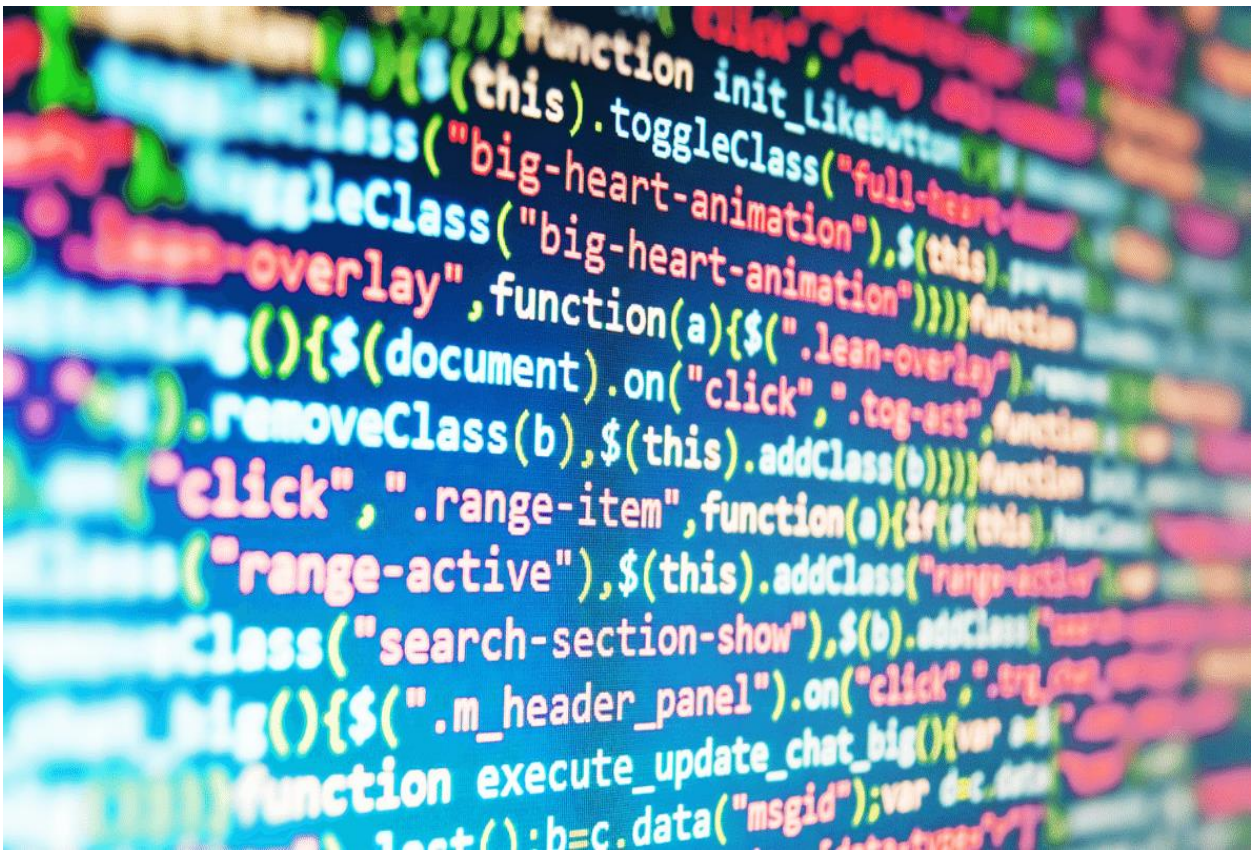


Detailed Syllabus for Computer Science & Engineering with Specialization in Artificial Intelligence & Machine Learning

UEM
श्रद्धावान लभते ज्ञानम्
UNIVERSITY OF ENGINEERING & MANAGEMENT
Good Education, Good Jobs

DEPT. OF COMPUTER SCIENCE & ENGINEERING

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

PREAMBLE

Education plays an enormously significant role in the building of a nation. There are quite a large number of educational institutions, engaged in imparting education in our country. Majority of them have entered recently into semester system to match with international educational pattern. However, our present education system is churning out youth who have to compete locally, regionally, nationally as well as globally. The present alarming situation necessitates transformation and/or redesigning of system, not only by introducing innovations but developing "learner-centric approach.

Majority of Indian higher education institutions have been following marks or percentage-based evaluation system, which obstructs the flexibility for the students to study the subjects/courses of their choice and their mobility to different institutions. There is need to allow the flexibility in education system, so that students depending upon their interests can choose inter-disciplinary, intra-disciplinary and skill-based courses. This can only be possible when choice based credit system (CBCS), an internationally acknowledged system, is adopted. The choice based credit system not only offers opportunities and avenues to learn core subjects but also explore additional avenues of learning beyond the core subjects for holistic development of an individual. The CBCS will undoubtedly facilitate benchmarking of our courses with best international academic practices.

Advantages of the choice based credit system:

•Shift in focus from the teacher-centric to student-centric education.

•Student may undertake as many credits as they can cope with (without repeating all courses in a given semester if they fail in one/more courses).

•CBCS allows students to choose inter-disciplinary, intra-disciplinary courses, skill oriented papers (even from other disciplines according to their learning needs, interests and aptitude) and more flexibility for students.

•CBCS makes education broad-based and at par with global standards. One can take credits by combining unique combinations.

•CBCS offers flexibility for students to study at different times and at different institutions to complete one course (ease mobility of students). Credits earned at one institution can be transferred to another institution.

CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions have been moving from the conventional annual system to semester system. Currently many of the institutions have already introduced the Choice Based Credit System. The semester system accelerates the teaching-learning process and enables vertical and horizontal mobility in learning. The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The Choice Based Credit System provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses to acquire more than the required credits and adopt an interdisciplinary approach to learning.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

It has been a necessity to align higher education with the emerging needs of the economy so as to ensure that the graduates of higher education system have adequate knowledge and skills for employment and entrepreneurship since last few years. The higher education system has to incorporate the requirements of various industries in its curriculum, in an innovative and flexible manner while developing a well-groomed graduate. CSE department aims to encourage research and innovation in the field of Machine Learning, Cyber security, Artificial Intelligence and other allied areas such as Computational Theory, Cloud Computing, Blockchain Technology, Data Science, Big Data Analytics and many more. The objective of the Computer Science & Engineering Programme with Specialization in Artificial Intelligence & Machine Learning is to prepare students to undertake careers involving innovative technologies, develop a problem solving capability, or to opt for advanced studies for research oriented careers.

In order to give due importance to practical applications as well as theoretical aspects of CSE, the curriculum for the Computer Science & Engineering Programme with Specialization in Artificial Intelligence & Machine Learning covers most of the foundational aspects as well as develops engineering skills for problem solving.

JOB OPORTUNITIES

Booming IT sector in India has plenty of jobs for fresh computer science graduates. Candidates with a high percentage of mark and good communication skills as well as sound computer knowledge do not face problem in getting a job. Computer engineers can get jobs in non-IT companies like universities, research, private and public industries, government departments, business organizations, commercial organizations and the manufacturing sector, etc. Besides the Computer Engineers have plenty of options to work in IT companies in departments such as design, development, assembly, manufacture, and maintenance, etc. Software Developers: Software developers are professionals who are concerned with facets of the software development process which involves activities such as design and coding, computer programming, project management, etc.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 01: High Quality Engineering Design and Development Work: Graduates of the program will engage in the effective practice of computer science and engineering to identify and solve important problems in a diverse range of application areas.

PEO 02: Real Life Problem Solving: To educate students with proficiency in core areas of Computer science & Engineering and related engineering so as to comprehend engineering trade-offs, analyze, design, and synthesize data and technical concepts to create novel products and solutions for the real life problems.

PEO 03: Leadership: Graduates of the program will engage in successful careers in industry, academia and attain positions of importance where they have impact on their business, profession and community.

PEO 04: Lifelong Learning: Graduates of the program will adapt to contemporary technologies, tools and methodologies to remain at the frontier of computer science and engineering practice with the ability to respond to the need of a challenging environment.

PROGRAM OUTCOME (PO)

PO	Summary	Description
PO1	**Engineering knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**	Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**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.
PO4	**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.
PO5	**Modern tool usage**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**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.
PO7	**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.
PO8	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**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.
PO11	**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.
PO12	**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

TYPES OF COURSES

1. Courses are the subjects that comprise the Computer Science & Engineering Programme with Specialization in Artificial Intelligence & Machine Learning.
2. A course may be designed to comprise lectures, tutorials, laboratory work, fieldwork, outreach activities, project work, vocational training, viva, seminars, term papers, assignments, presentations, self-study etc. or a combination of some of these components.
3. The learning outcomes of each course will be defined before the start of a semester.
4. Following are the course types:

   i. **Professional Core Course (PCC):** This is a course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of B.Tech in Computer Science & Engineering with Specialization in Artificial Intelligence & Machine Learning.

   ii. **Elective Course:** An elective course is a course, which can be chosen from a pool of courses. It is intended to support the discipline of study by providing an expanded scope, enabling exposure to another discipline/domain and nurturing a student's proficiency and skill. An elective may be of following types:

   a) **Discipline Elective Courses (DE):** It is an elective course that adds proficiency to the students in the discipline.

   b) **Open Elective Courses (OE):** It is an open elective course taken from other engineering disciplines and enhances the generic proficiency and interdisciplinary perspective of students.

   c) **Specialization Elective Courses (SEC):** This is a course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of B.Tech in Computer Science & Engineering with Specialization in Artificial Intelligence & Machine Learning.

   iii. **Obligatory Courses:**

   a) **Mandatory Courses (MC)**: It can be taken from among a pool of foundation courses, which aim at value-based education. They may provide hands-on training to improve competencies and skills or provide education on human, societal, environmental and national values.

   b) **Internship/Training/Project/Dissertation (PTI):** Course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project

   c) **Humanities, Social Sciences & Management (HSM):** It is an elective course taken from non-engineering disciplines (humanities, social sciences and management) that broadens the perspective of an engineering student.

   d) **Basic Science Courses (BSC):** It is based upon content that leads to fundamental knowledge enhancement in sciences, and basic engineering principles.

   e) **Engineering Science Courses (ESC):** It is based upon content that leads to fundamental knowledge enhancement in basic Engineering Principles.

   f) **NPTEL (NPT):** National Programme on Technology Enhanced Learning/Massive Open Online Courses (MOOCs) courses are based on the respective year's offered courses.

g) **General Studies Courses (GSC):** "Essential Studies for Professionals Skill & Skill Development for Professionals" courses designed to encourage and enrich the students for the technical and professional exams.

h) Mandatory Additional Requirements (MAR): A student has to do the following things to achieve the MAR points: The student should engage herself / himself in activities outside the curriculum. Join different types of Clubs of NSCBIP, write something for the wall magazine, remain active in outer society, participate in Tech Fests activities, etc.

5. Each credit course contributes certain credits to the programme. A course can be offered either as a full course (4 credits) or as a half course (2 credits). A full course is conducted with 3 hours of lectures and either 1 hour of tutorial or 2 hours of practical work per week. A half course is conducted with 2 hours of lectures. There are also some exceptional electives with 3 credits and 1 credit.

Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week Or 2 Hr. Practical (Lab)/week	0.5 Credits Or 1 Credit

6. A project work/dissertation is considered as a special course involving application of the knowledge gained during the course of study in exploring, analyzing and solving complex problems in real life applications. A candidate completes such a course with an advisory support by a faculty member.
7. **Mandatory Courses** may be offered. They do not carry credits but aim at expanding knowledge or bridging deficiency in knowledge or skill.
8. A course may have pre-requisite course(s) that are given in the Semester-wise Course Allocation scheme.
9. A student can opt for a course only if he/she has successfully passed its pre- requisite(s).
10. A student has to register for all courses before the start of a semester.
11. **Program codes:** The codes for various undergraduate programmes are as follows:

    i. Civil Engineering: CE

    ii. Computer Science & Engineering: CS

    (Specialization in Artificial Intelligence & Machine Learning (CS-AIML))

    iii. Electronics and Communication Engineering: EC

    iv. Electrical Engineering: EE

    v. Mechanical Engineering: ME

12. **Departmental Course Codes:** The codes for departmental core courses and discipline-specific electives are specific to each discipline. The first two characters are derived from departmental codes listed above. The third character is 'C' for core courses and 'D' for discipline-specific courses and 'INT' for Dissertation/Project/Training/Internship. This is followed by a digit sequence number:

    i. CSCyyy: Core Course

    ii. CSDyyy: Discipline Elective Courses

    iii. AIMLyyy: Specialization Elective Courses

iv. XXXyyy: Open Elective Courses (Depends on the respective Dept.)

v. INTyyy: Project/Training/Internship/ Dissertation

13. **Common Elective Course Codes:** All disciplines will follow a common code as shown below. The 3-digit sequence number 'yyy' is taken from the respective tables of different types of courses.

i. HSMyyy: Humanities, Social Sciences & Management Course

ii. BSCyyy: Basic Science Course

iii. MCyyy: Mandatory Course

iv. GSCyyy: General Studies Courses

v. MARyyy: Mandatory Additional Requirements

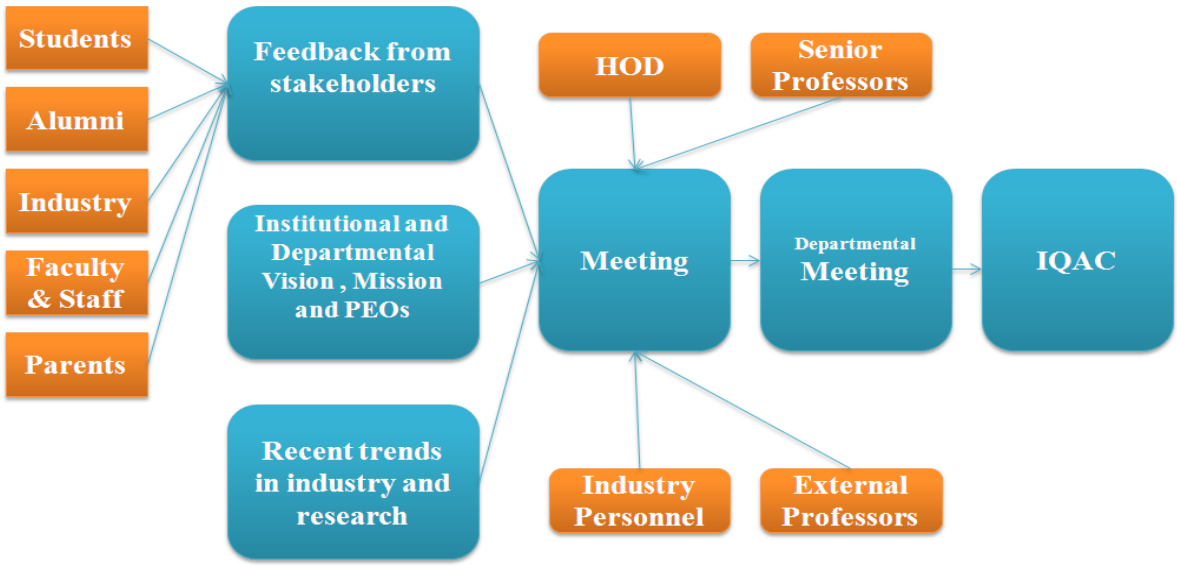
Here, yyy will be follow by a sequence of digit.

14. **General Electives:** A student may take a course under the category of General Elective (GE) offered by any other Department of the Institute under the categories of Core Course (CC) and Discipline Specific Electives (DE). However, such options shall be offered to a student as per prescribed guidelines of the Institute.

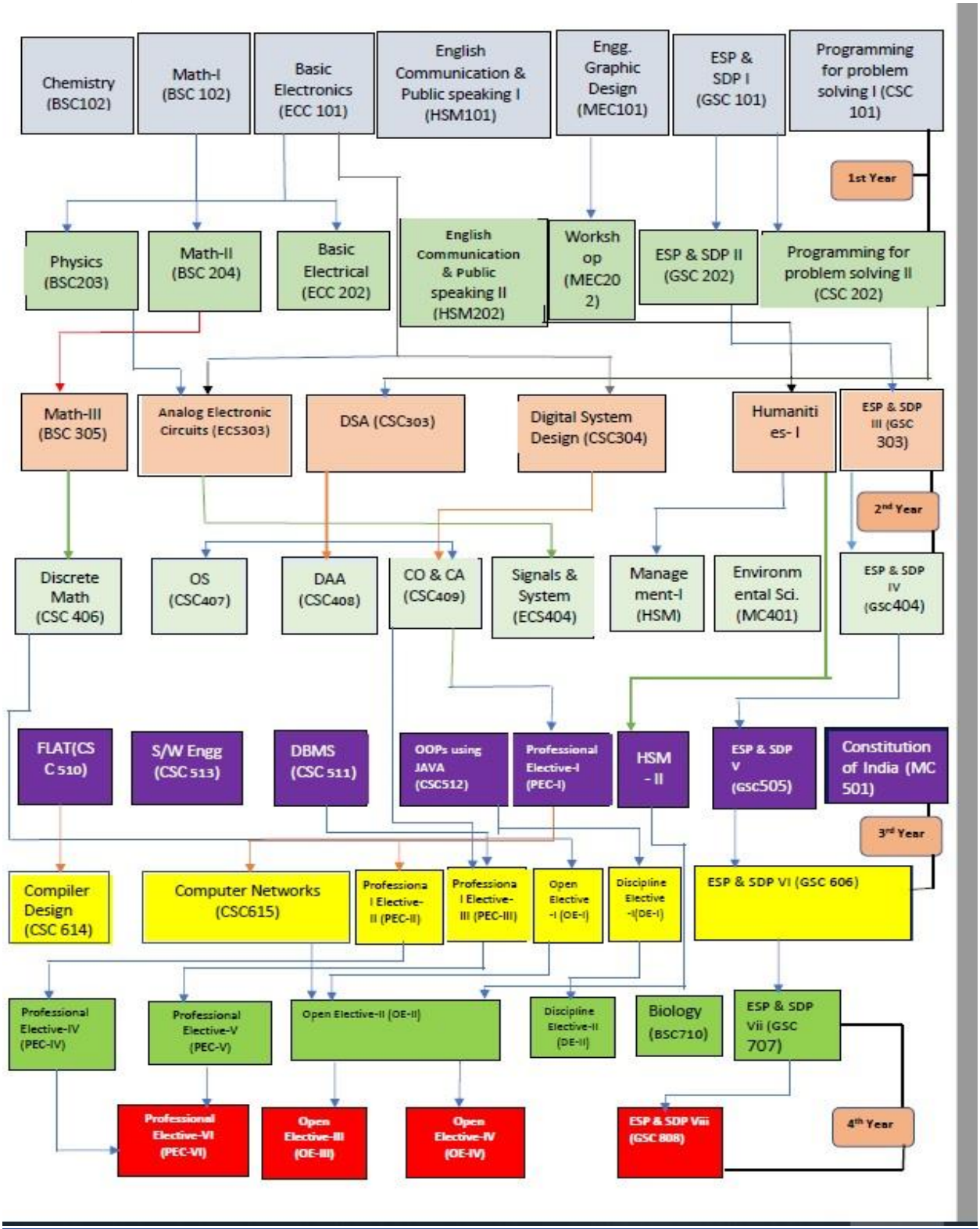
15. The opting of a course by the student will depend upon the requisites for that course and with the consent of the course advisor.

PROCESS FOR DESIGNING THE PROGRAM CURRICULUM

The process for designing the program curriculum involves consideration of the following aspects:
i) Feedback from stakeholders
ii) Institutional and Departmental Vision, Mission and PEOs
iii) Recent trends in industry and research



PREREQUISITE TREE



SCHEME – SEMESTER WISE COURSE ALLOCATION

First Semester Syllabus

Sl No.	Type	Subject Code	Topic	L	T	P	S	Credit Points
1.	BSC	BSC101	Chemistry	3	1	3	0	5.5
2.	BSC	BSC102	Mathematics-I (Calculus & Linear Algebra)	3	1	0	0	4
3.	ESC	ECC101	Basic Electronics Engineering	2	0	2	0	3
4.	ESC	MEC101	Engineering Graphics & Design	1	0	2	0	2
5.	ESC	CSC101	Programming for Problem Solving-I (C)	2	0	0	2	2
6.	HSM	HSM101	English Communication & Public Speaking Skills-I	0	0	2	0	1
7.	GSC	GSC101	ESP & SDP-I	2	0	0	2	2
			Total	13	2	9	4	19.5/28

#Students will undergo a mandatory Induction Program

TITLE OF COURSE: CHEMISTRY
COURSE CODE: BSC101
L-T-P: 3-1-3-0
CREDITS: 5.5

Pre-requisite: Fundamental ideas of inorganic chemistry and DNA sequencing at XI, XII level. Basic knowledge of Organic Molecules and their orientation.

Introduction:
The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels.
The course will enable the student to:

Course Outcomes (CO):
Upon successful completion of this course, students should be able to:

CO1: Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
CO2: Rationalize bulk properties and processes using thermodynamic considerations.
CO3: Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
CO4: Rationalize periodic properties such as ionization potential, electronegativity, oxidation states
CO5: List major chemical reactions that are used in the synthesis of molecules.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓			✓		✓			
CO2	✓	✓	✓	✓					✓			
CO3		✓	✓	✓			✓		✓			
CO4		✓	✓	✓					✓			
CO5		✓	✓	✓			✓		✓			

Course Contents:

Module-1: Atomic and molecular structure (12 lectures)

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and 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.

Module-2: Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering.

Module-3: Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

Module-4: Use of free energy in chemical equilibria (6 lectures)

Thermodynamic functions: energy, entropy and free energy, Estimations of entropy and free energies, Free energy and emf. Cell potentials, Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

Module-5: Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

Module-6: Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

Module-7: Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Text Books

1. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publishing Co. 17th Edition
2. The Chemistry of Nanomaterials, C.N.R. Rao, A. Muller, A.K. Cheetham, Wiley.
3. Applications of Graphene and Graphene- Oxide based nanomaterials, Sekhar Chandra Ray, Micro and nano technology series
4. Fundamentals of Molecular Spectroscopy, C.N. Banwell, McGraw-Hill 3rd Edition

References

1. Introduction to Bioinformatics, Fourth Edition. Arthur M. Lesk. Publisher: OUP Oxford.
2. Physical Chemistry, P.C. Rakshit, Sarat Book distributors,Calcutta, 7th ed.

