | H | H | M | M | M | L | L | | | | | H | H | M | M | M |
| CLO4 | H | H | M | M | M | | | | | | | H | H | M | M | M |
| CLO5 | H | H | M | M | M | | | | | | | H | H | M | M | M |

**H: High M: Medium L: Low**

# DATABASE MANAGEMENT SYSTEMS LAB
# BCS5515

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Learning Objectives:**

- To make students to do hands on practice on database management systems software and to execute SQL queries on it.
- To make students to Understand Functional Dependency and Functional Decomposition.
- To make students to Understand database concepts and structures and query language

1. Write the queries for Data Definition and Data Manipulation Language.
2. Write SQL queries using logical operators.
3. Write SQL queries using SQL operators
4. Write SQL query using character, number, date and group functions
5. Write SQL queries for relational algebra
6. Write SQL queries for extracting data from more than one table
7. Write SQL queries for sub queries, nested queries
8. Write program of PL/SQL
9. Concepts for ROLL BACK, COMMIT & CHECK POINTS
10. Create VIEWS, CURSORS and TRIGGERS

**Course Learning Outcomes (CLO):** On completion of the course students will be able to

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** a database schema for a given problem-domain. | 1,2 Remembering, Understanding |
| CLO2 | **Apply** integrity constraints in tables. | 3 Applying |
| CLO3 | **Analyze** databases and tables using queries. | 4 Analyzing |
| CLO4 | **Evaluate** and **create** applications using PL/SQL & front-end tools. | 5,6 Evaluating , Creating |

## Mapping of CO-PO/PSO:

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO1 | PLO1 | PLO1 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | | | M | | | | | | H | | H | | H | |
| CLO2 | | | | M | | | | | | | | H | | M | | H |
| CLO3 | | H | | | | M | | | | | M | | H | | | |
| CLO4 | | | M | | | L | | | | | H | | | | L | |

**H: High** **M: Medium** **L: Low**

# DESIGN AND ANALYSIS OF ALGORITHMS
# BCS5001

**L T P C**

**3 1 0 4**

**(40 Hours)**

**Course Learning Objectives:**

- To remember and analyze the asymptotic performance of algorithms.
- To write rigorous correctness proofs for algorithms.
- To demonstrate a familiarity with major algorithms and data structures.
- To apply important algorithmic design paradigms and methods of analysis.
- To evaluate efficient algorithms in common engineering design situations.

**Unit-I**

**(08 Hours)**

**Introduction**: Algorithms, Analyzing algorithms, Complexity of algorithms, Growth of Functions, Recurrences, Substitution method, Iteration method, Master method, Merge Sort, Quick-Sort, Sorting in linear time.

**Unit-II**

**(08 Hours)**

**Advanced Data Structures:** Red-black trees, Augmenting data structures, Order-statistic tree, B-Trees, Binomial heaps, Fibonacci heaps.

**Unit-III**

**(08 Hours)**

**Dynamic Programming:** Elements of dynamic programming, Assembly-line scheduling problem, Matrix chain multiplication, finding longest common subsequence;
**Greedy Algorithm:** Elements of greedy strategy, Activity selection problem, Huffman encoding, Task-scheduling problem, Knapsack problem, Amortized analysis.

**Unit-IV**

**(08 Hours)**

**Graph Algorithms:**Searching in graph, Spanning trees, Minimum cost spanning trees: Kruskal's and Prim's algorithms; Single source shortest path algorithms, Dijkstra's and Bellman Ford algorithms; All pair shortest paths algorithms, Floyd Warshal's algorithm, Network flow problem, Ford-Fulkerson method

**Unit-V**

**(08 Hours)**

**String Matching Algorithms:** Naïve string-matching algorithm, Rabin-Karp algorithm, Knuth-Morris-Pratt algorithm. Introduction of NP-completeness, Randomized algorithms, backtracking.

**TEXT BOOK**

**T1.** Coreman, Leiserson and Rivest, "Introduction to Algorithms", PHI

**REFERENCE BOOKS:**

**R1.** Dasgupta, Papadimitriou and Vazirani, "Algorithms", TMH
**R2.** Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms", Pearson.

**Course Learning Outcomes (CLO):** On completion of the course students will be able to

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** basic graph properties and how they are related to each other. | 1,2 **Remembering, Understanding** |
| CLO2 | **Apply** various algorithms design techniques for implementing data structures and graph algorithms. | 3 **Applying** |
| CLO3 | **Analyze** and **evaluate** various searching, sorting and string matching algorithms. | 4,5 **Analyzing, Evaluating** |
| CLO4 | **Analyze** and **formulate** NP completeness and different NP complete problems. | 4,6 **Analyzing, Creating** |

## Mapping of CO-PO/PSO

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO1 | PLO1 | PLO1 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | L | - | L | L | L | L | M | L | H | H | H | H | M |
| CLO2 | H | H | H | M | M | - | L | - | - | M | M | H | H | H | - | M |
| CLO3 | M | H | H | M | - | L | - | - | - | L | M | M | H | H | - | L |
| CLO4 | H | H | H | M | H | - | - | - | - | L | L | M | H | H | - | L |

H: High M: Medium L: Low

# DESIGN AND ANALYSIS OF ALGORITHM LAB
# BCS5501

**L T P C**
**0 0 2 1**

**Course Learning Objectives:**

- To implement various sorting algorithm, operations on trees, finding minimum spanning trees in a graph, finding shortest paths in between nodes in a graph.
- To analyze worst-case running time of algorithms and understand fundamental algorithmic problems.
- To understand how asymptotic notation is used to provide a rough classification of algorithms, how a number of algorithms for fundamental problems in computer science and engineering work and compare with one another.
- To study about various designing paradigms of algorithms for solving real world problems.

1. Implementation of Quick Sort and Merge Sort.
2. Implementation of Linear-time Sorting Algorithms.
3. Implementation of Red-Black Tree operations.
4. Implementation of Binomial Heap operations.
5. Implementation of an application of Dynamic Programming.
6. Implementation of an application of Greedy Algorithm.
7. Implementation of Minimum Spanning Tree Algorithm.
8. Implementation of Single-pair shortest path Algorithm.
9. Implementation of All-pair shortest path Algorithm.
10. Implementation of String-Matching Algorithm.

**Course Learning Outcome (CLO):** On completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** the complexities of various problems in different domains. | **1,2 Remembering, Understanding** |
| CLO2 | **Prove** the correctness and **analyze** the running time of the basic algorithms for those classic problems in various domains. | **4,5 Analyzing, Evaluating** |
| CLO3 | **Understand** the methods for **analyzing** the efficiency and correctness of algorithms (such as exchange arguments, recurrence, induction, and average case analysis) | **2,4 Understanding, Analyzing** |
| CLO4 | **Analyze** and **evaluate** appropriate algorithmic design techniques to present an algorithm that solves a given problem | **4,5 Analyzing, Evaluating** |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO1 | PLO1 | PLO1 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | - | L | L | L | L | M | L | M | H | H | - | M |
| CLO2 | H | H | H | H | M | L | L | - | - | M | M | M | H | H | - | M |
| CLO3 | H | H | H | H | - | L | - | - | - | - | M | M | H | H | - | - |
| CLO4 | H | H | H | H | H | L | - | - | - | - | L | M | H | H | - | - |

**H: High M: Medium L: Low**

# OBJECT ORIENTED PROGRAMMING
# BCS5017

**L T P C**
**2 1 0 3**

**Course Learning Objectives:** **(30 Hours)**

To study the key aspects of OOPS and its implementation with Java.

- To propose and implement event handling with GUI programming.
- To understand fundamentals of programming such as variables, conditional and iterative execution methods etc.
- To understand fundamentals of object-oriented programming in Java, defining classes, invoking methods, using class libraries, etc.
- To understand and analyze the principles of inheritance, packages and interfaces.

**UNIT I**

**(6 Hours)**

**Object Modeling:** Objects and classes, links and association, generalization and inheritance, aggregation, abstract class, multiple inheritance, meta-data, candidate keys, constraints.

**UNIT II**

**(6 Hours)**

**Dynamic Modeling:** Events and states, operations, nested state diagrams and concurrency, advanced dynamic modeling concepts, a sample dynamic model.

**UNIT III**

**(6 Hours)**

**Introduction to Java:** Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Arrays in java, Basics of objects and classes in java, Constructors, Java methods, Static, This keyword, Overloading, Finalizer, Visibility modifiers, Package.

**UNIT IV**

**(6 Hours)**

**Inheritance and Polymorphism:** Single level and multilevel inheritance, Super keyword, method overriding, final keyword, Interfaces, Abstract class.
**Multithreading:** Multithreading in java, thread life cycle and methods, runnable interface, thread synchronization. Exception handling with try-catch-finally, collections in Java, introduction to java beans and network programming.

**UNIT V**

**(6 Hours)**

**Event and GUI programming:** Applets**,** Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components: Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Introduction to swing.

**TEXT BOOKS**

**T1.** Herbert Schildt, The Complete Reference, Java 2 (Fourth Edition) TMH.
**T2.** Michael R Blaha, James R Rambaugh, Object Oriented Design and Modeling with UML, (Second Edition) Pearson

**REFERENCE BOOKS:**

**R1.**Kathy Sierra & Bert Bates, Head First Java, SPD (O'Reilly).
**R2.** Sachin Malhotra & Saurabh Chaudhary, Programming in Java Oxford University Press.
**R3.** Daniel Liang, Introduction to Java Programming, Pearson, Seventh Edition.

**Course Learning Outcomes (CLO):** On completion of the course students will be able to

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | Remember and understand OOPS concepts to make robust, maintainable programs to satisfy their requirements. | 1,2 Remembering, Understanding |
| CLO2 | Develop an understanding of the concepts of polymorphism and inheritance | 2,3 Understanding, Applying |
| CLO3 | Choose and simplify Java programs to implement error handling techniques using exception handling | 1, 4 Remembering, Analyzing |
| CLO4 | Analyze and evaluate OOPS concepts to make efficient programs according to the problem. | 4,5 Analyzing, Evaluating |

**Mapping of CLOs with PLOs & PSOs**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | H | H | L | M | | | | | | H | H | H | | H | |
| **CLO2** | H | H | H | M | | | | | | M | | H | H | M | | H |
| **CLO3** | H | H | M | L | | M | | | | | | H | H | | | H |
| **CLO4** | H | H | M | L | | L | | | | H | H | H | H | | L | |

**H: High M: Medium L: Low**

# OBJECT ORIENTED PROGRAMMING LAB

## BCS5516

**L T P C**

**0 0 2 1**

**Course Learning Objectives:**

- To remember and understand the basic concepts and techniques of the object oriented programming paradigm.
- To apply the essentials of the Java class library, and learn how to learn about other parts of the library when you need them.
- To analyze and evaluate event driven Graphical User Interface (GUI) progamming.

1. Write a Java program for understanding reference to an instance of a class (object), methods.
2. Write a Java program for handling Arrays and Vectors in Java.
3. Write a Java program for handling strings in Java.
4. Write a Java program for Package creation and developing user defined packages in java.
5. Write a Java program for developing user-defined interfaces and implementation and use of predefined interfaces.
6. Write a Java program for creation of thread in Java applications and Multithreading.
7. Write a Java program for handling pre-defined exceptions and handling user-defined exceptions.
8. Write a Java program for Java Database Connectivity – Data Retrieval.
9. Write a Java program for File Operations.
10. Write a Java program for Applet and creation of color palette.

**Course Learning Outcomes (CLO):** On completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** classes, objects, members of a class and relationships among them needed for a specific problem | 1, 2<br>**Remembering, Understanding** |
| CLO3 | **Identify** usage of collection framework by **applying** various programming concepts. | 3<br>**Applying** |
| CLO2 | **Apply** and **analyze** OOP Principles on application programs. | 3,4<br>**Applying, Analyzing** |
| CLO4 | **Explain** method overriding v/s method overloading by **creating** JDBC-ODBC connectivity. | 5,6<br>**Evaluating, Creating** |

**Mapping of CLOs with PLOs & PSOs**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | H | L | M | M | | | | | | H | H | H | M | H | |
| **CLO2** | **H** | H | L | M | | | | | | | | H | H | M | | H |
| **CLO3** | **H** | H | L | M | | M | | | | | M | H | H | M | | |
| **CLO4** | **H** | H | M | M | | L | | | | | H | H | H | M | L | |

H: High M: Medium L: Low

# SIGNALS AND SYSTEMS
# BEC5015

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**40 Hours**

**Course Learning Objectives:**

- Remember and understand basic concept of mathematical modeling and properties of signals and systems.
- To develop the understanding of system properties and analyse their effect on various system with varying input signals.
- To understand the basic concept of time domain and frequency domain and analyze various transformation techniques and their application to various standard signals and systems.
- To understand the basic of state space analysis and multi-input, multi-output representation and analyze the concept of sampling of continuous time signals.

**UNIT I:**

**(6 Hours)**

Signals and systems application: Signals and systems as seen in everyday life, and in various branches of engineering and science.

**UNIT II:**

**(6 Hours)**

Properties of signals: Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

**UNIT III:**

**(7 Hours)**

Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations.

**UNIT IV:**

**(7 Hours)**

Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases.

**UNIT V:**

**(7 Hours)**

The Laplace Transform, notion of Eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis.

**UNIT VI:**

**(7 Hours)**

State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal

interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.

**TEXT/REFERENCE BOOKS:**

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: c1999.

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

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Understand** importance of signals and system in everyday life **and Analyze** the properties of signals. | **2,4 Understanding, Analyzing** |
| CLO2 | **Compare** linear shift-invariant and linear time-variant system **and Understand** and remember the basic concepts of standard signals using shifting properties on system. | **2, 4 Understanding, Analyzing** |
| CLO3 | **Understand** of time domain and frequency domain signal analysis and **Comparison** of **Discrete**-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT) | **2, 4 Understanding, Analyzing** |
| CLO4 | **Remember** the concept of Laplace transform and Z-Transform and understand and analyze its effect on system | **1, 2 and 4 Remembering, Understanding and Analysing** |
| CLO5 | **Understand State space analysis and analyse** the relation between continuous and discrete time system. | **2 and 4 Understanding and Analyzing** |

**Mapping of CLOs with PLOs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | H | | | | L | | | | L | | L | H | M | M | M |
| **CLO2** | H | H | | | | | | | | | | L | H | M | M | M |
| **CLO3** | H | H | | | M | L | L | | | | | L | H | M | M | M |
| **CLO4** | H | H | | | | | | | | | | L | H | M | M | M |
| **CLO5** | H | M | | | H | M | L | | | | | M | H | M | M | M |

**H: High M: Medium L: Low**

# PRINCIPLES OF MANAGEMENT
## BMG5007

**L T P C**
**3 0 0 3**

**Course Learning Objectives:**

- To understand the concepts and scope of management which will help the student in their management career.
- To demonstrate and apply the various functions of management and developing decision-making skills among the students.
- To analyze the effective application of staffing and the various motivational theories.
- To understand the necessity of Leadership qualities and development of communication skills among the students.
- To create co-ordination and cooperation among the students so that they can work as a team.

**UNIT-I** **(8 Hours)**

Basics of Management- Concept, Scope, and Importance of Management, Evolution of Management-Early and Modern approaches. Management & Administration –Management as an art or science. Management skills & levels, Roles of a manager. Business ethics & Social responsibility. Management by objectives.

**UNIT-II** **(10 Hours)**

Introduction to Management functions. Planning: Nature, Scope, Purpose, Planning process, Types of Planning, Merits & Demerits of planning. Organizing: Nature, Purpose, Types of organizational structure, span of control, Delegation of Authority, Centralization & Decentralization of authority, Decision making & its styles.

**UNIT-III** **(8 Hours)**

Staffing: Concept & purpose of staffing, Components of Staffing.
Directing: Principles and elements of directing, Span of supervision
Motivation: Concept, Theories of Motivation, Motivational Techniques.

**UNIT-IV** **(7 Hours)**

Leadership: Concept & Nature, Functions of leadership, Types of leadership. Leadership styles.
Communication: Importance of Communication, communication Channels, communication Process, Barriers to communication, Effective communication.

**UNIT -V** **(7 Hours)**

Coordination: Meaning, significance, Relationship between Coordination and Cooperation, Techniques of effective coordination.

Controlling: Meaning, Nature, Significance and Types of control, Control Process, Total Quality control, Control Techniques: Modern &Traditional.

**TEXT BOOKS:**

**T1**. Robbins S.P. and Decenzo David A. – "Fundamentals of Management: Essential Concepts and Applications" (Pearson Education, 6th Edition).

**T2.** Weihrich Heinz and Koontz Harold – "Management: A Global and Entrepreneurial Perspective" (McGraw Hill, 12thEdition 2008).

**T3**. Prasad L.M. – "Principles and practices of Management"

**REFERENCE BOOKS:**

**R1.** Stoner, Freeman & Gilbert Jr – "Management" (Prentice Hall of India, 6th Edition).

**R2.** Koontz Harold & Weihrich Heinz – "Essentials of management" (Tata Mc Graw Hill, 5th Edition 2008).

**R3**. Robbins & Coulter – "Management" (Prentice Hall of India, 9th Edition)

**Course Learning Outcomes:** On completion of this course student will be able to:

| Course Learning Outcomes | Description | Bloom's taxonomy Level |
|---|---|---|
| **CLO1** | Describe and remember the influence of historical forces on the current practice of management. Understand and explain how organizations adapt to an uncertain environment and identify techniques managers use to influence and control the internal environment. | **1, 2 Remembering, Understanding** |
| **CLO2** | Describe and understand the process of management's five functions. Evaluate the centralization and decentralization of authority in a Business organization. | **2, 5 Understanding, Evaluating** |
| **CLO3** | Create cognizance of staffing. Analyze and Evaluate the effective application of Directing and Motivating | **4, 5, 6 Analyzing, Evaluating, Creating** |
| **CLO4** | Identify and evaluate the Leadership skills involved in Business situations. Understand the tools and techniques to be used in communication. | **2,5 Understanding, Evaluating** |
| **CLO5** | Evaluate and create the effective co-ordination so as to understand how to work in a team. | **2,5,6 Understand, Evaluate, Create** |

**Mapping of CLOs with PLOs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | | H | H | M | L | | H | H | L | H | M | M | H | | | H |
| CLO2 | | H | M | M | M | | H | H | H | H | M | H | H | | | H |
| CLO3 | | L | H | H | M | | M | L | H | M | M | H | M | | | H |
| CLO4 | | M | M | M | H | | M | M | M | H | M | H | M | | | H |
| CLO5 | | H | H | M | L | | L | M | H | H | M | H | L | | | H |

**H=High M=Medium L=Low**

# ECONOMICS
## BMG5301

**L T P C**
**3 0 0 3**

**Course Learning Objectives:** **(40 Hours)**

- Remember and understand the fundamental concepts of Economics and their relativity with technical courses
- Understand and analyze the economic problems
- Understand the market mechanism and analyze the factors it operates through along with the appropriate trade off strategies
- Analyze the predictors of macro-economic conditions and government interventions

### Unit 1 Introduction

**(06 Hours)**

Fundamental Concepts: Economics, Micro and Macro Economics, nature and scope of Economics

Fundamental Principles of Micro Economics: Scarcity, Marginalize, Equi-Marginalism, Discounting, Opportunity Cost, Time Perspective

### Unit 2 Demand and Supply Analysis

**(10 Hours)**

**Demand Analysis**

Basic Concepts: Demand, essentials of demand, individual and market demand, determinants of demand, demand curve, law of demand, movement along and shifts in demand curve, demand function

Elasticity of demand: Meaning, types and measurement of elasticity-Price, Income and Cross Elasticity

Demand Forecasting: Survey Method, Statistical Method

**Supply Analysis**

Meaning, determinants of supply, supply curve, law of supply, movement along and shifts in supply curve, elasticity of supply and measurement

**Equilibrium Price**

Meaning, determination of Equilibrium Price, effects of shifts in demand and supply curves on Equilibrium Price

### Unit 3 Production, Cost and Revenue Analysis **(10 Hours)**

**Production**

Basic Concepts: Total, Average and Marginal Production, Production Function and its types- Short and Long Run

Laws of Returns: Law of Diminishing Returns, Return to Scale, Economies and Diseconomies of scale

**Cost-** Types of cost- Total Cost, Total Fixed cost, Total Variable Cost, Average Cost, Average Fixed Cost, Average Variable Cost and Marginal Cost, relationship among various types of cost, cost function

**Revenue-** Total, Average and Marginal revenue - meaning and relationship, revenue function

**Unit 4 Market Structure & Pricing Strategies** **(10 Hours)**

Perfectly Competitive Case- Characteristics, cost and output relationship

Imperfect Market Case- Monopoly, Oligopoly, Monopolistic Competition – Characteristics, cost and output relationship

Pricing Strategies- Cost plus Pricing, Penetration Pricing and Skimming Pricing

**Unit 5 Macro Economic Concepts** **(04 Hours)**

National Income- Components of National Income: Gross National Product (GNP), Net National Product (NNP), Gross and Net Domestic Product (GDP and NDP) - at market price and factor cost, methods of calculating National Income- Product, Income and Expenditure methods

Inflation- Meaning, Cost Push and Demand Pull Inflation, measures to control Inflation

Trade Cycle- Meaning and Stages of Trade Cycle

**Text Books**

**T1.** "Micro Economic Theory", M. L. Jhingan, Vrinda Publications Pvt. Ltd., 7th Edition, 2014
**T2.** "Macro Economics Theory & Policy", H. L. Ahuja, S. Chand, 20th Edtion, 2016

**Reference Books**

**R1** "Principles of Economics", N. Gregory Mankew Cengage Learning, 6th Edition, 2014
**R2.** "Micro Economics", R. Glenn Hubbard & Antony Patrick O. Brien, Pearson, 1st Edition, 2008
**R3.** "Macro Economics Theories & Policies" Richard T. Froyen, Pearson, 10th Edition, 2015
**R4.** "Macro Economics Theory & Policy", D. N. Dwivedi, Tata McGraw Hill, 3rd Edition, 2014
**R5.** "Economics", Sudeep Chaudhary & Anindya Sen, Tata McGraw Hill, 19th Edition, 2012

**Course Learning Outcomes:** On completion of this course student will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Understand** the fundamental concepts and principles of Economics. | **2**<br>**Understand** |
| CLO2 | **Understand** the dynamics of demand and supply; **calculate** the elasticities thereof and **analyze** various aspects of equilibrium price | **2,3. 4**<br>**Understand, Apply, Analyze** |
| CLO3 | **Understand** the fundamentals of production, cost and revenue and **calculate** their total, average and marginal concepts. | **2,3**<br>**Understand, Apply** |
| CLO4 | **Apply** economic concepts in specific issues of the firm and economy. | **3**<br>**Apply** |
| CLO5 | **Understand** and **analyze** the role and scope of macro-economic variables in the economy. | **2, 4**<br>**Understand, Analyze** |

**Mapping of CLOs with PLOs and PSOs**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | | H | H | M | L | | H | H | L | H | M | M | H | | | H |
| **CLO2** | | H | M | M | M | | H | H | H | H | M | H | H | | | H |
| **CLO3** | | L | H | H | M | | M | L | H | M | M | H | M | | | H |
| **CLO4** | | M | M | M | H | | M | M | M | H | M | H | M | | | H |
| **CLO5** | | H | H | M | L | | L | M | H | H | M | H | L | | | H |

H: High M: Medium L: Low

# ECOMMERCE
# BCS5001-DE1

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Learning Objectives**:

**(40 Hours)**

- To Remember and understand the basics of e-commerce.
- To understand and apply the infrastructure and techniques in computer networks which will be used in e-commerce.
- To apply the security of hardware and software and analyze various approaches to secure the network.
- To compare and analyze various payment methods and applications of e-commerce.