TITLE OF COURSE: CHEMISTRY LAB
COURSE CODE: BSC191
L-T-P: 0-0-3-0
CREDITS: 1.5

Pre-requisite: Fundamental ideas of inorganic chemistry and DNA sequencing at XI, XII level. Basic knowledge of Organic Molecules and their orientation.

Introduction:
The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels.

Course Outcomes (CO):
The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:
CO1: Estimate rate constants of reactions from concentration of reactants/products as a function of time
CO2: Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
CO3: Synthesize a small drug molecule and analyse a salt sample

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓			✓		✓			
CO2	✓	✓	✓	✓					✓			
CO3		✓	✓	✓			✓		✓			
CO4		✓	✓	✓					✓			
CO5		✓	✓	✓			✓		✓			

Course Contents:

SOFTWARE MODE: Amrita Virtual lab /Simulator base lab (Theory, observation table, result) Google Classroom. (Practical and assignment submission)

POSSIBLE EXPERIMENTS:

Choice of 10-12 experiments from the following:

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression

6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of oil
11. Chemical analysis of a salt

Some Important Link:

1. Determination of the hardness of water present in the given sample of water.

http://vlab.amrita.edu/?sub=2&brch=193&sim=1548&cnt=1

2. Determination of the alkalinity present in water.
http://vlab.amrita.edu/?sub=2&brch=193&sim=1548&cnt=1

3. Determination of the Chemical Oxygen Demand by titration.
http://vlab.amrita.edu/?sub=2&brch=193&sim=1548&cnt=1

4. Determination of the P H of different types of water by digital PH meter.
http://vlab.amrita.edu/?sub=2&brch=193&sim=575&cnt=1

5. Determination of the conductance of a given sample of water by digital conductivity meter.
http://vlab.amrita.edu/?sub=2&brch=193&sim=575&cnt=1

6. Determination of the turbidity of different kinds of water.
http://vlab.amrita.edu/?sub=2&brch=193&sim=575&cnt=1

7. Determination of the viscosity of solution by viscometer.
http://vlab.amrita.edu/?sub=2&brch=190&sim=339&cnt=1

8. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
http://vlabs.iitb.ac.in/vlabsdev/labs/nitk_labs/Environmental_Engineering_1/labs/determination-of-chloridenitk/simulation.html

TITLE OF COURSE: MATHEMATICS –I (Calculus & Linear Algebra)
COURSE CODE: BSC102
L-T-P: 3-1-0-0
CREDITS: 4

Pre-requisite: High School Mathematics

Introduction:
The objective of this course is to familiarize the prospective engineers with techniques in basic calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:
Course Outcomes (CO):
Upon successful completion of this course, students should be able to:

CO1: To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from various applications, they will have a basic understanding of Beta and Gamma functions.
CO2: The essential tools of matrices and linear algebra including linear transformations, eigenvalues, diagonalization and orthogonalization.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓								✓
CO2	✓	✓	✓									✓

Course Contents:

Module 1: Calculus: (6 lectures)
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.

Module 2: Calculus: (6 lectures)
Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 3: Matrices (in case vector spaces is to be taught) (8 lectures)
Matrices, vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

Module 4: Vector spaces (Prerequisite Module 3-Matrices) (10 hours)
Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, Matrix associated with a linear map.

Module 5: Vector spaces (Prerequisite Module 3 –Matrices & Module-4 Vector spaces) (10 lectures)
Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

Text Books

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

References

1. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
2. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

TITLE OF COURSE: BASIC ELECTRONICS ENGINEERING
COURSE CODE: ECC101
L-T-P: 2-0-2-0
CREDITS: 3

Pre-requisite: Students studying basic electronics need experience with math courses, such as geometry, physics and algebra. Students learn how to use scientific calculators and formulas that help with figuring out voltage, distribution, and other circuit formulas.

Introduction:
This course is suitable for engineers in academia. The purpose of this course is to provide the student with precise theoretical and practical up to date knowledge of Basic Electronics and it's applications in day- to-day life. This course enhances the instructional capabilities of a student. This course is devoted to fundamental theory and recent developments addressing the related theoretical and practical aspects on electronic devices-their characteristics and applications.

Course Outcomes (CO):
Upon successful completion of this course, students should be able to:
CO1: Student will be able to understand the fundamentals of semiconductors, diode circuits and rectifier and working of basic electrical instruments and electronic components.
CO2: To be able to explain the junction properties and the phenomenon of rectification, I-V characteristics and identify operating points.
CO3: Student will be able to explain the working principle and operations of basic diode, BJT, JFET, MOSFET.
CO4: Student will be able to understand the concept of feedback, oscillator and fundamentals of operational amplifiers and its application.
CO5: Student will be to develop the understanding regarding application of elementary ideas of electrical and electronics in modern technology.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓			✓								
CO2	✓			✓								
CO3	✓		✓	✓								
CO4	✓		✓	✓								
CO5	✓	✓	✓	✓	✓	✓						✓

Course Contents:
Module-1: Semiconductors:
Crystalline material and their properties, Energy band theory, Fermi levels; Conductors,

Semiconductors and Insulators: electrical properties, band diagrams. Semiconductors: intrinsic and extrinsic, energy band diagram, electrical conduction phenomenon, P-type and N-type semiconductors, drift and diffusion carriers.

Module-2: Diodes and Diode Circuits:

Formation of P-N junction, energy band diagram, built-in-potential forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics; Simple diode circuits, load line, linear piecewise model; Rectifier circuits: half wave, full wave.

Module-3: Bipolar Junction Transistors:

Device structure and physical operation, current – voltage characteristics, the BJT as an amplifier and a switch, Biasing BJT Amplifier Circuits, Single stage BJT amplifiers CE, CB, CC.

Module-4: Field Effect Transistors:

Device structure and physical operation, current – voltage characteristics, JFET & MOSFET Structure and characteristics; MOSFET as an amplifier and a switch, Biasing MOSFET Amplifier Circuits, Single stage MOS amplifiers Amplifier Configuration, Common Source, Source Follower, Common Gate Configuration; CMOS inverter.

Module-5: Feed Back Amplifier, Oscillators:

Concept (Block diagram), properties, positive and negative feedback, effect of positive feedback: instability and oscillation, Barkhausen criteria.

Module-6: Introduction to Integrated circuits:

Operational amplifier and its terminal properties; Application of operational amplifier; Inverting and non-inverting mode of operation, Adders, Subtractors, Constant-gain multiplier, Voltage follower, Comparator, Integrator, Differentiator.

Text Books

1. Salivahanan: “Electronics Devices & Circuits”, Tata McGraw-Hill Education, 3rd Edition 2012
2. JB Gupta: “Electronic devices and circuits”, S K KATARIA & SONS, 1st edition, 2012
3. Rakshit Chattopadhyay: “Electronics Fundamentals and Applications”, 11th Edition, 2010

References

1. Boylestad & Nashelsky : “Electronic Devices & Circuit Theory”, Pearson, 11th Edition, 2015
2. Malvino: Electronic Principle

TITLE OF COURSE: BASIC ELECTRONICS ENGINEERING LAB

COURSE CODE: ECC191
L-T-P: 0-0-2-0
CREDITS: 1

Pre-requisite: Students studying basic electronics need experience with math courses, such as geometry, physics and algebra. Students learn how to use scientific calculators and formulas that help with figuring out voltage, distribution, and other circuit formulas.

Introduction:

This course is suitable for engineers in academia. The purpose of this course is to provide the student with precise theoretical and practical up to date knowledge of Basic Electronics and it’s applications in day- to-day life. This course enhances the instructional capabilities of a student. This course is devoted to fundamental theory and recent developments addressing the related theoretical and practical aspects on electronic devices-their characteristics and applications.

Course Outcomes (CO):

Upon successful completion of this course, students should be able to:

CO1: Analyze and appreciate the working of electronic circuits involving applications of diodes.
CO2: Comprehend working of amplifiers.
CO3: Analyze and appreciate the working of electronic circuits involving applications of transistors.
CO4: Develop simple projects based on the different devices studied in this course.
CO5: Rectifying a voltage, such as turning AC into DC voltages
CO6: To learn hand on experience such that students can design basic electronics circuits.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓			✓								
CO2	✓			✓								
CO3	✓		✓	✓								
CO4	✓		✓	✓								
CO5	✓	✓	✓	✓	✓	✓						✓
CO6	✓			✓								

Course Contents:

Module 1: Identifying and study of different components like resistor, capacitors, and to determine the stated value of the resistor using color code

Module 2: Study of different instruments used in the laboratories like, power supply, Oscilloscope, Multi-meter etc.

Module 3: Characteristics of Pn Junction Diode:

a. To Plot the Volt Ampere Characteristics of PN Junction Diode under Forward and Reverse Bias Conditions.
b. To find the Cut-in voltage, Static Resistance, Dynamic Resistance for Forward Bias & Reverse Bias

Module 4: Characteristics of Zener Diode & Load Regulation:

a. To Obtain the Forward Bias and Reverse Bias characteristics of a Zener diode.
b. Find out the Zener Break down Voltage from the Characteristics.
c. c. To Obtain the Load Regulation Characteristics.

Module 5: Study of ripple characteristic of half wave and full wave rectifier

Module 6: To study and plot the Input and Output characteristics of a BJT-Common Base Configuration

Module 7: To study and plot the Input and Output characteristics of a BJT-Common Emitter Configuration

Module 8: To study the characteristics of JFET

Module 9: To study the characteristics of MOSFET

Module 10: To study the operation of inverting amplifier and non-inverting operational amplifier

Text Books

1. Salivahanan: Electronics Devices & Circuits; Chapter: 1-8
2. JB Gupta: electronic devices and circuits.
3. Rakshit Chattopadhyay: Electronics Fundamentals and Applications; Chapter: 1-8

References

1. Boylestad & Nashelsky : Electronic Devices & Circuit Theory
2. Malvino: Electronic Principle

TITLE OF COURSE: ENGINEERING GRAPHICS & DESIGN
COURSE CODE: MEC101
L-T-P: 1-0-2-0
CREDITS: 2

Pre-requisite: Basic concept of physics, computer.

Introduction:

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software.

This course is designed to

To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

To prepare you to communicate effectively

To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

Course Outcomes (CO):

Upon successful completion of this course, students should be able to:

CO1: Introduction to engineering design and its place in society
CO2: Exposure to the visual aspects of engineering design
CO3: Exposure to engineering graphics standards
CO4: Exposure to solid modelling
CO5: Exposure to computer-aided geometric design
CO6: Exposure to creating working drawings

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								
CO2	✓	✓	✓	✓	✓							
CO3	✓	✓		✓								

CO4	✓		✓		✓				✓			

Course Contents:

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

Module 1: Introduction to Engineering Drawing:

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Module 2: Orthographic Projections:

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Module 3: Projections of Regular Solids:

Those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module 4: Sections and Sectional Views of Right Angular Solids:

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Module 5: Isometric Projections:

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Module 6: Overview of Computer Graphic:

listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Module 7: Customization & CAD Drawing

Consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing;

Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Module 8: Annotations, layering & other functions:

Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two- dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Module 9: Demonstration of a simple team design project that illustrates

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Text Books

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

References

1. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
2. Corresponding set of) CAD Software Theory and User Manuals

TITLE OF COURSE: PROGRAMMING FOR PROBLEM SOLVING-I (C)
COURSE CODE: CSC101
L-T-P: 2-0-0-2
CREDITS: 2

Pre-requisite: Knowledge is also assumed of basic concepts on computer system.

Introduction:

The student understands programming language, concepts of Loops, reading a set of Data, stepwise refinement, Functions, Control structure, Arrays. After completion of this course the student is expected to analyze the real-life problem and write a program in 'C' language to solve the problem. The main emphasis of the course will be on problem solving aspect i.e. developing proper algorithms

Course Outcomes (CO):

This course will serve to broaden the student's understanding of the issues and latest developments in the area of Programming in C. To reach this goal, the following objectives need to be met:

CO-1: To formulate simple algorithms for arithmetic and logical problems

CO-2: To translate the algorithms to programs (in C language)

CO-3: To test and execute the programs and correct syntax and logical errors

CO-4: To implement conditional branching, iteration and recursion

CO-5: To decompose a problem into functions and synthesize a complete program using divide and conquer approach

CO6: To use arrays, pointers and structures to formulate algorithms and programs

CO7: To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

CO8: To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓
CO2	✓			✓								✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓
CO5	✓				✓							✓

Course Contents:

Module-1: Introduction to Programming & Computer

Generations, Classifications, Applications, Basic Organization, Input and output devices, Basic concept of Computer memory, disks, memory, processor, where a program is stored and executed, operating system, compilers etc.

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

Module-2: Number system

Decimal, Binary, Octal, Hexa-decimal, Conversion of numbers, Addition and subtraction of two numbers, Two's compliment, Multiplication and division of binary numbers, working with fractions, signed number representation in binary form, Logic gates

Module-3: Introduction to C

Compiling and executing C programs, using comments, keywords, identifiers, Data type, variables, constants, input/output statements in C, operators in C, type conversion and type casting.

Module 4: Arithmetic expressions and precedence

Operators in C, Precedence of operators, Operators Precedence & Associativity Table, associativity of operators

Module-5: Decision Control and looping statements

Conditional branching statement, iterative statements, nested loops, break and continue statements, goto statement

Module-6: Arrays & Strings

Declaration, accessing elements of array, storing values, calculating the length of array, two dimensional arrays, reading and writing strings, suppressing input, string taxonomy, string operations – using and without using library function, array of strings

Module-7: Functions

Declaration, prototype, definition, function call, return statement, passing parameters to the function, scope of variable, storage classes, recursive functions.

Module-8: Pointers

introduction, declaration, Pointer expression and arithmetic, null pointer, generic pointer, passing arguments to functions using pointer, pointers and arrays, passing an array to function, difference between array name and pointer, pointers and strings, array of pointers, function pointers, pointers to pointers, dynamic memory allocation, drawbacks

Module 9: Recursion

Recursion, as a different way of solving problems. Example programs, such as Finding, Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Module-10: Structure-union, Files, Preprocessor directives

Structure, nested structure, array of structure, union, array of union variable, unions inside structure, Files – Reading –writing etc, Preprocessor directives

Module 11: **Basic Algorithms**

Notion of order of complexity through example programs, Searching, Basic Sorting Algorithms (Bubble, Insertion).

Text Books

1. Let Us C by Yashavant P. Kanetkar
2. Programming in C by Reema Thareja
3. Computer Fundamentals and C Programming by Sumitabha Das
4. Programming in ANSI C by Balagurusamy

References

1. Programming with C by Byron S Gottfried
2. Computer Programming in C Dr. Syed Jalal Ahmad, Arshad Ahmad Khan Mohamma

TITLE OF COURSE: PROGRAMMING FOR PROBLEM SOLVING LAB
COURSE CODE: CSC191
L-T-P: 0-0-0-2
CREDITS: 0

Pre-requisite: Students must have already registered for the course.

Introduction:

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

Course Outcomes (CO):

To formulate the algorithms for simple problems

CO1: To translate given algorithms to a working and correct program
CO2: To be able to correct syntax errors as reported by the compilers
CO3: To be able to identify and correct logical errors encountered at run time
CO4: To be able to write iterative as well as recursive programs
CO5: To be able to represent data in arrays, strings and structures and manipulate them through a program
CO6: To be able to declare pointers of different types and use them in defining self referential structures.
CO7: To be able to create, read and write to and from simple text files.

All experiment must be done using gcc or dev c/Turbo c

Tutorial 1: Problem solving using computers: Lab1: Familiarization with programming environment
Tutorial 2: Variable types and type conversions: Lab 2: Simple computational problems using arithmetic expressions
Tutorial 3: Branching and logical expressions: Lab 3: Problems involving if-then-else structures
Tutorial 4: Loops, while and for loops: Lab 4: Iterative problems e.g., sum of series
Tutorial 5: 1D Arrays: searching, sorting: Lab 5: 1D Array manipulation
Tutorial 6: 2D arrays and Strings, memory structure: Lab 6: Matrix problems, String operations
Tutorial 7: Functions, call by value: Lab 7: Simple functions
Tutorial 8 & 9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Numerical methods problems
Tutorial 10: Recursion, structure of recursive calls: Lab 10: Recursive functions
Tutorial 11: Pointers, structures and dynamic memory allocation Lab 11: Pointers and structures

Tutorial 12: File handling: Lab 12: File operations

Online Platform for Code Sharing to be used like Google Colab/Github/Kaggle(Mandatory)

List of Experiments

Experiment 1: Write a program in C to compute the average of a few inputs given by the use.
Experiment 2: Write a program in C to swap 2 numbers using a user defined function and print the values in main.
Experiment 3: Write down the importance of type conversion with example.
Experiment 4: Write a program in C to reverse a number.
Experiment 5: Write a program to find largest number between two numbers.
Experiment 6: Write a program to find a character is vowel or not using switch case.
Experiment 7: Write a program to find a given number is even or odd?
Experiment 8: Write a program in C that will find the sum of the series:
Experiment 9: Write a C program to print the following pattern using loop control instructions.
Experiment 10: Write a program to calculate the sum of cubes of first n numbers
Experiment 11: Write a C program to determine the factorial of a given number
Experiment 12: Write a program in C that will find the sum of the following series:
Experiment 13: Write a C program to print the following pattern using loop control instructions:

Experiment 14: Write a program in C that will concatenate two strings.
Experiment 15: Write a C program to calculate the number of vowels present in the string. Experiment 16: Write a program in C to calculate number of characters present in a string. Experiment 16: How does one-dimensional array differ from two-dimensional array? Experiment 18. Write a program in C that will reverse a string.
Experiment 19: Write a program in C to sort a single dimension array in an ascending order. Experiment 20: Write a program in C that will find area and circumference of a circle using a user defined function calc(). Take input and display the output in main().
Experiment 21: Write a program of factorial using recursive function.
Experiment 22: Write a program to define a structure of a student which contains roll, name, section etc. Then you need to find a record using a given roll.
Experiment 23: Write a program to read and write a file.

References

1. Let Us C by Yashavant P. Kanetkar
2. Programming in C by Reema Thareja
3. Computer Fundamentals and C Programming by Sumitabha Das
4. Programming in ANSI C by Balagurusamy
5. Programming with C by Byron S Gottfried
6. Computer Programming in C Dr. Syed Jalal Ahmad, Arshad Ahmad Khan Mohammad Necaise Rance D; Wiley publish

TITLE OF COURSE: ENGLISH COMMUNICATION & PUBLIC SPEAKING SKILLS-I
COURSE CODE: HSM101
L-T-P: 0-0-2-0
CREDITS: 1

Pre-requisite: Basics of English.

Introduction:
Learn the English speaking and writing skills with this Basic English structure and soft skills.

Course Outcomes (CO):
It is a well-balanced course that focuses on the four core language skills:
CO1: Listening
CO2: Speaking
CO3: Reading
CO4: Writing
CO5: Use the English language more effectively.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									✓	✓		✓
CO2									✓	✓		✓
CO3									✓	✓		✓

CO4									✓	✓		✓
CO5										✓		✓

Course Contents:

Module-1 (ENGLISH LANGUAGE: GRAMMAR & VOCABULARY):

Correction of Errors in Sentences , Building Vocabulary, Word formation, Single Word for a group of Words, Fill in the blanks using correct Words, Sentence Structures and Transformation, Active & Passive Voice, Direct & Indirect Narration (MCQ Practice during classes)

Module-2 (READING COMPREHENSION):

Strategies for Reading Comprehension, Short Stories for Comprehension, Practicing Technical & Non-Technical Texts for Global/Local/Inferential/Referential comprehension; Précis Writing, Essay/Paragraph writing

Module-3 (TECHNICAL COMMUNICATION):

The Theory of Communication –Definition & Scope, Barriers of Communication, Different Communication Models, Effective Communication (Verbal / Non verbal), Presentation / Public Speaking Skills, (MCQ Practice during classes)

Module -4 (MASTERING TECHNICAL COMMUNICATION):

Technical Report (formal drafting); Business Letter (formal drafting); Job Application (formal drafting); Organizational Communication: Memo, Notice, Agenda, Minutes Group Discussion – Principle & Practice

Text Books

1. Communication Skills, Sanjay Kumar and Pushpa Lata,(OUP),2015
2. Objective English, Prasad and Sinha, Tata McGraw Hill Education Pvt. Ltd, 2013
3. English Grammar, Wren and Martin, Regular Edition
4. Fantasy- A Collection of Short Stories,V. Sashikumar,Orient Black swan (Reprint 2006)

References

1. Proficiency in Reading Comprehension, Ajay Singh, Paperback, 2015
2. Selected Contemporary Essays, Soumitra Mohan, Paperback, 2016

TITLE OF COURSE: ESP & SDP-I
COURSE CODE: GSC101
L-T-P: 2-0-0-2
CREDITS: 2

Pre-requisite: Basic concepts in mathematics, English

Introduction:

The Topics to be covered (tentatively): Aptitude, Indian Constitution and Governance, Basic English and Data Interpretation**.**

Course Outcomes (CO):

Students are expected to be capable numerical problems, literature, and basic of Indian constitution. To reach this goal, the following objectives need to be met:
CO1: Students would be able to design & implement any basic numerical problem properly.
CO2: Students would be able to know basic English language and communicate with the society.
CO3: Students would be able to know basic Indian constitution.
CO4: Students would be able to stress management by doing Yoga

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓
CO2	✓			✓								✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓

Course Contents:

Essential Studies for Professionals-I
Section-A: Employment Enhancement Skills:
Module-1: Number System:

Numbers, Face value and place value of a digit, Types of numbers, Tests of Divisibility, Factorial of a number, Modulus of a number, greatest integral value, Multiplication by short cut methods, Division Algorithm.