**Unit-I**

**(06 Hours)**

**Introduction:** Brief History, Business to Commerce, Defining E-Commerce. Network enabled business practices, Marketing Forces, Digital Convergence, Incentives, Advantages, Disadvantages, Framework, E-Commerce models, Needs, Impacts of E-Commerce on business.

**Unit-II**

**(06 Hours)**

**Infrastructure & Techniques:** Terminal Equipment. Topologies, LAN, MAN, WAN. Serial Communication: Simplex/Duplex, Character/Bit oriented. Transmission: Nodes, Circuit/Packet switching, TCP/IP, Analogy between TV transmission and internet.

**Unit-III**

**(06 Hours)**

**Security Hardware and Software:** Need for Security, Firewall, Cryptography, Secret Key Encryption, Private Key Encryption, Digital Signatures.

**Unit-IV**

**(06 Hours)**

**Payment Systems and Cyber Laws:** Payment System Overview, On-Line Banking, E-Cheques, And Card Systems: Credit Cards, Debit Cards, Smart Cards, And Magnetic Strip Cards. SET protocol, Payment Gateways, Digital Tokens & Certificates, Cyber Crimes and Cyber Laws.

**Unit-V**

**(06 Hours)**

**Typical Applications:** Banking and Ticketing, Retail Shopping and Virtual Stores. On-Line Publishing and WWW, Manufacturing and Supply Chain Management, Customer Assets & Corporate Finance Management, Miscellaneous: E-mails, Search Engines, Education, and Entertainment.

**TEXT BOOKS:**

**T1.** Kalakota & Whinston, "Electronic Commerce: A Manager's Guide", Pearson, 1st Edition, 1997.
**T2.** Atul Kahate, "Information Technology", TMH, 3rd Edition, 2008.

**REFERENCE BOOKS:**

**R1.** Laudon & Traver, "E-commerce: business. Technology. society.", Pearson, 4th Edition, 2009.
**R2.** Bharat Bhaskar, "Electronic Commerce: Framework, Technologies & Applications", McGraw Hill, 4th Edition, 2009
**R3.** Bajaj and Nag, "E-Commerce the cutting edge of Business", TMH
**R4.** Turban, "Electronic Commerce 2004: A Managerial Perspective", Pearson Education.

**Course Learning Outcomes (CLO):** On completion of the course students will be able to

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **Understand** the introduction of e-commerce. | **1,2 Remembering, Understanding** |
| CLO2 | **Understand** and **identify** the infrastructure and techniques in computer networks which will be used in e-commerce. | **2,3 Understanding, Applying** |
| CLO3 | **Apply** the security of hardware and software and **analyze** various approaches to secure the network. | **3,4 Applying, Analyzing** |
| CLO4 | **Compare** and **analyze** various payment methods and applications of e-commerce. | **4,6 Analyzing, Creating** |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | | | M | L | | | | | | L | H | M | M | M |
| CLO2 | H | H | | | M | L | | | | | | L | H | M | M | M |
| CLO3 | H | H | | | M | L | | | | | | L | H | M | M | M |
| CLO4 | H | H | | | M | L | | | | | | L | H | M | M | M |

H: High M: Medium L: Low

# GRAPH THEORY
## BCS5002 - DE1

**L T P C**
**3 0 0 3**
**(30 Hours)**

**Course Learning Objectives:**

- To remember and understand basic concepts in combinatorial graph theory.
- To develop an understanding about the concept of graph, tree, Euler graph, cut set and Combinatorics.
- To apply and analyze the applications of graphs in science, business and industry in solving practical problems.
- To understand matrix representation of graphs.

**Unit-I** **(07 Hours)**

**Introduction:** Graphs, Properties of graphs, Operation on graphs, Applications of graphs

**Paths and Circuits:** Isomorphism, Sub graphs, Walks, Path & Circuits, Directed and Undirected Graph, Connected Graphs, Disconnected Graphs and Component, Euler graphs, Hamiltonian Paths and Circuits

**UNIT- II** **(07 Hours)**

**Trees:** Trees, Properties of Trees, Rooted and Binary Trees, Spanning Trees, Minimum Spanning Trees, MST Algorithms, Prim's and Kruskal's Algorithms

**Cut Sets and Cut Vertices:** Introduction, Properties, All Cut Sets in a graph, Relation between Fundamental Circuits and Cut Sets, Connectivity and Separability, Network Flow, 1-Isomorphism, 2-Isomorphism

**UNIT -III** **(08 Hours)**

**Planar and Dual Graphs:** Combinatorial and Geometric Graphs, Planar Graphs, Kuratowski's Two Graphs, Detection of Planarity, Geometric Dual, Combinatorial Dual

**Vector Spaces of a Graph**: Sets with One Operation, Sets with Two Operations, Vectors and Vector Spaces

**UNIT -IV** **(08Hours)**

**Matrix Representation of Graphs:** Incidence Matrix, Circuit Matrix, Cut-set Matrix, Path Matrix, Adjacency Matrix

**Coloring, Covering and Partitioning:** Rank-nullity theorem, Chromatic Number, Chromatic partitioning, Chromatic polynomial, Matching, Covering, Four Color Problem

**Graph Theoretic Algorithms:** Travelling Salesman Problem

**TEXT BOOKS:**

**T1.** Robin J. Wilson, "Introduction to Graph Theory", Pearson
**T2.** Gary Chartrand and Ping Zhang, "Introduction to Graph Theory", TMH

**REFERENCE BOOKS:**

**R1.** V. Balakrishnan, Schaum's "Outline of Graph Theory", TMH
**R2.** Bondy and Murthy: "Graph Theory and Application." Addison Wesley.
**R3.** GeirAgnarsson, "Graph Theory: Modeling, Applications and Algorithms," Pearson

**Course Learning Outcomes (CLO):** On completion of the course students will be able to

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **Understand** basic graph properties and how they are related to each other. | **1,2 Remembering, Understanding** |
| CLO2 | **Understand** and **apply** simple connections between spectral properties and the structure of graphs. | **2,3 Understanding, Applying** |
| CLO3 | **Identify** and **apply** the probabilistic method and how to prove properties of almost all graphs. | **3 Applying** |
| CLO4 | **Apply** and **formulate** several standard graph algorithms to real-life problems on networks. | **3,6 Applying, Create** |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | M | | | | | | | | | L | H | M | M | M |
| CLO2 | H | H | M | | | | | | | | | L | H | M | M | M |
| CLO3 | H | H | M | | M | L | L | | | | | L | H | M | M | M |
| CLO4 | H | H | | | M | | | | | | | L | H | M | M | M |

H: High M: Medium L: Low

# MANAGEMENT INFORMATION SYSTEM
## BCS5003-DE1

| L | T | P | C |
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**Course Learning Objectives:**

- To remember and understand the fundamental concepts of information system.
- To develop an understanding about decision making using information systems.
- To understand and analyze various security issues associated with information system.
- To understand and evaluate the role of leadership in Management Information Systems for achieving business competitive advantage.
- To analyze and synthesize business information and systems to facilitate evaluation of strategic alternatives

**Unit- I**

**(7 Hours)**

**Introduction:** MIS versus Data processing, MIS & Decision Support Systems, MIS & Information Resources Management, End user computing, Concept of an MIS, Structure of a Management information system, Types of information systems, Effectiveness and efficiency criteria in information system, Solving business problems with information systems,

**Unit- II**

**(7Hours)**

**Concepts of planning & control:** Concept of organizational planning, The Planning Process, Computational support for planning, Characteristics of control process, the nature of control in an organization.

**Unit- III**

**(8 Hours)**

**Business applications of information technology:** Internet & electronic commerce, Intranet, Extranet & Enterprise Solutions, Information System for Business Operations, Information System for Managerial Decision Support, Information System for Strategic Advantage.

**Unit- IV**

**(8 Hours)**

**Managing Information Technology:** Enterprise & Global management, Security & Ethical challenges, Planning & Implementing changes; Advanced Concepts in Information Systems: Enterprise Resource Planning, Supply Chain Management, Customer Relationship Management, and Procurement Management.

**TEXTBOOKS:**

**T1.** O Brian, "Management Information System", TMH.
**T2.** Gordon B. Davis & Margrethe H. Olson, "Management Information System", TMH

**REFERENCE BOOKS:**

**R1**. Jawadekar, "Management Information System", TMH.
**R2**. G.B.Davis, M.H.Olson, Management Information System, TMH
**R3**. Laudon and Laudon, "Management Information System, Pearson.

**Course Learning Outcomes (CLO):** On completion of the course students will be able to

| Course Learning Outcomes | Description | Blooms Taxonomy Level |
|---|---|---|
| CLO1 | **Remember and understand** the state-of art in Management Information System. | 1,2 Remembering, Understanding |
| CLO2 | **Identify** and **construct** solution for existing business systems in the areas of accounting, finance, marketing and manufacturing. | 3 Applying |
| CLO3 | **Analyze** and examine the technical aspect of telecommunication systems and internet as well as their roles in business environment. | 4 Analyzing |
| CLO4 | **Analyze** and **evaluate** the business applications by organized planning and control. | 4,5 Analyzing, Evaluating |

## Mapping of CLOs with PLOs & PSOs:

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | H | M | L | H | H | H | M | L | M | H | M | H |
| CLO2 | H | H | H | H | H | M | H | H | H | H | H | L | M | H | M | H |
| CLO3 | H | H | H | H | H | H | H | H | M | H | M | L | M | H | M | H |
| CLO4 | H | H | H | H | M | H | H | H | H | H | M | L | M | H | M | H |

H: High M: Medium L: Low

# COMPUTER GRAPHICS
# BCS5004-DE1

L T P C

3 0 0 3

**Course Learning Objectives:** **(40 Hours)**

- To provide a comprehensive introduction to computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends.
- To provide a thorough introduction to computer graphics techniques, focusing on 3D modeling, image synthesis, and rendering.
- To provide the knowledge of the interdisciplinary nature of computer graphics.

**Unit- I** **(8Hours)**

**Introduction to Computer Graphics**: Interactive/Interactive graphics, Uses of computer graphics, Classification of application, Programming Language, Graphics and Operating software.

**Graphics Systems:** Cathode Ray Tube basics refresh display, direct view storage tube, raster display, input/ output devices, Integration of graphics software, Interactive Graphics Techniques, Graphics user Interface.

**Raster Graphics:** Representing Image, Line drawing algorithms: DDA, Mid-point, Bresenham'sLine algorithms. Circle generating Algorithms: Bresenhams Circle, Mid-point circle algorithm, Mid-point Ellipse Generating algorithm.

**Unit-II** **(8Hours) Polygon**

**Fill:** Drawing and filling polygons, flood fill, boundary fill and scan line fill algorithms.

**Two dimensional transformations:** Introduction, representation and transformation of points, straight line. Mid-point transformation. Transformation of parallel lines, intersecting lines. Reflection, Rotation, scaling of straight lines and polygons**.** Combined transformation. Translation and homogeneous coordinates, rotation about an arbitrary point, reflection about an arbitrary line.

**Unit-III** **(8 Hours)**

**Windowing and Clipping:** Viewing transformation, clipping, Point clipping, Cohen- Sutherland Line clipping, Parametric Liang-Barsky 2d Line clipping algorithm, Polygon clipping, Sutherland-Hodgman Algorithm.

**3D concepts and Techniques:** 3D transformation, Rotation about an Axis Parallel to a coordinate axis and arbitrary plane. 3D modelling schemes, Projection, Orthographic Projection, Isomeric Projection, one, two, three Point perspective viewing. Viewing parameters, Object Coordinate Conversion to View plane coordinate.

**Unit-IV** **(8 Hours)**

**Space Curve**: Introduction, Parametric cubic polynomial curves, solution of cubic polynomial curves. Bezier curves, spline representation, parametric and geometric continuity condition. Spline as piece wise Polynomials, blending function, curve design tool.

**Hidden Surface Removal:** Introduction**,** Need for hidden surface removal**,** The Depth - Buffer Algorithm**,** Properties that help in reducing efforts**,** Scan Line coherence algorithm**,** Span - Coherence algorithm**,** Area-Coherence Algorithms**,** Warnock's Algorithm.

**Unit-V** **(8 Hours)**

**Animation:** History of animation, Types of animation (Stop motion, puppet animation, 2d and 3d animation, motion and performance capture).

**Morphing:** coordinate grid approach, feature based approach.

**Motion Capture:** Motion capture technologies, processing the images, Camera Calibration, 3-D position reconstruction: Multiple markers, multiple cameras.

**TEXT BOOKS:**

**T1.** Amrendra N Sinha and Arun D Udai," Computer Graphics", TMH.
**T2.** Donald Hearn and M Pauline Baker, "Computer Graphics C Version", Pearson Education.

**REFERENCES BOOKS:**
**R1.** Donald Hearn and M Pauline Baker, "Computer Graphics with OpenGL", Pearson education.
**R2.** Steven Harrington, "Computer Graphics: A Programming Approach", TMH.
**R3.** Rogers, "Procedural Elements of Computer Graphics", McGraw Hill.

**R4.** Computer Animation: Algorithms and Techniques, 3rd Edition, by Rick Parent (Morgan Kauffmann, 2012), ISBN: 0124158420

**Course Learning Outcomes (CLO):** On completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Blooms Taxonomy Level |
|---|---|---|
| CLO1 | **member** and **understand** the basics of computer graphics and its applications. | **1,2 Remembering, Understanding** |
| CLO2 | **ply** various algorithms for scan conversion and filling objects and their comparative analysis. | **3 Applying** |
| CLO3 | **ply** and **analyze** different clipping methods and its geometrical transformation mechanism. | **3,4 Applying, Analyzing** |
| CLO4 | **Develop** an **understanding** of projects and surface detection technique for 2D and 3D screen | **2,3 Understanding, Applying** |

**Mapping of CLOs with PLOs & PSOs**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO | PLO | PLO | PLO | PLO | PLO | PLO | PLO | PLO | PLO | PLO | PLO | PSO | PSO | PSO 3 | PSO 4 |
| CLO1 | H | H | M | L | - | L | L | L | L | M | L | M | H | H | H | H |
| CLO2 | H | H | M | M | M | - | L | - | - | M | M | M | H | H | H | H |
| CLO3 | H | H | H | M | - | L | - | - | - | - | M | M | M | H | H | H |
| CLO4 | H | H | H | M | H | - | - | - | - | - | L | M | M | H | H | H |

H: High M: Medium L: Low

# A & R AND ONLINE TEST FOR EVEN SEMESTER
# BAP 5501

**Course Learning Objectives:**

- To enable the students to refine their mathematical, logical and analytical skills.
- To enhance their employability skills.
- To prepare the students for competition.
- To give them practice sessions to increase their speed and confidence.

**UNIT 1**

**INTRODUCTION TO BASIC LR (3 hours)**

Coding and decoding, alphabet, blood relationship, direction sense test, series completion.

**UNIT 2**

**INTRODUCTION TO DATES AND TIME (3 hours)**

Calendar: day fetching using the concept of standard table, backward stepping table, forward stepping table, clock: problem on angle, time variation, incorrect time.

**UNIT 3**

**NUMBER SYSTEM (6 hours)**

Number system, introduction, divisibility rule, last digit calculation, number of zeroes, remainder theorem.

**UNIT 4**

**BASICS OF QUANTITATIVE APTITUDE (8 hours)**

HCF and LCM, work and time, statistics, power and roots, percentage.

**UNIT 5**

**PROFIT LOSS AND DISCOUNT (4 hours)**

Profit and loss, function inequalities and crypto arithmetic.

**REFERENCE BOOKS:**

R1. Dr. R S Aggarwal "Quantitative aptitude",S. Chand Publishing , 2018
R2. Dr. R S Aggarwal "A modern aproach to logical reasoning",S. Chand Publishing , 2018

**Course Learning Outcomes(CLO):** On completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Identify** their weakness for various competitive exams their quantitative and reasoning skills. | **3** Apply |
| CLO2 | **Examine** their employability skills | **4** Analyze |
| CLO3 | **Develop** their Competitive skills | **6** Create |
| CLO4 | **Improve** their quantitative and reasoning skills. | **6** Create |

**Mapping of CLOs with PLOs & PSOs**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | | H | H | L | M | | | | | | | | M | M | H | |
| CLO2 | | H | H | L | M | | | | | | | | M | M | H | |
| CLO3 | | H | H | L | M | | | | | | | | M | M | H | |
| CLO4 | | H | H | L | M | | | | | | | | M | M | H | |

H: High M: Medium L: Low

# BIG DATA ANALYTICS
# BCS5702

| L | T | P | C |
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**Course Learning Objectives:**

- Understand what Big Data is
- Develop an understanding of the complete open-source Hadoop ecosystem and its near term future directions
- Understand the major challenges of data
- Understand how Big SQL fits in the Hadoop architecture

**UNIT I: Introduction to Big Data**

open-source Hadoop ecosystem and its near term future directions, Hadoop distributions and their ecosystem components strengths and their limitations ,key components of various big data ecosystem components and their roles in building a complete big data ,solution to common business problems Describe the functions and features of HDP, List the IBM value-add components • IBM Watson Studio, value-add components

**UNIT II : Apache Ambari and HDFS**

purpose of Apache Ambari in the HDP stack, Architecture of Ambari and Ambari's relation to other services and components of a Hadoop cluster ,List the functions of the main components of Ambari ,start and stop services from Ambari Web Console, need for a big data strategy in terms of parallel reading of large data files and internode network speed in a cluster ,nature of the Hadoop Distributed File System (HDFS) , function of the Name Node and Data Nodes in an Hadoop cluster, file storage and replication

**UNIT –III :MapReduce, YARN and Apache Spark**

MapReduce model v1, List the limitations of Hadoop 1 and MapReduce 1, Review the Java code required to handle the Mapper class , Reducer class and the program driver needed to access MapReduce ,YARN model Compare Hadoop 2/YARN with Hadoop 1, nature and purpose of Apache Spark in the Hadoop ecosystem ,List and describe the architecture and components of the Spark unified stack ,Resilient Distributed Dataset (RDD) ,principles of Spark programming ,Spark libraries ,Launch and use Spark's Scala and Python shells

**Unit –IV: Storing and Quering data**

characteristics of data file formats flat/text files CSV XML JSON and YAML, characteristics of NoSQL datastores ,HBase ,open source programming languages Pig and Hivee characteristics of programming languages :R and Python, ZooKeeper, role of ZooKeeper , generic use cases and some real-world scenarios for ZooKeeper, the ZooKeeper services, ZooKeeper CLI, Sqoop, Jupyter Notebook , Essential packages: NumPy SciPy Pandas Scikit-learn NLTK BeautifulSoup ,Data visualizations: matplotlib ,PixieDust , Jupyter "Magic" commands, Streaming Data Engines (SDEs)

**UNIT-V : Big SQL and Watson Studio**

Overview of Big SQL ,Big SQL fits in the Hadoop architecture, Start and stop Big SQL using Ambari and command line, Connect to Big SQL using command line , Connect to Big SQL using IBM Data Server Manager, create Big SQL schemas and tables ,Big SQL data types , Work with various Big SQL DDLs,Load data into Big SQL tables using best practices, Big SQL supported file formats , Query Big SQL tables, Big SQL Server ,Big SQL Scheduler , Big SQL federation, Watson Studio, Setting up a projects.

**Text BOOKS:**

T1. Shankarmani "Bigdata Analytics",Wiley , 2017.

T2. "IBM AP Skills", IBM , 2019.

**Video lectures:**

1.https://nptel.ac.in/courses/106/104/106104189/
2 https://www.sas.com/en_sa/insights/analytics/big-data-analytics.html
3.https://www.youtube.com/watch?v=HjWOMK4k4Z0&list=PL7FnN5oi7Ez9itAnZ6rs9A30YYjVB1wN_
4. https://www.youtube.com/watch?v=ec-dBSHeR3Y&list=PLzpeuWUENMK3u3j_hffhNZX3-Jkht3N6V
5. https://www.youtube.com/watch?v=5P9T08lDXbE

**Course Learning Outcomes(CLO):** On completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember and Understand** complete open-source Hadoop ecosystem and its near term future directions. | **1,2** Remember understand |
| CLO2 | **Understand the** benefits of using Data Science Notebooks by applying SQL queries. | **2,3** Understand Apply |
| CLO3 | **Analyze and evaluate** Big SQL using Ambari and command line. | **4,6 Analyze** Create |
| CLO4 | **Create** projects on Watson studio. | **6** Create |

**Mapping of CLOs with PLOs & PSOs**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | H | H | L | M | L | M | | | | L | M | M | M | H | |
| **CLO2** | H | H | H | L | M | L | M | | | | L | M | M | M | H | |
| **CLO3** | H | H | H | L | M | L | M | | | | L | M | M | M | H | |
| **CLO4** | H | H | H | L | M | L | M | | | | L | M | M | M | H | |

H: High M: Medium L: Low

# BIG DATA ANALYTICS LAB
# BCS5702

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 3 |

**Course Learning Objectives:**

- Understand what Big Data is?
- Develop an understanding of the complete open-source Hadoop ecosystem and its near term future directions
- Understand and analyze the major challenges of data.
- Understand how Big SQL fits in the Hadoop architecture.

1.Implement the following file management tasks in Hadoop: Adding files and directories

- Retrieving files
- Deleting files

2. Install and Run Hive then use Hive to create, load, alter, and drop databases, tables, joins.

3. Implement Hive partitioning and bucketing with data set.

4. Install and Run Pig then write Pig Latin scripts to sort, group, join and filter your data.

5. Implement Sqoop commands.

6. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm with data set.

7. Working with Jupiter notebooks:
   - Creating notebooks
   - Coding and running notebooks
   - Sharing and publishing notebooks
   - Creating a notebook
   - Using notebooks

8.Create Big SQL table and load dataset into table.

9. Managing the Big SQL Server

- Update the database resource percentage for the Big SQL database instance
- Inspect the Big SQL scheduler configuration file
- View the registries for compiler and runtime performance Improvement
- Use PixieDust for data visualization

10. Analyzing data with Watson Studio
    - Run through a sample notebook in Watson Studio
    - Use PixieDust for data visualization

**Text BOOKS:**

T1. Shankarmani "Bigdata Analytics",Wiley , 2017.
T2. "IBM AP Skills", IBM , 2019.