Module-2: HCF and LCM of Numbers:
Factors and Multiples, HCF or GCD, LCM, Product of two numbers, Co-primes, HCF and LCM of fractions, HCF and LCM of decimal fractions, Comparison of fractions,
Module-3: Average & Percentage:
Concepts, Results on population, Results on Depreciation
Module-4: Profit and Loss:
Cost Price, Selling Price, Profit or Gain, Loss

Section B: Yoga, Games and Meditation:
Module-5: Asana sitting postures and Karate, Asana lying in supine & prone position and karate, Surya Namaskar, Asana standing posture and Karate, Kriyas, Pranayam and Karate, Meditation and Karate, Meditative posture and Karate, Tratak, Kapalbhati and Meditation.
Meditation and Stress Management, Meditation, Stretching and Self Defense. Meditation, Kicking and Punching of Karate. (Games and Sports will be evaluated on the basis of the participation and performance in different sports events that the students shall participate in).

Section C: Skill Development for Professionals-I
Module-1: Parts of speech: Introduction, Brief discussion of Parts of speech, noun, Kinds of Noun, Rules & Application. Pronoun, Examples, Rules & Application, Verb, Kinds of Verb, Rules & Application, Definition of Tense, Different types of Tenses, Examples, Rules & Application, Adjective, Kinds of Adjective, Rules & Application, Adverb, Kinds of Adverb, Rules & Application, Preposition, Examples, Rules & Application, Interjection, Examples, Rules & Its Application,

Conjunction, Examples, Rules & Application, Articles, Examples, Rules & Application English Grammar.
Vocabulary- : Synonyms, Antonyms with examples, one word Substitution, Idioms & Phrases, Spotting Errors.
Reading Comprehension (Level I)

Module-2: Indian Constitution and Governance: Historical background (in brief) - The company Rule (1773-1858), the crown rule (1858-1947), making of constitutions, features of constitution. The Preamble- Ingredients, keywords, amendment of preamble. Part & schedule, Citizenship (in brief) - Constitutional provisions, Citizenship act, Comparing PIO & OCI card holders, Fundamental Rights- Concept & different articles, Right to equality, prohibition of discrimination on certain ground, Equality of opportunity, abolition of untouchability & titles, right to freedom, right to education, right against exploitation, right to freedom of religion, cultural & educational rights, different writes & scopes, DPSP- Classification of directive principle, sanctioned of directive principal, criticism, Distinction between fundamental rights & directive principle List of Fundamental duties, criticism, significance, Verma committee. Features of parliament govt. Features of Presidential Govt. Merits & Demerits. Duties of Honorable President & Vice President & their selection, Provision & scopes, Duties of PM, CM & Governor & their selections

Module-3: Data Interpretation Level-I
Newspaper reading: The Hindu & Economic Times

Text Books

1. Quantitative Aptitude for Competitive Examinations by R S Aggarwal
2. Introduction to the Constitution of India, by D D Basu
3. The Constitution of India by Dr. B.R. Ambedkar Under Chairmanship of Dr. Rajendra Prasad Including Coloured Preamble, Signatures

References

1. The Constitution of India by Dr. B.R. Ambedkar 2020.

Second Semester Syllabus

Sl No.	Type	Subject Code	Topic	L	T	P	S	Credit Points
1.	BSC	BSC203	Physics (Semi-Conductor Physics)	3	1	3	0	5.5
2.	BSC	BSC204	Mathematics-II(Probability & Statistics)	3	1	0	0	4
3.	ESC	EEC202	Basic Electrical Engineering	2	0	2	0	3
4.	ESC	MEC202	Workshop & Manufacturing Practices	1	0	2	0	2
5.	ESC	CSC202	Programming for Problem Solving-II (Python)	2	0	0	2	2
6.	HSM	HSM202	English Communication & Public Speaking Skills-II	1	0	3	0	2
7.	GSC	GSC202	ESP & SDP-II	2	0	0	2	2
8.	NPT	NPT201	(NPTEL/MOOCs)	-	-	-	-	2
			Total	15	0	9	4	22.5/28

#(NPT201)NPTEL/MOOCs are based on the respective year's offered courses.

TITLE OF COURSE: PHYSICS (SEMI-CONDUCTOR PHYSICS)
COURSE CODE: BSC203
L-T-P: 3-1-3-0
CREDITS: 5.5

Pre-requisite: Basic knowledge of classical mechanics at XI, XII level. Basic knowledge of wave theory of light. Basic knowledge of Vector calculus, Differential and Integral calculus along with differential equations, concept of Cartesian and spherical coordinate, linear algebra and partial differential equation. Basic knowledge of probability and statistics. Basic knowledge of electrostatics and magneto statics at XI, XII level.

Introduction:

An obvious, very important motivation for the study of Semiconductor Physics is the fact that the microscopic properties it deals with are responsible for the majority of modern technology. These properties determine the material mechanical strength, how they interact with light, how they conduct electricity, etc.

Course Outcomes (CO):

Upon successful completion of this course, students should be able to:

CO1: Have knowledge about the physics of semiconductor materials.

CO2: Express the atomic structure of solids.

CO3: Analyse the characteristics and theories in semiconductor materials in terms of crystal structures, charge carriers and energy bands.

CO4: Describe crystalline structures of semiconductors.

CO5: Explain the properties of n-type and p-type semiconductors.

CO6: Describe the physical characteristics such as electronic structure and optical and transport properties, and current-voltage characteristics of semiconductors.

CO7: Explain how to find the fermi energy level and carrier density in n-type and p-type semiconductors.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓			✓								
CO3	✓	✓										
CO4	✓	✓	✓	✓			✓					
CO5	✓	✓		✓								
CO6	✓	✓										
CO7	✓	✓										

Course Contents:

Module 1: Introduction to Quantum Mechanics (5)

Wave Particle duality, De-Broglie Hypothesis, Wave packets, Wave Function, Physical Significance of a wave function, Probability Density, Normalization of a wave function, Expectation Value, Operator Correspondence, Schrödinger Wave Equations (Time dependent and Independent), Particle in one Dimensional Box and its Energy sates, Particle in a Three Dimensional box, Energy Degeneracy

Module 2: Electronic materials (8)

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 bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Occupation probability, Fermi level, Effective mass, Phonons.

Module 3: Semiconductors (10)

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 optoelectronic devices.

Module 4: Measurements (6)

Four-point probe measurement for resistivity, Hall Effect, Measurement of Hall coefficient and Hall Mobility, Capacitance-voltage measurements. Hot-Point probe Measurements.

Module 5: Semiconductor Lasers (6)

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission, Einstein's Relation, Threshold Condition for Lasing Action, Design and Working of Ruby Laser, He-Ne Laser and Semiconductor Laser, Applications of Lasers

Text Books

1. Jasprit. Singh, Semiconductor Physics and Devices: Wiley.
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).

References

1. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
2. Malik and Singh, Engineering Physics, Tata Mc-Graw Hill

TITLE OF COURSE: PHYSICS (SEMI-CONDUCTOR PHYSICS) LAB
COURSE CODE: BSC291
L-T-P: 0-0-3-0
CREDITS: 1.5

Pre-requisite: Basic knowledge of classical mechanics at XI, XII level. Basic knowledge of wave theory of light. Basic knowledge of Vector calculus, Differential and Integral calculus along with differential equations, concept of Cartesian and spherical coordinate, linear algebra and partial differential equation. Basic knowledge of probability and statistics. Basic knowledge of electrostatics and magneto statics at XI, XII level.

Introduction:

An obvious, very important motivation for the study of Semiconductor Physics is the fact that the microscopic properties it deals with are responsible for the majority of modern technology. These properties determine the material mechanical strength, how they interact with light, how they conduct electricity, etc.

Course Outcomes (CO):

Upon successful completion of this course, students should be able to:

CO1: Develop familiarity with range of experimental methods.

CO2: Design, perform, document and analyze experiments in physics.

CO3: Learn to work in a group.

CO4: Verify the theories learnt with the help of instruments and measurement techniques, learn the sources of error in the experiment and calculate the error percentage.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓								
CO2	✓	✓	✓	✓								
CO3								✓	✓	✓	✓	
CO4	✓	✓	✓	✓								

Course Contents:

Experiment-1:

Study of a half wave rectifier using single diode without any filter and with L and Π section filters.

Experiment-2:

Study of a power supply using two diodes/bridge rectifier with various filter circuit

Experiment-3:

Study of single stage transistor audio-amplifier

Experiment-4:

To study the change in resistivity of any semiconductor with temperature by four probe method. cnt=4

Experiment-5:

To study the characteristic of given junction and Zener diodes

Experiment-6:

To study and draw the characteristics curve of given field effect transistor (FET).

Experiment-7:

To study the gain frequency response of transistor amplifier with (a) resistive load (b) inductive load (c) transformer load (d) to find its input and output impedance

Experiment-8

Study of OR,AND and NOT logic gates by applying different components and hence their comparison with the gates formed with integrated circuits

Experiment-9

To Study I-V characteristics of LED and Diode Laser. To Study P-I characteristics of LED and Diode Laser

Experiment-10

To Study I-V characteristics in reverse bias and to measure variation of photocurrent as a function of reverse voltage and intensity.(photodiode)

Experiment-11 Determination of energy band gap of a given semiconductor using P-N junction diode.

Experiment-12 Determination of dielectric constant of a given dielectric material.

Experiment-13 Determination of wavelength of ligth by laser diffraction method.

Experiment-14 Determination of young's modulus of the material of the bar by flexure method.

Experiment-15 Determination of modulus of rigidity of the material of a wire by dynamic method.

Experiment-16 Determination of time constant by charging and discharging of capacitor.

Experiment-17

Determination of specific resistance of material of agiven wire with the help of carey foster's

Text Books

1. Jasprit. Singh, Semiconductor Physics and Devices: Wiley.
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).

References

1. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
2. Malik and Singh, Engineering Physics, Tata Mc-Graw Hill

TITLE OF COURSE: MATHEMATICS-II (PROBABILITY & STATISTICS)

COURSE CODE: BSC204

L-T-P: 3-0-1-0

CREDITS: 4

Pre-requisite: High School Mathematics & BSC103

Introduction:

The objective of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

Course Outcomes (CO):

Upon successful completion of this course, students should be able to:

CO1: The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.

CO2: The basic ideas of statistics including measures of central tendency, correlation and regression.

CO3: The statistical methods of studying data samples.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓
CO2	✓	✓	✓	✓	✓							✓

CO3	✓	✓	✓		✓							✓

Course Contents:

Module 1: Basic Probability: *(12 lectures)*

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Module 2: Continuous Probability Distributions: *(4 lectures)*

Continuous random varibales and their properties, distribution functions and densities, normal, exponential and gamma densities.

Module 3: Bivariate Distributions: *(4 lectures)*

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

Module 4: Basic Statistics: *(8 lectures)*

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

Module 5: Applied Statistics: *(8 lectures)*

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Module 6: Small samples: *(4 lectures)*

Test for single mean, difference of means and correlation coefficients, test for ratio of variances Chi-square test for goodness of fit and independence of attributes.

Text Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition.
3. B.Basu Mallik & Krishanu Deyasi, Engineering Mathematics-1B, Cengage Learning.
4. B.Basu Mallik & Krishanu Deyasi, Engineering Mathematics-2B, Cengage Learning.
5. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
6. Jain & Iyengar, Advanced Engineering Mathematics, Narosa.
7. H.K.Dass, Advanced Engineering Mathematics, Sultan Chand.

References

1. Linear Algebra and its Applications, Gilbert Strang, Cengage.
2. Linear Algebra, Kenneth M Hoffman, Ray Kunze, Pearson.
3. Miller & Freund's, Probability and Statistics for Engineers, Pearson Education
4. S. Ross, a First Course in Probability, Pearson Education India

TITLE OF COURSE: BASIC ELECTRICAL ENGINEERING
COURSE CODE: EEC202
L-T-P: 2-0-2-0
CREDITS: 3

Pre-requisite: Basics especially class 12th Physics, chapters leading to Electricity, Magnetism and Semiconductors and Mathematics.

Introduction:

The course of basic electrical engineering is an essential and fundamental for the students of engineering.

Course Outcomes (CO):

The students are able to understand the basics of networks and circuits and methods to solve them.
Knowledge:

CO1: To understand and analyze basic electric and magnetic circuits
CO2: To study the working principles of electrical machines and power converters.
CO3: To introduce the components of low voltage electrical installations
CO4: Student will be to develop the understanding of single phase transformer, induction motor.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓									
CO2	✓		✓									
CO3	✓		✓									
CO4	✓		✓									

Course Contents:

Module 1 : DC Circuits (8 hours)

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

Module 2: AC Circuits (8 hours)

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

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed

control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Text Books

1. Basic Electrical Engineering -Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda

References

1. Basic Electrical Engineering (vol2)-B.L.Thereja
2. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition
3. Hughes Electrical & Electronics Technology, 8/e, Hughes, Pearson Education

TITLE OF COURSE: BASIC ELECTRICAL ENGINEERING LAB
COURSE CODE: EEC292
L-T-P: 0-0-2-0
CREDITS: 1

Pre-requisite:

Basics especially class 12th Physics, chapters leading to Electricity, Magnetism and Semiconductors and Mathematics.

Introduction:

1. To learn how we can connect the different elements (like resistance) series and parallel in Bread board.
2. Learn the practical verification of the network theorem with the theoretical results
3. Know about the connection of wattmeter, and how the power can be calculated for a given load by using a particular wattmeter.

Course Outcomes (CO):

By doing this practical students will gain the knowledge about the requirement of the breadboard in the circuit connection and the proper way of connection of the elements in the bread board.
Upon the completion of this practical course, the student will be able to:
CO1: Get an exposure to common electrical components and their ratings.
CO2: Make electrical connections by wires of appropriate ratings.
CO3: Understand the usage of common electrical measuring instruments.
CO4: Understand the basic characteristics of transformers and electrical machines.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	✓	✓	✓						✓			
CO2	✓	✓	✓						✓			
CO3	✓	✓	✓						✓			
CO4	✓	✓	✓						✓			

Course Contents:

Exercises that must be done in this course are listed below:

Exercise No.1: Basic safety precautions. Introduction and use of measuring instruments‐voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.

Exercise No.2: Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits ‐ impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.

Exercise No.2: Transformers: Observation of the no-load current waveform on an oscilloscope (nonsinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.

Exercise No.2: Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.

Exercise No.2: Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.

Exercise No.2: Torque Speed Characteristic of separately excited dc motor.

Exercise No.2: Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor.

Generator operation of an induction machine driven at super-synchronous speed.

Exercise No.2: Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.

Exercise No.2: Demonstration of (a) dc-dc converters (b) dc-ac converters ‐ PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Text Books

1. Basic Electrical Engineering -Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda

References

1. Basic Electrical Engineering (vol2)-B.L.Thereja
2. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition

3. Hughes Electrical & Electronics Technology, 8/e, Hughes, Pearson Education

TITLE OF COURSE: WORKSHOP & MANUFACTURING PRACTICES
COURSE CODE: MEC202
L-T-P: 1-0-2
CREDITS: 2

Pre-requisite: The basic need is to provide theoretical and practical knowledge of manufacturing processes and workshop technology to all the engineering students.

Introduction:
Manufacturing is fundamental to the development of any engineering product. This course is intended to expose engineering students to different types of manufacturing/ fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weightage, some lectures and video clips available on different methods of manufacturing are also included. The course intends to prepare students for:

Course Outcomes (CO):
Upon successful completion of this course, students should be able to:
CO1: Understanding different manufacturing techniques and their relative advantages/ disadvantages with respect to different applications
CO2: The selection of a suitable technique for meeting a specific fabrication need
CO3: Acquire a minimum practical skill with respect to the different manufacturing methods and develop the confidence to design & fabricate small components for their project work and also to participate in various national and international technical competitions.
CO4: Introduction to different manufacturing methods in different fields of engineering
CO5: Practical exposure to different fabrication techniques
CO6: Creation of simple components using different materials
CO7: Exposure to some of the advanced and latest manufacturing techniques being employed in the industry
CO8: Understand modern manufacturing operations, including their capabilities, limitations, and how to design economically.
CO9: Gain insight into how designers influence manufacturing schedule and cost, and cost of different components.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓						✓			
CO2	✓		✓						✓			
CO3	✓		✓	✓					✓			
CO4	✓		✓						✓			
CO5	✓			✓					✓		✓	

CO6	✓		✓	✓					✓			✓
CO7	✓			✓					✓		✓	
CO8	✓		✓	✓					✓			
CO9	✓			✓					✓		✓	

Course Contents:

Module-1: Manufacturing Methods

Introduction, classification of manufacturing methods, casting, forming, Machining: Machining principle, single point cutting tool, lathe machine, shaper machine, drilling machine; joining, advanced manufacturing

Module-2: CNC machining, Additive manufacturing:

What is NC, Components of traditional NC systems, Advantages of NC systems over manual methods of production, Computer Numerical Control (CNC), Components of modern CNC systems, Advantages & Disadvantages of CNC systems, Direct Numerical Control (DNC), Application of CNC Machine Tools, Classification of CNC Machines, G-code, M-code. Additive Manufacturing, Basic structure of additive manufacturing and its subcategories, Pros and Cons of AM, AM Benefits, Classification of Additive Manufacturing Systems, Important Technologies of AM: Stereo lithography Apparatus (SLA), Fused deposition modeling (FDM), Selective Laser Sintering (SLS)

Module-3: Fitting operations & power tools:

Introduction, tools used in fitting shop, operations performed in fitting work, power tools.

Module-4: Electrical &Electronics: Basic Concepts of Electrical Engineering:

Electric Current, Electromotive force, Electric Power, Ohm's Law, Basic Circuit Components, Faraday's Law of Electromagnetic Induction, Lenz's Law, Kirchhoff's laws, Network Sources, Resistive Networks, Series Parallel Circuits, Node Voltage Method, Mesh Current Method, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems, Transformers, Rotating Electrical Machines, Basic Electronics.

Module-5: Carpentry:

Introduction, hard and soft wood, types of common timbers, their qualities and uses, felling, conversion and seasoning of wood, defects in timber, characteristics of a good timber, plywood and applications, common tools used in carpentry shop, common wood joints common safety in carpentry shop.

Module-6: Plastic moulding, glass cutting:

Introduction, Classification of Plastic processing methods, Fundamentals of Processing, Primary Processing Technology Types; Injection Moulding, Blow Moulding, Extrusion Process, Compression Moulding, Secondary Processing Technology Types: Rotation Moulding, Thermoforming Moulding, Calendering, Coating; glass cutting.

Module-7: Metal casting:

Introduction, fluidity, pattern, common pattern materials, types of pattern, pattern allowances, core and core box, hand tools used in foundry shop, molding sand, constituents of molding sand, kinds of moulding sand, properties of moulding sand, moulding methods, casting, permanent mold or gravity die casting, slush casting, pressure die, shell mold casting, casting, centrifugal casting, casting, Defects, causes and remedies.

Module-8: Welding (arc welding & gas welding), brazing:

Introduction, terminology of welding process: edge preparations, welding joints, welding positions, classification of welding and allied processes, gas welding processes: oxy-acetylene welding, types

of welding flames, gas welding equipment's, safety recommendations for gas welding, arc welding processes: principle of arc welding, arc welding equipment, safety recommendations for arc welding, welding defects, brazing, soldering

Text Books

1. Elements of Workshop Technology Hajra & Choudhary, Media Promoters & Publisher.
2. Introduction to Basic Manufacturing Processes and Workshop Technology, Rajender singh, New age international publishers.

References

1. Workshop Practice HS Bawa, Tata McGraw Hill 2nd ed. India.
2. Mechanical Workshop Practice, K.C. John, PHI Learning New Delhi.
3. Workshop Technology, W.A.J.Chapman, CBS Publisher & Distributor New Delhi.

TITLE OF COURSE: WORKSHOP & MANUFACTURING PRACTICES
COURSE CODE: MEC292
L-T-P: 0-0-2
CREDITS: 1

Pre-requisite: The basic need is to provide theoretical and practical knowledge of manufacturing processes and workshop technology to all the engineering students.

Introduction:

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Course Outcomes (CO):

Upon successful completion of this course, students should be able to:

CO1: Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

CO2: They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

CO3: By assembling different components, they will be able to produce small devices of their interest.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓						✓			
CO2	✓		✓						✓			
CO3	✓		✓	✓					✓			

Lectures & videos: (10 hours)

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)
[More hours can be given to Welding for Civil Engineering students as they may have to deal with Steel structures fabrication and erection; 3D Printing is an evolving manufacturing technology and merits some lectures and hands-on training.]

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 - 8 hours (Arc welding 4 hrs + gas welding 4 hrs)
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.

TITLE OF COURSE: PROGRAMMING FOR PROBLEM SOLVING-II (PYTHON)
COURSE CODE: CSC202
L-T-P: 2-0-2
CREDITS: 3

Pre-requisite: Knowledge is also assumed of basic concepts in data structures, programming languages, and basic mathematics.

Introduction:
Python is developed by Guido van Rossum. Guido van Rossum started implementing Python in 1989. Python is a very simple programming language so even if you are new to programming, you can learn python without facing any issues. Learning Python gives the programmer a wide variety of career paths to choose from. Python is an open-source (free) programming language that is used in web programming, data science, artificial intelligence, and many scientific applications. Learning Python allows the programmer to focus on solving problems, rather than focusing on syntax. Its relative size and simplified syntax give it an edge over languages like Java and C++, yet the abundance of libraries gives it the power needed to accomplish great things.

Course Outcomes (CO):
After completion of the course, students will able:
CO1: Develop algorithmic solutions to simple computational problems
CO2: Read, write, execute by hand simple Python programs.
CO3: Structure simple Python programs for solving problems.

CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, and dictionaries.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓
CO2	✓		✓									✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓
CO5	✓		✓		✓							✓

Course Contents:

Module 1: INTRODUCTION TO PYTHON

Python Installation, Writing some basic programs, Installation using pip, Operators in Python, Assignment Operator

Module-2: ALGORITHMIC PROBLEM SOLVING

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

Module-3: DATA, EXPRESSIONS, STATEMENTS

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

Module-4: CONTROL FLOW, FUNCTIONS

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

Module-5: LISTS, TUPLES, DICTIONARIES

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

Module 6: OBJECT ORIENTED PROGRAMMING IN PYTHON

Classes in Python, Constructor, Creation of methods in class, Polymorphism in Python, Inheritance concept, Method overriding concept

Module-7: INPUT AND OUTPUT IN PYTHON

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules,

Module 8: ADVANCED MODULES IN PYTHON

Packages; Illustrative programs: word count, copy file, NumPy packages, Matplotlib Scipy, Scikitlearn (Overview), Pandas

Module 8: Overview Machine Learning

Introduction: Supervised Learning – Basic Overview, Distance Based, Tree Based. Unsupervised Learning – Clustering Approach, Some Implementation without Function calling

Text Books

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers.
2. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

References

1. John V Guttag, ―Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
5. Charles Dierbach, ―Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, ―Practical Programming: An Introduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

TITLE OF COURSE: PROGRAMMING FOR PROBLEM SOLVING-II LAB
COURSE CODE: CSC292
L-T-P: 0-0-2
CREDITS: 1

Pre-requisite: Knowledge is also assumed of basic concepts in data structures, programming languages, and basic mathematics.

Course Outcomes (CO):

After completion of the course, students will able:

CO1: Write, test, and debug simple Python programs.
CO2: Implement Python programs with conditionals and loops.
CO3: Develop Python programs step-wise by defining functions and calling them.
CO4: Use Python lists, tuples, dictionaries for representing compound data.
CO5: Read and write data from/to files in Python.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	✓	✓	✓		✓							✓
CO2	✓		✓									✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓
CO5	✓		✓		✓							✓

PLATFORM NEEDED: All experiment must be done using Python 3.x Windows/Linux (3.7 or 3.8 preferred or Anaconda).

Course Contents:

Assignment 1: Implementation of various operators in python
Assignment 2: Design of different patterns, accessing lists and other structures using loops. Implementation of different conditional statements.
Assignment 3: Function definition, Invocation, keyword argument implementation, Lambda function.
Assignment 4: Fundamental Data structure programs
Assignment 5: Advanced operations in data structures
Assignment 6: Creation of classes and objects in Python
Assignment 7: Polymorphism and Inheritance concept in Python.
Assignment 8: Creation of different file, Accessing .xlsx and CSV files using pandas
Assignment 9: Implementation of mathematical computation using Numpy and Scipy
Assignment 10: Implementation of mathematical computation using Numpy and Scipy
Assignment 11: Implementation of mathematical computation using Numpy,Scipy,Pandas
Assignment 12: Implementation of graphs, charts and figures using Matplotlib
Assignment 13: Mathematical Problem Solving.
Assignment 14: Supervised/Unsupervised Learning

List of Experiments

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton‘s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

Text Books

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition,

Updated for Python 3, Shroff/O'Reilly Publishers.
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

References

1. John V Guttag, —Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, —Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,, 2015.
4. Kenneth A. Lambert, —Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
4. Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, —Practical Programming: An Introduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

TITLE OF COURSE: ENGLISH COMMUNICATION & PUBLIC SPEAKING SKILLS-II
COURSE CODE: HSM202
L-T-P: 1-0-3-0
CREDITS: 2

Pre-requisite: Basic Grammar, Comprehension, Writing skills.

Introduction:

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course Outcomes (CO):

It is a well-balanced course that focuses on the four core language skills:
CO1: Facilitate students to communicate effectively in academic and social contexts.
CO2: Make students industry ready.
CO3: The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						✓				✓		✓
CO2										✓		✓
CO3										✓		✓

Course Contents:

Module 1 (Communication Skills)

1. Vocabulary Building

1.1 The concept of Word Formation

1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations.

2. Basic Writing Skills
2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing
3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

4. Nature and Style of sensible Writing
4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

5. Writing Practices
5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing

6. Oral Communication
(This unit involves interactive practice sessions in Language Lab)

6.1 Listening Comprehension

6.2 Pronunciation, Intonation, Stress and Rhythm

6.3 Common Everyday Situations: Conversations and Dialogues

6.4 Communication at Workplace

6.5 Interviews

6.6 Formal Presentations

Text Books

1. Advanced English Communication Skills Lab, Lakshminarayan, Paperback, 2015
2. English Language Laboratories-A Comprehensive Manual, Nira Konar, (OUP), 2016

3. Advanced Grammar in Use with Answers: A Self-Study Reference and Practice Book for Advanced Learners of English 3rd Edition, Martin Hewings, Paperback, 2015
4. Communication Skills, Sanjay Kumar and Pushpa Lata,(OUP),2015
5. Practical English Usage. Michael Swan. OUP. 1995.
6. Remedial English Grammar. F.T. Wood. Macmillan.2007

References

1. English Grammar, Wren and Martin, Regular Edition
2. The Art of Public Speaking, 10th Edition, Stephen E. Lucas, McGraw-Hill, 2008

TITLE OF COURSE: ENGLISH COMMUNICATION & PUBLIC SPEAKING SKILLS-II LAB
COURSE CODE: HSM292
L-T-P: 0-0-3-0
CREDITS: 1

Pre-requisite: Basic Grammar, Comprehension, Writing skills.

Introduction:
To enable students listen, speak, read and write effectively for academic purposes and face real life situations

Course Outcomes (CO):
It is a well-balanced course that focuses on the four core language skills:
CO1: Facilitate students to communicate effectively in academic and social contexts.
CO2: Make students industry ready.
CO3: The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						✓				✓		✓
CO2										✓		✓
CO3										✓		✓

Course Contents:

Module-1

Listening: Listening Skill & its sub skills helps the students to improve their concentration power, simultaneously honing their vocabulary. (Assignment: Listening to passages read aloud and then answering the questions set from that passage, and so forth), like- Dialogue Practice Sessions, Oral Comprehension. Conversation Practice Sessions: Situational Dialogue, Role Play, Use of Audio aids for Conversation Practice, Use of Video Clips for Conversation Practice

Module-2

Presentation: It helps to teach students effective communication through innovative methods of learning, like Individual Presentation, Group Presentation, Using Power point/OHP in Presentation,

Project Work on PowerPoint Presentation, Paper Presentation. Public Speaking and Soft Skills: Just A Minute (JAM) Sessions

Module- 3

Grammar and Vocabulary: Students will be able to communicate ideas effectively and powerfully using correct grammar and appropriate vocabulary. Related areas include topics like-Connectives, Modifiers, Idiomatic Usage, Online exercises on Grammar and Vocabulary. Report Writing: Report Writing - Principles and Practice

Module-4

GROUP DISCUSSION: Prepares B.Tech first year students for various aspects of their social and professional lives through interactive sessions, handouts, workshops, self-assessment, peer assessment, and teacher assessment. Related activities include, Group Discussion - Principles and Practice

Text Books

1. Advanced English Communication Skills Lab, Lakshmi narayan, Paperback, 2015
2. English Language Laboratories-A Comprehensive Manual, Nira Konar, (OUP), 2016
3. Advanced Grammar in Use with Answers: A Self-Study Reference and Practice Book for Advanced Learners of English 3rd Edition, Martin Hewings, Paperback, 2015
4. Communication Skills, Sanjay Kumar and Pushpa Lata,(OUP),2015

References

1. English Grammar, Wren and Martin, Regular Edition
2. The Art of Public Speaking, 10th Edition, Stephen E. Lucas, McGraw-Hill, 2008

TITLE OF COURSE: ESP & SDP-II
COURSE CODE: GSC202
L-T-P: 2-0-0-2
CREDITS: 2

Pre-requisite: Basic concepts in mathematics, English

Introduction:

The Topics to be covered (tentatively): Aptitude, Indian Constitution and Governance, Basic English and Data Interpretation**.**

Course Outcomes (CO):

Students are expected to be capable numerical problems, literature, and basic of Indian constitution. To reach this goal, the following objectives need to be met:

CO1: Students would be able to design & implement any basic numerical problem properly.
CO2: Students would be able to know basic English language and communicate with the society.
CO3: Students would be able to know basic Indian constitution.
CO4: Students would be able to stress management by doing Yoga

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓

CO2	✓			✓								✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓

Course Contents:

Essential Studies for Professionals-II
Section-A: Employment Enhancement Skills

Module 1: Ratio and Proportion (2 lectures)
Ratio, Proportion, Proportional, Comparison of Ratios, Compounded Ratios, Duplicate Ratio, Triplicate Ratio, Variation.

Module 2: Time, Work and Distance (2 lectures)
Time, Speed and Distance, Relative Speed

Module 3: Alligation or Mixture (2 lectures)
Alligation, Mean price, Rule of Alligation

Module 4: Clocks and Calendar (2 lectures)
Clocks, Odd days, Leap Year, Ordinary year, Counting of odd days, Day of the week related to odd days.

Module 5: Permutations and Combinations (2 lectures)
Factorial n, Permutations, Combinations.

Module-6: Logical Reasoning
1) Cube Dice, Miscellaneous Problems
2) Data Sufficiency
a) Problems on Blood Relation, ages, Numbers b) Logical Test Based on Data Sufficiency
3) Non Verbal Reasoning
a) Image Formation b) Water –Images c) Mirror Image
d) Image completion
e) Paper Cutting and Folding

Section B: Yoga, Games and Meditation
Module-1: Asana sitting postures and Karate, Asana lying in supine & prone position and karate, Surya Namaskar, Asana standing posture and Karate, Kriyas, Pranayam and Karate, Meditation and Karate, Meditative posture and Karate, Tratak, Kapalbhati and Meditation.
Meditation and Stress Management, Meditation, Stretching and Self Defense. Meditation, Kicking and Punching of Karate. (Games and Sports will be evaluated on the basis of the participation and performance in different sports events that the students shall participate in).

Section C: Skill Development for Professionals -II
Course Contents:

Module-1: Listening

Listening to stories, newspaper articles, Oral Comprehension, Dialogue/ Conversation

Module-2: Speaking

Group discussion, debate, Oral Presentation, Just A Minute (JAM)

Language Function Permission – Request, Order

Practice of Phonetics, Pronunciation, Voice modulation, Accent and voice through passage reading

Story-telling, Role play model (telephonic conversation, situation)

Module-3: Reading Comprehension

Read and analyze through passages, diagrams, graphics, technical and non-technical passages

Learn to read Global, inferential, Contextual Comprehension.

Story writing, Passage writing, Essay writing, Rearranging Jumbled Sentences, Word formation: Prefixes and Suffixes, Homonyms and Homophones, Question and Answer – Comprehension Passages.

Module-4: Indian Constitution and Governance

Central State relation, Interstate relation,

Supreme Court-Appointment of Chief Justice, Acting Chief Justice, Qualification, Oath or Affirmation, Tenure of Judge, Removal of Judges, Salaries & allowance, Adhoc Judge, Procedure of the court, write jurisdiction, Power of Judicial review.

High Court-Appointment of Chief Justice, Acting Chief Justice, Qualification, Oath or Affirmation, Tenure of Judge, Removal of Judges, Salaries & allowance, Adhoc Judge, Procedure of the court, write jurisdiction, Power of Judicial review

Duties & Powers of **Attorney & Advocate General** (in brief)

Panchayati Raj- Three tier system, Different committees recommendation

Municipality, Municipal Council & Corporation, Official Languages & related Articles.

UPSC (in brief): Formation, Related Articles, Scope & Power, Duties of **CAG**, Formation **SPSC**, Related Articles, Scope & Power.

Election Commission (in brief) - Related Articles, Power & Function & Provision of Election

Emergency Provisions (in brief)- Related Articles, Conditions Application, Supreme power during emergency.

National Commission for SC/ST/OBC (in brief)**:** Function of the commissions, Special offer & related articles for SC/ST/OBC

Different amendments (in brief) of Indian Constitution & the related articles

Module-5: Data Interpretation level-II

Newspaper reading: The Hindu & Economic Times

Text Books

1. Quantitative Aptitude for Competitive Examinations by R S Aggarwal
2. Introduction to the Constitution of India, by D D Basu
3. The Constitution of India by Dr. B.R. Ambedkar Under Chairmanship of Dr. Rajendra Prasad Including Coloured Preamble, Signatures

References

1. The Constitution of India by Dr. B.R. Ambedkar 2020

Third Semester Syllabus

Sl No.	Type	Subject Code	Topic	L	T	P	S	Credit Points
1.	BSC	BSC305	Mathematics-III (Differential Calculus)	2	0	0	0	2
2.	PCC	CSC303	Data Structure & Algorithms	3	0	3	0	4.5
3.	ESC	ECS303	Analog Electronic Circuits	2	0	3	0	3.5
4.	PCC	CSC304	Digital Electronics	3	0	3	0	4.5
5.	PCC	CSC305	IT Workshop (Sci Lab/MATLAB)	1	0	4	0	3
6.	HSM	HSM---	Humanities-I	3	0	0	0	3
7.	GSC	GSC303	ESP & SDP-III	2	0	0	2	2
8.	MAR	MAR381	Mandatory Additional Requirements (MAR)	0	0	0	1	0.5
9.	NPT	NPT302	(NPTEL/MOOCs)	-	-	-	-	2
			Total	17	0	13	3	25/33

#(NPT302): NPTEL/MOOCs are based on the respective year's offered courses.

Suggestive Choice Based Subjects

Sl No	Type	Subject Code	Topic	L	T	P	Credit Points
1.	HSM	**HSM303**	Organizational Behavior	3	0	0	3
2.	**HSM**	**HSM304**	**Values and Ethics in Profession**	3	0	0	3
3	HSM	HSM305	Industrial Psychology	3	0	0	3

TITLE OF COURSE: MATHEMATICS-III (CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS)
COURSE CODE: BSC305
L-T-P: 2-0-0-0
CREDITS: 2

Pre-requisite: Determinant, Basic Probability Concept, Set Theory, Matrix

Introduction: The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. More precisely, the objectives are:

Course Outcomes (CO):
Upon successful completion of this course, students should be able to:
CO1: To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
CO2: To introduce effective mathematical tools for the solutions of differential equations that model physical processes.
CO3: To introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓						✓	✓
CO2	✓			✓							✓	✓
CO3	✓	✓	✓	✓							✓	✓
CO4	✓	✓	✓	✓							✓	✓

Course Contents:
Module 1: Sequences and series: (Prerequisite 2b) (8 hours)
Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions.
Module 2: Multivariable Calculus (Differentiation) (Prerequisite 2b) (8 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.
Module 3: Multivariable Calculus (Integration) (Prerequisite 3a) (10 hours)
Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.
Module 4: First order ordinary differential equations (6 hours)
Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 5: Ordinary differential equations of higher orders (8 hours)
Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Text Books
1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 43 rd Edition.
3. B.Basu Mallik & Krishanu Deyasi, Engineering Mathematics-2B, Cengage Learning.
4. Michael Greenberg, Advanced Engineering Mathematics, Pearson
5. Jain & Iyengar, Advanced Engineering Mathematics, Narosa.
6. H.K.Dass, Advanced Engineering Mathematics, Sultan Chand.
7. S. Ross, A First Course in Probability, Pearson Education India

References
1. Gupta & Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons
2. Miller & Freund's, Probability and Statistics for Engineers, Pearson Education.
3. Spiegel M R., Schiller J.J. and Srinivasan R.A.: Probability and Statistics (Schaum's Outline Series), TMH.
4. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.

TITLE OF COURSE: DATA STRUCTURE & ALGORITHMS
COURSE CODE: CSC303
L-T-P: 3-0-2-0
CREDITS: 4

Pre-requisite: Basic concepts in mathematics and programming languages.
Introduction:
This course examines data structures and algorithms basics using python. The Topics to be covered (tentatively) include: an introduction to programming and problem solving in Python with basic concepts such as conditionals, loops, functions, lists, strings and tuples; Time and space analysis of algorithms; Linear Data structures like array, linked list, stack, queue; Non-linear Data structures like graph and tree; Sorting; Searching and Hashing.

Course Outcomes (CO):
In this course we will study the basic components of data structure and algorithm. Students are expected to be capable of understanding the data structures, their advantages and drawbacks, how to implement them in python, how their drawbacks can be overcome and what the applications are and where they can be used. To reach this goal, the following objectives need to be met:
CO1: Students would be able to design & implement any data structure properly.
CO2: Students would be able to implement any problem by writing their own algorithm.
CO3: To understand basic concepts about stacks, queues, lists, trees and graphs.
CO4: To enable them to write algorithms for solving problems with the help of fundamental data structures
CO5: For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓
CO2	✓			✓								✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓
CO5	✓	✓	✓		✓							✓

Course Contents:

Module 1:

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. **Searching:** Linear Search and Binary Search Techniques and their complexity analysis.

Module 2:

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation - corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Module 3:

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Module 4:

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Text Books

1. Data Structures and Algorithms in Python: Michael H. Goldwasser, Roberto Tamassia, Michael T. Goodrich, Publisher: John Wiley & Sons
2. Data Structure and Algorithmic Thinking with Python:Narasimha Karumanchi; Careermonk publication.

Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
3. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
4. "Data Structures in C" by Aaron M. Tenenbaum.

References

1. Problem Solving in Data Structures & Algorithms Using Python: Programming Interview Guide:Hemant Jain; Createspace Independent Pub

2. Data Structures and Algorithms Using Python: Necaise Rance D; Wiley publish

TITLE OF COURSE: DATA STRUCTURE & ALGORITHMS LAB
COURSE CODE: CSC393
L-T-P: 0-0-2-0
CREDITS: 1

Pre-requisite: Basic concepts in mathematics and programming languages.

Introduction:

This course examines data structures and algorithms basics using python. The Topics to be covered (tentatively) include: an introduction to programming and problem solving in Python with basic concepts such as conditionals, loops, functions, lists, strings and tuples; Time and space analysis of algorithms; Linear Data structures like array, linked list, stack, queue; Non-linear Data structures like graph and tree; Sorting; Searching and Hashing.

Course Outcomes (CO):

In this course we will study the basic components of data structure and algorithm. Students are expected to be capable of understanding the data structures, their advantages and drawbacks, how to implement them in python, how their drawbacks can be overcome and what the applications are and where they can be used. To reach this goal, the following objectives need to be met:
CO1: Students would be able to design & implement any data structure properly.
CO2: Students would be able to implement any problem by writing their own algorithm.
CO3: By analyzing the logic of any algorithm, students would be able to write efficient program.
CO4: To become an efficient programmer

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓
CO2	✓			✓								✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓

Course Contents:

Exercises that must be done in this course are listed below:
Exercise No.1: Implementation of array operations
Exercise No. 2: Stacks and Queues: adding, deleting elements
Exercise No. 3: Circular Queue: Adding & deleting elements
Exercise No. 4: Merging Problem: Evaluation of expressions operations on multiple stacks & queues
Exercise No. 5: Implementation of linked lists: inserting, deleting, and inverting a linked list. Exercise No. 6: Implementation of stacks & queues using linked lists, Polynomial addition, and Polynomial multiplication
Exercise No. 7: Sparse Matrices: Multiplication, addition. Exercise No. 8: Recursive and Non-recursive traversal of Trees
Exercise No. 9: Threaded binary tree traversal. AVL tree implementation
Exercise No. 10: Application of Trees. Application of sorting and searching algorithms

Text Books

1. Data Structures and Algorithms in Python: Michael H. Goldwasser, Roberto Tamassia, Michael T. Goodrich, Publisher: John Wiley & Sons
2. Data Structure and Algorithmic Thinking with Python:Narasimha Karumanchi; Careermonk publication.
Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
3. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
4. "Data Structures in C" by Aaron M. Tenenbaum.

References

1. Problem Solving in Data Structures & Algorithms Using Python: Programming Interview Guide:Hemant Jain; Createspace Independent Pub

2. Data Structures and Algorithms Using Python: Necaise Rance D; Wiley publisher

TITLE OF COURSE: ANALOG ELECTRONIC CIRCUITS
COURSE CODE: ECS303
L-T-P: 2-0-3-0
CREDITS: 3.5

Pre-requisite: Binary numbers & Basic Boolean algebra, Logic gates, Truth Tables and function realization, Basic Electronics

Introduction:
To introduce circuit realizations with components such as diodes, BJTs and transistors studied earlier.
To give understanding of various types of amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers.
To familiarize the Concept of feedback in amplifiers so as to differentiate between negative and positive feedback

Course Outcomes (CO): At the end of this course students will demonstrate the ability to
CO1: Understand the characteristics of diodes and transistors
CO2: Design and analyze various rectifier and amplifier circuits
CO3: Design sinusoidal and non-sinusoidal oscillators
CO4: Understand the functioning of OP-AMP and design OP-AMP based circuits

CO5: Design ADC and DAC

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1		✓	✓	✓	✓							
CO2	✓	✓		✓								
CO3	✓	✓	✓	✓	✓							✓
CO4	✓	✓	✓	✓								✓
CO5	✓	✓	✓	✓								✓

Course Contents:

Module 1: Circuits, Amplifiermodels: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

Module 2: High frequency transistor models, frequency response of single stage andmultistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues. Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.

Module 3: Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators(phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators.

Module 4: mirror: Basic topology and its variants, V-I characteristics, outputresistance and minimum sustainable voltage (VON), maximum usable load. Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation.

Module 5: OP-AMP applications: review of inverting and non-inverting amplifiers, integratorand differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop, design guidelines.

Module 6: Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistorstring etc. Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, flash etc. Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.

Text Books

1. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
2. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.

References

1. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, Edition IV
2. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition

TITLE OF COURSE: ANALOG ELECTRONIC CIRCUITS LAB
COURSE CODE: ECS393
L-T-P: 0-0-3-0
CREDITS: 1.5

Hands-on experiments related to the course contents ECS303

TITLE OF COURSE: DIGITAL ELECTRONICS
COURSE CODE: CSC304
L-T-P: 3-0-3-0
CREDITS: 4.5

Pre-requisite: Binary numbers & Basic Boolean algebra, Logic gates, Truth Tables and function realization, Basic Electronics

Introduction:
This course is important for number system, Boolean algebra, basic requirements for a design application etc.

Course Outcomes (CO):
Upon successful completion of this course, students should be able to:
CO1: Students would be able to convert from one number system to another, work out and design problems related to Boolean algebra, minimization etc.
CO2: Have the ability to identify basic requirements for a design application and propose a cost-effective solution.
CO3: Have the ability to understand, analyse and design various combinational and sequential circuits.
CO4: Have the ability to understand, analyse and design various A/D and D/A conversion techniques.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1		✓	✓	✓	✓							
CO2	✓	✓	✓	✓	✓							
CO3	✓	✓	✓	✓	✓							✓
CO4	✓	✓	✓	✓								✓

Course Contents:
Module-1:
Binary Number System & Boolean Algebra (recapitulation); BCD, ASCII, EBCDIC, Gray codes and

their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic, Venn diagram, Boolean algebra (recapitulation); Representation in SOP and POS forms; Minimization of logic expressions by KMAP, Quine-McCluskey Minimization Technique (Tabular Method).