**Video lectures:**

1.https://nptel.ac.in/courses/106/104/106104189/
2 https://www.sas.com/en_sa/insights/analytics/big-data-analytics.html
3.https://www.youtube.com/watch?v=HjWOMK4k4Z0&list=PL7FnN5oi7Ez9itAnZ6rs9A30YYjVB1wN
4. https://www.youtube.com/watch?v=ec-dBSHeR3Y&list=PLzpeuWUENMK3u3j_hffhNZX3-Jkht3N6V
5. https://www.youtube.com/watch?v=5P9T08lDXbE

**Course Learning Outcomes(CLO):** On completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember and Understand** complete open-source Hadoop ecosystem and its near term future directions. | **1,2** Remember understand |
| CLO2 | **Understand the** benefits of using Data Science Notebooks by applying SQL queries. | **2,3** Understand Apply |
| CLO3 | **Analyze and evaluate** Big SQL using Ambari and command line. | **4,6 Analyze** Create |
| CLO4 | **Create** projects on Watson studio. | **6** Create |

**Mapping of CLOs with PLOs & PSOs**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | H | H | L | M | L | M | | | | L | M | M | M | H | |
| **CLO2** | H | H | H | L | M | L | M | | | | L | M | M | M | H | |
| **CLO3** | H | H | H | L | M | L | M | | | | L | M | M | M | H | |
| **CLO4** | H | H | H | L | M | L | M | | | | L | M | M | M | H | |

H: High M: Medium L: Low

# COMPILER DESIGN
# BCS6014

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**Course Learning Objectives**:

**(40 Hours)**

- To provide a student with an understanding of the fundamental principles in compiler design.
- To provide the skills needed for building compilers for various situations that one may encounter in a career in Computer Science.
- To cover programming in various tools like LEX and YACC for scanning and parsing etc.
- To provide student an understanding to build scanner, parser and semantic analyzer.

**Unit-I** **(8 Hours)**

**Introduction to Compiler**: Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, implementation of lexical analysers, LEX-compiler, Formal grammars and their application to syntax analysis, ambiguity, The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.

**Unit-II** **(8 Hours)**

**Basic Parsing Techniques**: Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, YACC tool.

**Unit-III** **(8 Hours)**

**Syntax-directed Translation:** Syntax-directed Translation schemes, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, Translation of simple statements and control flow statements, Type checking, Type conversions, Equivalence of type expressions, Overloading of functions and operations.

**Unit-IV** **(8Hours)**

**Symbol Tables**: Data structure for symbols tables, representing scope information.
**Run-TimeAdministration:** Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.

**Unit-V** **(8Hours)**

**Code Generation**: Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis

**TEXT BOOKS:**

**T1:**Aho, Sethi& Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education
**T2:**VRaghvan, "Principles of Compiler Design", TMH

**REFERENCE BOOKS:**

**R1:**Kenneth Louden," Compiler Construction", Cengage Learning.

**R2.** Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson Education.

**Course Learning Outcomes (CLO):** On completion of this course, the studentswill be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember and understand** the lexical, syntactic and semantic structures of advanced language features. | 1,2 Remembering, Understanding |
| CLO2 | **Understand** the lexical, syntactic and semantic analysis into meaningful phases for a compiler by **applying** the language translation. | 2,3 Understanding, Applying |
| CLO3 | **Demonstrate, Construct and analyze** a scanner, parser, and semantic analyzer without the aid of automatic generators. | 2,3,4 Understanding, Applying, Analyzing |
| CLO4 | **Creating** the structure and support required for compiling advanced language features by **analyzing** and **understanding** fully processed source code for a novel language into machine code for a novel computer. | 2,4,6 Understanding, Analyzing, Creating |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | | | | | | | | | | L | H | M | M | M |
| CLO2 | H | H | | | | | | | | | | L | H | M | M | M |
| CLO3 | H | H | | | M | L | L | | | | | L | H | M | M | M |
| CLO4 | H | H | | | M | | | | | | | L | H | M | M | M |

**H: High M: Medium L: Low**

# COMPILER DESIGN LAB
# BCS6515

**L T P C**
**0 0 2 1**

**Course Learning Objectives:**

- To implement Lexical Analyzer using Lex tool & Syntax Analyzer or parser using YACC Tool
- To implement NFA and DFA from a given regular expression
- To implement front end of the compiler by means of generating Intermediate codes.
- To implement code optimization techniques.

1. Write a program to check whether a string belongs to the grammar or not.
2. Practice of Lex of Compiler writing.
3. Write a LEX program to count number of printf and scanf from a given c program file and replace them with write and read respectively.
4. Write a program to check whether a grammar is left recursive and remove left recursion.
5. Write a program to remove left factoring
6. Write a program to compute FIRST and FOLLOW of non-terminals.
7. Write a program to check whether a grammar is Operator precedent. .
8. Practice of Yacc of Compiler writing.
9. Write a YACC program to recognize the grammer[$a^n b/n>0$] . Test whether the following string belongs to this grammer.
10. Write a YACC & LEX program to identify valid if and if-else statement.

**Course Learning Outcomes (CLO):**On completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** Lexical analyzer for given language using C and LEX tools. | 1,2 Remembering, Understanding |
| CLO2 | **Demonstrate, Construct** and convert BNF rules into YACC form to generate various parsers. | 2,3 Understanding, Applying |
| CLO3 | **Construct** Symbol table. | 3 Applying |
| CLO4 | **Analyze** machine code from the intermediate code forms. | 4 Analyzing |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | | | | | | | | | | L | H | M | M | M |
| CLO2 | H | H | | | | | | | | | | L | H | M | M | M |
| CLO3 | H | H | | | M | L | L | | | | | L | H | M | M | M |
| CLO4 | H | H | | | M | | | | | | | L | H | M | M | M |

**H: High M: Medium L: Low**

# COMPUTER NETWORKS
# BCS6001

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Learning Objectives:** **(40 Hours)**

- Understand state-of-the-art in network protocols, architectures, and applications.
- Build an understanding of the fundamental concepts of computer networking.
- Familiarize the student with the basic taxonomy and terminology of the computer networking area.
- Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
- Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

**Unit- I** **(8 Hours)**

**Introduction:** Networks, Internet, Network Components, Network Categories, Applications of Computer Networks

**Reference Models:** Concept of Layering, OSI Model, TCP/IP Protocol Suite, Functions of Layers

**Physical Layer:** Transmission Mode, Physical Topology, Multiplexing, Transmission Media, Switching

**Unit- II** **(8 Hours)**

**Data Link Layer:** Design Issues, Error Detection and Correction Techniques, Elementary Data Link Protocols, Sliding Window Protocols, Multiple Access Protocols, Ethernet, Connecting Devices

**Unit- III** **(8 Hours)**

**Network Layer:** Logical addressing, IPv4 Addresses, NAT, IPv6 Addresses, Internet Protocol, IPv4, IPv6, Internetworking, Internet Control Protocols, Routing Algorithms, Distance Vector Routing, Link State Routing, Routing in the Internet

**Unit- IV** **(8 Hours)**

**Transport Layer:** Process-to-Process Delivery, Transport Layer Protocols, UDP, User Datagram, TCP, TCP Segment, TCP Connection, Flow Control and Error Control, TCP Transmission Policy, Principles of Congestion Control, TCP Congestion Control, Quality of Service

**(8 Hours)**

**Unit- V**

**Application Layer:** Principles of Network Applications, WWW and HTTP, Non-Persistent and Persistent Connections, Cookies, Web Caching, File Transfer, Remote Logging, Electronic Mail in the Internet, Domain Name System,Security: Introduction, Cryptography and Cryptanalysis, Public Key Cryptography Algorithms, RSA Algorithm, DES, Authentication and Authorization

**TEXT BOOKS:**

T1. Tanenbaum, "Computer Networks", Fourth Edition, Pearson(ISBN: 9788177581652)
T2.Forouzan, "Data Communications and Networking", Fourth Edition, McGraw Hill(ISBN: 9780070634145)

**REFERENCES:**

R1.Kurose and Ross, "Computer Networking: A Top-Down Approach", Fifth Edition, Pearson(ISBN: 9788131790540)
R2.Trivedi, "Computer Networks", Oxford University Press(ISBN: 9780198066774)
R3. Black, "Computer Networks: Protocols, Standards and Interface", PHI (ISBN: 9788120310414)

R4. Gupta, "Data Communications and Computer Networks", PHI (ISBN: 9788120328464)
R5. Halsall and Kulkarni, "Computer Networking and The Internet" Fifth Edition, Pearson (ISBN: 97881775847

**Course Learning Outcomes(CLO):**On completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** different types of network Interfaces and their standards. | 1,2 Remembering, understanding |
| CLO2 | **Explain** and **identify** the importance of data communications and the Internet in supporting business communications and daily activities. | 2,3 understanding, Applying |
| CLO3 | **Understand, apply** and **analyze** data communications system layers and its functions. | 2,3,4 understanding, Applying, Analyzing |
| CLO4 | **Identify** the different types of network devices by **comparing** their functions while **evaluating** a network performance. | 3,4,5 Applying, Analyzing, Evaluating |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | | H | | | | H | | M | L | H | M | M | M |
| CLO2 | H | H | H | | H | | | | H | | M | L | H | M | M | M |
| CLO3 | H | H | H | | H | | | | H | | M | L | H | M | M | M |
| CLO4 | H | H | H | | H | | | | H | | M | L | H | M | M | M |

**H: High M: Medium L: Low**

# COMPUTER NETWORKS LAB

## BCS6501

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Learning Objectives:**

- To understand the working principle of various communication protocols.
- To analyze the various routing algorithms.
- To know the concept of data transfer between nodes.

**1.** WAP in Prolog to have an introduction of Prolog fundamentals: constants, predicates, arguments, variables.
**2.** WAP in Prolog to have an introduction of Tests, Backtracking.
**3.** WAP in Prolog to have an introduction of Recursion.
**4.** WAP in Prolog to have an introduction of State-Space Search: DFS,BFS
**5.** Write a program to implement supervised learning on IRIS Dataset using Bayes classifier.
**6-7.** Write a program to implement Genetic Algorithm to find out the optimal solution of different equation.
**8.** Write a program to implement Principal Component Analysis algorithm for dimensionality reduction.
**9.** Write a program to implement Nearest Neighbour classification technique.
**10.** Write a program to implement k-means clustering on IRIS Dataset.

**Course Learning Outcomes (CLO):** On completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy level |
|---|---|---|
| CLO1 | **Define** and **demonstrate** wired network from wireless with the Help of practical approach. | 1,2 Remembering, understanding |
| CLO2 | **Understand** and **apply** different protocol at different layers of a network and in different types of design of a network with the help of algorithms. | 2,3 understanding Applying |
| CLO3 | **Compare** and **estimate** the performance of various communication protocols. | 2,5 Understanding, Evaluating |
| CLO4 | **Apply** different routing algorithms for **analyzing** network performance. | 3,4 Applying, Analyzing |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | | H | | | | H | | M | L | H | M | M | M |
| CLO2 | H | H | H | | H | | | | H | | M | L | H | M | M | M |
| CLO3 | H | H | H | | H | | | | H | | M | L | H | M | M | M |
| CLO4 | H | H | H | | H | | | | H | | M | L | H | M | M | M |

**H: High M: Medium L: Low**

# MOOC: OPERATIONS RESEARCH
# BCS6004-DE2

**L T P C**

**3 0 0 3**

**Course Learning Objectives:** **(30 Hours)**

- The objective of this course is to acquaint the students with applications of operations research to business and industry. Decision - making is increasingly becoming more and more complex.
- This course exposes the students to the significance of various scientific tools and models that are available in operations research.

**Unit-I** **(6 Hours)**

Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem – Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables, big-M method, two-phase method, degeneracy and unbound solutions.

**Unit- II** **(6 Hours)**

Transportation Problem.Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method.

**Unit- III** **(6 Hours)**

Assignment model.Formulation.Hungarian method for optimal solution.Solving unbalanced problem.Traveling salesman problem and assignment problem.

**Unit- IV** **(6 Hours)**

Sequencing models. Solution of Sequencing Problem – Processing n Jobs through 2 Machines – Processing n Jobs through 3 Machines – Processing 2 Jobs through m machines – Processing n Jobs through m Machines.

**Unit- V** **(6 Hours)**

Dynamic programming.Characteristics of dynamic programming.Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems. Games Theory. Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game.

**TEXT BOOKS:**

**T1**. P. SankaraIyer, "Operations Research", Tata McGraw-Hill, 2008.
**T2**. A.M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 2005.

**REFERENCE BOOKS:**

**R1**. J K Sharma., "Operations Research Theory &Applications , 3e", Macmillan India Ltd, 2007.
**R2.**P. K. Gupta and D. S. Hira, "Operations Research", S. Chand & co., 2007.
**R3.** J K Sharma., "Operations Research, Problems and Solutions, 3e", Macmillan India Ltd.
**R4.** N.V.S. Raju, "Operations Research", HI-TECH, 2002.

**Course Learning Outcomes (CLO):**
On completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | Remember and understand the characteristics of different types Of decision-making environments and the appropriate decision taking approaches and tools to be used in each type. | 1,2 Remembering, understanding |
| CLO2 | Build and solve Transportation Models and Assignment Models. | 6,3 creating Applying |
| CLO3 | Identify and classify operational research models from the verbal description of the real system. | 3,4 Applying, Analyzing |
| CLO4 | Understand the mathematical tools that are needed to evaluate the optimisation problems. | 2,5 understanding, Evaluating |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | | H | | | | H | | M | L | H | M | M | M |
| CLO2 | H | H | H | | H | | | | H | | M | L | H | M | M | M |
| CLO3 | H | H | H | | H | | | | H | | M | L | H | M | M | M |
| CLO4 | H | H | H | | H | | | | H | | M | L | H | M | M | M |

**H: High M: Medium L: Low**

# COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES
# BCS6001-DE2

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**Course Learning Objectives:**

**(30 Hours)**

- To demonstrate understanding of numerical and statistical methods in support of the analysis, design and application for problem solving in the field of engineering and technology.
- To develop the mathematical skills of the students in the areas of numerical methods.
- To teach theory and applications of numerical methods in a large number of engineering subjects which require solutions of linear systems, finding eigen values, eigenvectors, interpolation and applications, solving ODEs, PDEs and dealing with statistical problems like testing of hypotheses.
- To lay foundation of computational mathematics for post-graduate courses, specialized studies and research.

**Unit-I** **(8 Hours)**

Introduction: Numbers and their accuracy, Computer Arithmetic, Mathematical preliminaries, Errors and their Computation, General error formula, Error in a series approximation. Solution of Algebraic and Transcendental Equation: Bisection Method, Iteration method, Method of false position, Newton-Raphson method, Methods of finding complex roots, Muller's method, Rate of convergence of Iterative methods, Polynomial Equations.

**Unit-II** **(7 Hours)**

Interpolation: Finite Differences, Difference tables Polynomial Interpolation: Newton's forward and backward formula Central Difference Formulae: Gauss forward and backward formula, Stirling's, Bessel's, Everett's formula. Interpolation with unequal intervals: Langrange's Interpolation, Newton Divided difference formula, Hermite's Interpolation

**Unit-III** **(8 Hours)**

Numerical Integration and Differentiation: Introduction, Numerical differentiation Numerical Integration: Trapezoidal rule, Simpson's 1/3 and 3/8 rule, Boole's rule, Waddle's rule. Solution of differential Equations: Picard's Method, Euler's Method, Taylor's Method, Runge-Kutta Methods, Predictor Corrector Methods, Automatic Error Monitoring and Stability of solution.

**Unit-IV** **(7 Hours)**

Statistical Computation: Frequency chart, Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves etc., Data fitting with Cubic splines, Regression Analysis, Linear and Nonlinear Regression, Multiple regression, Statistical Quality Control methods.

**Text Books:**

**1.** Raja Raman V, "Computer Oriented Numerical Methods", PHI, 3rd edition.
**2.**PradipNiyogi, "Numerical Analysis and Algorithms", TMH, 1st Edition. 3. Jain, Iyengar and Jain, "Numerical Methods for Scientific and Engineering Computations", New Age Int

**References:**

**1.** Gerald &Whealey, "Applied Numerical Analyses", AW

**Course Learning Outcomes (CLO):**
On completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | Remember and understand to analyze error for arithmetic and numerical stability analysis. | 1,2 Remembering, understanding |
| CLO2 | Apply knowledge of Statistical methods for solving real world problems. | 3 Applying |
| CLO3 | Apply and evaluate method of interpolation and extrapolation for prediction. | 3,5 Applying, Evaluating |
| CLO4 | Analyze and evaluate mean, median and mode for individual series. | 4,5 Analyzing Evaluating |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | | H | | | | H | | M | L | H | M | M | M |
| CLO2 | H | H | H | | H | | | | H | | M | L | H | M | M | M |
| CLO3 | H | H | H | | H | | | | H | | M | L | H | M | M | M |
| CLO4 | H | H | H | | H | | | | H | | M | L | H | M | M | M |

**H: High M: Medium L: Low**

# GEOGRAPHICAL INFORMATION SYSTEM
## BCS6002-DE2

| L | T | P | C |
|---|---|---|---|
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**Course Learning Objectives:** **(30 Hours)**

- To describe GIS, Major GIS software.
- To explain the components and functionality of a GIS and the differences between GIS and other information systems.
- To understand the nature of geographic information and explain how it is stored in computer (including map projection) and the two types of GIS data structure.
- To design and complete a GIS project (data capture, data storage and management, analysis, and presentation).

**Unit- I** **(6 Hours)**

**Introduction:** Define GIS, Origin of GIS, Importance of GIS, Why implement a GIS?, Applications of GIS, GIS in different disciplines, Map Layout, Coordinate Systems, Map Scales, Map Projections, Geometric Transformation.

**Unit- II** **(6 Hours)**

**Data models, Spatial Features &Data Structures:** Spatial data model - Raster, Vector; Representation of geographic information, Temporal Dimension.

**Unit- III** **(6 Hours)**

**Spatial database management systems:** Database Concepts, Fundamental of Database Elements, Database design, Encoding methods of data input: keyboard, manual digitizing, scanning and automatic digitizing methods, Electronic data transfer, GPS, remote sensing Data Editing: locations error, spatial data accuracy standards, topological and non- topological errors, Kinds of visual representations, Map Design, Map production.

**Unit- IV** **(6 Hours)**

**Spatial Analysis:** Map algebra, Raster and Vector overlay methods, Terrain modelling, spatial interpolation, Buffering and Neighbourhood function etc, Networks, Spatial relationship and Generalization.

**Unit- V** **(6 Hours)**

**Web Based GIS:** Introduction to Web Mapping Applications, Importance of Web Based GIS, OGC Standards, Map services.

**TEXT BOOKS:**

**T1.** Longley, P. A., Goodchild, M. F., Maguire, D. J., and Rhind, D. W., Geographic Information Systems and Science, 2nd Edition, John Wiley and Sons, 2005.
**T2.** Burrough, P. A., and McDonnell, R. A., Principles of Geographical Information Systems, 2nd Edition, Oxford University Press, 1998.
**T3.** Demers, M. N., Fundamentals of Geographic Information Systems, John Wiley & Sons, 3rd Edition, 2002.

**REFERENCE BOOKS:**

**R1.**Kang-tsung Chang, "Introduction to Geographic Information Systems", McGraw-Hill Book Company, 2006.
**R2.** Heather J. Campbell, "GIS and Organizations".

**Course Learning Outcomes(CLO):**

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

| Course Learning Outcomes | Description | Blooms Taxonomy Level |
|---|---|---|
| CLO1 | **Define** the geographic space with concepts and terms commonly used to **build** operating models in GIS. | **1,3** Remembering, Applying |
| CLO2 | **Understand** and **apply** some basic techniques to thematic mapping design and also to know where to find more information. | **1,2** Understanding, Remembering |
| CLO3 | **Develop** an **understanding** of informed and critical judgments by **analyzing** specific problems using GIS. | **3,4** Applying, Analyzing |
| CLO4 | **Select** methods to **compare** and **examine** images properly by spatial analysis. | **2,3,4** Applying, Understanding, Analyzing |

**Mapping of CLOs with PLOs & PSOs:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | | H | H | | H | | | | H | | M | L | | M | M | M |
| CLO2 | H | | H | | H | | | | H | | | L | H | M | M | M |
| CLO3 | M | H | M | | H | | | | M | | M | L | H | M | H | M |
| CLO4 | M | L | H | | M | | | | H | | M | L | H | M | H | M |

H: High M: Medium L: Low

# ARTIFICIAL INTELLIGENCE
## BCS6003 -DE2

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Learning Objectives:**

**(30 Hours)**

- To remember appreciation and understanding of both the achievements of AI and the theory underlying those achievements.
- To introduce the concepts of a Rational Intelligent Agent and the different types of Agents that can be designed to solve problems.
- To review the different stages of development of the AI field from human like behaviour to Rational Agents.
- To apply basic proficiency in representing difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing.
- To analyze the basic issues of knowledge representation and Logic and blind and heuristic search, as well as an understanding of other topics such as minimal, resolution, etc. that play an important role in AI programs.
- To introduce advanced topics of AI such as planning, Bayes networks.

**Unit-I** **(6 Hours)**

**Introduction:** Applications of Artificial Intelligence, Intelligent Agents, Computer vision, Natural Language Possessing.

**Unit-II** **(6 Hours)**

**Introduction to Search :** Searching for solutions, Solving problem by search strategies, Constraint Satisfaction Search, Informed search Strategies, Adversarial Search, Search for games, Alpha - Beta pruning.

**Unit-III** **(6 Hours)**

**Knowledge Representation &Reasoning:** Introduction to Knowledge Representation &Reasoning, Propositional and Predicate Logic, First Order Logic, Representing Knowledge in terms of rules, Statistical Reasoning, Basics of Fuzzy Logic, Markov chain, Hidden Markov Models (HMM),Bayesian Networks.

**Unit-IV** **(6Hours)**

**Machine Learning:** Supervised and unsupervised learning, Decision trees, Statistical learning models: Neural network, learning with complete data - Naive Bayes model, Genetic algorithm, Reinforcement learning,

**Unit-V** **(6 Hours)**

**Pattern Recognition :** Introduction, Design principles of pattern recognition system, Statistical, Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Support Vector Machine (SVM), K – means clustering.

**TEXT BOOKS:**

**T1.**Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", PearsonEducation.
**T2.** Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill

**REFERENCE BOOKS:**

**R1.** N.P. Padhy,Artificial Intelligence and Intelligence Systems,Oxford,2005
**R2.** Dan W. Patterson,Artificial Intelligence and Expert Systems,PHI.

**R3.** Neil C. Rowe,Artificial Intelligence through Prolog,SECOND,Prentice-Hall,1988

**Course Learning Outcomes(CLO):**

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

| Course Learning Outcomes | Description | Blooms Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** the problems that are amenable to solution by AI methods, and which AI methods maybe suited to solving a given problem. | **1,2** Remembering, Understanding |
| CLO2 | **Understand** and **apply** the state-of art in AI. | **2,3** Understanding, Applying |
| CLO3 | **Analyze** and **evaluate** the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them. | **4,5** Analyzing, Evaluating |
| CLO4 | **Apply** concept Natural Language processing to problems leading to **understanding** and **analyzing** cognitive computing. | **2,3,4** Applying, Understanding, Analyzing |

**Mapping of CO-PO/PSO:**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **H** | **L** | **M** | **L** | **-** | **L** | **L** | **L** | **M** | **M** | **L** | **L** | **L** | **-** | **-** | L |
| **CO2** | **M** | **H** | **M** | **-** | **M** | **-** | **L** | **-** | **-** | **M** | **L** | **L** | **-** | **-** | **H** | - |
| **CO3** | **M** | **M** | **H** | **M** | **-** | **-** | **L** | **-** | **-** | **-** | **M** | **M** | **-** | **H** | **M** | - |
| **CO4** | **H** | **M** | **M** | **M** | **H** | **-** | **-** | **-** | **-** | **-** | **M** | **M** | **M** | **H** | **-** | |

**H: High M: Medium L: Low**

# DIGITAL IMAGE PROCESSING
# BCS6001-DE3

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Learning Objectives:** **(30 Hours)**

- Remember the fundamental concepts of image processing.
- Understand the different Image enhancement techniques
- To demonstrate analytical tools and methods to the student which are currently used in digital image processing as applied to image information for human viewing.
- To create small image processing systems and they have the opportunity to explore the current topics in this area.