Module-2:

Combinational circuits - Adder and Subtractor circuits (half & full adder & subtractor); Encoder,Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator.

Module-3:

Sequential Circuits - Basic Flip-flop & Latch, Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops, Registers (SISO,SIPO,PIPO,PISO), Ring counter, Johnson counter , Basic concept of Synchronous and Asynchronous counters (detail design of circuits excluded), Design of Mod N Counter.

Module-4:

A/D and D/A conversion techniques – Basic concepts (D/A :R-2-R only, A/D: successive approximation, Logic families- TTL, ECL, MOS and CMOS - basic concepts.

Text Books

1. Digital Logic Design by Morris Mano - PHI
2. Digital Electronics by S. Salivahanan,S. Arivazhagan-OXFORD
3. Digital Electronics by P.Raja - Scitech Publications
4. Digital Fundamentals by Floyed & Jain -Pearson.

References

1. Microelectronics Engineering by Sedra & Smith-Oxford.
2. Principles of Electronic Devices & circuits by B L Thereja & Sedha,
3. S Chand Digital Electronics, Kharate –Oxford

TITLE OF COURSE: DIGITAL ELECTRONICS LAB
COURSE CODE: CSC394
L-T-P: 0-0-3-0
CREDITS: 1.5

Pre-requisite: Binary numbers & Basic Boolean algebra, Logic gates, Truth Tables and function realization, Basic Electronics.

Introduction:

This course is important for number system, Boolean algebra, basic requirements for a design application etc.

Course Outcomes (CO):

Upon successful completion of this course, students should be able to:

CO1: Students would be able to convert from one number system to another, work out and design problems related to Boolean algebra, minimization etc.

CO2: Have the ability to identify basic requirements for a design application and propose a cost-effective solution.

CO3: Have the ability to understand, analyse and design various combinational and sequential circuits.
CO4: Have the ability to understand, analyse and design various A/D and D/A conversion techniques.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1		✓	✓	✓	✓							
CO2	✓	✓	✓	✓	✓							
CO3	✓	✓	✓	✓	✓							✓
CO4	✓	✓	✓	✓								✓

Course Contents:
Experiment-1: Realization of Basic Gates & Universal Gates
Experiment-2: Realization of Basic Gates using Universal Gates
Experiment-3: Realization of XOR and XNOR using Universal Gates
Experiment-4: Realization of Boolean functions using Universal Gates only
Experiment-5: Realization of Prime and Non-Prime Indicator Circuit
Experiment-6: Realization of 2-bit comparator circuit
Experiment-7: Realization of a 4bit Binary to Gray Code converter and vice-versa
Experiment-8: Realization of a 4:1 multiplexer using basic gates.
Experiment-9: Design of Odd/Even Parity Generator and checker circuit.
Experiment-10:
a. Realization of S-R Latch using NAND gate.
b. Realization of S-R Flip Flop using NAND gate.
Experiment-11:
a. Realization of J-K Flip Flop using NAND gate.
b. Realization of T Flip Flop using NAND gate.
Experiment-12: Study of DAC.

Text Books
1. Digital Logic Design by Morris Mano - PHI
2. Digital Electronics by S. Salivahanan,S. Arivazhagan-OXFORD
3. Digital Electronics by P.Raja - Scitech Publications

References
1. Microelectronics Engineering by Sedra & Smith-Oxford.
2. Principles of Electronic Devices & circuits by B L Thereja & Sedha,

TITLE OF COURSE: IT WORKSHOP (SCI LAB/MATLAB)
COURSE CODE: CSC305
L-T-P: 1-0-4-0
CREDITS: 3

Pre-requisite:
1. Knowledge of Programming Logic
2. Experience with a high-level language (C/C++,) is suggested.
3. Prior knowledge of a scripting language and Object-Oriented concepts is helpful but not mandatory.

Introduction:
MATLAB is a proprietary multi-paradigm programming language and numeric computing environment developed by MathWorks. MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages.

Course Outcomes (CO):
On completion of the course students will be able to:
CO1: To master an understanding of scripting & the contributions of scripting languages
CO2: Design real life problems and think creatively about solutions
CO3: Apply a solution in a program using R/Matlab/Python.
CO4: To be exposed to advanced applications of mathematics, engineering and natural sciences to program real life problems

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓				✓	✓		✓	✓
CO2	✓	✓	✓	✓				✓	✓		✓	✓
CO3	✓	✓	✓	✓	✓	✓						✓
CO4	✓	✓	✓	✓	✓	✓						✓

Course Contents:
Matlab
Module-1: Introduction
Why MATLAB? History, Its strengths, Competitors, Starting MATLAB, Using MATLAB as a calculator, Quitting MATLAB Basics Familiar with MATLAB windows, Basic Operations, MATLAB-Data types, Rules about variable names, Predefined variables Programming-I Vector, Matrix, Array Addressing, Built-in functions, Mathematical Operations, Dealing with strings (Array of characters), Array of array (cell) concept Programming-II Script file, Input commands, Output commands, Structure of function file, Inline functions, Feval command, Comparison between script file and function file Conditional statements and Loop Relational and Logical Operators, If-else statements, Switch-case statements, For loop, While loop, Special commands (Break and continue), Import data from large database, Export data to own file or database,
Module-2: 2D Plotting
In-built functions for plotting, Multiple plotting with special graphics, Curve fitting, Interpolation, Basic fitting interface
Module-3: 3D Plotting
Use of meshgrid function, Mesh plot, Surface plot, Plots with special graphics

Laboratory Experiments:
Practical Assignments related with implementation of course

Text Books
1. Computer Organization and Architecture: Designing for Performance, William Stallings, Prentice-Hall India
2. Computer Organization, Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Tata McGraw Hill
3. Computer Architecture A Quantitative Approach, John L Hennessy and David Patterson, Morgan Kaufman
4. Structured Computer Organization, Andrew S. Tanenbaum, Prentice-Hall India

References
1. Computer Architecture & Parallel Processing. Kai Hwang & Briggs, Tata McGraw Hill
2. Computer System Architecture, M. M. Mano, PHI.
3. Computer Organization & Architecture, P N Basu, Vikas Publication

TITLE OF COURSE: ORGANIZATIONAL BEHAVIOR
COURSE CODE: HSM303
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Basic knowledge of general Management

Introduction:
Students in this course learn to get accustomed to workplace and they understand how to keep going in this world called profession. This course teaches them to be more confident and the theories which talks about the basic survival within the professional world.

Course Outcomes (CO):
CO1: Learning about organization
CO2: Personality development
CO3: Job satisfaction and factors responsible for the same
CO4: Motivation factors in profession, Group behavior
CO5: Communication process, Organizational politics, handling stress

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						✓		✓				✓
CO2						✓		✓	✓	✓		✓
CO3						✓		✓		✓	✓	✓
CO4						✓		✓	✓	✓	✓	✓
CO5				✓		✓		✓	✓	✓	✓	✓

Course Contents:

Module 1:

i) Organizational Behavior: Introduction, Concept, Features, Foundation, Importance ii) Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making iii) Motivation: Concept, Models of motivation, Types of Motivation

Module 2:

iv) Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction

v) Individual Decision Making in Organization: Rational Decision making, Decision making style, Common biases and judgment error in decision making

Module 3:

vi) Group Behavior: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making

vii) Leadership: Definition, Importance, Leadership Styles

viii) Technological Changes and Behavior: Introduction, Technology and occupation, computerization, TQM, Reengineering, Flexible system

Unit 4:

ix) Organizational Design: Various Organizational Structures and their Effects on Human Behavior Concepts of Organizational Climate and Organizational Culture

x) Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process

xi) Stress Management: Concept, forms, stages, causes, Effects, Coping strategies

Text Books

1. Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15th Edn. Resources, PHI, 10th Edn.

2. A Textbook of Organizational Behaviour Paperback –by Gupta C.B. 1st Edition published on 1 Jan 2014

3. Organizational Behaviour: M. N. Mishra. Vikas Publishing House Pvt Ltd.

References

1. http://bba12.weebly.com/uploads/9/4/2/8/9428277/organizational_behavior_15e_-_stephen_p_ robbins timothy_a_judge_pdf_qwerty.pdf

2. Cole, G. A.: Organizational Behaviour: Theory and Practice. Thomson Publication https://books.google.co.in/books?id=K5EKfJaZqgwC&printsec=frontcover&dq=organiza tional +behavior &hl=en&sa=X&ved=0ahUKEwiZgr30mZLVAhXCE5QKHXyqDgYQ6AEIP jA E#v= onepage&q&f=false

TITLE OF COURSE: VALUES AND ETHICS IN PROFESSION
COURSE CODE: HSM304
L-T-P: 3-0-0-0
CREDITS: 3

Pre-requisite: Ethical thinking in professional context has certain requirements. It should be universal, normative, interpersonal, rational, and sensitive to circumstances.

Introduction:

This course teaches students the basic principles of Values and Ethics within profession. These deals mainly with

- Values in professional life
- Ethics in professional life
- Resources depletion
- Conservation of resources for future generations
- Technology transfer
- Eco friendly Technology
- Value crisis in society
- Present society without values and Ethics.

Course Outcomes (CO):

Upon successful completion of this course, students should be able to:

CO1: Understand the present scenario of degradation of values and Ethics system
CO2: Depletion of resources and how to conserve them.
CO3: Club Of Rome and what all stalwarts have thought to improve the situation
CO4: Sustainable Development.
CO5: Value spectrum of a good life
CO6: Present societal changes in terms of values and ethics
CO7: What steps to be taken to improve value system?
CO8: How to avoid conflicts to have a peaceful job life.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓							✓	✓	✓		✓
CO2								✓				✓
CO3								✓	✓			✓
CO4							✓	✓				✓
CO5							✓	✓		✓		✓
CO6							✓	✓		✓		✓
CO7								✓		✓		✓
CO8								✓	✓	✓		✓

Course Contents:

Module 1: Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: Sustainable development Energy Crisis: Renewable Energy Resources Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics Appropriate Technology Movement of Schumacher; later developments Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis. Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

Module 2: Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes

of professional ethics. Whistle blowing and beyond.
Module 3: Values Crisis in contemporary society Nature of values: Value Spectrum Of good life Psychological values: Integrated personality; mental health Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution. Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity Moral and ethical values: Nature of moral judgments; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

Text Books
1. AN Tripathi ,Human values in the Engineering Profession, Monograph published byIIM,Calcutta1996

TITLE OF COURSE: INDUSTRIAL PSYCHOLOGY
COURSE CODE: HSM305
L-T-P: 2-0-0-0
CREDITS: 2

Pre-requisite: Basic idea of human behavior.

Introduction:
The industrial psychology course is concerned with the application of psychological theories and principles to organizations. It focuses on increasing efficiency, productivity, and related issues as the physical and mental well-being of employees at industrial organizations.

Course Outcomes (CO):
After having the course, students are expected to:
CO1: Perform a thorough and systematic competency model (job analysis)
CO2: Validate and develop a job specific selection design
CO3: Understand how to design, develop, and evaluate job specific training program
CO4: Explain organizational recruitment, selection and retainment
CO5: Evaluate the work performance of employees
CO6: Explaining the organizational issues including teams, attitudes, and occupational health
CO7: Describe the motivating factors of employees

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						✓						✓
CO2						✓						✓
CO3						✓				✓		✓
CO4						✓	✓		✓	✓	✓	✓
CO5						✓			✓		✓	✓
CO6						✓	✓		✓	✓	✓	✓
CO7						✓	✓		✓		✓	✓

Course Contents:

Module-1: Introduction to Industrial/Organizational Psychology:
Describing Industrial / Organizational Psychology and what I/O psychologist do. The history of I/O psychology. Research in I/O psychology. Ethics in I/O psychology

Module-2: Job Analysis and Evaluation:
Job analysis and job evaluation

Module-3: Legal Issues and Employee Selection:
The legal process. Determining whether an Employment decision is legal. Harassment. Family medical leave act. Affirmative action. Privacy issues.

Module-4: Employee Selection: recruiting and interviewing
Job analysis, recruitment, realistic job previews, effective employee selection techniques, employment interviews, job search skills.

Module-5: Employee Selection: references and testing
Predicting performance using references and letter of recommendation. Performance using applicant training and education. Performance using applicant knowledge, ability, skill, prior experience, personality and interest and character. Performance limitations due to medical and psychological problems. Comparison techniques

Module-6: Evaluating Selection Techniques and Decisions:
Characteristics of effective selection techniques. Establishing the usefulness of a selection device. Determining the fairness of a test. Making the hiring decision.

Module-7: Evaluating Employee Performance:
Determine the reason for evaluating employee performance, identify environmental and cultural limitations, determine who will evaluate performance, and select the best appraisal method to accomplish your goals, train raters, observe and document performance, evaluate performance, communicate appraisal results to employees, terminate employees Behaviorally anchored rating scales, forced-choice rating scales, mixed standard scales, behavioral observation scales

Text Books:

1. "Industrial/Organizational Psychology, 6th Edition, 2010", Authors: Michael G. Aamodt, Publisher: Cengage Learning, ISBN: 978-0-495-60106-7

TITLE OF COURSE: ESP & SDP-III
COURSE CODE: GSC303
L-T-P: 2-0-0-2
CREDITS: 2

Pre-requisite: Basic concepts in mathematics and Basic English languages.

Introduction:
This course examines economy, governance. The Topics to be covered, (tentatively): Economic Affairs, Quantitative Aptitude, Reasoning, Ancient & Medieval History.

Course Outcomes (CO):

In this course we will study the basic components of Indian economy and Reasoning. Students are expected to be capable of understanding their advantages and drawbacks, how to implement them it all over the country, how their drawbacks can be overcome and what the applications are and where they can be used. To reach this goal, the following objectives need to be met:

CO1: Understand the values of the exam like Gate, IAS etc.

CO2: Understand the values of tax payment and mutual Fund

CO3: Understand the values of literature, languages etc.

CO4: Understand Working & Policies, Money Market & Capital Market.

CO5: Know about different short cut techniques to solve any kind of aptitudes.

CO6: Know about different short cut techniques to solve any kind of reasoning.

CO7: Know about different short cut techniques to solve any kind of communicating problems.

CO8: Know about different short cut techniques to solve any kind of societal problems.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓
CO2	✓			✓								✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓
CO5	✓	✓	✓		✓							✓
CO6	✓			✓								✓
CO7	✓	✓	✓									✓
CO8	✓	✓	✓		✓							✓

Course Contents:

Section A: Employment Enhancement Skills-III

Module-1: GK & CA, National income: Concept of GDP, GNP, NNP both in FC & MP, PCI

Tax: Concept of TAX, objective of TAX, Direct & Indirect Tax, Progressive, Regressive & Proportional tax.

Module-2: Market structure: Perfect competition, monopoly, oligopoly, duopoly, monophony, duopoly, Oligopoly. SEBI, IRDA, NHB –Working & Policies, Money Market & Capital Market, functions of Banks & Types of accounts, cheques & loans, Mutual Fund, Banking Terminologies.

Module-3: Science, Technology, Literature (with current updates): Monuments, sculptures, Literature, Languages, Visual arts – paintings etc. Performing arts – classical and folk dances, puppetry etc. ,Religious diversity, Satellite, GPS, SIM, GSM, CDMA, Indian Regional Navigation Satellite System (IRNSS), NAVIC,WIFI, SIM, GPRS, ISRO, NASA.

Module-4: Ancient & Medieval History at a glance: From Indus valley civilization to Pre-Foreign (British, Dutch, French) Invasion. Current Affairs.

Section B: Skill Development for Professional – III

Module-1: Quantitative Aptitude: Basic concept of SI & CI, different formulas & their applications, concept of Growth & Contraction of Business. Data Interpretation- Tables, pie chart, histogram, Bar chart, solution tricks & techniques. Quant Review- Miscellaneous problems from different chapters & short cuts. Indices & Surds- Basic concept, Formulae & their applications, Finding out the square roots, Elimination of Surds, Equation solve. Quadratic Equation- Polynomials, degree, powers, Equation & factors Solution. Progression-Concept of AP, GP & HP

Module-2: Reasoning:

Syllogism: a) Logical Venn diagram b) The If Else Statement

Puzzles a) Seating Arrangement b) Classification c) Seating Arrangement with Blood relations

Machine Input-Output: a) Pattern Based I/O

Inequality: a) Coded Inequality, b) Jumbled Inequality, c) Conditional inequality

Sentence: a) Sentence Corrections b) Fill the blanks with appropriate words/articles/ preposition/ verbs/adverbs/conjunction. **d**) Reading Comprehension (Advance Level) d) Vocabulary

Module-3: Advanced Data Interpretation level-III

Newspaper reading: The Hindu & Economic Times

Text Books

1. Quantitative Aptitude for Competitive Examinations by R S Aggarwal
2. The Indian Economy, An Analysis of Economic Survey 2019-20 & Budget 2020-21 by Sanjiv Verma
3. Indian Financial System by Sujatra Bhattacharyya

References

1. Indian Economy for Civil Services, Universities and Other Examinations by Ramesh Singh
2. Indian Financial System, by Pathak PEARSON publisher

Fourth Semester Syllabus

Sl No.	Type	Subject Code	Topic	L	T	P	S	Credit Points
1.	PCC	CSC406	Discrete Mathematics	3	0	0	0	3
2.	PCC	CSC407	Operating System	3	0	3	0	4.5
3.	PCC	CSC408	Design & Analysis of Algorithms	3	0	3	0	4.5
4.	PCC	CSC409	Computer Organization & Architecture	3	0	3	0	4.5
5.	ESC	ECS404	Signals & System	2	0	0	0	3
6.	HSM	HSM---	Management-I	3	0	0	0	3
7.	GSC	GSC404	ESP & SDP-IV	2	0	0	2	2
8.	MC	MC401/402	Environmental Sciences/Disaster Management	0	0	0	0	2
9.	MAR	MAR484	Mandatory Additional Requirements (MAR)	0	0	0	1	0.5
10.	NPT	NPT403	(NPTEL/MOOCs)	-	-	-	-	2
			Total	19	0	12	3	27/34

#(NPT403): NPTEL/MOOCs are based on the respective year's offered courses.

Suggestive Choice Based Subjects

Sl No.	Type	Subject Code	Topic	L	T	P	Credit Points
1.	HSM	HSM406	Human Resource Development and Organizational Behavior	3	0	0	3
2.	HSM	**HSM407**	**Economics & Financial Accounting**	3	0	0	3
3.	HSM	HSM408	Economics for Engineers	3	0	0	3

TITLE OF COURSE: DISCRETE MATHEMATICS
COURSE CODE: CSC406
L-T-P: 3-0-0-0
CREDITS: 3

Pre-requisite: The readers are expected to have a reasonably good understanding of elementary algebra and arithmetic

Introduction:
To develop logical thinking and its application to computer science (to emphasize the importance of proving statements correctly and de-emphasize the hand-waving approach towards correctness of an argument). The subject enhances one's ability to reason and ability to present a coherent and mathematically accurate argument.

Course Outcomes (CO):
Upon successful completion of this course, students should be able to:
CO1: Write an argument using logical notation and determine if the argument is or is not valid.

CO2: Demonstrate the ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described.
CO3: Understand the basic principles of sets and operations in sets.
CO4: Prove basic set equalities.
CO5: Apply counting principles to determine probabilities.
CO6: Demonstrate an understanding of relations and functions and be able to determine their properties.
CO7: Demonstrate different traversal methods for trees and graphs.
CO8: Model problems in Computer Science using graphs and trees.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓							✓
CO2	✓	✓	✓	✓								✓
CO3	✓			✓								✓
CO4	✓			✓								
CO5				✓								✓
CO6				✓								✓
CO7		✓	✓		✓						✓	
CO8		✓	✓		✓							

Course Contents:
Module 1: Sets and Counting Techniques

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic. Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination, Disjunctive and Conjunctive Normal Form.

Module 2: Propositional Logic

Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by conditional.

Module 3: Algebraic Structures and Morphism

Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation

Module 4: Advanced Algebraic Structure and Boolean Algebra

Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function.

Module 5: Graphs and Trees

Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, chromatic number, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distance methods.

Module 6: Definitions and Examples of Perfect Matching, Maximal and Maximum Matching, Hall's Marriage Theorem (Statement only) and related problems.

Text Books

1. Satya narayana & shyam Prasad :discrete mathematics and graph theory, PHI
2. Kishor shinde: Discrete Structure, Everest publishing house
3. Hari Parihar&Ritu Agarwal, discrete mathematical structures, ashirwad

TITLE OF COURSE: OPERATING SYSTEM
COURSE CODE: CSC407
L-T-P: 3-0-3
CREDITS: 4.5

Pre-requisite: Knowledge is also assumed of basic concepts in mathematics and basic computing.

Introduction:

This course examines operating system design concepts, data structures and algorithms, and systems programming basics. The Topics to be covered (tentatively) include:

- Computer and operating system structures
- Process and thread management

• Process synchronization and communication
• Memory management
• Virtual memory
• File system
• I/O subsystem and device management
• Selected examples in networking, protection and security

Course Outcomes (CO):
Upon successful completion of this course, students should be able to:
CO1: Understand the theory and logic behind the design and construction of operating systems.
CO2: You will examine the algorithms used for various operations on operating systems.
CO3: You will differentiate between various operating systems functionalities in terms of performance.
CO4: Become aware of the issues in the management of resources like processor, memory and input-output.
CO5: Know the problems in the design of operating system and study the probable solutions.
CO6: Learn to calculate the performance of CPU scheduling and disk scheduling
CO7: Learn File systems and methods of accessing
CO8: Understanding various security threats
CO9: An overview of advanced operating systems and compare the technical aspects of all the advanced operating systems

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓								✓
CO2	✓	✓		✓								✓
CO3	✓		✓	✓								✓
CO4	✓	✓	✓		✓							✓
CO5	✓		✓	✓								✓
CO6	✓	✓	✓	✓								✓
CO7	✓		✓									✓
CO8	✓	✓	✓	✓	✓	✓						✓
CO9	✓		✓		✓							✓

Course Contents:
Module-1:
Introduction, Operating system structure - Monolithic systems, Layered systems, Virtual machines, Client-Server model.
Module-2:
Process Management – process creation, deletion, inter process communication tools: pipe, FIFO, shared memory, process synchronization, synchronization primitives and Classical IPC problems.

Module-3:
Process scheduling, Processor Allocation - Allocation Model, Design issues for processor allocation algorithms, Threads and Deadlock.

Module-4:
Memory Management, paging scheme, segmentation, virtual memory concept, page replacement algorithms, threshing, working set model, issues in Virtual memory management.

Module-5:
File System management. Input output management, Disk scheduling, Case study of UNIX/LINUX.

Text Books

1. Silberschatz, P. Galvin and Greg Gagne, "Operating System Concepts", Wiley International Company.
2. A.S. Tanenbaum, Modern Operating Systems, Prentice Hall India.

References

1. J. Archer Harris, Operating systems – Schuam's outlines, Tata Mc Graw Hill.
2. Gary Nutt, Operating Systems – A modern perspective, Pearson Education.

TITLE OF COURSE: OPERATING SYSTEM LAB
COURSE CODE: CSC497
L-T-P: 0-0-3-0
CREDITS: 1.5

Pre-requisite: Knowledge is also assumed of basic concepts in mathematics and basic computing.

Introduction:
1. To learn and understand system calls related to files, processes, signals, semaphores and implement system programs based on that.
2. To provide an understanding of the design aspects of operating system.
3. To provide an efficient understanding of the language translation peculiarities by designing a complete translator for a mini language

Course Outcomes (CO):
Upon successful completion of this course, students should be able to:
CO1: Understand the theory and logic behind the design and construction of operating systems.
CO2: You will examine the algorithms used for various operations on operating systems.
CO3: You will differentiate between various operating systems functionalities in terms of performance.
CO4: Become aware of the issues in the management of resources like processor, memory and input-output.
CO5: Know the problems in the design of operating system and study the probable solutions.
CO6: Learn to calculate the performance of CPU scheduling and disk scheduling
CO7: Learn File systems and methods of accessing
CO8: Understanding various security threats
CO9: An overview of advanced operating systems and compare the technical aspects of all the advanced operating systems

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓								✓
CO2	✓	✓		✓								✓
CO3	✓		✓	✓								✓
CO4	✓	✓	✓		✓							✓
CO5	✓		✓	✓								✓
CO6	✓	✓	✓	✓								✓
CO7	✓		✓									✓
CO8	✓	✓	✓	✓	✓	✓						✓
CO9	✓		✓		✓							✓

Course Contents:
Exercises that must be done in this course are listed below:
Exercise No.1: CPU scheduling
Exercise No. 2: File allocation Strategy
Exercise No. 3: Simulate MVT, MFT (Multiprogramming Fixed and Variable)
Exercise No. 4: Simulate all File Organization Techniques
Exercise No. 5: Simulate Banker's Algorithm for Dead Lock Avoidance
Exercise No. 6: Simulate Banker's Algorithm for Dead Lock Prevention
Exercise No. 7: Simulate all page replacement Strategies
Exercise No. 8: Simulate Paging Technique of Memory Management
Exercise No. 9: Shell programming (cut, grep, sed) Exercise No. 10: Process

Text Book:
1. Maurice J. Bach, Design of the UNIX Operating System, PHI.

Recommended Systems/Software Requirements:
Intel based desktop PC with minimum of 166 MHZ or faster processor with at least 64 MB RAM and 100 MB free disk space.
Turbo C or TC3 complier in Windows XP or Linux Operating System.

TITLE OF COURSE: DESIGN & ANALYSIS OF ALGORITHMS
COURSE CODE: CSC408
L-T-P: 3-0-3-0
CREDITS: 4.5

Pre-requisite: Basic concepts in mathematics and programming languages and Data Structure.

Introduction:

This course covers basic concepts of design and analysis of algorithm. The Topics to be covered (Tentatively) include: Complexity Analysis, Divide and Conquer, Priority queue, Dynamic Programming, Branch and Bound, Backtracking, Greedy Method, Disjoint set manipulation, Lower bound Theory, Graph traversal algorithm, Network Flow, String matching problem, Amortize Analysis, Matrix Manipulation Algorithm, Notion of NP-completeness and Approximation Algorithms.

Course Outcomes (CO):

The objective of the course is to get an overview of design and analysis of algorithms with an emphasis on the resource utilization in terms of time and space. Various techniques in development of algorithms will be implemented, so that the effect of problem size and architecture design on the efficiency of the algorithm is appreciated. Proving the correctness of the algorithms is one of the objectives for this course.

To reach this goal, the following objectives need to be met:

CO1: Understand the different complexity analysis according different problem. You will examine the algorithms used for various operations on operating systems.

CO2: Visualize different types of algorithm techniques. Become aware of the issues in the management of resources like processor, memory and input-output.

CO3: Know about lower bound concept of sorting techniques and different disjoint set manipulation.

CO4: Understand how to traverse a graph and the maximum flow of a network and also pattern matching of a text.

CO5: Understand the basic principle of different classes of problems like P, NP, and NP-complete.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓						✓	✓
CO2	✓	✓		✓								✓
CO3	✓	✓	✓	✓								✓
CO4	✓	✓	✓	✓								✓
CO5	✓	✓		✓	✓						✓	✓

Course Contents:

Module-1:

Complexity Analysis of an algorithm, Different Asymptotic notations – their mathematical significance

Module-2:

Basic method, use, Examples of Divide and Conquer algorithm, Dynamic Programming, Greedy Method, Branch and bound methods, Backtracking and their complexity.

Module-3:

Basic concept of Lower Bound Theory, Disjoint set manipulation, Amortized Analysis.

Module-4:

Basic method and example of Graph traversal algorithm, String matching problem, Network Flow, Matrix Manipulation Algorithm.

Module-5:

Basic concept of Notion of NP-completeness, Approximation Algorithms.

Text Books

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms", 3rd edition, PHI.
2. Biswajit Bhowmik,"Design and analysis of algorithm", 2ndedition, katson publication.

References

1. E.Horowitz and Shani "Fundamentals of Computer Algorithms", 2nd edition, Orient Black Swan.
2. A. Aho, J. Hopcroftand J. Ullman "The Design and Analysis of computer Algorithms",Pearson.

TITLE OF COURSE: DESIGN & ANALYSIS OF ALGORITHMS LAB
COURSE CODE: CSC498
L-T-P: 0-0-3-0
CREDITS: 1.5

Pre-requisite: Basic concepts in mathematics and c programming languages.

Introduction:

This course covers basic concepts of design and analysis of algorithm. The Topics to be covered (tentatively) include: Complexity Analysis, Divide and Conquer, Priority queue, Dynamic Programming, Branch and Bound, Backtracking, Greedy Method, Disjoint set manipulation, Lower bound Theory, Graph traversal algorithm, Network Flow, String matching problem, Amortize Analysis, Matrix Manipulation, Notion of NP-completeness and Approximation Algorithms.

Course Outcomes (CO):

The objective of the course is to get an overview of design and analysis of algorithms with an emphasis on the resource utilization in terms of time and space. Various techniques in development of algorithms will be implemented, so that the effect of problem size and architecture design on the efficiency of the algorithm is appreciated. Proving the correctness of the algorithms is one of the objectives for this course.

To reach this goal, the following objectives need to be met:

CO1: Understand the different complexity analysis according different problem. You will examine the algorithms used for various operations on operating systems.

CO2: Visualize different types of algorithm techniques. Become aware of the issues in the management of resources like processor, memory and input-output.

CO3: Know about lower bound concept of sorting techniques and different disjoint set manipulation.

CO4: Understand how to traverse a graph and the maximum flow of a network and also pattern matching of a text.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓						✓	✓
CO2	✓	✓		✓								✓

CO3	✓	✓	✓	✓								✓
CO4	✓	✓	✓	✓								✓

Recommended Systems/Software Requirements:
1. Intel based desktop PC with minimum of 166 MHZ or faster processor with at least 64 MB RAM and 100 MB free disk space.
2. Turbo C or TC3 complier in Windows XP or Linux Operating System

Course Contents:
Exercises that must be done in this course are listed below:
Exercise No.1:
>Implement Binary Search using Divide and Conquer approach
> Implement Merge Sort using Divide and Conquer approach
Exercise No.2:
>Implement Quick Sort using Divide and Conquer approach
> Find Maximum and Minimum element from an array of integer using Divide and Conquer approach
Exercise No.3:
>Find the minimum number of scalar multiplication needed for chain of matrix
Exercise No.4:
>Implement all pair of Shortest path for a graph (Floyed Warshall Algorithm)
>Implement Single Source shortest Path for a graph (Bellman Ford Algorithm) Exercise No.5:
>Implement 15 Puzzle Problem
Exercise No.6:
>Implement 8 Queen Problem
>Graph Coloring Problem
Exercise No.7:
>Knapsack Problem orJob sequencing with deadlines
>Implement Single Source shortest Path for a graph (Dijkstra Algorithm) Exercise No.8: (implement any one of the following problem):
>Minimum Cost Spanning Tree by Prim's Algorithm
>Minimum Cost Spanning Tree by Kruskal's Algorithm
Exercise No.9: (implement any one of the following problem):
>Implement Breadth First Search (BFS)
>Implement Depth First Search (DFS) Exercise No.10:
>Implement Naïve algorithm for string matching.

Text Book:
1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, “Introduction to Algorithms”, 3rd edition, PHI.
2. E.Horowitz and Shani “Fundamentals of Computer Algorithms”, 2nd edition, Orient Black Swan.

TITLE OF COURSE: COMPUTER ORGANIZATION & ARCHITECTURE
COURSE CODE: CSC409
L-T-P: 3-0-3-0
CREDITS: 4.5

Pre-requisite: Concept of basic components of a digital computer, Basic concept of Fundamentals & Program structures, Basic number systems, Binary numbers, Representation of signed and unsigned numbers, Binary Arithmetic as covered in Basic Computation & Principles of Computer Programming, Boolean Algebra, Karnaugh Maps, Logic Gates.

Introduction:
Computer Organization and Architecture is the study of internal working, structuring and implementation of a computer system. ... Organization of computer system is the way of practical implementation which results in realization of architectural specifications of a computer system.

Course Outcomes (CO):
On completion of the course students will be able to:
CO1: Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations. Understand RISC processors.
CO2: Understand basic structure of different combinational circuits multiplexer, decoder, encoder etc.
CO3: Learn about memory hierarchy and mapping techniques. Understand memory and I/O operations
CO4: Learn pipelining concepts with a prior knowledge of stored program methods
CO5: Study of parallel architecture and interconnection network.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓				✓	✓		✓	✓
CO2	✓	✓	✓	✓				✓	✓		✓	✓
CO3	✓	✓	✓	✓	✓	✓						✓
CO4	✓	✓	✓	✓	✓	✓						✓
CO5	✓	✓	✓	✓	✓	✓						✓

Course Contents:
Module-1:
- Introduction to computer organization & architecture
- Basic organization of the stored program computer and operation sequence for execution of a program. Role of operating systems and compiler/assembler.
- Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes
- Quantitative techniques in computer design - Part1
- Introduction to RISC architectures. RISC vs CISC architectures

Module-2:
- Commonly used number systems. Fixed and floating-point representation of numbers; Concept of Overflow and Underflow.
- Design of adders - ripple carry and carry look ahead principles.

- Fixed point multiplication - Unsigned and Signed - Booth's algorithm.
- Fixed point division - Restoring and non-restoring algorithms.
- Floating point - IEEE 754 standard.
- Design of ALU.
- Design of control unit - hardwired and micro programmed control.
- Introduction to Von-Nuemann & Harvard Architecture

Module-3:

- Memory organization, static and dynamic memory, memory hierarchy, associative memory.
- Hierarchical memory technology: Inclusion, Coherence and locality properties
- Cache memory organizations, Techniques for reducing cache misses;
- Virtual memory organization, mapping and management techniques, memory replacement policies.
- Memory unit design with special emphasis on implementation of CPU-memory interfacing. Data path design for read/write access.
- I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA

Module-4:

- Quantitative techniques in computer design - Part2
- Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards.
- Pipeline optimization techniques, Compiler techniques for improving performance.
- Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, superpipelined architectures. Array and vector processors.

Module-5:

- Multiprocessor architecture: taxonomy of parallel architectures - Introduction to Flynn's Classification; Centralized shared - memory architecture: synchronization, memory consistency, Interconnection networks. Distributed shared memory architecture.
- Non von-Neumann architectures - Data flow computers.

Text Books

1. Computer Organization and Architecture: Designing for Performance, William Stallings, Prentice-Hall India
2. Computer Organization, Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Tata McGraw Hill
3. Computer Architecture A Quantitative Approach, John L Hennessy and David Patterson, Morgan Kaufman
4. Structured Computer Organization, Andrew S. Tanenbaum, Prentice-Hall India

References

1. Computer Architecture & Parallel Processing. Kai Hwang & Briggs, Tata McGraw Hill
2. Computer System Architecture, M. M. Mano, PHI.
3. Computer Organization & Architecture, P N Basu, Vikas Publication

TITLE OF COURSE: COMPUTER ORGANIZATION & ARCHITECTURE LAB
COURSE CODE: CSC499
L-T-P: 0-0-3-0
CREDITS: 1.5

Pre-requisite: Concept of basic components of a digital computer, Basic concept of Fundamentals & program structures, Basic number systems, Binary numbers, Representation of signed and unsigned numbers, Binary Arithmetic as covered in Basic Computation & Principles of Computer Programming, Boolean algebra, Karnaugh Maps, Logic Gates.

Introduction:
Computer Organization and Architecture is the study of internal working, structuring and implementation of a computer system. ... Organization of computer system is the way of practical implementation which results in realization of architectural specifications of a computer system.

Course Outcomes (CO):
On completion of the course students will be able to
CO1: Use Xilinx ISE or online platform (www.edaplayground.com) independently
CO2: To program VHDL
CO3: To analyze industry problem and design digital circuits
CO4: Extend the idea of an integrated environment elsewhere

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							
CO2	✓	✓	✓		✓							
CO3	✓	✓	✓		✓							
CO4		✓	✓		✓							✓

Course Contents:
Experiment-1: HDL introduction
Experiment-2: Basic digital logic base programming with HDL
Experiment-3: 8-bit Addition, Multiplication, Division
Experiment-4: 8-bit Register design
Experiment-5: Memory unit design and perform memory operations.
Experiment-6: 8-bit simple ALU design
Experiment-7: 8-bit simple CPU design
Experiment-8: Interfacing of CPU and Memory.

Text Books
1. Computer Organization and Architecture: Designing for Performance, William Stallings, Prentice-Hall India
2. Computer Organization, Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Tata McGraw Hill
3. Computer Architecture A Quantitative Approach, John L Hennessy and David Patterson, Morgan Kaufman
4. Structured Computer Organization, Andrew S. Tanenbaum, Prentice-Hall India

References

1. Computer Architecture & Parallel Processing. Kai Hwang & Briggs, Tata McGraw Hill
2. Computer System Architecture, M. M. Mano, PHI.
3. Computer Organization & Architecture, P N Basu, Vikas Publication

TITLE OF COURSE: SIGNALS & SYSTEM
COURSE CODE: ECS404
L-T-P: 3-0-0-0
CREDITS: 3

Pre-requisite: Concept of basic components of a digital computer, Basic concept of Fundamentals & program structures, Basic number systems, Binary numbers, Representation of signed and unsigned numbers, Binary Arithmetic as covered in Basic Computation & Principles of Computer Programming, Boolean algebra, Karnaugh Maps, Logic Gates.

Introduction:
Signals and Systems covers analog and digital signal processing, ideas at the heart of modern communication and measurement. We present the basic concepts for continuous-time and discrete-time signals in the time and frequency domains. Time and frequency are related by the Fourier transform.

Course Outcomes (CO):
At the end of this course students will demonstrate the ability to
CO1: Analyze different types of signals
CO2: Represent continuous and discrete systems in time and frequency domain using different transforms
CO3: Investigate whether the system is stable
CO4: Sampling and reconstruction of a signal

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							
CO2	✓	✓	✓		✓							
CO3	✓	✓	✓		✓							
CO4		✓	✓		✓							✓

Course Contents:
Module 1: systems as seen in everyday life, and in various branches of engineering and science. 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.
Module 2: 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.

Module 3: Periodic and semi-periodic inputs to an LSI system, the notion of a frequencyresponse 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
Moduke 4: The Laplace Transform, notion ofeigen 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.
Module 5: z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis.
Module 6: 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 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

References

1. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
2. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.
3. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
4. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
5. Ashok Ambardar,"Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.

TITLE OF COURSE: HUMAN RESOURCE DEVELOPMENT AND ORGANIZATIONAL BEHAVIOR
COURSE CODE: HSM406
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Basic knowledge of general Management

Introduction:
The main objective of this course is to help the students to acquire and develop skill to take rational decisions. People have always been regarded as important in managing organizations.

Course Outcomes (CO):
During the study of this course,
CO1: student would come to know about the theory and application of human resource management,

the broad range of influences acting on human resource management, about the human resources planning and policies through its information system, training and development of human capital of the organization.

CO2: This course emphasis on the knowledge of performance assessment methods, improvements and resultant in terms of employee service condition reviews. Compensation and workers participation in management including the discipline matters and strategic human resources management

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						✓		✓	✓		✓	✓
CO2						✓		✓	✓		✓	✓

Course Contents:

Module 1: Introduction:

Human resources in Organizations, role of Human Resource Management; the historical background, personnel Management, Human Resource Development, Typical Organizational setup of a Human Resource Management department.

Module 2: Human Resource Planning:

Supply and Demand Forecasting methods, Manpower Inventory, Career Planning, Succession Planning, Personnel Policy, Human Resource Information System (HRIS), Recruitment and Selection: Process, Sources, Methods of selection, Interviewing Method, Skills and Errors Performance Appraisal Systems: Purpose, Methods, Appraisal instruments, 3600 Appraisal HR Score Card, Errors in appraisal, Potential Appraisal, Appraisal Interview.

Module 3: Human Resource Development:

Policy and Programs, Assessment of HRD Needs, HRD, Methods: Training and Non-Training. Compensation Management: Wages- Concepts, Components; System of Wage Payment, Fringe Benefits, Retirement Benefit.

Module 4: Workers' Participation in Management:

Concept, Practices and Prospects in India, Quality Circles and other Small Group Activities. Discipline Management: Misconduct, Disciplinary action, Domestic Enquiry, Grievance Handling

Module 5: Strategic HRM:

Meaning, Strategic HRM vs Traditional HRM, SHRM Process, Nature of e-HRM, e-Recruitment & Selection ,e-Performance Management, e-Learning

Text Books

1. Agarwala T.-Strategic Human Resource Management, OUP
2. Aswathappa, K.-Human Resource Management, Tata McGraw Hill

References

1. Jyothi P. &Venkatesh, D. N.-Human Resource, Management

TITLE OF COURSE: ECONOMICS & FINANCIAL ACCOUNTING
COURSE CODE: HSM407
L-T-P: 3-0-0

CREDITS: 3

Pre-requisite: Basic Mathematics, accounting and economics

Introduction:
Accounting and economics both involve plenty of number-crunching. But accounting is a profession devoted to recording, analyzing, and reporting income and expenses, while economics is a branch of the social sciences that is concerned with the production, consumption, and transfer of resources.

Course Outcomes (CO):
CO1: Make different economic decisions and estimate engineering costs by applying different cost estimation models. Create cash flow diagrams for different situations and use different interest formulae to solve associated problems.
CO2: Take decisions regarding different engineering projects by using various criteria like rate of return analysis, present worth analysis, cost-benefit analysis etc. Incorporate the effect of uncertainty in economic analysis by using various concepts like expected value, estimates and simulation.
CO3: Understand the concepts of depreciation and replacement analysis and solve associated problems. Understand the process of inflation and use different price indices to adjust for its effect.
CO4: Apply the various concepts of Accounting like balance sheet and ratio analysis. Understand the scope of Finance and the role of financial planning and management.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓										✓
CO2		✓	✓				✓					✓
CO3	✓	✓	✓								✓	✓
CO4	✓	✓	✓								✓	✓

Course Contents:
Module 1:
1. Economic Decisions Making – Overview, Problems, Role, Decision making process.
2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And
Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-
Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.
Module 2:
3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal& Effective Interest. 4. Cash Flow & Rate of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing an Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity and Breakeven

Analysis. Economic Analysis In The Public Sector -Quantifying And Valuing Benefits & drawbacks.

Module 3:

5. Inflation and Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates. 6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives. 7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.

Module 4:

8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances. 9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems. 10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.

Text Books

1. James L.Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle: Engineering Economics Analysis, OUP
3. John A. White, Kenneth E. Case, David B. Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Sullivan and Wicks: Engineering Economy, Pearson

References

1. R.Paneer Seelvan: Engineering Economics, PHI
2. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub
3. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House (AICTE Recommended Textbook – 2018)

TITLE OF COURSE: ECONOMICS FOR ENGINEERS
COURSE CODE: HSM408
L-T-P: 3-0-0
CREDITS: 3

Introduction:

It consists of Economic Decisions Making, cash flow, different decision making skills of economics etc.

Course Outcomes (CO):

CO1: To make fundamentally strong base for decision making skills by applying the concepts of economics.

CO2: Educate the students on how to systematically evaluate the various cost elements of a typical manufactured product, an engineering project or service, with a view to determining the price offer.
CO3: Prepare engineering students to analyze profit/revenue data and carry out make economic analysis in the decision making process to justify or reject alternatives/projects.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓						✓			✓	✓
CO2	✓	✓		✓							✓	✓
CO3	✓	✓	✓	✓							✓	✓

Course Contents:

Module 1

Economic Decisions Making – Overview, Problems, Role, Decision making process.
Engineering Costs & Estimation– Fixed, Variable, Marginal & Average Costs, Sunk Costs ,Opportunity Costs, Recurring And Non-recurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models-Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement &Learning Curve, Benefits.

Module 2

Cash Flow, Interest and Equivalence: Cash Flow Diagrams, Categories & Computation, Time Value of Money, Debtre payment, Nominal & Effective Interest. Cash Flow & Rate Of Return Analysis– Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Break even Analysis. Economic Analysis In The Public Sector – Quantifying And Valuing Benefits & drawbacks.