**Unit-I** **(6 Hours)**

**Introduction and Fundamentals:** Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.
Image Enhancement in Spatial Domain: Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian.

**Unit-II** **(6 Hours)**

**Image Enhancement in Frequency Domain:** Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Low-pass Filters; Sharpening Frequency Domain Filters – Gaussian High-pass Filters; Homomorphic Filtering.

**Unit-III** **(6 Hours)**

**Image Restoration:** A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering– Band-pass Filters; Minimum Mean-square Error Restoration.

**Unit-IV** **(6 Hours)**

**Color Image Processing:**Color Fundamentals, Color Models, Converting Colors to different models, Color Transformation, Smoothing and Sharpening, Color Segmentation.
Morphological Image Processing: Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening.

**Unit-V** **(6 Hours)**

**Image Compression:** Fundamentals, image compression models, Compression methods: Huffman coding, Golomb Coding, Arithmetic Coding, LZW coding, Run-Length coding, Symbol based coding.error-free compression, lossy predictive coding, image compression standards.
**Image Segmentation:**Fundamentals, Point, Line and edge detection. Thresholding: foundation, Basic Global Thresholding, Otsu's Method, Image smoothing to improve global thresholding.

**Text Books:**

**T1.** Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing', Pearson, Second Edition, 2004.
**T2.** Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson 2002.

**Reference Books:**

**R1.**Kenneth R. Castleman, Digital Image Processing, Pearson, 2006.
**R2.**Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB',Pearson Education, Inc., 2004.
**R3.**D,E. Dudgeon and RM. Mersereau, , Multidimensional Digital Signal Processing', PrenticeHallProfessional Technical Reference, 1990.
**R4.**William K. Pratt, , Digital Image Processing' , John Wiley, New York, 2002
**R5.**MilanSonkaetaI, 'IMAGE PROCESSING, ANALYSIS AND MACHINE VISION', Brookes/Cole, VikasPublishing House, 2nd edition, 1999.

**Course Learning Outcomes:**

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

| Course Learning Outcomes | Description | Blooms Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** principles and techniques of digital image processing in applications. | **1,2** Remembering, Understanding |
| CLO2 | **Apply** and **analyze** image processing algorithms. | **3,4** Understanding, Analyzing |
| CLO3 | **Understand, classify** and **examine** the image Segmentation techniques. | **2,3,4** Understanding, Analyzing, Applying |
| CLO4 | **Select and Design** Color image processing and its real world applications | **3,6** Applying, Creating |

**Mapping of CLOs with PLOs & PSOs**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | L | M | L | - | L | L | L | M | M | L | L | L | - | - | L |
| CLO2 | M | H | M | - | M | - | L | - | - | M | L | L | - | - | H | - |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CLO3** | **M** | **M** | **H** | **M** | **-** | **-** | **L** | **-** | **-** | **-** | **M** | **M** | **-** | **H** | **M** | **-** |
| **CLO4** | **H** | **M** | **M** | **M** | **H** | **-** | **-** | **-** | **-** | **-** | **M** | **M** | **M** | **H** | **-** | |

H: High M: Medium L: Low

# INFORMATION SECURITY AND CYBER LAW
# BCS6002-DE3

| L | T | P | C |
|---|---|---|---|
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**Course Learning Objectives:** **(30 Hours)**

- To understand importance of internet security. Course has covered its different aspects from business to research.
- To **understand** key terms and concepts in cyber law, intellectual property and cybercrimes, trademarks and domain theft.
- To **discover** how to protect personal data, securing simple computer networks, and safe Internet usage.
- To **identify** various approaches to secure networks,
- To **compare** and **contrast** various firewalls, intrusion detection systems, and intrusion prevention systems.

**Unit-I** **(6 Hours)**

**Introduction:** History of Information Systems and its Importance ,basics, Changing Nature of Information Systems, Need of Distributed Information Systems, Role of Internet and Web Services, Information System Threats and attacks, Classification of Threats and Assessing Damages Security Challenges in Mobile Devices, authentication Service Security, Confidentiality, Integrity Availability and other terms in Information Security.

**Unit-II** **(6 Hours)**

**Security Threats:** Security Threats to E Commerce, Virtual Organization, Business Transactions on Web, E Governance and EDI ,Physical Security- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factors in Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric Systems, Interoperability Issues, Economic and Social Aspects, Legal Challenges.

**Unit-III** **(6 Hours)**

Network Security- Basic Concepts, Dimensions, Perimeter for Network Protection, Network Attacks, Virtual Private Networks- Need, Use of Tunnelling with VPN, Authentication Mechanisms, Types of VPNs and their Usage, Security Concerns in VPN.

**Unit-IV** **(6Hours)**

**Security metrics-** Classification and their benefits Information Security & Law, Intellectual Property Right (IPR) , Patent Law, Copyright Law, Legal Issues in Data mining Security, Building Security into Software Life Cycle Ethics- Ethical Issues, Issues in Data and Software Privacy Cyber Crime Types & overview of Cyber Crimes

**Unit- V** **(6 Hours)**

**Information Technology Act 2000**:Information Technology Act-2000-1 (Sec 1 to 13), Information Technology Act-2000-2 (Sec 14 to 42 and Certifying authority Rules), Information Technology Act-2000-3 (Sec

43 to 45 and Sec 65 to 78), Information Technology Act-2000-4(Sec 46 to Sec 64 and CRAT Rules), Information Technology Act-2000-5 (Sec 79 to 90), Information Technology Act- 2000-6.

**TEXT BOOKS:**

**T1.**Godbole," Information Systems Security", Willey

**T2**. Merkov, Breithaupt," Information Security", Pearson Education

**REFERENCE BOOKS:**

**R1**. Schou, Shoemaker, " Information Assurance for the Enterprise", Tata McGraw Hill

**R2**. IT Act 2000

**Course Learning Outcomes:**

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

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **Understand** principles of web security | 1,2 Remembering, Understanding |
| CLO2 | **Develop** an **understanding** of Internet security issues and various cyber-crimes and laws to protect them. | 2,3 Understanding, Applying |
| CLO3 | **Analyzing** security threats and security metrics by **identifying** security procedures and policies. | 3,4 Applying, Analyzing |
| CLO4 | **Develop** an **understanding** of IT act and its **importance.** | 2,3,5 Understanding, Applying, Evaluating |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | | M | L | | | | | | L | H | M | M | M |
| CLO2 | H | H | H | | M | L | | | | | | L | H | M | M | M |
| CLO3 | H | H | H | | M | L | | | | | | L | H | M | M | M |
| CLO4 | H | H | H | | M | L | | | | | | L | H | M | M | M |

**H: High M: Medium L: Low**

# CRYPTOGRAPHY AND NETWORK SECURITY
# BCS6003DE-3

| L | T | P | C |
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**Course Learning Objectives:** **(40Hours)**

- Understand the basic concept of Cryptography and Network Security, their mathematical models.
- Apply various types ciphers, DES, AES, message Authentication, digital Signature, Network security, virus, worms and firewall.
- Analyze security issues, services, goals and mechanism.
- Apply mathematical foundation required for various cryptographic Algorithms.

**UNIT-I** **(08 Hours)**

**Introduction:** Security Goals, Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services and Mechanisms, A model for Internetwork Security, Euclidian Algorithm, Modular operator, Congruence, Additive inverse, Multiplicative Inverse, Cryptanalysis, Cipher and Types of Cipher, Substitution Cipher, Caesar Cipher, Affine Cipher, Mono-alphabetic and Polyalphabetic cipher.

**UNIT-II** **(08 Hours)**

**Symmetric key and Encryption:** Groups and Applications, Modern Block Ciphers, Component of Modern Bloch Ciphers, D Boxes, Straight D Boxes, Modern Stream ciphers, Encryption, Conventional Encryption Principles & Algorithms, Data Encryption Standard (DES), Des Structure, DES Function, DES Algorithm and key generation, Security of DES, Advanced Encryption Standard(AES), Criteria, Round Data Unit, Algorithm, Analysis of AES,RC4.

**UNIT-III** **(08Hours)**

**Cryptography:** Public key and Private key in Cryptography, Role of public key in cryptography, Cipher, Types of Cipher, Mode of Operation, Cryptography Algorithms (RSA, RABIN, ELGAMAL,Diffie-Hellman, ECC), Key Distribution, Approaches of Message Authentication, Hash Functions in cryptography.

**UNIT-IV** **(08 Hours)**

**Email and Web Security:** Pretty Good Privacy (PGP) and S/MIME.IP Security Overview, IP Security Architecture, Authentication Header, Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

**UNIT V** **(08 Hours)**

**Network Security**: Intruders, Viruses and related threats, Virus Countermeasures, Firewall Design principles, Trusted Systems, Intrusion Detection Systems.

**TEXT BOOKS:**

**T1.** William Stallings, “Network Security Essentials (Applications and Standards)”, Pearson Education, 2008.

**T2.** B. A. Forouzan, "Cryptography & Network Security", Tata McGraw Hill.

**REFERENCE BOOKS:**

**R1.**Douglas Stinson, "Cryptography Theory and Practice", 2nd Edition, Chapman & Hall/CRC.

**R2.**AtulKahate, Cryptography and Network Security, McGraw Hill.

**Course Learning Outcomes:**

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

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **Apply** various security aspects in today's scenario and improve E-Information. | 1,3 Remembering, Applying |
| CLO2 | **Understand** and **identify** the ethical issues related to the misuse of computer security. | 2,3 Understanding, Applying |
| CLO3 | **Develop** code and **create** new ways to implement a cryptographic algorithm or write an analysis report by **analyzing** existing security product. | 3,4,6 Applying Analyzing Creating |
| CLO4 | **Compare and Analyze** different digital signature algorithmsto achieve authentication and **create** secure applications. | 2,4,6 Understanding Analyzing Creating |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcome | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LO1 | LO2 | LO3 | LO4 | LO5 | LO6 | LO7 | LO8 | LO9 | LO10 | LO11 | LO12 | SO1 | SO2 | SO3 | SO4 |
| CLO1 | H | H | - | M | M | - | - | - | - | - | - | L | H | M | M | M |
| CLO2 | H | H | - | - | M | L | - | - | -- | - | - | L | H | M | L | M |
| CLO3 | H | M | H | M | M | H | L | - | - | - | - | L | H | M | H | H |
| CLO4 | H | H | - | - | M | - | - | - | - | - | - | L | H | M | H | M |

H: High M: Medium L: Low

# MOOC: CLOUD COMPUTING
# BCS6005DE-3

| L | T | P | C |
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**Course Learning Objectives:** **(30Hours)**

- To provide with the comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications.
- To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.
- To identify and analyzethe architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
- To explain the core issues of cloud computing such as security, privacy, and interoperability.

**Unit- I** **(6 Hours)**

**Understanding cloud computing**: Recent trends in computing: Grid computing, Cluster computing, Distributed computing, Cloud computing, Evaluation of Cloud Computing – History of Cloud Computing ,Advantages of Cloud Computing – Disadvantages of Cloud Computing, Companies in the Cloud Today

**Unit- II** **(6 Hours)**

**Cloud Computing Architecture :**Cloud Computing stack, Service models: Infrastructure as a service(Iaas),Platform as a service (Paas) ,Software as a service( SaaS) , Deployment Models, IaaS :Introduction to virtualization and different approaches of virtualization, Resource virtualization : server, storage, platform.

**Unit- III** **(6 Hours)**

**Developing cloud services**: Platform as a service(Paas) :Service oriented Architecture, Cloud platform and management : Computation and Storage, Examples: Google App Engine, Microsoft Azure, Software as a service(SaaS): Web Services ,Web 2.0,Web OS. Examples of Software as a service.

**Unit- IV** **(6 Hours)**

**Service Management in Cloud Computing:** Service level Agreements (SLAs), Billing and Accounting, Comparing scaling hardware : traditional vs cloud

**Cloud Security**: Infrastructure security, Data security and storage, Access control, Authentication in cloud computing

**Unit- V** **(6 Hours)**

**Cloud computing for everyone**: Centralizing Email Communications ,Collaborating on Schedules, Collaborating on To-Do Lists ,Collaborating Contact Lists ,Cloud Computing for the Community ,Collaborating on Group Projects and Events, Cloud Computing for the Corporation

**TEXT BOOKS:**

**T1.** Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

**T2.** Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011.

**REFERENCE BOOKS:**

**R1**Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

**R2**Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

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

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** the advantages and the potential applications of Cloud computing. | 1,2 Remembering, Understanding |
| CLO2 | **Develop** an **understanding** of cloud computing platforms | 2,3 Understanding, Applying |
| CLO3 | **Identify** and **analyze** the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc. | 3,4 Applying Analyzing |
| CLO4 | **Explain** and **examine** the core issues of cloud computing such as security, privacy, and interoperability. | 4,5 Analyzing, Evaluating |

## Mapping of CLOs with PLOs & PSOs

H: High M: Medium L: Low

| Course Learning Outcomes | PO-1 1 | PO-2 2 | PO-3 3 | PO-4 4 | PO-5 5 | PO-6 6 | PO-7 7 | PO-8 8 | PO-9 9 | PO-10 10 | PO-11 11 | PO-12 12 | PSO1 1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | H | L | M | L | H | L | M | - | L | L | - | L | H | L | L | M |
| **CO2** | H | H | H | H | M | M | L | - | L | M | M | L | - | L | L | - |
| **CO3** | M | M | H | M | - | - | L | - | - | - | L | L | - | H | M | - |
| **CO4** | M | H | M | L | H | - | - | - | - | - | L | L | - | L | L | |

# MACHINE LEARNING
# BCS6004-DE3

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**Course Learning Objectives:**
**Hours)**

- To make students aware of the current application areas of machine learning such as medical diagnosis, computer vision, face recognition etc.
- To remember appreciation and understanding of both the achievements of ML and the theory underlying those achievements.
- To review the different stages of development of the learning process from humans.
- To apply basic proficiency in representing difficult real life problems in a state space representation so as to solve them using ML techniques.

**Unit– I** **(07 Hours)**

**Machine Learning Foundations:** Overview, applications; Mathematical Foundations; Calculus, linear algebra, probability theory, statistics, Curse of dimensionality, Curve fitting, Decision theory, Information theory.

**Unit– II** **(08 Hours)**

**Supervised Learning:** Linear Methods, Regression; Linear Basis Function Models, Bayesian Linear Regression, Classification; Discriminant Functions, Generative vs. Discriminative models; Naive Bayes and Logistic Regression.

**Unit– III** **(10 Hours)**

**Supervised Learning:** Non-Linear Methods, Max-margin classification and optimization; Support Vector Machines, Kernel Methods; Dual optimization, kernel trick, Radial Basis Function Networks, Instance based learning; Nearest-neighbours, Neural Networks; Neural Network models, Feed-forward Network Functions, Network Training, Error Back propagation, Regularization in Neural Networks, Mixture Density Networks, Bayesian Neural Networks.

**Unit– IV** **(07 Hours)**

**Unsupervised Learning:** Clustering; Expectation-Maximization and k-means, EM and Clustering; Gaussian mixture models, TheEM Algorithm.

**Unit– V** **(08 Hours)**

**Graphical Models**: Bayesian networks and conditional independence, Markov Random Fields andExact inference, Sequential graphical models; Max Sum and Max Product, Hidden Markov Models and Conditional Random Fields.

**TEXT BOOK:**

**T1.** C.M.Bishop, "Pattern Recognition and Machine Learning", Springer.

**REFRENCE BOOKS:**

**R1**. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", Wiley.
**R2.** Tom Mitchell, "Machine Learning", McGraw Hill.

**Course Learning Outcome (CLO):**
On completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Define** an **understanding of** the statistical bases of classification theory and machine learning systems. | 1,2 Remembering, Understanding |
| CLO2 | **Analyse** and **formulate** the problem as a state space, graph, design heuristics and **select** amongst different search or game-based techniques to solve them through supervised and unsupervised learning methods. | 3,4,6 Applying, Analyzing, Creating |
| CLO3 | **Apply** supervised and unsupervised learning methods to **evaluate** real-world data. | 3, 5 Applying, Evaluating |
| CLO4 | **Develop** an **understanding** to **Create** graphical models. | 2,3,6 Understanding, Applying, Creating |

**Mapping of CLOs with PLOs & PSOs**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | | | | M | | | | | | L | | | H | M | |
| **CLO2** | | | | M | | | | | | | | | | L | | H |
| **CLO3** | | H | | | | M | | | L | | | | H | | | |
| **CLO4** | | | M | | | L | | | | H | | | | | | M |
| **CLO5** | M | | | | | | | | | | | | | L | | |

**H: High M: Medium L: Low**

# SOFT-SKILL AND INTERPERSONAL COMMUNICATION
# BSS6001

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**Course Learning Objectives:** **(24 Hours)**

Students will be able to:

- To enable the students to improve their communication skills.
- To introduce them to professional skills & personal skills.
- To train the students to be suitable for employment.

**Unit 1: Group Discussion** **(05 Hours)**

GD Skills, types of topics, roles and techniques: Skills required for and tested in a GD, types of topics discussed, role as initiator, mediator, etc. techniques of participation.

Practice & Analysis: GD practice on topical & contentious issues, analysis of performance.

**Unit 2: Goal Setting & SWOT** **(01 Hours)**

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Elements of Goal Setting, Goal setting for career, SWOT analysis, identify strengths for career & resume.

**Unit 3: Resume** **(01 Hours)**

Resume format, preparation, framing career objective & using appropriate vocabulary for the job requirements.

**Unit 4: Interview Skills** **(10 Hours)**

Aims and types of Interview, skype and telephonic interview & preparation of interview: Aims of interview, different types of interview, tips for skype and telephonic interview & how to prepare for an interview.

Interview etiquettes, skills & questions: Etiquette and body language during an interview, skills required for an interview & likely questions asked during an interview.

Telephonic & skype interview: Practice telephonic & Skype interview

**Unit 5: Communication Skills** **(05 Hours)**

Email Writing: Practice Email writing & correction.
Business & Cover letter writing: Writing business & cover letter.
Interpersonal Skills: What are interpersonal skills, how to develop them, their advantages.
Extempore speech: Making meaningful speech with modulation & confidence.
Written comprehension: Understanding a written passage & answering questions.

**Unit 6: Professional Skills** **(02 Hours)**

Adaptability: What is adaptability, how to develop it, advantages & applications.
Campus to Corporate: How to handle the first job, corporate etiquettes.

**TEXT BOOKS:**

**T1.** The Ace of Soft Skills- G Ramesh, Mhadevan Ramesh-2013 Edition

**T2.** Communication Skills for Engineers & Scientists- Sangeeta Sharma, Binod Mishra-2013 Edition

**REFERENCE BOOKS:**

**R1** Personality Development by Rajiv Mishra-2014 Edition

**Course Learning Outcomes (CLO):**

On completion of this course the students will be able to

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Explain** GD Skills **Demonstrate** the importance of GD Skills **Conclude and Compare** Importance, purpose, types, do's & don'ts , difference between GD& Debate. | 5,2,4<br>Explain, Demonstrate,Conclude, Compare, |
| CLO2 | **Evaluate** Goal setting & SWOT **HOW** to do SWOT **Apply** SWOT & Goal setting | 5, 1, 3<br>Evaluate, How, Apply |
| CLO3 | **Develop** resume, **List** various factors required for resume | 3, 4<br>Develop, List |
| CLO4 | **Explain** aim and types of interview. **Discuss** the various skills required for interview. **Demonstrate** body language during interview **Analyse** likely questions to be asked, **Organize** mock interview | 2,6,4,3<br>Explain, Discuss, Demonstrate, Analyse, Organize |
| CLO5 | **Illustrate** the importance of email writing, application writing, role play **Demonstrate** the format of email and application. **Evaluate** through practice of writing applications, emails, **Test** written and verbal communication skills | 2,5,6<br>Illustrate, Demonstrate, Evaluate, test<br>. |

**Mapping of CLOs with PLOs and PSOs:**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | - | M | M | - | - | M | L | - | H | L | H | M | M | M |
| CLO2 | H | H | - | - | M | L | - | M | H | - | H | L | H | M | L | M |
| CLO3 | H | M | H | M | M | H | L | M | L | - | H | L | H | M | H | H |
| CLO4 | H | H | - | - | M | - | - | M | H | - | H | L | H | M | H | M |

H: High M: Medium L: Low

# PROJECT-I
# BCS6516

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**Course Learning Objective:**

- To provide opportunities to understand basic concept of creating a project.
- To apply the capabilities in analyzing and solving Problems in designing a new project
- To analyze students with skills on development of project using project life cycle
- To discover and understand new idea in preparation of project

**Guidelines for Project Development:**

- If more than one student is working on same project then they should separate the work assigned from the project area which is relevant and which will contribute for completion of project.
- Weekly report of students work for finalization of his area of work and topic of project should be submitted to the faculty during designated hours meant for project.
- It is expected that the candidate prepares a report based on outcomes of literature studies, field visits, observation schedules, focus group meetings etc. related to aproblem in relevant technology area.
- The report shall be tested for any plagiarism out of books, journals and internet based articles and reports by appropriate web-based tool.

**Course Learning Outcome (CLO):** On completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Understand** the Concept to develop a project. | 2<br>Understanding, |
| CLO2 | **Identify** to troubleshooting. | 3<br>Applying |
| CLO3 | **Design** a model of software system. | 5<br>Creating |
| CLO4 | **Discover and understand** new idea in preparation of project | 2,4<br>Analyzing, Understanding |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | - | M | M | - | - | M | L | - | H | L | H | M | M | M |
| CLO2 | H | H | - | - | M | L | - | M | H | - | H | L | H | M | L | M |
| CLO3 | H | M | H | M | M | H | L | M | L | - | H | L | H | M | H | H |
| CLO4 | H | H | - | - | M | - | - | M | H | - | H | L | H | M | H | M |

H: High M: Medium L: Low

# SEMINAR
# BCS6505

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**Course Learning Objectives:**

Students will be able to:

- To Demonstrate skills in preparing detailed report describing the project and results.
- To Identify promising new directions of various cutting-edge technologies.
- To Examine the interpersonal & communication skills and awareness about the industrial environment.
- To Evaluate presentation skills in students.

**Guidelines for presenting a seminar:**

The seminar will consist of a typewritten report covering the topic related to his area of final year project.