Module 3

Inflation And Price Change Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.
Present Worth Analysis: End-Of Year Convention, View point Of Economic Analysis Studies, Borrowed Money View point, Effect of Inflation & Deflation, Taxes, Economic Criteria, Applying Present worth Techniques, Multiple Alternatives.
Uncertainty In Future Events-Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, and Expected Value, Economic Decision Trees, Risk, and Risk vs Return, Simulation, Real Options.

Module 4

Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.
Replacement Analysis- Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.
Accounting–Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.

Text Books:

1. James L. Riggs, David D. Bedworth, Sabah U. Randhawa: Economics for Engineers 4e, Tata Mc Graw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle: Engineering Economics Analysis, OUP
3. John A. White, Kenneth E. Case, David B. Pratt: Principle of Engineering Economic Analysis, John Wiley
4. Sulliv anand Wicks: Engineering Economy, Pearson
5. R. Paneer Seelvan: Engineering Economics, PHI
6. Michael RLindeburg : Engineering Economics Analysis, Professional Pub Readings

References:

1. James L. Riggs, David D. Bedworth, Sabah U. Randhawa: Economics for Engineers 4e, Tata Mc Graw-Hill
2. Donald Newnan,Ted Eschembach, JeromeLavelle: Engineering Economics Analysis, OUP
3. John A.White, Kenneth E. Case, David B. Pratt: Principle of Engineering Economic Analysis, John Wiley
4. Sullivan and Wicks: Engineering Economy, Pearson
5. R. Paneer Seelvan: Engineering Economics, PHI
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

TITLE OF COURSE: ESP & SDP-IV
COURSE CODE: GSC404
L-T-P: 2-0-0-2
CREDITS: 2

Pre-requisite: Basic concepts in mathematics and economics.

Introduction:

This course examines Taxes in India and market structure. The Topics to be covered (tentatively) include: National income, Market structure, Science & Technology, Logical Reasoning.

Course Outcomes (CO):

In this course we will study the basic components of upcoming Science & technology. Students are expected to be capable of understanding the Indian Tax system, their advantages and drawbacks, how to implement in Indian Economy, how their drawbacks can be overcome and what the applications are and where they can be used. To reach this goal, the following objectives need to be met:

CO1: Know about many books and authors.

CO2: Gain knowledge about important dances & festivals of Indian states.

CO3: Understand the values of Important about banks like payment banks, small banks & license system.

CO4: Know about many learning techniques.

CO5: Know about different short cut techniques to solve any kind of aptitudes.

CO6: Know about different short cut techniques to solve any kind of reasoning.

CO7: Know about different short cut techniques to solve any kind of communicating problems.

CO8: Know about different short cut techniques to solve any kind of societal problems.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓
CO2	✓			✓								✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓
CO5	✓	✓	✓		✓							✓
CO6	✓			✓								✓
CO7	✓	✓	✓									✓
CO8	✓	✓	✓		✓							✓

Course Contents:

Section A: Employment Enhancement Skills-IV
Course Contents:

Module-1: GK & CA, Modern History& National Movement.Indian Geography at a glance (Physical, Regional & Economic)

Tax: Concept of TAX, objective of TAX, Direct & Indirect Tax, Progressive, Regressive & Proportional tax.

Module-2: Calendar etc. capitals of countries, currency of countries, important dates, Sports football, hockey etc. recent events & awards too.

Module-3: Important books & authors, Important Hydropower dams, atomic power plant s, important national parks, Minster & portfolio & constituencies, Population census, Persons in news - most famous, popular recent only,

Module-5: Important dances & festivals of Indian states, International Head Quarters & world organization, important president & pm elected from various countries

Module-6: Important about banks like payment banks, small banks & license system, Awards, Sports, Books & author, National & International affairs.

Section B: Skill Development for Professional – IV
Module-1: Quantitative Aptitude: Permutation & Combination. Probability- basic concepts of probability, different theorems & applications, binomial, poison & normal Distributions. Geometry- Concept of different shapes like triangle, quadrilateral, rectangle, square, circle etc. different theorems & their applications. Mensuration- Formulae on triangles, square, Rhombus, parallelogram, sphere, circle, cone, pyramid etc. Application based problem solving. Coordinate Geometry- Locus, Straight lines, Circle etc

Module-2: Reasoning:

Puzzles: Seating Arrangement

a) Circular seating arrangement

b) Square seating Arrangement

c) Line Arrangement, Calendar and Clock, Miscellaneous Problems

Sentence: a) Sentence Corrections b) Fill the blanks with appropriate words/articles/ preposition/ verbs/adverbs/conjunction. **d**) Reading Comprehension (Advance Level) d) Vocabulary

Logical Reasoning: Alphanumeric series, Analogies, Artificial Language, Blood Relations, Calendars, Cause and Effect, Clocks, Coding-Decoding, Critical path, Cubes and cuboids. Data Sufficiency, Decision Making, Deductive Reasoning/Statement Analysis, Dices, Directions

Embedded Images, Figure Matrix, Input-Output, Mirror and Water Images, Odd One Out, Picture Series and Sequences, Paper Folding, Puzzles, Pattern Series and Sequences, Order & Ranking, Seating Arrangements, Shape Construction, Statement and Assumptions, Statement and Conclusions, Syllogism

Module-4: Advanced Data Interpretation level-IV

Newspaper reading: The Hindu & Economic Times

Text Books

1. The Oxford Handbook of Tax System in India: An Analysis of Tax Policy and Governance (Oxford Handbooks) by Mahesh C. Purohit, Vishnu Kanta Purohit
2. Taxation of Income From Non Resident Indian under Direct Tax Law - 2019 Edition by Ram Dutt Sharma

References

1. Marketing Management | marketing cases in the Indian context | Fifteenth Edition | By Pearson by Philip Kotler, Keven Lane Keller
2. A Modern Approach to Logical Reasoning, by R.S. Aggarwal

TITLE OF COURSE: ENVIRONMENTAL SCIENCES
COURSE CODE: MC401
L-T-P: 0-0-0-0
CREDITS: 0

Pre-requisite: Basic concepts in social Science.

Introduction: This course examines basic environment. The Topics to be covered (tentatively) include: Renewable and non-renewable resources, Ecosystems in INDIA, Environmental Pollution, Social Issues and the Environment.

Course Outcomes (CO):

In this course we will study the basic components of numerical system. Students are expected to be capable of understanding the Indian society for environment, their advantages and drawbacks, how to implement them in ecology aspect, how their drawbacks can be overcome and what the applications are and where they can be used. To reach this goal, the following objectives need to be

met:

CO1: Students would be able to know Environment problem properly.

CO2: Students would be able to know ecology system in India, national plan to protect ecology.

CO3: By analyzing student will be proper person to guide our society

CO4: To become an efficient human being for the society.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓	✓		✓		✓	✓				✓
CO2				✓			✓	✓				✓
CO3		✓	✓				✓	✓				✓
CO4		✓	✓		✓		✓	✓				✓

Course Contents:

Module-1: Basic Ideas of Environment & Ecology, Environmental Geology & Microbiology, Multidisciplinary nature of environmental studies, Definition, scope and importance Need for public awareness,

Module-2: Renewable and non-renewable resources: Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Module-3: Ecosystems in INDIA : Basic Concept of an ecosystem, Structure and function of an ecosystem, Energy Flow in Ecosystem, Ecosystem, Biogeochemical Cycles, Nitrogen Cycle, Biodiversity, Biodiversity Hotspots in India, IUCN Red List Conservation of Biodiversity, Importance of Biodiversity, Loss of Biodiversity, Causes of Loss of Biodiversity, Food chains, food webs and ecological pyramids.

Biosphere Reserves in India, Tiger Conservation of India Wildlife, Protection Act 1972, Climate Change in India Alien Invasive Species, Paris Agreement, UNFCCC, Kyoto Protocol, Albedo of Earth, National Green Tribunal Montreal Protocol, Kigali Agreement, Green House Gases (GHGs), Air PollutantsCentral Board, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

National Health Mission, National Action Plan on Climate Change, National Water Mission, National Mission for Sustaining Himalayan Ecosystem (NMSHE), National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, Green India Mission

Module-5: Environmental Pollution: Environmental ethics, Cause, effects and control of:- Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, global warming, acid rain, Climate change, ozone layer depletion, nuclear accidents and holocaust.

Solid waste Management: Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Module-7: **Social Issues and the Environment:** Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns.

Module-7: Human Population and the Environment: Population growth, variation among nations, Population explosion – Family Welfare Program, Environment and human health, Human Rights, Value Education, Women and Child Welfare, Role of Information Technology in Environment and human health, Virus and vaccination.

Text Books

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., India,
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001,
6. Environmental Encyclopedia, Jaico Publ. House, Mumbai,
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment (R)
9. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev, Environment & Security. Stockholm Env. Institute Oxford Univ. Press.
10. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay

TITLE OF COURSE: DISASTER MANAGEMENT
COURSE CODE: MC402
L-T-P: 2-0-0
Credits: 2

Introduction:

Disasters are seen as the effect of hazards on vulnerable areas. Hazards that occur in areas with low vulnerability do not result in a disaster. Great damage, loss, destruction and devastation to life and property are the results of Disasters. The immeasurable damage caused by disaster varies with the geographical location. In the concerned areas disasters have the following effects: It completely upsets the normal day to day life. Harmfully persuade the emergency systems Depending on the

intensity and severity of the disaster the normal needs and processes are badly affected and deteriorated. Disasters are the effect of hazard on vulnerable or defenseless areas. Hazards that occur in areas with low vulnerability do not result in a disaster.

Course Outcomes (CO):

CO1: Develop an understanding of the key concepts, definitions a key perspectives of All Hazards Emergency Management

CO2: Understand the Emergency/Disaster Management Cycle REVISED

CO3: Have a basic understanding for the history of Emergency management

CO4: Develop a basic under understanding of Prevention, Mitigation, Preparedness, Response and Recovery.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										✓
CO2	✓	✓		✓								✓
CO3	✓										✓	✓
CO4	✓	✓								✓	✓	✓

Course Contents:

Module-I: Introduction

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Module-II: Repercussions Of Disasters And Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Module-III: Disaster Prone Areas in India: Study Of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

Module-IV: Disaster Preparedness And Management: Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Module-V: Risk Assessment: Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co- Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Module-VI: Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

Suggested reading

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies 'New

Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

Fifth Semester Syllabus

Sl No.	Type	Subject Code	Topic	L	T	P	S	Credit Points
1.	PCC	CSC510	Formal Language & Automata Theory	3	0	0	0	3
2.	PCC	CSC511	Data Base Management System	3	0	3	0	4.5
3.	PCC	CSC512	Object Oriented Programming Using Java	2	0	3	0	3.5
4.	PCC	CSC513	Software Engineering	2	0	2	0	3
5.	PEC	AIML---	Specialization Elective -I	3	0	0	0	3
6.	HSM	HSM---	Humanities-II	3	0	0	0	3
7.	MC	MC503	Constitution of India/Essence of Indian Knowledge Tradition	0	0	0	0	0
8.	GSC	GSC505	ESP & SDP-V	2	0	0	2	2
9.	PTI	INT501	Internship/Project-I	0	0	0	1	1
10.	NPT	NPT504	(NPTEL/MOOCs)	-	-	-	-	2
			Total	19	0	6	3	25/28

#(NPT504): NPTEL/MOOCs are based on the respective year's offered courses.

Suggestive Choice Based Subjects

Sl No.	Type	Subject Code	Topic	L	T	P	Credit Points
1.	PEC	AIML501	Introduction to AI & Machine Learning	2	0	2	3
2.	HSM	HSM509	Industrial Psychology	2	0	0	2
3.	HSM	**HSM510**	**Principle of Management**	2	0	0	2
4.	HSM	HSM511	Total Quality Management	2	0	0	2

TITLE OF COURSE: FORMAL LANGUAGE & AUTOMATA THEORY
COURSE CODE: CSC510
L-T-P: 3-0-0-0
CREDITS: 3

Pre-requisite: Knowledge is also assumed of basic concepts in mathematics like set theory.

Introduction:
This course examines formal language and automata theory concepts. The Topics to be covered (tentatively) include:
• Finite state model & Finite state machine
• Regular language and finite automata
• Context free language and pushdown automata
• Turing Machine

Course Outcomes (CO):
Upon successful completion of this course, students should be able to:
CO1: To distinguish between computing and other kinds of machines.
CO2: To define a system, recognize the behavior of a system and to minimize, compare it with different systems.
CO3: To relate computing problems to machines, languages and grammars.
CO4: To construct regular expressions and grammars.
CO5: To design deterministic and nondeterministic automata and Turing machines.
CO6: To convert grammars to normal forms and eliminate ambiguities.
CO7: To recognize unsolvable problems and limitations of computing.
CO8: To prove theorems by deduction, induction and contradiction.
CO9: Get familiarity with the seminal works of Turing and Chomsky.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2	✓	✓										✓
CO3	✓		✓	✓								✓
CO4	✓	✓	✓	✓								✓
CO5	✓	✓	✓									✓
CO6	✓	✓	✓	✓	✓							✓
CO7	✓											✓
CO8	✓	✓	✓	✓								✓
CO9	✓				✓							✓

Course Contents:

Module-1:
Introduction toFinite State Model and Sequential circuit, design of Sequence detector and introduction to Finite State Machine. Finite Automata: introduction, types, application and limitations.
Module-2:
Regular language and grammar – definition of RE, rules, closure properties, Constructing FA to RE and vice versa, Pumping lemma of regular sets.
Module-3:
Context free language and grammar - definition of CFL, closure properties, Pumping lemma and Ogden's lemma of CFL, Pushdown Automata: definition, type, constructing PDA to CFL and vice versa.
Module-4:
Turing Machine: definition, construction, types of TM. Concepts of Universal Turing machine and Halting problem.

Text Books
1. Mishra and Chandrashekaran,"Theory of Computer Science , Automata Languages and computation", 2nd edition, PHI.
2. Peter Linz, "Introduction to Formal Language and Automata", 5th edition, Jones and Bartlett's Publications.
3. ZVI Kowhai, "Switching & Finite Automata", 2nd edition, Tata McGraw Hill.

References
1. C.K.Nagpal, "Formal Languages and Automata Theory", Oxford.
2. Hopcroft H.E. and Ullman J. D, "Introduction to Automata Theory Language and Computation", Pearson Education.

TITLE OF COURSE: DATABASE MANAGEMENT SYSTEM
COURSE CODE: CSC511
L-T-P: 3-0-3-0
CREDITS: 4.5

Pre-requisite: The proper understanding of data structures and algorithms and Discrete Mathematics.

Introduction:
The proper understanding of data structures and algorithms and Discrete Mathematics.

Course Outcomes (CO):
This course will serve to broaden the student's understanding of the issues and latest developments in the area of Database Management System and its maintenance. To reach this goal, the following objectives need to be met:
CO1: Ability to build normalized databases.
CO2: Knowledge of Entity Relationship Modeling.
CO3: Familiarity with SQL, embedded SQL and PLSQL, query processing and query optimization techniques, ODBC, JDBC
CO4: Understanding of transaction processing.
CO5: Ability to handle recovery and concurrency issues.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									✓
CO2	✓	✓	✓									✓
CO3	✓	✓	✓	✓	✓							✓
CO4	✓	✓	✓		✓	✓						✓
CO5	✓	✓	✓	✓								✓

Course Contents:

Module 1:

Introduction to DBMS- Concept & overview of DBMS, Data Models & database Language, Database Administrator, Database Users, architecture of DBMS, Three levels of abstraction.

Module 2:

Entity Relationship Model – Basic concepts, Design Issues, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features. Relational Model-Structure of relational Databases, Relational Algebra, Relational Algebra Operations, Views, Modifications of the Database.

Module 3:

SQL and Integrity Constraints: Concept of DDL, DML, DCL, Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, nested Sub queries.

Module 4:

Relational Database Design: -Functional Dependency, Different anomalies in designing a Database, Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF.

Module 5:

Transaction: -Transaction concept, transaction model, serializability, transaction isolation level, Transaction atomicity and durability, transaction isolation and atomicity. Concurrency control and recovery system: Lock based protocol, dead lock handling, time stamp based and validation based protocol, failure. Classification, storage, recovery algorithm, recovery and atomicity, backup.

Module 6:

Internals of RDBMS:-Physical data structures, Query optimization: join algorithm, Statistics and cost based optimization.

Module 7:

File Organization & Index Structures:-File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree.

Text Books

1. Silberschatz, Korth and Sudarshan, "Database System Concepts", 6th Edition,McGraw Hill, 2010
2. Elmasri and Navathe, "Fundamentals of Database Systems", 6th Edition, Pearson, Addison- Wesley, 2010

References

1. C.J. Date, "An Introduction to Database Systems", 8thEdition, Addison-Wesley, 2003

2. Ramakrishnan&Gherke, Database Management Systems, 2nd Edn., McGraw
3. Connolly and Begg, "Database Systems", 4th Edn., Addison-Wesley, 2005
4. Toby, Lightstone and Jagadish, "Database Modeling and Design", 5thEdn, Elsevier, 2011
5. Coronel and Rob, "Database Systems", 9th Edn., Cen gage, 2011

TITLE OF COURSE: DATA BASE MANAGEMENT SYSTEM LAB
COURSE CODE: CSC511
L-T-P: 0-0-3-0
CREDITS: 1.5

Pre-requisite: Knowledge is also assumed of basic concepts of DBMS.

Introduction:

Designing database and writing applications for manipulation of data for a standalone and shared database including concepts like concurrency control, transaction roll back, logging, report generation etc. The implementation shall being with the statement of the objectives to be achieved, preparing ER diagram, designing of database, normalization and finally manipulation of the database including generation of reports, views etc. The problem may first be implemented for a standalone system to be used by a single user.

Course Outcomes (CO):

This course will serve to broaden the student's understanding of the issues and latest developments in the area of Database Management System and its maintenance. To reach this goal, the following objectives need to be met:

CO1: Ability to build normalized databases.
CO2: Knowledge of Entity Relationship Modeling.
CO3: Familiarity with SQL, embedded SQL and PLSQL, query processing and query optimization techniques, ODBC, JDBC
CO4: Understanding of transaction processing.
CO5: Ability to handle recovery and concurrency issues.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									✓
CO2	✓	✓	✓									✓
CO3	✓	✓	✓	✓	✓							✓
CO4	✓	✓	✓		✓	✓						✓
CO5	✓	✓	✓	✓								✓

Course Contents:

Exercises that must be done in this course are listed below:

Exercise No.1:

ER Model: An entity-relationship model (ERM) is an abstract and conceptual representation of data. Entity-relationship modeling is a database modeling method, used to produce a type of conceptual

schema or semantic data model of a system.

Exercise No. 2:

EER Model: In computer science, the enhanced entity-relationship (EER) model is a high-level or conceptual data model incorporating extensions to the original entity-relationship (ER) model, used in the design of databases. It was developed by a need to reflect more precisely properties and constraints that are found in more complex databases.

Exercise No. 3:

Relational Model: The relational model for database management is a database model based on first-order 4predicate logic, first formulated and proposed in 1969 by E.F. Codd. The model uses the concept of a mathematical relation, which looks somewhat like a table of values -as its basic building block, and has its theoretical basis in set theory and first-order predicate logic.

Exercise No. 4:

1 NF: First normal form (1NF or Minimal Form) is a normal form used in database normalization. A relational database table that adheres to 1NF is one that meets a certain minimum set of criteria. These criteria are basically concerned with ensuring that the table is a faithful representation of a relation and that it is free of repeating groups.

Exercise No. 5:

2 NF: Second normal form (2NF) is a normal form used in database normalization. 2NF was originally defined by E.F. Codd in 1971. A table that is in first normal form(1NF) must

Exercise No. 6:

3 NF: The Third normal form (3NF) is an important form of database normalization. 3NF is said to hold if and only if both of the following conditions hold: • The relation R (table) is in second normal form (2NF) • Every non-prime attribute of R is non-transitively dependent (i.e. directly dependent) on every candidate key of R.

Exercise No. 7:

BCNF: A relation R is in Boyce-Codd normal form (BCNF) if and only if every determinant is a candidate key. 4The definition of BCNF addresses certain (rather unlikely) situations which 3NF does not handle.

Exercise No. 8:

SQL-1: In this Lab., we discuss basic SQL operations like creating a table, deleting a table, changing the schema of the table, primary key and foreign key constraints on a table and creating indexes on tables.

Exercise No. 9:

SQL-2: Its scope includes efficient data insert, query, update and delete, schema creation and modification, and data access control. In this lab., we discuss SQL operations for populating the tables like inserting into a table, deleting values from a table, and updating the content of the tables.

Text Books

1. Silberschatz, Korth and Sudarshan, “Database System Concepts”, 6thEdition,McGraw Hill, 2010
2. Elmasri and Navathe, “Fundamentals of Database Systems”, 6thEdition, Pearson, Addison Wesley,2010
3. Ivan Bayross, “The programming language of oracle”, 5thEdition, BPB Publication 2016

References

1. “Database Systems: A Practical Approach to design, Implementation and Management”. Thomas Connolly, Carolyn Begg; Third Edition, Pearson Education.
2. "Fundamentals of Database Systems" Elmasri, Navathe, Pearson Education.
3. Bipin C Desai, An Introduction to Database Systems, Galgotia. Publications Pvt Limited, 2001

4. “An Introduction to Database Systems”, C.J.Date, Pearson Education.
5. “A first course in Database Systems”, Jeffrey D. Ullman, Jennifer Windon, Pearson, Education.

TITLE OF COURSE: OBJECT ORIENTED PROGRAMMING USING JAVA
COURSE CODE: CSC512
L-T-P: 2-0-2-0
CREDITS: 3

Pre-requisite: Basic concept of programming.

Introduction:
Covers software design, implementation, and testing using Java. Introduces object-oriented design techniques and problem solving. Emphasizes development of secure, well-designed software projects that solve practical real-world problems.