- If more than one student is working on same project then they should separate the seminar topics from the project area which is relevant and which will contribute for completion of project.
- Weekly report of students work for finalization of his area of work and topic of seminar should be submitted to the faculty during designated hours meant for

seminar

- Format of weekly report should be finalized by the department with sufficient inputs received from the students. It should have following stage wise reports:
  - Project Area and Project Groups by 3rd week
  - Tentative seminar topics by 4th week
  - Literature/Field Study Mechanism identified sources and strategy by 5th week
  - Weekly report on Literature/Field Study 6th, 7th& 8th week.
  - Presentation Format contents & Trial Presentations to student groups $9^{th}$ ,$10^{th}$ week.
  - Journal on above stages and Final Presentation Report 11th week.
- It is expected that the candidate prepares a report based on outcomes of literature

studies, field visits, observation schedules, focus group meetings etc. related to a

problem in relevant technology area.

- The report shall be tested for any plagiarism out of books, journals and internet

based articles and reports by appropriate web-based tool.

- The candidate shall deliver seminar on the topic on first two occasions to students

of his class for peer assessment.

- Format for peer group assessment should be designed by the faculty with approval

of department. Peer assessment should not be given more than 15% weightage.

- Final presentation for term work should be attended by minimum TWO faculty

members. Each candidate may be given time minimum of 8 to 10 minutes.

- Assessment criteria for seminar delivery for term work should be designed by the

faculty with inputs received from students of the class. It should include provision

for peer group assessment as per the norm stated above.

- Assessment Criteria so designed will be displayed on the department notice board with the approval from department along with these guidelines.

**Course Learning Outcomes:**

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

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | To Demonstrate skills in preparing detailed report describing the project and results. | 1,2 Remembering, Understanding |
| CLO2 | To Identify promising new directions of various cutting-edge Technologies. | 2,3 Understanding, Applying |
| CLO3 | To Evaluate presentation skills in students. | 4,5 Analyzing Evaluating |
| CLO4 | To Develop presentation skills in students. | 5, 6 Evaluating Creating |

**Mapping of CLOs with PLOs & PSOs**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | - | M | M | - | - | M | L | - | H | L | H | M | M | M |
| CLO2 | H | H | - | - | M | L | - | M | H | - | H | L | H | M | L | M |
| CLO3 | H | M | H | M | M | H | L | M | L | - | H | L | H | M | H | H |
| CLO4 | H | H | - | - | M | - | - | M | H | - | H | L | H | M | H | M |

H: High M: Medium L: Low

# APTITUDE AND REASONING AND ONLINE TEST
# BAP6501

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**Course Learning Objectives: (24 Hours)**

Students will be able to:

- To enable the students to refine their mathematical, logical and analytical skills.
- To enhance their employability skills.
- To prepare the students for competition.
- To give them practice sessions to increase their speed and confidence.

**UNIT I (3 hours)**

**LOGICAL REASONING 1:** Cube Cuboid, Dice and Figure Problem, Venn diagram, Syllogism, Set Theory

**UNIT II (3 hours)**

**LOGICAL REASONING 2 :**Puzzle Test, Matrix, Sitting Arrangement, Statement, Binary Logic

**UNIT III (6 hours)**

**QUANTITATIVE APTITUDE 1 :**Mixture and Allegation, Ratio and Proportion, Problems on Ages, Time Speed and Distance, Problems on Boats and Trains, Geometry

**UNIT IV (6 hours)**

**QUANTITATIVE APTITUDE 2 :**Trigonometry, menstruation, algebra and linear and quadratic equations, simple and compound interest

**UNIT V (6 hours)**

**QUANTITATIVE APTITUDE 3 :**Permutation and Combination, Probability, Data Interpretation

## REFERENCE BOOKS:

R1. Dr. R S Aggarwal "Quantitative aptitude",S. Chand Publishing , 2018
R2. Dr. R S Aggarwal "A modern aproach to logical reasoning",S. Chand Publishing , 2018

**Course Learning Outcomes:**

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

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Identify** their weakness for various competitive exams their quantitative and reasoning skills. | 3 Apply |
| CLO2 | **Examine** their employability skills | 4 Analyze |
| CLO3 | **Develop** their Competitive skills | 6 Create |
| CLO4 | **Improve** their quantitative and reasoning skills. | 6 Create |

**Mapping of CO-PO/PSO:**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | | H | | M | | H | | | L | | | M | M | M | H | |
| CLO2 | | H | | M | | H | | | L | | | M | M | M | H | |
| CLO3 | | H | | M | | H | | | L | | | M | M | M | H | |
| CLO4 | | H | | M | | H | | | L | | | M | M | M | H | |

H: High M: Medium L: Low

# DATA SCIENCE
# BCS6703

L T P C
2 0 0 3

## Course Learning Objectives:

- Understand the evolution and relevance of data science in the world today.
- Explore end-to-end data science industry use cases using the data analytics lifecycle.
- Understand the scientific method for science projects, and the data science team key roles
- Acquire technical expertise using popular open source data science frameworks including Jupyter notebooks and Python.

**UNIT I: DATA SCIENCE LANDSCAPE**

Data Science Overview, Data Science Domains, Data Science Roles, Data Analytics in Practice, Data Analytics Methodologies, Data Science Method

**UNIT II: DATA SCIENCE ON THE CLOUD**

Integrated environment for Data Science projects, Cloud-based Data Science Lifecycle, Data Science capabilities on the cloud

**Unit III: EXPLORE AND PREPARE DATA**

Business understanding, Explore data, Prepare data, Understanding data, Statistics and representation techniques, Data transformation, Represent and transform unstructured data, Data transformation tools

**Unit IV: DATA VISUALIZATION AND PRESENTATION**

Decision-centered Visualization, Fundamentals of Visualizations, Common Graphs, Common Tools

**Unit V: DATA MODELING**

Overview of modeling techniques, Machine learning techniques, Accuracy, precision and recall, Model Deployment, About Machine Learning, From Regression to Neural Nets, Decision Tree Classifier, Machine Learning Framewor

**TEXT BOOKS:**

**T1.** Herbert Schildt, The Complete Reference, Java 2 (Fourth Edition) TMH.
**T2.** Michael R Blaha, James R Rambaugh, Object Oriented Design and Modeling with UML, (Second Edition) Pearson

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | Remember and Understand the evolution and relevance of data science in the world today. | Remembering, Understanding **1,2** |
| CLO2 | Remember and Understand the deployment of cloud. | Remembering, Understanding **1,2** |
| CLO3 | Analyze data by applying various machine learning algorithms. | 3,4 Applying Analyzing |
| CLO4 | Analyze and Evaluate data visualization. | **4,5** Evaluating, Analyze |

## Mapping of CLOs with PLOs & PSOs:

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | H | L | | | | L | M | H | H | M | M | H |
| CLO2 | H | H | H | M | H | L | | | | L | M | H | H | H | H | H |
| CLO3 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |
| CLO4 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |

**H: High M: Medium L: Low**

# DATA SCIENCE LAB
# BCS6703

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**Course Learning Objectives:**

- Acquire technical expertise using popular open source data science frameworks including Jupyter notebooks and Python.
- Gain a competitive edge using low-code cloud- based platform for data science - IBM Watson Studio
- Data engineering and data modeling practices using machine learning
- Explore data science industry case studies: transportation, automotive, human resources, aerospace, banking and healthcare
- Experience teamwork agile industry practices using design thinking.

**List of Experiments:**

## 1.ACCESSING IBM CLOUD

- Create an IBM Cloud Account
- Navigate the Catalog

## 2. EXPLORING AND PREPARING AUTO DATA

- Access IBM Cloud
- Provision Watson Studio Service
- Import automobile data

## 3. VALIDATING AUTOMOTIVE DATA

- Data Refinery
- Sort and filter data
- Review Frequency and statistics

### 4.DATA REFINERY VISUALIZATION

- Visualize preliminary data wrangling results
- Run summary statistics on the results

### 5. VISUALIZING AUTOMOTIVE DATA

- Create new project in Watson Studio
- Create Jupyter Notebook environment
- Import dataset into Pandas data frame
- Visualize data using Brunel

### 6.PREDICT HEART FAILURE

- Load patient data into Object Storage
- Create Apache Spark machine learning
- Train and evaluate a model
- Persist a model in a Watson ML repository

### 7.APPLY ML MODELS TO ATTRITION

- Create a new Watson Studio project
- Import data set from local drive
- Perform data cleansing and transformation
- Apply various machine learning models
- Conclude which model gives best prediction

**Text Book:**

- Machine Learning: The Art and Science of Algorithms that Make Sense of Data by Peter Flach
- Thinking with Data: How to Turn Information into Insights by Max Shron

**Reference Book:**

- Bayesian Reasoning and Machine Learning by David Barber

**Course Learning Outcomes (CLO):** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | Remember and Understand IBM Cloud. | Remembering, Understanding **1,2** |
| CLO2 | Remember and Understand data science visualization. | Remembering, Understanding **1,2** |
| CLO3 | Analyze systems by applying Machine learning algorithms. | 3,4 Applying Analyzing |
| CLO4 | Analyze and Evaluate data from real world. | 4,5 Evaluating, Analyze |

Mapping Of CO-PO/PSO

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | H | L | | | | L | M | H | H | M | M | H |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CLO2 | H | H | H | M | H | L | | | | L | M | H | H | H | H | H |
| CLO3 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |
| CLO4 | H | H | H | M | H | L | | | | L | M | H | M | M | H | H |

H: High M: Medium L: Low

# MOBILE APPLICATION DEVELOPMENT
# BCS7001 – DE4

**L T P C**

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**Course Learning Objectives:** **(40 Hours)**

- To introduce mobile application development for the Android platform. Android is a software stack for mobile devices that includes an operating system, middleware and key applications.
- To understand the tools and APIs necessary for developing applications on the Android platform using the Java programming language.
- To learn skills for creating and deploying Android applications, with particular emphasis on software engineering topics including software architecture, software process, usability, and deployment. Student should be good in java and basic XML.

**Unit- I** **(08 Hours)**

**Introduction**: History and Versions, Installing softwares, Android Software Stack, Android Emulator, AndroidManifest.xml, Activity, Activity Lifecycle, Hello World App., Intents

**Unit- II** **(08 Hours)**

**User Interface:** Button,Toast, Image Button, Toggle Button, Switch Button, CheckBox, Radio Buttons, RatingBar, DatePicker, TimePicker, ProgressBar, Toasts, Custom Toasts, AlertDialog Layout Manager: Relative Layout, Linear Layout, Table Layout, Grid Layout

**Unit- III** **(08 Hours)**

**Advanced User Interface:** ListViews, WebViews, ScrollView, TabHosts, **Android Menus**: Option Menu, Context Menu, Popup Menu, Fragments, Fragments Lifecycle, Dynamic Fragments, Notifications, Custom Notifications

**Unit- IV** **(08 Hours)**

**Data Storage:** Shared Preferences, File Access, SQLite Databases, Preferences activity, Cotent Provider, Contact Content Provider, Creating Custom Content Providers, Content Resolvers, Sharing Information from Custom Content Providers

**Unit- V** **(08 Hours)**

**Network:** Android Services, Android Service Life Cycle, Android Started Services, Android Bound Services, Working with Google Maps, Communication Web Services: HTTP Client, XML and JSON Services, Preparing for publishing, Signing and preparing the graphics, Publishing to the Android Market

**TEXT BOOK:**

- "Professional Mobile Application Development", Jeff McWherter, Scott Gowell,John Wiley & Sons, Inc

**REFERENCE**

https://www.coursera.org/course/android
http://developer.android.com/index.html
Video Lecture will be provided by University
http://www.tutorialspoint.com/android/

http://www.tutorialspoint.com/android/
http://www.vogella.com/tutorials/android.html

**Course Learning Outcomes:** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** business trends impacting mobile applications. | **1,2 Remember Understand** |
| CLO2 | **Develop** an **understand** characterization and architecture of mobile applications. | **2,3 Understand apply** |
| CLO3 | **lyze** enterprise scale requirements of mobile applications. | **4 Analyze** |
| CLO4 | **ıte** and **evaluate** Android applications, with particular emphasis on software engineering topics including software architecture, software process, usability, and deployment. | **4,5 Analyze Evaluate** |

**Mapping of CLOs with PLOs & PSOs**

| Course Learning Outcome | Program Learning Outcomes PLOs) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CLO1 | H | H | H | M | L | L | - | - | - | - | L | H | H | H |
| CLO2 | H | H | H | M | L | L | - | - | - | - | L | H | H | H |
| CLO3 | H | H | H | M | M | L | L | - | - | - | L | H | H | H |
| CLO4 | H | H | H | M | M | - | - | - | - | - | L | L | H | H |
| CLO5 | H | H | H | M | M | - | - | - | - | - | L | L | H | H |

**H: High M: Medium L: Low**

# PARALLEL ALGORITHM
# BCS7002- DE4

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**Course Learning Objectives:** **(40 Hours)**

- To study various design techniques and representative algorithms on shared memory and network models of parallel computation, and, possibly, a few emerging topics in distributed and network computing arena.
- To discuss algorithms for sorting, searching, selection, trees, graphs, data structures, etc.
- To analyze sequential programs and determine if they are worthwhile to parallelize.
- To develop, analyze, and implement algorithms for parallel computers.

**Unit- I** **(08 Hours)**

Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

**Unit- II** **(08 Hours)**

Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Cost- optimality, an example of illustrate Cost- optimal algorithms- such as summation, Min/Max on various models.

**Unit- III** **(08 Hours)**

Parallel Sorting Networks, Parallel Merging Algorithms on CREW/EREW/MCC, Parallel Sorting Networks on CREW/EREW/MCC/, linear array

**Unit- IV** **(08 Hour)**

Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.

**Unit- V** **(08 Hours)**

**Graph Algorithms** - Connected Graphs, search and traversal, Combinatorial Algorithms- Permutation, Combinations, Derangements.

**TEXT BOOKS:**

T1. Grama, " Introduction to Parallel Computing", Pearson Education

**REFERENCE BOOKS:**

R1. M.J. Quinn, "Designing Efficient Algorithms for Parallel Computer", McGrawHill.
R2. S.G. Akl, "Design and Analysis of Parallel Algorithms"
R3. S.G. Akl, "Parallel Sorting Algorithm" by Academic Press

**Course Learning Outcomes: After completion of this course, the students will be able to:**

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|

| | | |
|---|---|---|
| CLO1 | **ıember** and **understand** the role of computation models in parallel computation. | **1,2 Remember Understand** |
| CLO2 | **elop** an **understand** network models and the basics of merging and sorting networks. | **2,3 Understand Apply** |
| CLO3 | **ly** and **analyze** graph algorithms. | **3,4 Apply Analyze** |
| CLO4 | **uss** and **analyze** the PRAM and BSP models and their theoretical foundations. | **4,5 Analyze Evaluate** |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | - | M | L | - | - | - | - | - | L | H | M | M | M |
| CLO2 | H | H | H | - | M | L | - | - | - | - | - | L | H | M | M | M |
| CLO3 | H | H | H | - | M | L | - | - | - | - | - | L | H | M | M | M |
| CLO4 | H | H | H | - | M | L | - | - | - | - | - | L | H | M | M | M |

**H: High M: Medium L: Low**

# MICROPROCESSOR
## BEC7003- DE4

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**Course Learning Objectives:** **( 40 Hours)**

- To understand the internal architecture and organization of 8086.
- To analyze the assembly language programs of 8086.
- To evaluate the internal architecture and real time control of 8085.
- To remember the internal architecture and real time control of 8085 and 8086.

**Unit– I** **(08 Hours)**

**Introduction to Microprocessor:** Microprocessor architecture and its operations, Memory, Input & output devices, Logic devices for interfacing, The 8085 MPU, Example of an 8085 based computer, Memory interfacing.

**Unit– II** **(08 Hours)**

**ALU:** Additional data transfer and 16 bit arithmetic instruction, Arithmetic operations, related to memory, Logic operation: rotate, compare, counter and time delays, Illustrative program: Hexadecimal counter, zero-to-nine, (module ten) counter, generating pulse waveforms, debugging counter and time delay, Stack, Subroutine, Restart, Conditional call and return instructions, Advance subroutine concepts, The 8085 Interrupts, 8085 vector interrupts.

**Unit– III** **(08 Hours)**

**Basic interfacing concepts:** Interfacing output displays, interfacing input devices, Memory mapped I/O, Flow chart symbols, Data Transfer operations, Arithmetic operations, Logic Operations, Branch operation, Writing assembly language programs, Programming techniques: looping, counting and indexing.

**Unit– IV** **(08 Hours)**

**Program:** BCD-to-Binary conversion, Binary-to-BCD conversion, BCD-to-Seven segment code converter, Binary-to-ASCII and ASCII-to-Binary code conversion, BCD Addition, BCD Subtraction, Introduction to Advance instructions and Application, Multiplication, Subtraction with carry.

**Unit– V** **(08 Hours)**

**8255 Programmable peripheral interface:** Interfacing keyboard and seven segment display, 8254 (8253) programmable interval timer, 8259A programmable interrupt controller, Direct Memory Access and 8237 DMA controller. Introduction to 8086 microprocessor: Architecture of 8086 (Pin diagram, Functional block diagram, Register organization).

**TEXT BOOKS:**

**T1.** Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Penram International Publication (India) Pvt. Ltd.
**T2.** Douglas V. Hall, "Microprocessors and Interfacing", 2nd Edition, TMH, 2006.

**REFERENCE BOOKS:**

**R1.** Kenneth L. Short, "Microprocessors and programmed Logic", 2nd Ed, Pearson Education Inc.
**R2.** Kumar Umashankar, "The 8085 Microprocessor", Pearson Education.

**Course Learning Outcomes:** After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Blooms Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **outline** some of the characteristics of RISC and CISC architectures. | **1,2 Remember Understand** |
| CLO2 | **Understand** how to select an appropriate architecture or program design to apply to a particular situation. | **2,3 Understand Apply** |
| CLO3 | **Analyze** assembly language programs of moderate complexity. | **4 Analyze** |
| CLO4 | **Evaluate** the effects of the properties of the BUS on the overall performance of a system. | **5 Evaluating** |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | M | L | L | L | - | - | - | M | - | L | - | L | - | - | M |
| **CLO2** | L | H | M | - | M | - | L | - | - | M | M | - | - | - | H | - |
| **CLO3** | M | M | H | M | - | - | L | - | - | - | L | M | - | H | M | - |
| **CLO4** | H | H | M | M | H | - | - | - | - | - | L | M | - | H | - | - |

**H: High M: Medium L: Low**

# MOOC: REAL TIME SYSTEMS
# BCS7005DE4

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**Course Learning Objectives:** **(40 Hours)**

- To understand the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.
- To gain knowledge about various hardware and software tools used in real time systems.
- To understand and design real time operating systems which are backbone of embedded industry.
- To understand real-time scheduling and schedule ability analysis.

**Unit- I** **(08 Hours)**

**Introduction:** Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

**Unit- II** **(08 Hours)**

**Real Time Scheduling:** Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

**Unit- III** **(08 Hours)**

**Resources Sharing:** Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects.

**Unit- IV** **(08 Hours)**

**Real Time Communication:** Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols

**Unit- V** **(08 Hours)**

**Real Time Operating Systems and Databases:** Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Concurrency Control, Overview of Commercial Real Time databases

**TEXT BOOKS:**

**T1.** "Real Time Systems", Jane W. S. Liu, Pearson Education Publication.

**REFERENCE BOOKS:**

**R1.** Mall Rajib, "Real Time Systems", Pearson Education
**R2.** Albert M. K. Cheng, "Real-Time Systems: Scheduling, Analysis, and Verification" Wiley

Course Learning Outcomes: After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** the importance of real time systems and its applications. | **1,2 Remember Understand** |
| CLO2 | **Apply** and **examine** the engineering methods to complex engineering problem solving. | **3,4 Apply Analyze** |
| CLO3 | **Apply** and **analyze** the engineering techniques, tools and resources and systematic engineering synthesis and design processes. | **3,4 Apply Analyze** |
| CLO4 | **ess** knowledge of advanced computer science to analyze problems in computing and solve them. | **5 Evaluate** |
| CLO5 | **Propose** the experiments to analyze and interpret data. | **6 Create** |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcome | Program Learning Outcomes PLOs) | | | | | | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CLO1 | H | H | H | M | L | L | - | - | - | - | L | H | H | H |
| CLO2 | H | H | H | M | L | L | - | - | - | - | L | H | H | H |
| CLO3 | H | H | H | M | M | L | L | - | - | - | L | H | H | H |
| CLO4 | H | H | H | M | M | - | - | - | - | - | L | L | H | H |
| CLO5 | H | H | H | M | M | - | - | - | - | - | L | L | H | H |

**H: High M: Medium L: Low**

# DISTRIBUTED SYSTEMS
# BCS7004-DE4

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**Course Learning Objectives:** **(40 Hours)**

- To provide an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission.
- To understand, appreciate and apply parallel and distributed algorithms in problem solving.
- To discuss about the different communication operations and their benefits.
- To describe the different principle of message passing programming.

**Unit- I** **(08 Hours)**

**Characterization of Distributed Systems.** Examples of distributed systems, Resource sharing on the web, challenges.
**System Models:** Introduction, Architectural model fundamental model.
**Networking and Internetworking:** Types of network, Network Principles, Internet Protocols**.** Ethernet, WiFi, Bluetooth and ATM.

**Unit- II** **(08 Hours)**

**Inter-process Communication:** API for the internet protocols, External data representation and marshalling, client-server communication, Group communication, Inter-process communication.
**Distributed Objects and Remote Invocation:** Communication between distributed objects, Remote Procedure calls, Events and notifications, Java RMI, Sun network File system.

**Unit- III** **(06 Hours)**

**Operating System Support:** Operating system Layer, Protection, Processes and threads, Communication and Invocation, Operating system Architecture.
**Security:** Overview of security techniques, Cryptographic algorithms, Digital signatures, Cryptography pragmatics.

**Unit- IV** **(08 Hours)**

**Time and Global states:** Clocks, events and process states, synchronizing physical clocks, logical time and logical clocks.
**Coordination and agreement:** Distributed mutual exclusion, elections, multicast communication, consensus and related problems.

**Unit- V** **(10 Hours)**

**Transactions and concurrency control:** Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control.
**Distributed Transactions:** Flat and Nested transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.

**TEXT BOOKS:**

**T1** Distributed Systems Concepts and Design, G Coulouris, J Dollimore and T Kindberg, Third Edition, Pearson Education.
**T2** Distributed Operating Systems, Pradeep K. Sinha, PHI.

**REFERENCES:**

**R1** Advanced Concepts in Operating Systems, M Singhal, N G Shivarathri, Tata McGraw-Hill Edition.
**R2** Distributed Systems, S. Ghosh, Chapman & Hall/CRC, Taylor & Francis Group,2010.
**R3** Distributed Systems – Principles and Paradigms, A.S. Tanenbaum and M.V. Steen, Pearson Education.
**R4** Distributed Algorithms, N.A. Lynch, Elsevier.

Course Learning Outcomes: After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **ıember** and **understand** the importance and working style of a distributed system. | **1,2 Remember Understand** |
| CLO2 | **ıonstrate** and **apply** distributed algorithms to solve complex real-world problems. | **2,3 Understand Apply** |
| CLO3 | **lyze** and **evaluate** mechanisms such as client/server and P2P algorithms, remote procedure call (RPC/RMI), cloud computing. | **4,5 Analyze Evaluate** |
| CLO4 | **ıpare** and **discuss** the performance metrics of parallel and distributed programs. | **5, 6 Evaluate Create** |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | L | - | M | L | - | - | - | - | - | L | H | M | M | M |
| CLO2 | H | H | L | - | M | L | - | - | - | - | - | L | H | M | M | M |
| CLO3 | H | H | L | - | M | L | - | - | - | - | - | L | H | M | M | M |
| CLO4 | H | H | L | - | M | L | - | - | - | - | - | L | H | M | M | M |

**H: High M: Medium L: Low**

# DATA MINING AND DATA WAREHOUSING
## BCS7001-DE5

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Learning Objectives**: (40 Hours)

- To understand mathematical foundations of data mining tools, data mining theory and algorithms and their applications; Data visualization; concepts of Data warehousing.
- To understand the basic principles, concepts and applications of data warehousing and data mining.
- To introduce the task of data mining as an important phase of knowledge recovery process.
- To provide a good knowledge of the fundamental concepts that provide the foundation of data mining.

**Unit-I** **(10 Hours)**

Overview, Motivation, Data Mining-Definition & Functionalities, Data Preprocessing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection),Inconsistent Data, Data Integration and Transformation.

**Data Reduction**:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Clustering, Discretization and Concept hierarchy generation.

**Unit- II** **(10 Hours)**

**Concept Description**: - Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases. Measuring Central Tendency, Measuring Dispersion of Data, Graph Displays of Basic Statistical class Description, Mining Association Rules in Large Databases, Association rule mining, mining Single- Dimensional Boolean Association rules from Transactional Databases– Apriority Algorithm, Mining, Multilevel Association rules from Transaction Databases and Mining Multi-Dimensional Association rules from Relational Databases

**Unit- III** **(08 Hours)**

**Classification and Predictions**: Classification, Prediction and related issues, Decision tree, Bayesian Classification, Classification by Back propagation, Multilayer feed-forward Neural Network,
Back propagation Algorithm, Classification methods: K-nearest neighbor classifier, Genetic Algorithm.

**Cluster Analysis**: Data types in cluster analysis, Categories of clustering methods,
Partitioning methods. Hierarchical Clustering. Density Based Methods-DBSCAN, OPTICS. Grid Based Methods- STING, CLIQUE. Model Based Method –Statistical Approach, Neural Network approach, Outlier Analysis.

**Unit- IV** **(06 Hours)**

**Data Warehousing**: Overview, Definition, Delivery Process, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data Marting.

**Unit- V** **(06 Hours)**

Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse.

**TEXT BOOKS:**

**T1.**Jiawei Han, MichelineKamber, "Data Mining Concepts & Techniques" Elsevier

**REFERENCE BOOKS:**
**R1.**M.H.Dunham,"DataMining: Introductory and Advanced Topics" Pearson Education
**R2.** Pang-NingTan , Michael Steinbach, VipinKumar,"Introduction to data mining", Pearson education.

Course Learning Outcomes: After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** data processing algorithm in better context. | **1,2 Understand Remember** |
| CLO2 | **ssify** databases by **applying** data mining concepts. | **3,4 Apply Analyze** |
| CLO3 | **Apply** and **analyze** conceptual, logical, and physical design of data warehouses OLAP applications and OLAP deployment. | **3,4 Apply Analyze** |
| CLO4 | **mine** and **formulate** different data mining tool to access information from data warehouse. | **4,6 Analyze Create** |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | H | H | H | - | L | L | L | - | - | - | H | M | - | - | H |
| **CLO2** | H | H | H | H | - | L | - | L | L | L | - | H | H | - | - | L |
| **CLO3** | H | H | H | H | L | L | M | M | L | L | M | H | H | M | L | - |
| **CLO4** | H | M | H | H | H | L | - | L | H | M | H | H | H | H | H | M |

**H: High M: Medium L: Low**

# MOOC: SOFT COMPUTING
# BCS7005-DE5

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Learning Objectives**: **(40 Hours)**

- To introduce students to artificial neural networks and fuzzy theory from an engineering perspective
- To identify and describe soft computing techniques and their roles in building intelligent machines.
- To recognize the feasibility of applying a soft computing methodology for a particular problem.
- To develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.

**Unit- I** **(08 Hours)**

**Soft Computing:** Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non monotonic reasoning, forward Reasoning, backward reasoning, Weak & Strong Slot & filler structures, NLP.

**Unit- II** **(08 Hours)**

**Neural Network:** Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Widrow&Hebbs learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BBPA, momentum, limitation, characteristics and application of EBPA,

**Unit- III** **(08 Hours)**

Counter propagation network, architecture, functioning & characteristics of counter Propagation network, Hopfield/ Recurrent network, configuration, stability constraints, associative memory, and characteristics, limitations and applications. Hopfield v/s Boltzman machine. Adaptive Resonance Theory: Architecture, classifications, Implementation and training. Associative Memory.

**Unit- IV** **(08 Hours)**

**Fuzzy Logic:** Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations,
**Fuzzy systems:** crisp logic, fuzzy logic, introduction & features of membership functions,
**Fuzzy rule base system:** fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.

**Unit- V** **(08 Hours)**

**Genetic algorithm:** Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional method.

**TEXT BOOKS:**

**T1.** Fuzzy sets and Fuzzy logic by George Klir, Bo Yuan, PHI

**T2.** Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications by S. Rajsekharan, VijayalaxmiPai Elements of Artificial Neural Network by K. Mehrotra

**REFERENCE BOOKS:**

**R1.** Neural Networks, a comprehensive foundation By Simon Haykins

**R2.** Artificial Neural Networks by B. Yegnanarayana

Course Learning Outcomes: After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **nember** and **understand** soft computing techniques and their roles in building intelligent machines. | **1,2 Understand Remember** |
| CLO2 | **ly** fuzzy logic, genetic algorithms and reasoning to handle uncertainty and solve engineering problems. | **3 Apply** |
| CLO3 | **lyze** neural networks to pattern classification and regression problems. | **4 Analyze** |
| CLO4 | **lyze** and **evaluate** solutions by implementing various soft computing approaches for a given problem. | **4,5 Analyze Evaluate** |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | - | L | L | L | - | - | - | H | M | - | - | H |
| CLO2 | H | H | H | H | - | L | - | L | L | L | - | H | H | - | - | L |
| CLO3 | H | H | H | H | L | L | M | M | L | L | M | H | H | M | L | - |
| CLO4 | H | M | H | H | H | L | - | L | H | M | H | H | H | H | H | M |

**H: High M: Medium L: Low**

# SEMANTIC WEB AND WEB SERVICES
# BCS7002-DE5

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**(40 Hours)**

**Course Learning Objectives:**

- To teach students the concepts, technologies and techniques underlying and making up the semantic web.
- To develop an understanding of web graph processing for various applications such as search engine, community detection.
- To introduce technical architecture of the semantic web, and its integration with the World Wide Web.
- To apply common application vocabularies in use on the semantic web.

**UNIT I** **(8 Hours)**

Introduction to Semantic Web: History of Semantic Web, goals and vision, problems, Semantic Web Technologies, Layered Approach, Syntactic vs semantic web, Applications of semantic web.

**UNIT II** **(8 Hours)**

Architecture: XML with Document Type Definitions and Schema, addressing and querying XML documents, RDF (Resource Description Framework), basic idea and syntax, quering in RQL, URI

**UNIT III** **(8 Hours)**

Ontologies: Role of Ontology in intelligent information retrieval on web, OWL, Ontologies for different applications. Ontology engineering: constructing ontologies manually, reusing existing ontologies.

**UNIT IV** **(8 Hours)**

Semantics: Kinds of semantics, use of semantics, Search Engines: Role of search Engines in intelligent retrieval of information on web, Semantic web browsers.

**UNIT V** **(8 Hours)**

Logic and inference: examples of Monotonic rules: family relationships, monotonic rules: syntax and semantics, Non-monotonic rules: Motivation and syntax, Non-monotonic rule example: and Brokered Trade, Rule Mark-up XML: Monotonic and Non-Monotonic rules.

**TEXT BOOKS:**

**T1.** Salam, A. F., ed. Semantic Web Technologies and E-Business: Toward the Integrated Virtual Organization and Business Process Automation: IGI Global, 2006.
**T2.** Cardoso, Jorge, ed. Semantic Web Services: Theory, Tools and Applications: Theory, Tools and Applications. IGI Global, 2007

**REFERENCE BOOKS:**

**R1.** Antoniou, Grigoris, and Frank Van Harmelen. A semantic web primer. MIT press, 2004.
**R2.** Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph, Foundations of Semantic Web Technologies, CRC Press
**R3.** Daconta, Michael C., Leo J. Obrst, and Kevin T. Smith. The semantic web: a guide to the future of XML, web services, and knowledge management. John Wiley & Sons, 2003.

Course Learning Outcomes: After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** the semantic web Vision and technologies | **1,2 Remember Understand** |
| CLO2 | **Develop** an **understand** ontology. | **2,3 Understand Apply** |
| CLO3 | **Develop** an **understand** data web by analyzing web technologies. | **3,4 Apply Analyze** |
| CLO4 | **Discuss** and **explain** the concepts of web science, semantics of knowledge and resource, ontology. | **5,6 Evaluate Create** |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | - | L | L | L | - | - | - | H | H | - | - | H |
| CLO2 | H | H | H | H | - | L | - | L | L | L | - | H | H | - | - | L |
| CLO3 | H | H | H | H | L | L | M | M | L | L | M | H | H | M | L | L |
| CLO4 | H | M | H | H | H | L | - | L | H | M | H | H | H | H | H | M |

**H: High M: Medium L: Low**

# DATA COMPRESSION
# BCS7003-DE5

| L | T | P | C |
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**Course Learning Objectives:** **(40 Hours)**

- To know the importance of compression in our daily life and various ways of compressing the data using various tools available and complexity lying in the tools.
- To estimate the effect and efficiency of a data compression algorithm.
- To use lossless and lossy applications to compress data/multimedia.
- To learn how to design and implement compression algorithms.

**Unit- I** **(08 Hours)**

Compression Techniques: Loss less compression, Lossy Compression, Measures of prefonnance, Modeling and coding, Mathematical *Preliminaries* for Lossless compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes.

**Unit- II** **(08 Hours)**

The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression.

**Unit-III** **(08 Hours)**

Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression-The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress, Image Compression: The Graphics Interchange Format (GIF), Compression over Modems: V.42, bits, Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPE SYMBOL, length of context, The Exclusion Principle, The Burrows-Wheeler Transform: Move to-front coding, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding, Dynamic Markoy Compression.

**Unit-IV** **(08 Hours)**

Distortion criteria, Models, Scalar Quantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization.

**Unit-V** **(08 Hours)**

Advantages of Vector Quantization *over* Scalar Quantization, The Linde-Buzo-Gray Algorithm, Tree structured Vector Quantizers. Structured *Vector* Quantizers.

**TEXT BOOKS**:

**T1.** Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers
**T2.** Introduction to Data Compression, 3rd ed. by Khalid Sayood. ISBN-10: 0-12-620862-

**REFERENCE BOOKS:**

**R1.**Data Compression The Complete Reference, 4th ed. by David Salomon. ISBN-13: 978-1-84628-602-5

Course Learning Outcomes: After completion of this course, the students will be able to:

| Course | Description | Bloom's Taxonomy Level |
|---|---|---|

| Learning Outcomes | | |
|---|---|---|
| CLO1 | **nember** and **understand** image and video compression processes, overview of the modern compression standards. | **1,2**<br>**Remember**<br>**Understand** |
| CLO2 | **ntify** what new trends and what new possibilities of data compression are available. | **2,3**<br>**Understand**<br>**Apply** |
| CLO3 | **ntify** the basic software and hardware tools used for data compression. | **3**<br>**Understand** |
| CLO4 | **lyze** the operation of a range of commonly used coding and compression techniques. | **4**<br>**Analyze** |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | - | H | - | - | - | - | L | L | H | - | - | H |
| CLO2 | H | H | H | H | - | M | - | - | - | - | - | M | H | - | - | L |
| CLO3 | H | M | H | M | L | L | - | - | - | - | L | L | H | M | L | L |
| CLO4 | H | M | H | H | H | M | - | - | - | - | L | L | H | H | H | M |

**H: High M: Medium L: Low**

# MOBILE COMPUTING
# BCS7004-DE5

| L | T | P | C |
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**Course Learning Objectives:** **(40 Hours)**

- To make student learn about the working of current state of the art technologies in present mobile communication era as GSM, GPRS, Bluetooth and wireless LAN.
- To Introduce an advanced element of learning in the field of wireless communication.
- To introduce wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices.
- To understand the use of transaction and e-commerce principles over such devices to support mobile business concepts

**Unit- I** **(8 Hours)**

**Introduction**: A short history of wireless communication, Wireless transmission, Frequencies for radio transmission

**Multiplexing**: Space division multiplexing, Frequency division multiplexing, Time division multiplexing, Code division multiplexing, spread spectrum, Direct sequence spread spectrum, Frequency hopping spread spectrum, Cellular systems

**Unit- II** **(8 Hours)**

**Medium Access Control:** Motivation for a specialized MAC, Hidden and exposed terminals, near and far terminals, Carrier sense multiple access, Multiple access with collision avoidance

**Telecommunications Systems:**

GSM, Mobile services, System architecture, Radio interface, Localization and calling, Handover

**Unit- III** **(8 Hours)**

**Wireless LAN:** Infra red vs. radio transmission, Infrastructure and ad-hoc network, IEEE 802.11, System architecture, Physical layer, Medium access control layer, Bluetooth

**Unit- IV** **(8 Hours)**

**Mobile network layer:** Mobile IP: Goals, assumptions and requirements, Entities and terminology, IP packet delivery, Agent discovery, Registration, Tunneling and encapsulation

**Mobile ad-hoc networks:** Routing, Destination sequence distance vector, Dynamic source routing, Overview ad-hoc routing protocols.

**Unit- V** **(8 Hours)**

**Mobile transport layer:** Traditional TCP, Congestion control, Slow start, Fast retransmit/fast recovery, Implications of mobility ,Classical TCP improvements , Indirect TCP , Snooping TCP, Mobile TCP ,Wireless application protocol.

**TEXT BOOKS:**

**T1**. J. Schiller, Mobile Communications, Addison Wesley.

**REFERENCE BOOKS:**

**R1.** A. Mehrotra , GSM System Engineering.
**R2**. M. V. D. Heijden, M. Taylor, Understanding WAP, Artech House.
**R3**. Charles Perkins, Mobile IP, Addison Wesley.
**R4.** Charles Perkins, Ad hoc Networks, Addison Wesley**.**

Course Learning Outcomes: After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **ıember** and **understand** the characteristics and limitations of mobile hardware devices including their user-interface modalities | **1,2 Remember Understand** |
| CLO2 | **elop** an understanding of applications that are mobile-device specific and demonstrate current practice in mobile computing contexts. | **3 Apply** |
| CLO3 | **erstand** the functionality of mobile network layer by analyzing the layer architecture. | **2,4 Understand Analyze** |
| CLO4 | **ıde** and **create** context-aware solutions for mobile devices. | **5,6 Evaluate Create** |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | M | L | - | - | - | - | - | H | H | M | M | H |
| CLO2 | H | H | H | H | M | L | - | - | - | - | - | H | H | M | M | H |
| CLO3 | H | H | H | H | M | L | - | - | - | - | - | H | H | M | M | H |
| CLO4 | H | H | H | H | M | L | - | - | - | - | - | H | H | M | M | H |

**H: High M: Medium L: Low**

# SATELLITE COMMUNICATION
# BEC7305

**L T P C**
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**Course Learning Objectives:** **40 Hours**

- To understand of the characteristics of common orbits used by communications and other satellites, and their launching mechanism into those orbits.
- To understand the systems required by a communications satellite to function and the trade-offs and limitations encountered in the design of a communications satellite system.
- To understand the radio propagation channel for earth station to satellite and satellite to satellite communications links, and the basics of designing antenna systems to accommodate the needs of a particular satellite system.
- To understand the need of error detection and correction process implemented in satellite communication.

**UNIT I:** **(8 Hours)**

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

**UNIT II:** **(8 Hours)**

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

**UNIT III:** **(8 Hours)**

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift. Satellite link budget

**UNIT IV:** **(8 Hours)**

Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

**UNIT V:** **(8 Hours)**

Modulation and Multiple Access Schemes:Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

**TEXT /REFERENCE BOOKS:**

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India 2nd edition 2002
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

Course Learning Outcomes (CLO):After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Recall**, **Explain** and **Analyze** the characteristics of common orbits used by communications and other satellites, and their launching mechanism into those orbits. | **1, 2, 4 Remember Understand Analyze** |
| CLO2 | **Define**, **illustrate** and **develop** the systems required by a communications satellite to function and the tradeoffs and limitations encountered in the design of a satellite communication subsystem. | **1,2,3 Remember Understand Apply** |
| CLO3 | **Name, Describe** and **categorize** the radio propagation channel for Earth station to satellite and satellite to satellite communications links, and the basics of designing antenna systems to accommodate the needs of a particular satellite subsystem. | **1,2, 4 Remember Understand Analyze** |
| CLO4 | **Define** and **analyze** the need of error detection and correction process implemented in satellite communication. | **1, 4 Remember Analyze** |
| CLO5 | **Recall, Explain** and categorize Gain an understanding of various satellite systems. | **1,2, 4 Remember Understand Analyze** |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | | | | | | | | | | L | H | M | M | M |
| CLO2 | H | H | | | | | | | | | | L | H | M | M | M |
| CLO3 | H | H | | | L | L | L | | | | | L | M | L | M | L |
| CLO4 | H | H | | | | | | | | | | L | H | M | M | M |
| CLO5 | H | H | | | | | | | | | | H | L | L | L | L |

H: High M: Medium L: Low

# TOTAL QUALITY MANAGEMENT
# BME7304

**L T P C**
**3 0 0 3**

**Course Learning Objectives:** **(40 Hours)**

- To illustrate the philosophy and core values of Quality Management (QM).
- To list and examine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization.
- To apply and evaluate best practices for the attainment of total quality.
- To determine the quality of a product and develop model to show that if the process in control or out of control.

**UNIT-I** **(8 Hours)**

**Quality Concepts**

Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type.

**Control on Purchased Product**

Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure.

**Manufacturing Quality**

Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims.

**UNIT-II** **(7 Hours)**

**Quality Management**

Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme.

**Human Factor in Quality**

Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error and corrective methods.

**UNIT-III** **(9 Hours)**

**Control Charts**

Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts.

**Attributes of Control Charts**

Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart.

**UNIT-IV** **(8 Hours)**

**Defects Diagnosis and Prevention**

Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability.

**UNIT-V** **(8 Hours)**

**IS0-9000 and Concept of Quality Management:**

ISO 9000 series, zero defects, quality circle, JIT, Taguchi method

**TEXT BOOKS**

**T 1.** Lt. Gen. H.LaI, "Total Quality management", Wiley Eastern Limited, 1990. .

**REFERENCE BOOKS:**

**R1.** Greg Bounds. "Beyond Total Quality Management". McGraw Hill, 1994.

**R2**. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992

Course Learning Outcomes: After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Select** and **apply** appropriate techniques in identifying customer needs, as well as the quality impact that will be used as inputs in quality management methodologies. | **1,3 Remember Apply** |
| CLO2 | **List, apply** and **illustrate** the cost of poor quality and process effectiveness and efficiency to track performance quality and to identify areas for improvement | **1,2,3,4 Remember Understand Apply Analyze** |
| CLO3 | **Relate** and **identify** proven methodologies to enhance management processes, such as benchmarking and business process reengineering. | **1,2,3 Remember, Understand Apply** |
| CLO4 | **Choose** and **examine** frameworks to **show** the performance excellence of an organization. | **1,2,3,4 Remember Understand, Apply Analyze** |

**Mapping of CLOs with PLOs & PSOs**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | | | | H | M | | | | | M | L | H | L | M | M |
| CLO2 | H | | | | H | | | | | | L | L | H | M | M | M |
| CLO3 | H | | | | H | | | | | | L | L | H | M | M | M |
| CLO4 | H | | | | H | | | | | | M | L | H | L | M | M |

**H: High M: Medium L: Low**

# MOOC: BLOCKCHAIN ARCHITECTURE
# BCS-7305

**L T P C**
**3 0 0 3**

**Course Learning objectives:** **(40Hours)**

- To remember and understand basics of block chain architecture.
- To apply hash function and cryptography in securing digital transactions.
- To understand bitcoin and transactions in bitcoin network.
- To analyze and evaluate blockchain security.

**UNIT-I Introduction to Blockchain** **(08 Hours)**

What is Blockchain?, Public Ledgers, Blockchain as public ledgers, Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions Distributed Consensus, The Chain and the Longest Chain, Cryptocurrency to Blockchain 2.0.

**UNIT II: Basic Crypto Primitives** **(08 Hours)**

Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.

**UNIT-III Bitcoin** **(08 Hours)**

Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining.

**UNIT-IV Distributed Consensus** **(08 Hours)**

Why Consensus, Distributed consensus in open environments, Consensus in a Bitcoin network, Bitcoin Consensus, Proof of Work (PoW) – basic introduction, Hashcash PoW.

**UNIT-V: Blockchain Security** **(08 Hours)**

Security properties , Security considerations for Blockchain, Privacy in a Blockchain System, Privacy through Fabric Channels ,Smart Contract Confidentiality, SideDB Motivation.

**Textbooks:**

1.Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos

2. Blockchain by Melanie Swa, O'Reilly

3. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric

4. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits
https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

Course Learning Outcomes: After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** the detailed concept of blockchain technology. | **1,2 Remember Understand** |
| CLO2 | **Develop** an **understanding** of bitcoin and bitcoin networking. | **2, 3 Understand Apply** |
| CLO3 | **ly** hashing and cryptographic techniques to secure digital transactions. | **3 Apply** |
| CLO4 | **Analyze** and **evaluate** blockchain security. | **4, 5 Analyze Evaluate** |

**Mapping of CLOs with PLOs & PSOs**

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | M | H | H | L | H | H | H | M | M | H | H | - | - | M |
| CLO2 | H | H | H | H | H | L | H | H | H | M | M | H | M | H | - | - |
| CLO3 | H | H | M | H | H | L | H | H | H | M | M | H | - | H | - | M |
| CLO4 | H | H | H | H | H | L | H | H | H | M | L | M | M | H | - | - |

**H: High M: Medium L: Low**

# BIOLOGY
# BBT7010

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**Course Learning Objectives:** **(20 Hours)**

a. To acquaint students with the basic understanding of biological mechanisms of living organisms from the perspective of engineers.
b. To convey that all forms of life have the same building blocks and yet the manifestations are diverse.
c. To encourage engineering students to think about solving biological problems with engineering tools.

**UNIT I: Introduction** **(4 hours)**

Science and Engineering, Biology, Applications of Biology, Biological Classification, Kingdom Monera, Kingdom Protista, Kingdom Fungi, Kingdom Plantae, Kingdom Animalia, Viruses, The Basic Unit of Life, Cell, Basic Properties of Cells, Prokaryotic Cells, Eukaryotic Cells, Cell Cycle and Cell Division.

**UNIT II: Biochemistry** **(4 hours)**

Chemical Composition of Living Forms, Analysis of Chemical Composition, Carbohydrates, Amino acids and Proteins, Nucleic Acids, Lipids, Enzymes, Classification and Nomenclature of Enzymes, Co-Factors, Importance of Enzymes.

**UNIT III: Introduction to Metabolism** **(4 hours)**

Metabolism and Its Concepts, Metabolic Basis for Living—Anabolic and Catabolic Pathways, Concept of Non-Equilibrium and Steady State, Photosynthesis, Photorespiration, Factors Affecting Photosynthesis, Respiration, Glycolysis, Fermentation, Aerobic Respiration.

**UNIT IV: Genetics and Transfer of Genetic Information** **(4 hours)**

Mendel's Laws of Inheritance, Gene Interaction, Multiple Alleles, Chromosomal Theory of Inheritance, Linkage, Recombination (Crossing Over), Chromosome Mapping, Genetic Disorders, Nucleic Acid, Central Dogma of Molecular Biology, Replication of DNA, Types of RNA, Transcription, Genetic Code, Translation, Regulation of Gene Expression.

**UNIT V: Microbiology and Its Industrial Applications** **(4 hours)**

Microorganisms, Classification of Microorganisms Growth Kinetics, Culture Media, Sterilization Techniques, Microscopy, Applications of Microbiology, Immunology and Immunity, Cancer Biology, Stem Cell.

**TEXT BOOKS:**

1. Biology for Engineers: As per Latest AICTE Curriculum, Wiley Editorial, 2018.
2. Thyaga R.S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Richard W., Thilagaraj, Barathi S and Jaganthan M.K. 2012. "Biology for Engineers". Tata McGraw-Hill, New Delhi.

**REFERENCE BOOKS**

1. Nelson D.L., Lehninger A.L and Cox M.M. 2008. Lehninger Principles of Biochemistry. 5th Edition. W. H. Freeman, 2008.
2. Watson J.D. 2011. Molecular Biology of Gene. Pearson Education.

**Course Learning Outcomes (CLO): After completion of this course, the students will be able to:**

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Understand** the basic organization of organisms and living being. | **2 Understand** |
| CLO2 | **Analyze** the machinery of the cell that is ultimately responsible for various daily activities. | **4 Analyze** |
| CLO3 | **Solve** different biological problems with engineering expertise to solve them. | **3 Apply** |
| CLO4 | **List** the applications of microbiology in industries. | **1 Remember** |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | | | M | H | | | | | | | M | H | L | L | L | M |
| CLO2 | | H | H | | M | H | M | M | | M | | | M | M | M | H |
| CLO3 | H | | | | H | | H | | L | | | L | M | L | L | H |
| CLO4 | H | H | M | | | | | | | | | | L | L | M | H |

**H: High M: Medium L: Low**

# PROJECT-II
# BCS 7507

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**Course Learning Objectives:**

- To gain hands on experience on innovative technology project.
- To encourage the students to find new solution of current problems in real life scenario.
- To prepare the students to solve/work on the real world/practical problems involving issues in software engineering

Course Learning Outcomes (CLO): After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Demonstrate** and execute well defined objective. | **2**<br>**Understand** |
| CLO2 | **Organize** work in team at component level and system level. | **3**<br>**Apply** |
| CLO3 | **Evaluate** reuse-or integrate with-existing components. | **5**<br>**Evaluate** |
| CLO4 | **Build** the performance metrics and **analyze** assess quantitatively the performance of system. | **4,6**<br>**Analyze**<br>**Create** |

Mapping Of CO-PO/PSO

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | - | M | M | - | - | M | L | - | H | L | H | M | M | M |
| CLO2 | H | H | - | - | M | L | - | M | H | - | H | L | H | M | L | M |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CLO3** | H | M | H | M | M | H | L | M | L | - | H | L | H | M | H | H |
| **CLO4** | H | H | - | - | M | - | - | M | H | - | H | L | H | M | H | M |

# SUMMER TRAINING
# BCS7503

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| 0 | 0 | 2 | 1 |

**Course Learning Objectives:**

- To understand various systems, their characteristics and practical.
- To acquire practical experience within the business environment.
- To acquire knowledge of the industry in which the internship is done.
- To apply knowledge and skills learned in the classroom in a work setting.

**Week 1**

- Submission of training certificates
- Discussion about layout/guidelines for presentations

**Week 2**

- Distributions of detailed presentation schedule
- Discuss about layout/guidelines for report preparation

**Week 3-8**

- Oral presentations (5 to 10 minutes) by each student about their formal/informal experience of visit.

**Week 9-11**

- Submission of Report
- Detailed presentation (20 to 30 minutes) by each student
- Feedback and suggestions should be given to the students based on their report and presentations.

**Week 12-14**

- Submission of report (after modification, if needed)
- Final presentation by Students (in case of repetition)

Course Learning Outcomes (CLO): After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** a greater **understanding** about career options while more clearly defining personal career goals. | **1,2 Remember, Understand** |
| CLO2 | **Identify** areas for future knowledge and skill development. | **3 Apply** |
| CLO3 | **lyze** and refine oral and written communication skills. | **4 Analyze** |
| CLO4 | **Discuss** the activities and functions of business professionals. | **6 Create** |

## Mapping of CO-PO/PSO:

| Course Learning Outcomes | Program Learning Outcomes PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | H | H | H | H | - | - | H | H | H | H | H | M | M | M |
| CLO2 | H | H | H | H | H | - | - | - | H | H | M | L | H | M | M | M |
| CLO3 | - | - | - | - | - | - | - | - | H | H | - | - | H | M | M | M |
| CLO4 | - | - | H | H | - | - | - | - | - | - | - | H | H | M | M | M |

**H: High M: Medium L: Low**

# ARTIFICIAL INTELLIGENCE AND DEEP LEARNING
# BCS7702

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|---|---|---|---|
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**Course Learning Objectives**: **(40 Hours)**

- Understand theevolutionandrelevanceofAI inthe world today.
- Explore opportunities brought by the intersection between human expertiseand machine learning.
- Analyze existing and future implementations of AI solutions across multiple industries including: automotive, education, policy, socialmedia,government,consumer,and others.
- Gainacompetitiveedgeusinglow-code cloud-basedAItoolsandpre-builtmachine learning algorithms.
- Understand AI technology building blocks, including: natural language processing, machine and deep learning, neural networks, virtual agents, autonomics and computer vision.

**Unit-I** **(08 Hours)**

**AI LANDSCAPE AND APPROACHES**

AI impact in the world today, History and Evolution of AI, AI Explained, AI Technologies, AI IndustryImpact Autonomous Vehicles, Smart Robotics, Future Workforce and AI

**Unit- II** **(08 Hours)**

**NATURAL LANGUAGE UNDERSTANDING**

NLP Overview, NLP Explained, Virtual AgentsOverview, Virtual Agents for the Enterprise, Computer Vision Overview, AI Vision through Deep Learning, Computer Vision for the Enterprise, Experiments

**Unit- III** **(08 Hours)**

**MACHINE LEARNING AND DEEP LEARNING**

MachineLearning Explained, Deep LearningExplained, Deep learningecosystem, Experiments, Artificial IntelligenceTrends, Limits of machine and human, AI predictions in the next 5 years

**Unit- IV** **(08 Hours)**

**NEURAL NETWORKS**

Why Deep Learning? What is a neural network?, Three reasons to go Deep, Deep Net, An old problem: The Vanishing Gradient, Restricted Boltzmann Machines, Deep Belief Nets, Convolutional Networks, Recurrent Nets, Autoencoders, Recursive Neural Tensor Nets, Deep Learning Platform, H2O.ai, Dato Graph Lab ,Deep Learning Library, Theano, Caffe, Tensor Flow, Linear Regression, Nonlinear Regression, Logistic Regression, Activation Functions

**Unit- V** **(08 Hours)**

**CNN AND RNN MODEL**

CNN History, Understanding CNNs, CNN Application, Intro to RNN Model, Long Short-Term memory (LSTM),Recursive Neural Tensor Network Theory, Recurrent Neural Network Model, Applications of Unsupervised Learning, Restricted Boltzmann Machine, Collaborative Filtering with RBM, Introduction to Autoencoders and Applications, Autoencoder, Deep Belief Network.

**TEXT BOOKS:**

1.IBM Skills Academy.

Course Learning Outcomes: After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **nember** and understand the evolution and relevance ofAI in the world today. | **1,2 Remember Understand** |
| CLO2 | **)evelop** an understanding by Exploring opportunities brought by the intersection between human expertiseand machine learning. | **2 understanding** |
| CLO3 | **Apply** and **analyze** existing and future implementations ofAI solutionsacrossmultipleindustries | **3,4 Apply Analyze** |
| CLO4 | derstanding and evaluating AI technology building blocks, including: natural language processing, machine and deep learning, neural networks, virtual agents, autonomics and computer vision. | **2,5 Evaluate understand** |

Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | H | H | H | M | M | L | - | - | - | - | - | L | H | M | M | M |
| **CLO2** | H | H | H | - | M | L | - | - | -- | - | - | L | H | M | L | M |
| **CLO3** | H | M | H | M | M | H | L | - | - | - | - | L | H | M | H | H |
| **CLO4** | H | H | H | - | M | L | - | - | - | - | - | L | H | M | H | M |

**H: High M: Medium L: Low**

# ARTIFICIAL INTELLIGENCE AND DEEP LEARNING LAB
# BCS7702

| L | T | P | C |
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**Course Learning Objectives:**

Understand AI technology building blocks, including: natural language processing, machine and deep learning, neural networks, virtual agents, autonomics and computer vision.

Develop a deeper understanding of machine learning techniques and the algorithms that power those systems.

Learn in-demand agile industry practices for design thinking and AI through an end-to-end industry use case experience.
Engage in role-playing challenge-based scenarios to propose real-world solutions to different industries using AI and design thinking

**List of Experiments:**

1. SETTING UP YOUR CLOUD ACCOUNT

   a. Obtain an IBM cloud account
   b. Apply promotion code

2. INFERRING AGE FROM PHOTOS WITH AI

   c. Create a Node-RED account
   d. Populate Node-RED canvas
   e. Run face recognition web page

3. CREATING AN AI VIRTUAL ASSISTANT

   - Create a dialog skill
   - Create a virtual assistant
   - Load virtual assistant with various dialog skills
   - Integrate your assistant

4. INTELLIGENT SEARCHES ON AIRBNB

   - Create Discovery Service
   - Create data collection
   - Upload and enrich data
   - Explore Negative Sentiments
   - Work with Discovery API (Optional)

5. BUILDING YOUR OWN TRANSLATOR WITH AI

   - Construct a Node-RED flow
   - Create a Telegram bot
   - Create a translator dialog using Watson services
   - Integrate Node-RED with Telegram

6. ANALYZE, CLASSIFY, & DETECT OBJECTS

- Use the General pre-trained classifier to identify objects in an image
- Build custom classifier to better suit your specific images
- Detect objects within an image

7. CLASSIFYING IMAGES USING NODE-RED

- Provision a Node-RED boilerplate
- Import the Node-RED flow
- Install zip node from Manage Palette menu
- Connect your node-RED app with Visual Recognition service

8. Deep Learning USE Cases

Course Learning Outcomes: After completion of this course, the students will be able to:

| Course Learning Outcomes | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **member** and understand the evolution and relevance of AI in the world today. | **1,2 Remember Understand** |
| CLO2 | **elop** an understanding by Exploring opportunities brought by the intersection between human expertise and machine learning. | **2 understanding** |
| CLO3 | **Apply** and **analyze** existing and future implementations of AI solutions across multiple industries | **3,4 Apply Analyze** |
| CLO4 | nderstanding and evaluating AI technology building blocks, including: natural language processing, machine and deep learning, neural networks, virtual agents, autonomics and computer vision. | **2,5 Evaluate understand** |

**Mapping of CLOs with PLOs & PSOs**

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | **H** | M | - | M | M | - | - | - | H | - | M | L | H | M | M | L |
| **CLO2** | **H** | H | - | L | M | L | - | - | L | - | M | L | H | M | L | L |
| **CLO3** | **H** | M | H | M | H | H | - | - | - | - | H | L | H | M | M | L |
| **CLO4** | **H** | H | - | M | M | - | - | - | M | - | M | L | H | M | H | L |

**H: High M: Medium L: Low.**

# EMBEDDED SYSTEMS
## BCS8001- DE6

| L | T | P | C |
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**Course Learning Objectives:** **(40 Hours)**

- To understand various systems, their characteristics, Digitization methods, controlling the flow of data, various methods for encoding and decoding the data.
- To identify and synthesis of solutions for embedded system problems.
- To design on embedded platforms.
- To execute and evaluate experiments on embedded systems.
- To perform analysis, design and testing of systems that includes both hardware and software.

**Unit-I:** **(8 Hours)**
Introduction to embedded systems: Classification, Characteristics and requirements.

**Unit-II:** **(8 Hours)**
Timing and clocks in Embedded systems, Task Modeling and management, Real time operating system issues.

**Unit-III:** **(8 Hours)**
Signals, frequency spectrum and sampling, digitization (ADC, DAC), Signal Conditioning and Processing , Modeling and Characterization of Embedded Computation System.

**Unit-IV:** **(8 Hours)**
Embedded Control and Control Hierarchy, Communication strategies for embedded systems, Encoding and Flow control.

**Unit-V:** **(8 Hours)**
Fault-Tolerance Formal Verification.

**TEXT BOOKS:**

**T1.**H.Kopetz, “Real-Time Systems”, Kluwer, 1997.

**REFERENCE BOOKS:**

**R1.**R.Gupta, “Co-synthesis of Hardware and Software for Embedded Systems”,Kluwer 1995.

**Course Learning Outcomes:** On Completion of this course, the student will be able to:

| CLO | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember and Understand** the modern hardware/software tools for building prototypes of embedded systems. . | 1,2 Remembering , Understanding |
| CLO2 | **nderstand** and **apply** design methodologies for embedded systems | 2,3 Understanding, Applying |
| CLO3 | **nalyze and appraise** the considerations of embedded systems design specification; technological choice; development process and fundamental building blocks of such systems (sensors, actuators, convertors, processors, intra- and inter-communication networks). | 4,5 Analyzing, Evaluating |
| CLO4 | **esigning** and **Testing** embedded system tools for both hardware and software. | 6 Creating |

**Mapping of CLO-PLO/PSO**

| Course Learning Outcomes | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 | PLO 8 | PLO 9 | PLO 10 | P0 11 | PLO 12 | PSO 1 | PS0 2 | PS0 3 | PS0 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | M | M | L | L | - | L | L | - | - | - | H | M | L | L | H |
| CO2 | H | M | M | L | L | L | - | - | L | L | - | H | H | M | M | L |
| CO3 | M | H | M | M | M | L | M | M | L | L | M | M | H | M | M | |
| CO4 | H | M | H | M | H | L | - | L | H | M | H | H | H | H | H | M |

**H: high, L: Low, M: Medium**

# NEURAL NETWORK
## BCS8002- DE6

| L | T | P | C |
|---|---|---|---|
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**Course Learning Objectives:** **(40 Hours)**

5. To remember the basic knowledge about the key algorithms and theory that forms the foundation of machine learning and computational intelligence.
6. To understand the principles, advantages, limitations and possible applications of machine learning.
7. To apply practical knowledge of machine learning algorithms and methods.
8. To evaluate and apply the appropriate machine learning techniques for classification, pattern recognition, and optimization.

**Unit- I** **(8 Hours)**
**Introduction:** Why Neural Networks, What Is a Neural Net, Where Are Neural Nets Being Used, How Are Neural Networks Used, the McCulloch-Pitts Neuron: Architecture, Algorithm, Applications
**Neural Nets for Pattern Classification:** Architecture, Biases and Thresholds, Linear Separability, Data Representation

**Unit- II** **(8Hours)**
**Perceptron, Adaline, Madaline:** Architecture, Algorithm, Application
**Pattern Association:** Training Algorithms for Pattern Association, Hetero associative Memory Neural Net, Auto associative Net

**Unit- III** **(8Hours)**
**Neural Networks Based on Competition:** Fixed-Weight Competitive Nets, Kohonen Self-Organizing Maps, Learning Vector Quantization

**Unit- IV** **(8Hours) Back**
**Propagation Neural Network:** Architecture, Algorithm, Applications, Alternative Activation Functions, Number of Hidden Layers, Multilayer Neural Nets as Universal Approximators.

**UNIT- V** **(8 Hours)**
**Other Neural Nets:** Fixed Weight Nets for Constrained Optimization, Boltzmann Machine, Continuous Hopfield Net, Gaussian Machine, Simple Recurrent Net, Neocognitron

**TEXT BOOKS:**
**T1.** LaureneFausett, "Fundamentals of Neural Network", Perason Education

**REFERENCE BOOKS:**
R1. J.A. Anderson, "An Intoduction to Neural Networks", MIT
R2. Hagen Demuth Beale, "Neural Network Design, Cengage Learning"R.L. Harvey, Neural Network Principles, PHI
R3. Kosko, "Neural Network and Fuzzy Sets", PHI

**Course Learning Outcomes (CLO):** On Completion of this course, the student will be able to:

| CLO | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **nember** and **understand** the basic structure of neural network and deep learning. | 1,2 Remembering, Understanding |
| CLO2 | **lerstand** the problems of real world and **identify** solutions involve in designing a good model for solving a problem. | 2,3 Understanding, Applying |
| CLO3 | **lyze** and **apply** the statistical bases of the classification theory. | 3,4 Analyzing, Applying |
| CLO4 | **ly and evaluate** machine learning algorithms for solving problems. | 3,5 Applying, Evaluating |

**Mapping of CLO-PLO/PSO:**

| Course Learning Objectives | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 | PLO 8 | PLO 9 | PLO 10 | P0 11 | PLO 12 | PSO 1 | PS0 2 | PS0 3 | PS0 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | L | L | L | L | L | - | - | - | - | - | H | H | L | - | L |
| CO2 | H | H | L | L | L | L | - | - | L | L | - | H | H | M | | L |
| CO3 | H | L | M | L | M | L | L | - | L | - | - | H | H | M | L | M |
| CO4 | H | L | M | M | M | - | - | L | - | M | - | H | H | H | H | M |

# SIMULATION AND MODELING
# BCS8003- DE6

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Learning Objectives:** **(40 Hours)**

- To understand basic of system modeling using both computer simulation and mathematical techniques.
- To understand analytical methods and simulation techniques applied in performance modelling of communication systems and networks.
- To provide necessary knowledge and skills to evaluate core compositing work.

**Unit– I** **(8 Hours)**

System definition and components, stochastic activities, continuous and discrete system, system modeling, types of models, static and dynamic physical models, Static and dynamic mathematical models

**Unit– II** **(8 Hours)**

**System Simulation:** Basic nature of simulation, technique of simulation, comparison of simulation and analytical methods, types of system simulation, real time simulation, hybrid simulation, simulation of pure pursuit problem single server queuing system and an inventory problem, Monte Carlo simulation.

**Unit– III** **(8 Hours)**

**System Dynamics:** Exponential growth models, exponential decay models, modified exponential growth models, logistic curves, generalization of growth models, System dynamics diagrams.

**Unit– IV** **(8 Hours)**

**Simulation of PERT Networks:** Critical path computation, uncertainties in activity duration, resource allocation and consideration.

**Unit– V** **(8 Hours)**

**Analysis of Simulation Results:** Confidence intervals, design of experiments Markov Chain Monte Carlo techniques.

**TEXT BOOKS:**

**T1.** "Simulation Modeling and Analysis": Averill M Law, McGraw Hill.
**T2.**"System Simulation: G. Gordon", PHI Learning Pvt. Ltd.

**REFERENCE BOOKS:**

**R1.** "System Simulation with Digital Computer": N. Deo, PHI Learning Pvt. Ltd.
**R2.** "Introduction to Probability Models": Sheldon M. Ross, Academic Press.

**Course Learning Outcomes (CLO):** On Completion of this course, the student will be able to:

| CLO | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Understand** the system concept and **apply** functional modeling method to model the activities of a static system. | 2,3<br>Understanding,<br>Applying |
| CLO2 | **Apply** and **analyze** the operation of a dynamic system and make improvement according to the simulation results. | 3,4<br>Applying,<br>Analyzing |
| CLO3 | **Analyze** the behavior of a dynamic system. | 4<br>Analyzing |
| CLO4 | **Create** an analogous model for a dynamic system. | 6<br>Creating |

**Mapping of CLO-PLO/PSO**

| Course Learning Objectives | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 | PLO 8 | PLO 9 | PLO 10 | P0 11 | PLO 12 | PSO 1 | PS0 2 | PS0 3 | PS0 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | H | L | M | - | - | - | L | M | L | - | H | H | L | L | L |
| CO2 | H | H | M | M | M | L | - | L | M | M | M | H | H | H | H | M |
| CO3 | H | H | M | M | - | M | L | L | - | - | - | H | H | L | L | L |
| CO4 | H | M | H | M | H | M | L | - | - | M | M | H | H | H | H | H |

**L:Low M: Medium H: High**

# INFORMATION STORAGE MANAGEMENT
# BCS8004- DE6

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Learning Objectives:** **(40 Hours)**

- To understand the need for Storage Area Network and Data protection to satisfy the information explosion requirements.
- To study storage technologies: SAN, NAS, IP storage etc., which will bridge the gap between emerging the trends in industry and academics.
- To get an analysis of Storage area network architecture, protocols and its infrastructure
- To understand and evaluate case studies on the storage area network technology.

**UNIT I** **(08 Hours)**

**Introduction to Storage Technology:** Server-Centric IT Architecture and its Limitations, Storage-Centric IT Architecture and its Advantages, Information life cycle management, Evaluation of storage networking, Storage networks basics, Network attached storage, Difference between SAN and NAS

**UNIT II** **(08 Hours)**

**Technologies for storage networks** Intelligent Disk Subsystems Overview, Architecture of Intelligent Disk Subsystem, JBOD, Different RAID Levels in Detail, Hot Sparing & Swapping, Caching: Acceleration of Hard Disk Access, Instant copies, Remote mirroring, LUN masking.

**UNIT III** **(08 Hours)**

**I/O Techniques:** SCSI, Fiber channel overview, Fiber channel protocol stack, Links and different ports, topologies of Fiber channel, classes of services, Data transport in fiber channel, different SAN devices

**UNIT IV** **(08 Hours)**

**IP Storage**: IP storage standards: iSCSI, iFCP, FCIP and iSNS, Infiniband and its architecture, Application of distributed Storage Networking: Storage integration, remote backup, disk mirroring, Data Migration, Business Continuity/Disaster Recovery, Remote Operation of Peripheral Devices, Mainframe/Open Systems Connectivity Network Attached Storage (NAS)

**UNIT V** **(08 Hours)**

**Storage Virtualization and management**: The concept of storage virtualization, Storage virtualization on various levels of the storage network, Symmetric & Asymmetric Storage virtualization, Requirements of management system, Management Interfaces, Standardized and Proprietary Mechanisms, In-band Management, Out-band Management

**Text Books:**

**T1.** "Storage Networks Explained", Ulf Troppens, Rainer Erkens, John Wiley& Sons
**T2.** "Distributed Storage Networks :Architecture, Protocols and Management",Thomas C. Jepsen, John Wiley& Sons
**T3.** "Stroage networks" Daniel J. Worden, Apress

**Reference Books**

**R1.**"Storage Networks: The Complete Reference",R. Spalding, McGraw-Hill
**R2.**"Storage Networking Fundamentals: An Introduction to Storage Devices, Subsystems, Applications, Management, and Filing Systems", Marc Farley, Cisco Press.
**R3.**"Designing Storage Area Networks: A Practical Reference for Implementing Fibre Channel and IP SANs, Second Edition",TomClark,yll Addison Wesley.

**Course Learning Outcomes (CLO):** On Completion of this course, the student will be able to:

| S.No. | Description | Blooms Taxonomy Level |
|---|---|---|
| 1. | **Remember and Understand** the limitations of the client-server architecture and the need for data protection and storage centric architectures such as intelligent storage system. | **1,2 Remembering ,Understanding** |
| 2. | **Understand** and **apply** various SAN technologies. | **2,3 Understanding , Applying** |
| 3. | **Analyze** the SAN architecture and its uses. | **4 Analyzing** |
| 4. | **Analyze** and **determine** the difference between SAN and NAS technologies and storage virtualization and management. | **4,5 Analyzing, Evaluating** |

**Mapping of CLO-PLO/PSO**

| Course Learning Objectives | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 | PLO 8 | PLO 9 | PLO 10 | P0 11 | PLO 12 | PSO 1 | PS0 2 | PS0 3 | PS0 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | H | M | M | M | L | - | L | L | - | - | M | H | M | M | L |
| CO2 | H | H | M | M | M | L | - | - | L | - | - | M | H | M | M | H |
| CO3 | H | H | H | H | M | L | - | - | - | - | - | M | H | M | M | M |
| CO4 | H | H | H | H | M | L | - | - | - | - | - | M | H | M | M | M |

**L:Low M: Medium H: High**

# PROJECT-III
# BCS 8503

**Course Learning Objectives:**

- To provide opportunities to apply and integrate his/her knowledge acquired throughout the undergraduate study.
- To develop the capabilities in analyzing and solving complex and possibly real-case problems
- To develop skills on systematic development and documentation of a significant piece of work.

**Course Learning Outcomes (CLO):** On Completion of this course, the student will be able to:

| CLO | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **ıember and Understand** the different techniques evelop a project. | 1,2 Remember Understand |
| CLO2 | **ly and Analyze** a project based on real time applications. | 3,4 Apply Analyze |
| CLO3 | **luate** an investigative or developmental project based eneral objectives and guidelines. | 5 Evaluate |
| CLO4 | **lerstan**d and **analyze** the software development product development strategy. | 2,4 Understand Analyze |

## Mapping Of CO-PO/PSO

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | H | - | M | M | - | - | M | L | - | H | L | H | M | M | M |
| CLO2 | H | H | - | - | M | L | - | M | H | - | H | L | H | M | L | M |
| CLO3 | H | M | H | M | M | H | L | M | L | - | H | L | H | M | H | H |
| CLO4 | H | H | - | - | M | - | - | M | H | - | H | L | H | M | H | M |

H: High M: Medium L: Low

# GREEN COMPUTING
# BCS8307

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Learning Objectives**: **(30 Hours)**

- To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
- To examine technology tools that can reduce paper waste and carbon footprint by user.
- To understand how to minimize equipment disposal requirements. To gain skill in energy saving practices in their use of hardware.

**UNIT-I** **(8 Hours)**

**Green IT Fundamentals:** Business, IT and the Environment, Green computing: carbon foot print, scoop on power, Green IT Strategies: Drivers, Dimensions and Goals, Environmentally Responsible Business: Policies, Practices, and Metrics.

**UNIT-II** **(7 Hours)**

**Green Assets:** Buildings, Data Centers, Networks, and Devices, Green Business Process Management: Modeling, Optimization, and Collaboration, Green Enterprise Architecture, Environmental Intelligence, Green Supply Chains, Green Information Systems: Design and Development Models.

**UNIT-III** **(8 Hours)**

**Green Grid Framework:** Virtualizing of IT systems, Role of electric utilities, Telecommuting, teleconferencing and teleporting, Materials recycling, Best ways for Green PC, Green Data center, Green Grid framework.

**UNIT-IV** **(7 Hours)**

Socio-cultural aspects of Green IT, Green Enterprise Transformation Roadmap, Green Compliance: Protocols, Standards, and Audits, Emergent Carbon Issues: Technologies and Future.

**Text Books:**

**T1**:Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2011

**T2:**Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August 2009.

**References:**

**R1**:Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: Steps for the Journey", Shoff/IBM Rebook, 2011

**R2**:John Lamb, "The Greening of IT", Pearson Education, 2009.

**R3**:Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry", Lulu.com, 2008.

**R4**:Carl speshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010.

**R5**:Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC Press, 2012.

**Course Learning Outcomes(CLO):**

| CLO | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** the concept of green IT and relate it to sustainable development. | 1,2, Remembering Understanding, |
| CLO2 | **Apply** the green computing practices to **estimate** and save energy. | 3,5 Applying, Evaluating |
| CLO3 | **Develop** an **understanding** of green IT and grid framework by **analyzing** the IT systems and technologies. | 2,3 4 Understanding, Applying, Analyzing |
| CLO4 | **Analyze** tools to **evaluate** energy consumption. | 4, 5 Analyzing, Evaluating |

**Mapping of CLO-PLO/PSO**

| Course Learning Outcomes | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 | PLO 8 | PLO 9 | PLO 10 | P0 11 | PLO 12 | PSO 1 | PS0 2 | PS0 3 | PS0 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | H | M | M | L | L | H | H | M | M | L | H | H | - | L | M |
| CO2 | H | H | M | M | L | L | H | H | M | M | L | H | - | H | L | M |
| CO3 | H | H | H | H | M | L | H | H | M | M | L | H | M | H | L | - |
| CO4 | H | H | H | H | M | L | H | H | M | M | L | M | M | H | L | - |

**H: High M: Medium L: Low**

# DIGITAL MARKETING
## BCS8308

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Learning Objectives**: **(40 Hours)**

- To understand about Internet Marketing topics including online advertising, search, social media, and online privacy.
- To remember to quantitatively and qualitatively evaluate the measures of effectiveness of business decisions and online advertising effectiveness in particular. They will also become familiar with designing and implementing an experiment in marketing field.
- To understand about social media management platforms like Hoot Suite. They will learn and apply best practices for social media marketing.

**Unit- I** **(08 Hours)**

**Introduction to Digital Marketing:** Evolution of Digital Marketing from traditional to modern era, Role of Internet; Current trends, Info-graphics, implications for business & society; Emergence of digital marketing as a tool; Drivers of the new marketing environment; Digital marketing strategy; P.O.E.M. framework, Digital landscape, Digital marketing plan, Digital marketing models.

**Unit- II** **(08 Hours)**

**Internet Marketing and Digital Marketing:** Internet Marketing, opportunities and challenges; Digital marketing framework; Digital Marketing mix, Impact of digital channels on IMC;
**Search Engine Advertising:** Pay for Search Advertisements, Ad Placement, Ad Ranks, Creating Ad Campaigns, Campaign Report Generation, **Display marketing**: Types of Display Ads, Buying Models, Programmable Digital Marketing, Analytical Tools, YouTube marketing.

**Unit- III** **(08 Hours)**

**Social Media Marketing**: Role of Influencer Marketing, Tools & Plan– Introduction to social media platforms, penetration & characteristics; Building a successful social media marketing strategy **Facebook Marketing:** Business through Facebook Marketing, Creating Advertising Campaigns, Adverts, Facebook Marketing Tools **LinkedIn Marketing**: Importance of LinkedIn Marketing, Framing LinkedIn Strategy, Lead Generation through LinkedIn, Content Strategy, Analytics and Targeting **Twitter Marketing:** difference with other forms of digital marketing, framing content strategy, Twitter Advertising Campaigns **Mobile Marketing:** Forms of Mobile Marketing, Features, Mobile Campaign Development, Mobile Advertising Analytics, Introduction to social media metrics.

**Unit- IV** **(08 Hours)**

**Introduction to SEO:** Understanding SEO, Need for SEO, SEO Keyword Planning, Meta Tags and Meta Description, Website Content Optimization, How to use internet & search engines; search engine and its working pattern, On-page and off-page optimization, SEO Tactics,
**Introduction to SEM and SMM:** Difference between SEO, SEM and SMM, Need for SEM and SMM

**Unit- V** **(08 Hours)**

**Web Analytics:** Intro to Web Analytics Integrating with Website, Measurement Metrics, Accounts and Profiles Analytics Reporting, Re-Marketing Audiences Goals and Conversion Reports Developing Intelligence Report
**Google Analytics & Google AdWords**: Introduction to Google Webmaster Tool, Setting up Tool for SEO, data collection for web analytics, multichannel attribution, Universal analytics, Tracking code,
**Trends in digital advertising**

**TEXT BOOKS:**

**T1.** Ian Dodson, "The Art of Digital Marketing", Wiley Publications.
**T2.** Seema Gupta, "Digital Marketing", Tata McGraw Hill.

**REFERENCE BOOKS:**

**R1.** Puneet Singh Bhatia, "Fundamentals of Digital Marketing", Pearson Publications.

**R2.** Vandana Ahuja, "Digital Marketing", Oxford University Press.

## Course Learning Outcomes (CLO):

| CLO | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Remember** and **understand** Digital Marketing Platforms like Facebook, Twitter, YouTube, etc. | 1,2, Remembering Understanding, |
| CLO2 | **Develop** an **understanding** insight on Current Trends – Digital and Social marketing. | 2,3 Applying, Understanding |
| CLO3 | **Understand** the importance of strategies involved in **analyzing** marketing products and Services digitally. | 2, 4 Understanding, Analyzing |
| CLO4 | **Examine** trending topics like Search Engine Optimization (SEO) and Mobile Marketing. | 4 Analyzing, |

**Mapping of CLO-PLO/PSO:**

| Course Learning Outcomes | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | H | H | M | M | M | L | L | L | M | M | M | H | H | - | H | M |
| CO2 | H | H | M | M | M | L | L | L | M | M | M | H | - | H | H | M |
| CO3 | H | H | H | M | H | L | L | L | - | M | M | H | M | H | H | - |
| CO4 | H | H | H | M | H | L | L | L | - | M | L | M | M | H | H | - |

H: High M: Medium L: Low

# BIOINFORMATICS

## BBT8301

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Learning Objectives:**

- This course provides the necessary basic protocols in computers and various biological databases.
- Students will understand the tools used for biological sequential data analysis and methods of analysing genetic and protein information.
- Students will learn the methods used for Phylogenetic analysis, DNA mapping and sequencing.

**UNIT I: Data Representation and Database [6 hours]**

Introduction and applications of Bioinformatics; various databases and bioinformatics; Literature databases: Nucleic acid sequence databases (GenBank, EMBL, DDBJ); Protein sequence databases (SWISS-PROT, TrEMBL, PIR, PDB ); Genome Databases (NCBI, EBI, TIGR, SANGER); BLAST : types and applications.

**UNIT II: Biological Sequence Analysis [6 hours]**

Introduction to sequence alignment, Dynamic programming, Hidden Markov Model, Genetic algorithms, Multiple Sequence Alignment, Gapped alignment, Sequence Alignment: Pairwise sequence alignments: Dot matrix for sequence alignment, Dynamic programming for Local and Global alignment.

**UNIT III: Biomolecules Interaction [6 hours]**

Electrostatic interactions, Prediction of Protein- protein interactions, Prediction of Protein-nucleic acid interactions, Docking Methods: Introduction, Docking and scoring, Application in the drug design.

**UNIT IV: Expression Analysis [6 hours]**

Gene expression array analysis, Spot finding and Measurement, Spreadsheet Arrays and Data Displays, Applications with Expression Arrays.

**UNIT V: Bioprogramming [6 hours]**

Introduction to Perl, Variables and Data types, Perl variables, Scalar values, Introduction to Biopython, Running programs, Types and operations, Functions, Modules, Classes, Exceptions.

**TEXT BOOKS**

1. Mount D.W.2013. Bioinformatics sequence and genome analysis.5th Edition.CBS Publishers, New Delhi.
2. Schwartz R. 2005. Learning Perl. 4th Edition. O'Reilly.

**REFERENCE BOOKS**

1. James D.T. 2013. Mastering Perl for Bioinformatics. 1st Edition. O'Reilly and Associates, New Jersey.
2. Attwood T. K. and Parry-Smith D. 2002. Introduction to Bioinformatics.1st Edition.Pearson Education, Delhi.

**Course Learning Outcomes (CLO): On completion of this course, the students will be able to:**

| CLO | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Understand** the basic essential tools in bioinformatics and their implementation. | 2 Understanding |
| CLO2 | **Identify** the available biological database resources and analysis. | 3 Applying |
| CLO3 | **Examine** the Gene expression array analysis and applications of expression array. | 4 Analyzing |
| CLO4 | **Solve** different problems using program codes in Perl and Biopython | 3 Applying |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | - | - | - | - | - | - | - | M | - | M | H | H | M | L | H |
| CLO2 | - | - | M | - | H | - | - | - | - | - | - | - | M | L | L | M |
| CLO3 | H | - | - | - | - | H | - | L | - | - | M | H | M | L | M | M |
| CLO4 | M | - | - | - | H | - | - | - | M | - | - | - | M | H | H | H |

H: High M: Medium L: Low

# FUZZY SYSTEMS & ITS APPLICATIONS
## BEE 8301

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Learning Objectives:**

1. Provide an **understanding** of the basic mathematical elements of the theory of fuzzy sets.
2. Provide **comparison** between fuzzy sets and classical sets theories.
3. Cover fuzzy logic **inference** with emphasis on their use in the design of intelligent or humanistic systems.
4. Provide a brief **explanation** to fuzzy arithmetic concepts. **Build up** an insight into fuzzy inference applications in the area of control and robotics.

**UNIT-I** **(8 Hours)**

**DIFFERENT FACES OF IMPRECISION:** – Inexactness, Ambiguity, Undecidability, Fuzziness and certainty, Probability and fuzzy logic, Intelligent systems.

**UNIT-II** **(8 Hours)**

**FUZZY SETS AND CRISP SETS:** - Intersections of Fuzzy sets, Union of Fuzzy sets, the complement of Fuzzy sets.

**UNIT-III** **(8 Hours)**

**FUZZY REASONING**: - Linguistic variables, Fuzzy propositions, Fuzzy compositional rules of inference- Methods of decompositions, Defuzzification.

**UNIT-IV** **(8 Hours)**

**METHODOLOGY OF FUZZY DESIGN**: - Direct & Indirect methods with single and multiple experts, Adaptive fuzzy control, Rule base design using dynamic response.

**UNIT-V** **(8 Hours)**

**FUZZY LOGIC APPLICATIONS: -**

Fuzzy logic applications to engineering, Fuzzy decision making, Neuro-Fuzzy systems, Fuzzy Genetic Algorithms.

**TEXT BOOKS:**

**T1**. Zimmermann, H.J., 'Fuzzy set theory and its applications', Allied publishers limited, Madras,1966
**T2.** Klir, G.J., and Folge., T., 'Fuzzy sets, uncertainty and information', PHI, New Delhi,1991.

**REFERENCE BOOKS:**

**R1**. EarlCox,,'The Fuzzy Systems Handbook', AP professional Cambridge, MA 02139, 1994.

***Course Learning Outcomes (CLO):*** *On the completion of this course, students will be able to:*

| CLO | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | To **distinguish** between the crisp set and fuzzy set concepts through the learned differences between the crisp set characteristic **function** and the fuzzy set membership function. | 4 Analyzing |

| | | |
|---|---|---|
| CLO2 | To **design** a parallelism between crisp set operations and fuzzy set operations through the use of characteristic and membership **functions** respectively. | 4, 6<br>Analyzing, Creating, |
| CLO3 | To **define** fuzzy sets using linguistic words and represent these sets by membership **functions.** | 1, 4<br>Remembering, Analyzing, |
| CLO4 | Know how to **construct** mapping of fuzzy sets by a **function** and also use the α -level sets in such instances. | 3, 4<br>Applying, Analyzing |

**Mapping of CLOs with PLOs & PSOs**

| **Course Learning Outcomes** | **Program Learning Outcomes (PLOs)** | | | | | | | | | | | | **Program Specific Outcomes(PSOs)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PLO1** | **PLO2** | **PLO3** | **PLO4** | **PLO5** | **PLO6** | **PLO7** | **PLO8** | **PLO9** | **PLO10** | **PLO11** | **PLO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CLO1** | H | H | | | H | | | | | | | L | L | H | M | M |
| **CLO2** | M | L | M | | M | | | | | | | L | H | M | M | M |
| **CLO3** | M | M | | | M | L | | | | | | L | H | M | M | M |
| **CLO4** | H | M | | | M | L | | | | | | L | H | M | M | M |

H: High M: Medium L: Low

# MOBILE COMMUNICATION AND NETWORKS
## BEC8304

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Learning Objectives:**

1. To develop an understanding of cellular concept for wireless communication.
2. To analyze different modulation techniques for wireless communication.
3. To study different multiple access techniques.
4. To study standard systems such CDMA, GSM.

**UNIT I:** **(08 Hours)**

**Cellular concepts:** Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards.

**UNIT II:** **(08 Hours)**

**Signal propagation:** Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.

**UNIT III:** **(08 Hours)**

**Capacity of flat and frequency selective channels. Antennas:** Antennas for mobile terminal- monopole antennas, PIFA, base station antennas and arrays.

**UNIT III:** **(08 Hours)**

**Multiple access schemes:**FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.

**UNIT IV:** **(08 Hours)**

**Receiver structure:** Diversity receivers- selection and MRC receivers, RAKEreceiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme.

**UNIT V:** **(08 Hours)**

MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff. Performance measures- Outage, average snr, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

**TEXT/REFERENCE BOOKS:**

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.
3. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
4. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995. 5. VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

**Course Learning Outcomes (CLO):** On completion of this course, the students will be able to:

| CLO | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Demonstrate** their understanding on functioning of wireless communication system and **recall** evolution of different wireless communication systems and standards and also understand the evolution of cellular communication systems upto and beyond 3G | 1, 2 Remembering Understanding |
| CLO2 | **Recall and Compare** different technologies used for wireless communication systems and **apply** the various cellular concepts like frequency reuse, channel assignments, handoff strategies etc. to **develop** a cellular link and estimate the power budget. | 1, 2, 3 Remembering, Understanding, Applying, |
| CLO3 | **Explain** the architecture, functioning, protocols, capabilities and application of various wireless communication networks and **analyze** the multipath mitigation techniques based on the application. | 2, 4 Understanding, Analyzing |
| CLO4 | **Identify** and **analyze** the fundamental operational and design problems of wireless communication systems and also **compare** basic technical standards related to 2G/3G/4G wireless systems | 3,4 Applying, Analyzing |
| CLO5 | **Define** traffic channels for call processing and **solve** key performance metrics of a cellular communication system. | 1, 3 Remembering Applying, |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **CLO1** | | | | | L | M | M | | | | | | H | M | M | M |
| **CLO2** | M | | | | M | M | H | | | | | M | H | M | M | M |
| **CLO3** | M | | | | M | M | H | | | | | | H | M | M | M |
| **CLO4** | H | | | | M | | M | | | | | M | H | M | M | M |
| **CLO5** | M | | | | H | M | M | | | | | | H | M | M | M |

**H: High M: Medium L: Low**

# SIX SIGMA
## BME8309

**L T P C**
**3 0 0 3**

**Course Learning Objectives:**

1. To **develop** a comprehensive set of skills that will allow you to function effectively as a six sigma practitioner.
2. To **define** & **illustrate** techniques for both quantitative and non-quantitative analysis, as well as the team leadership skills necessary to get projects across the goal line.
3. To e**xplain** & **develop** understanding of risk Priority number and its practical application.
4. To **identify** the critical parameters and improving model.

**UNIT-I** **(9 Hours)**

**Six Sigma Fundamentals:**

Value of Six Sigma, Organizational drivers and metrics, aligning Six Sigma for achieving goals and competitive advantages. Understanding concepts and tools of lean manufacturing.

**Design for Six Sigma (DFSS):**

Design For Six Sigma Method - Failure Mode Effect Analysis (FMEA), FMEA process, Difference between DMADV and DMAIC

**UNIT-II** **(11 Hours)**

**Define Phase:**

Create Project Charter, Process mapping, identifying customers, collecting and analyzing customer data, translating customer requirements. Commonly used tools (in brief) – Force field analysis, Risk Priority Number (RPN), SIPOC Diagram.

**Measure Phase:**

Process measurement, AS IS Value Stream Map, Process inputs and outputs, Preparing data collection plan, assessing process capabilities (process capability and performance indices), process performance v/s specification.

**UNIT-III** **(10 Hours)**

**Analyze Phase:**

Identify critical inputs, data analysis, and process analysis, determining and prioritizing root causes. (This is done through various statistical tests. It is not required to perform any numerical analysis. Students should be just appraised of the significance of statistical testing during this phase).

**Improve Phase:**

Priority list of solutions, applying lean Six Sigma best practices, creating to be value stream map, risk assessment, pilot testing of solution.

**UNIT-IV** **(10 Hours)**

**Control Phase:**

Creating the process control plan, developing Standard Operating Procedures (SOPs), training, transition of ownership, project storyboard

**Evaluation and continuous improvement:** Return on Six Sigma (ROSS), Lean manufacturing, Kaizen, 5S

**TEXT BOOKS:**

**T1.** The Certified Six Sigma Green Belt Handbook, Second Edition, Roderick A. Munro, Govindarajan Ramu and Daniel J., ASQ Quality Press, 2015.

**T2.** The Certified Six Sigma Green Belt Handbook., T. M. Kubiak, Donald W. Benbow, Pearson,2010.

**REFERENCE BOOKS:**

R1. Six Sigma for Green Belts and Champions, Howard S. Gitlow and David M.Levine, Pearson, 2004.

***Course Learning Outcomes(CLO):*** *On completion of this course, the students will be able to :*

| CLO | Description | Bloom's Taxonomy Level |
|---|---|---|
| CLO1 | **Define** & **develop** the principles of Six Sigma. | 1 & 3<br>Remembering & applying |
| CLO2 | **Apply** the linkage of Six Sigma with competitive advantage | 3<br>Applying |
| CLO3 | **Apply** & **demonstrate** the knowledge of six sigma tools and techniques in process mapping in operations. | 3 & 2<br>Applying & understanding |
| CLO4 | **Analyze** & **show** the importance of six sigma methodologies in committed leadership in manufacturing. . | 4 & 1<br>Analyzing & remembering |

## Mapping of CLOs with PLOs & PSOs

| Course Learning Outcomes | Program Learning Outcomes (PLOs) | | | | | | | | | | | | Program Specific Outcomes(PSOs) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 | PLO8 | PLO9 | PLO10 | PLO11 | PLO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CLO1 | H | | | | H | M | | | | | M | L | H | L | M | M |
| CLO2 | H | | | | H | | | | | | L | L | H | M | M | M |
| CLO3 | H | | | | H | | | | | | L | L | H | M | M | M |
| CLO4 | H | | | | H | | | | | | M | L | H | L | M | M |

**H: High M: Medium L: Low**