Course Outcomes (CO):
Upon successful completion of this course, students should be able to:
CO1: Explain what constitutes an object-oriented approach to programming and identify potential benefits of Object-oriented programming over other approaches.
CO2: Augment a class definition using constructors, member functions and custom input/output operators to add functionality to a programming solution.
CO3: Read from and write to files using objects from the standard input output library and custom file operators for future restoration.
CO4: Design and compile java programs manipulating strings and text documents. Model polymorphic behavior of objects using coercion, overloading and function templates.
CO5: Be able to write simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles. Apply understanding of Git version control system to manage files for large and small projects.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓		✓		✓							✓
CO3	✓		✓		✓							✓
CO4	✓		✓		✓							✓
CO5	✓											✓

Course Contents:
Module-1: Introduction to Object-Oriented Thinking
Difference between OOP and other conventional programming – advantages and disadvantages
- Class, object, message passing,
- Encapsulation,
- Inheritance,
- Polymorphism

- Software Design
- Software Development Life Cycle

Module-2: Object-Oriented Programming Constructs

- Class, Object,
- Relationships among classes- association, dependency (use, call), aggregation, grouping, generalisation
- Relationships among objects - instantiation, links
- Meta-class
- Modelling with UML Class and Sequence Diagrams

Module-3: Designing for Reuse

- Good design principles e.g. Single Responsibility Principle (SRP). Don't Repeat Yourself (DRY) Principle.
- Interfaces and abstract classes.
- Loose coupling.
- Inheritance versus Delegation.

Module-4: Basic concepts of Java programming

Advantages of Java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, for-each loop, array, creation of class, object, constructor, object class, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, variable length arguments, static block, variables & methods, nested & inner classes.

Module-5: String Classes

String class, concept of string pool, concept of mutable and immutable string, basic methods of String class, StringBuffer class, basic methods of StringBuffer class, Introduction to StringBuilder class, basic methods of StringBuilder class, comparisons.

Basic of I/O operations

Command line argument, basic of I/O, different types of streams, basic stream classes, introduction to Buffered Reader class, basic file handling, introduction to Scanner class.

Module-6: Reusability properties

Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords comparison between super and this, dynamic method dispatch, method hiding, object type casting, use of abstract classes & methods, interfaces.

PackageIntroduction to package concept, Advantage of using package concept, basic inbuilt packages, package creation, different ways of importing packages, member access for packages

Module-7: Exception handling

Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, try with resources, creation of user defined exception classes.

Module-8: Threading

Introduction to process, scheduling, context switching, difference between process and thread, basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads.

Module-9: Swing

Advanced Topics: Basic concepts of AWT library, Creation of GUI using Swing library, Event Driven Programming (implementing ActionListener to multiple buttons, MouseListener, KeyListener interfaces), Painting (drawing objects) using AWT.

Module-10: Generic class and Collection framework

Introduction to generic class, advantage of generic class user defined generic class & method, introduction to collection framework, advantages, different classes, iterator.

Text Books

1. Herbert Schildt, "Java the Complete Reference", TMH. 8th edition.
2. Kathy Sierra & Bert Bates, "Head First Java", O'Reilly, 2nd Edition.

References

1. E Balagurusamy, "Programming with Java A Primer", TMH, 4th edition.
2. Patrick Naughton, "Java Handbook", Osborne McGraw-Hill

TITLE OF COURSE: OBJECT ORIENTED PROGRAMMING USING JAVA
COURSE CODE: CSC592
L-T-P: 0-0-3-0
CREDITS: 1.5

Pre-requisite: Students must have already registered for the course "Object Oriented Programming Using Java".

Objectives: Students will be able to strengthen their problem solving ability by applying the characteristics of an object oriented approach.

Course Outcomes: Students will be able to apply an object-oriented approach to develop applications of varying complexities.

Course Contents:

Module-1: Concepts of Java Programming: Class, object creation with source code compilation and execution

Module-2: Data structure using Java: Stack, Queue, and Linked List.

Module-3: String Handling and IO Operations: Methods of String and StringBuffer class, Input operations using Scanner and BufferedReader.

Module-4: Reusability Features Of Java: Inheritance, Packages, Access Specifiers.

Module-5: Exception Handling & Multithreading: User defined exception, usage of exception handling keywords, Thread creation and execution.

Module-6: GUI Programming: Applets, User Interface using Swing.

Module-7: Version Control: Git commands, Project and Branch creation, File addition, Issue tracker.

List of Experiments

1. Class creation with main method and steps of source code compilation and execution.
2. Design a stack and a queue and different types of linked lists for different operations.
3. Implement method overloading and method overriding.
4. Implement different types of inheritance and use of super keyword.
5. Abstract class and interface creation to implement abstraction.
6. Package creation and program using access specifiers.

7. Implement checked and unchecked exceptions through exception handling keywords.
8. Implement multi-thread application using thread class and runnable interface.
9. Calculator application using Java swing.
10. Implement version control using Git commands.

References

1. Rambaugh, James Michael, Blaha,"Object Oriented Modelling and Design", Prentice Hall, India
2. Ali Bahrami,"Object Oriented System Development",Mc Graw Hill
3. Patrick Naughton, Herbert Schildt,"The Complete Reference-Java2",Tata McGraw Hill
4. Deitel and Deitel,"Java How to Program",Pearson
5. Ivor Horton “Beginning Java 2 SDK” ,Wrox

TITLE OF COURSE: SOFTWARE ENGINEERING
COURSE CODE: CSC513
L-T-P: 2-0-2
CREDITS: 3

Pre-requisite: Knowledge is also assumed of basic concepts in data structures, programming languages, and computer architecture.

Introduction:
Software engineering concepts include the collection of tools, procedures, methodologies, and accumulated knowledge about the development and maintenance of software-based systems. This course is strongly suggested for any student planning to take an internship in Computer Science. After an overview of the phases of the software lifecycle, current methodologies, tools, and techniques being applied to each phase will be discussed in depth with localized exercises given to reinforce learning of concepts.

Course Outcomes (CO):
This course will serve to broaden the student's understanding of the issues and latest developments in the area of software development and maintenance. To reach this goal, the following objectives need to be met:
CO1: Define the current state of software development and maintenance characterized as "the software crisis".
CO2: Understand the multidimensional aspect of software engineering, which is the current best attempt at solving the software crisis.
CO3: Become familiar with popular models of the software development and maintenance process.
CO4: Using the waterfall model, study the inputs, outputs, and processes present in each phase.
CO5: Study the core concepts present in several popular methodologies and be able to identify strengths and weaknesses of each.
CO6: Understand the requirement and design approach to develop a software product.
CO7: Study existing CASE tools to be able to identify opportunities to automate tasks through the use of such tools.

CO8: Understand the testing techniques to develop an error free software product.
CO9: Briefly investigate problems present in project management and understand the estimation, techniques during a software development cycle.
CO10: Consider the issues and techniques present in confidence gaining measures residing in each phase of the software lifecycle.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2	✓	✓		✓								✓
CO3	✓											✓
CO4	✓											✓
CO5	✓											✓
CO6	✓	✓		✓								✓
CO7	✓	✓		✓	✓							✓
CO8	✓	✓		✓								✓
CO9	✓	✓	✓	✓								✓
CO10	✓		✓									✓

Course Contents:
Module-1: Software Process Model: Introduction to Software engineering, The Software Crisis and Software Engineering, Software Process Models- A Model of Software Development.
Module-2: Requirement Analysis: Requirement Elicitation, Analysis, Specification, SRS, Formal system development techniques.
Module-3: Design: Data modeling, Functional modeling Software Architecture and Design: Data design, Architectural Design Process, SADT, OOAD, TDD, BDD, MVC, function-oriented design, Design Patterns: Structural Patterns, Behavioral Patterns, and Creational Patterns.
Module-4: UML: Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Event trace diagram.
Module-5: Software Testing: Top-Down and Bottom–up Approach, Verification and Validation, Structural testing, functional Testing, Testing Strategies, Test Case design.
Module-6: Software Project Management: Estimating Size, Effort and Cost: Metric for Analysis, Metric for Design, COCOMO model, Putnam Model etc., Implementation and Integration: Coding standard and practices.
Module-7: Software Maintenance: Types, Cost of Software, maintenance, Software Maintenance Models, CASE Tool Taxonomy: Business Process Engineering tool, Process modeling and management tool, project planning tool, requirement tracking tool, Metric and management tool, documentation tool, system software tool etc. Introduction to software engineering for web and mobile applications.
Module-8: Software Management Tools: TFS, JIRA, Rally, Devops

Text Books

1. Software Engineering: A practitioner's approach: Roger S. Pressman, McGraw- Hill Publications (Sixth Edition).
2. Fundamentals of Software Engineering: Mall, Rajib, Prentice Hall of India, New Delhi (2nd Edition).

References

1. Software Testing Techniques, B. Beizer.
2. Structured Systems Analysis: Tools and Techniques, Gane and Sarson.
3. Software Engineering, Sommerville, Addison Wesley.
4. Modern Structured Analysis, E.Yourdon.
5. An Integrated approach to Software Engineering: Pankaj Jalote, Narosa Publishing House.
6. Structured design, E. Yourdon and L.Constantine.
7. Fundamentals of Software Engineering: Ghezzi, Jazayeri, Mandriol, PHI

TITLE OF COURSE: SOFTWARE ENGINEERING LAB
COURSE CODE: CSC513
L-T-P: 0-0-3
CREDITS: 1.5

Pre-requisite: Students must have already registered for the course, "Software Engineering".

Objectives:

Students will be capable to acquire the generic software development skill through various stages of software life cycle. He will also be able to ensure the quality of software through software development with various protocol based environment.

Course Outcomes (CO):

This course will serve to broaden the student's understanding of the issues and latest developments in the area of software development and maintenance. To reach this goal, the following objectives need to be met:

CO1: Define the current state of software development and maintenance characterized as "the software crisis".
CO2: Understand the multidimensional aspect of software engineering, which is the current best attempt at solving the software crisis.
CO3: Become familiar with popular models of the software development and maintenance process.
CO4: Using the waterfall model, study the inputs, outputs, and processes present in each phase.
CO5: Study the core concepts present in several popular methodologies and be able to identify strengths and weaknesses of each.
CO6: Understand the requirement and design approach to develop a software product.
CO7: Study existing CASE tools to be able to identify opportunities to automate tasks through the use of such tools.
CO8: Understand the testing techniques to develop an error free software product.
CO9: Briefly investigate problems present in project management and understand the estimation, techniques during a software development cycle.

CO10: Consider the issues and techniques present in confidence gaining measures residing in each phase of the software lifecycle.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2	✓	✓		✓								✓
CO3	✓											✓
CO4	✓											✓
CO5	✓											✓
CO6	✓	✓		✓								✓
CO7	✓	✓		✓	✓							✓
CO8	✓	✓		✓								✓
CO9	✓	✓	✓	✓								✓
CO10	✓		✓									✓

Course Contents:

Module-1: Software Process Model: A Model of Software Development

Module-2: Requirement Analysis: Requirement Elicitation, specification, IEEE standard template for SRS, Requirement Engineering tools.

Module-3: UML Modeling: Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Component Diagram, Event trace diagram, C++ code generation.

Module-4: Software Metrics: Product, process and project metrics.

Module-5: Software Testing: Structural testing, functional Testing, Testing Strategies, Tactics, Test Case design and Maven ANT

List of Experiments

1. Identifying the Requirements from Problem Statements Requirements, Characteristics of Requirements, Categorization of Requirements, Functional Requirements, Identifying Functional Requirements
2. E-R Modeling from the Problem Statements, Entity Relationship Model, Entity Set and Relationship Set, Attributes of Entity, Keys, Weak Entity, Entity Generalization and Specialization, Mapping Cardinalities, ER Diagram, Graphical Notations for ER Diagram Importance of ER modeling
3. Identifying Domain Classes from the Problem Statements, Domain Class, Traditional Techniques for Identification of Classes, Grammatical Approach Using Nouns, Advantages, Disadvantages, Using Generalization, Using Subclasses, Steps to Identify Domain Classes from Problem Statement, Advanced Concepts
4. Modeling UML Use Case Diagrams and Capturing Use Case Scenarios, Use case diagrams,

Actor, Use Case, Subject, Graphical Representation, Association between Actors and Use Cases, Use Case Relationships, Include

5. Modeling UML Class Diagrams and Sequence diagrams, Structural and Behavioral aspects, Class diagram, Elements in class diagram, Class Relationships, Sequence diagram, Elements in sequence diagram, Object, Life-line bar, Messages.

6. Modeling Data Flow Diagrams, Data Flow Diagram, Graphical notations for Data Flow Diagram, Explanation of Symbols used in DFD, Context diagram and leveling DFD

7. State chart and Activity Modeling State chart Diagrams, Building Blocks of a State chart Diagram State, Transition, Action, Guidelines for drawing State chart Diagrams, Activity Diagrams, Components of an Activity Diagram, Activity, Flow Decision, Merge, Fork, Join, Note, Partition, A Simple Example, Guidelines for drawing an Activity Diagram

8. Estimation of Project Metrics Project Estimation Techniques, COCOMO, Basic COCOMO Model, Intermediate COCOMO Model, Complete COCOMO Model, Advantages of COCOMO, Drawbacks of COCOMO, Halstead's Complexity Metrics.

9. Estimation of Test Coverage Metrics and Structural Complexity, Control Flow Graph, Terminologies, McCabe's Cyclomatic Complexity, Computing Cyclomatic Complexity, Optimum Value of Cyclomatic Complexity, Merits, Demerits

10. Ant - Deploying Applications, build.xml, Ant - Executing Java code, Ant - Creating WAR files, basedir, compress, Keepcompression, destfile, duplicate, excludes, excludesfile, includes, includesfile, update.

Text Books

1. Software Engineering: A practitioner's approach: Roger S. Pressman, McGraw- Hill Publications (Sixth Edition).
2. Fundamentals of Software Engineering: Mall, Rajib, Prentice Hall of India, New Delhi (2nd Edition).

References

1. Software Testing Techniques, B. Beizer.
2. Structured Systems Analysis: Tools and Techniques, Gane and Sarson.
3. Software Engineering, Sommerville, Addison Wesley.
4. Modern Structured Analysis, E.Yourdon.
5. An Integrated approach to Software Engineering: Pankaj Jalote, Narosa Publishing House.
6. Structured design, E. Yourdon and L.Constantine.
7. Fundamentals of Software Engineering: Ghezzi, Jazayeri, Mandriol, PHI

TITLE OF COURSE: Introduction to AI & Machine Learning
COURSE CODE: AIML501
L-T-P: 2-0-2
CREDITS: 3

Pre-requisite: Basics of concept of programming and mathematics.

Introduction:

• To review and strengthen important mathematical concepts required for AI & ML.
• Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state of the art Machine Learning algorithms.

Course Outcomes (CO):

After completion of course, students would be able to:
CO1: Design and implement machine learning solutions to classification, regression and clustering problems.
CO2: Evaluate and interpret the results of the different ML techniques.
CO3: Design and implement various machine learning algorithms in a range of Real-world applications.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓
CO2	✓			✓			✓				✓	
CO3	✓	✓	✓				✓				✓	✓

Course Contents:
Module 1: [Duration: 12 Lectures]
Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming, Mathematical foundations: Matrix Theory and Statistics for Machine Learning.
Module 2: [Duration: 8 Lectures]
Idea of Machines learning from data, Classification of problem –Regression and Classification, Supervised and Unsupervised learning.
Module 3: [Duration: 10 Lectures]
Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice.
Module 4: [Duration: 7 Lectures]
Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting.
Module 5: [Duration: 5 Lectures]
Discussion on clustering algorithms and use-cases cantered around clustering and classification.

Lab Work:
1. Implementation of logical rules in Python.
2. Using any data apply the concept of:
    a. Liner regression
    b. Gradient decent
    c. Logistic regression
3. To add the missing value in any data set.
4. Perform and plot under fitting and overfitting in a data set.
5. Implementation of clustering and classification algorithms.

Text Books

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 1st Edition 2011.
2. Anindita Das Bhattacharjee, "Practical Workbook Artificial Intelligence and Soft Computing for beginners, Shroff Publisher-X team Publisher.
3. M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna Publishing House, Delhi.
4. Jeeva Jose, Introduction to Machine Learning, Khanna Publishing House, Delhi.
5. Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.
6. Tom Mitchell, Machine Learning, McGraw Hill, 2017.

References

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011.
2. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.

Corresponding Online Resources:

1. Artificial Intelligence, https://swayam.gov.in/nd2_cec20_cs10/preview.

TITLE OF COURSE: INDUSTRIAL PSYCHOLOGY
COURSE CODE: HSM509
L-T-P: 2-0-0
CREDITS: 2

Pre-requisite: Basic idea of human behavior.

Introduction:

The industrial psychology course is concerned with the application of psychological theories and principles to organizations. It focuses on increasing efficiency, productivity, and related issues as the physical and mental well-being of employees at industrial organizations.

Course Outcomes (CO):

After having the course, students are expected to:
CO1: Perform a thorough and systematic competency model (job analysis)
CO2: Validate and develop a job specific selection design
CO3: Understand how to design, develop, and evaluate job specific training program
CO4: Explain organizational recruitment, selection and retainment
CO5: Evaluate the work performance of employees
CO6: Explaining the organizational issues including teams, attitudes, and occupational health
CO7: Describe the motivating factors of employees

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						✓						✓
CO2						✓						✓
CO3						✓				✓		✓

CO4						✓	✓		✓	✓	✓	✓
CO5						✓			✓		✓	✓
CO6						✓	✓		✓	✓	✓	✓
CO7						✓	✓		✓		✓	✓

Course Contents:

Module-1: Introduction to Industrial/Organizational Psychology:
Describing Industrial / Organizational Psychology and what I/O psychologist do. The history of I/O psychology. Research in I/O psychology. Ethics in I/O psychology

Module-2: Job Analysis and Evaluation:
Job analysis and job evaluation

Module-3: Legal Issues and Employee Selection:
The legal process. Determining whether an Employment decision is legal. Harassment. Family medical leave act. Affirmative action. Privacy issues.

Module-4: Employee Selection: recruiting and interviewing
Job analysis, recruitment, realistic job previews, effective employee selection techniques, employment interviews, job search skills.

Module-5: Employee Selection: references and testing
Predicting performance using references and letter of recommendation. Performance using applicant training and education. Performance using applicant knowledge, ability, skill, prior experience, personality and interest and character. Performance limitations due to medical and psychological problems. Comparison techniques

Module-6: Evaluating Selection Techniques and Decisions:
Characteristics of effective selection techniques. Establishing the usefulness of a selection device. Determining the fairness of a test. Making the hiring decision.

Module-7: Evaluating Employee Performance:
Determine the reason for evaluating employee performance, identify environmental and cultural limitations, determine who will evaluate performance, and select the best appraisal method to accomplish your goals, train raters, observe and document performance, evaluate performance, communicate appraisal results to employees, terminate employees Behaviorally anchored rating scales, forced-choice rating scales, mixed standard scales, behavioral observation scales

Text Books:

1. "Industrial/Organizational Psychology, 6th Edition, 2010", Authors: Michael G. Aamodt, Publisher: Cengage Learning, ISBN: 978-0-495-60106-7

TITLE OF COURSE: PRINCIPLE OF MANAGEMENT
COURSE CODE: HSM510
L-T-P: 2-0-0
CREDITS: 2

Pre-requisite: Determine issues of ethics, planning, goal setting, and effective decision-making processes.

Introduction:

This course deals with the principles of Management within workplace. Students understand the intricacies of management that operates to extract work from the employees. Students dig into topics like:

- Basic concepts of Management
- Functions of Management
- Structure of Management
- How management and society are interlinked
- People Management
- Leadership concepts
- Quantitative methods
- Customer relations

Course Outcomes (CO):

This course briefs students on the mode of operandi for the employees and the mechanism tool for job at a workplace. Furthermore the handling of customers is an integral part of the course. This subject deals with the growth of an individual as an employee.

CO1: Learning the various modes of operations for the management.

CO2: Customer handling and taking care of their needs and requirements keeping in mind the basic infrastructure of the company.

CO3: Managing people and their mode of work.

CO4: Understanding leadership skills that leads to growth of an individual.

CO5: Understanding the link between society and management and how to maintain a balance between the two.

CO6: Company's responsibility towards the society through CSR and Quantitative Methods.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								✓		✓	✓	✓
CO2						✓		✓	✓	✓	✓	✓
CO3						✓		✓	✓	✓	✓	✓
CO4		✓						✓	✓	✓	✓	✓
CO5						✓		✓		✓	✓	✓
CO6			✓			✓	✓	✓		✓	✓	✓

Course Contents:

Module-1: Basic concepts of Management: Definition, essence, Functions, Roles, Level Functions of Management Planning: Concept, Nature, Types, Analysis, Management, objectives

Structure: Concept, Structure, Principles, Centralization, Decentralization, Spn of Management, Organizational Effectiveness

Module-2: Management and Society: Concept, external environment, CSR, Corporate Governance, and Ethical Standards. People Management: Overview, Job design, Recruitment and Selection, Stress Management Managerial competencies: Communication, Motivation, Team Effectiveness, Conflict

Management, Creativity, and Entrepreneurship.
Module-3: Leadership concept: Nature, Styles, Decision Making, Process, Tools and Techniques. Economic, Financial and quantitative Analysis : Production Markets, National Income Accounting, Financial Function, and goals, Financial statements, Ratio Analysis. Quantitative Methods: Statistical Interference, Forecasting, Regression Analysis, Statistical Quality Control
Module-4: Customer Management: Market planning and research, Market Mix, Advertising and Brand Management. Operations and Technology Management: Production and Operations Management, Logistics, & supply chain Management. TQM, Kaizen and Six Sigma, MIS.

Text Book:
1. "Management" by Stoner J A and Freeman R E
2. "Great Ideas in Management" by Parkinson C N and Rustomji M K and Sapre S A
3. "Management Principles and Practices" by Lallan Prasad and S S Gulshan

References:
1. "Management: Principles and Practice" by S K Mandal
2. "Principles and Practices of Management" by Khusboo Manoj

TITLE OF COURSE: TOTAL QUALITY MANAGEMENT
COURSE CODE: HSM511
L-T-P: 2-0-0
CREDITS: 2

Pre-requisite: Basic idea of leadership, need of quality department, training, product/service design etc.

Introduction:
Total quality management concepts include the Quality & Management Philosophies, Managing Quality and control, Managing Quality and control and TQM tools.

Course Outcomes (CO):
This course will serve to broaden the student's understanding of the issues and latest developments in the area of total quality management. To reach this goal, the following objectives need to be met:
CO1: Define the current state of total quality management.
CO2: Understand the Quality & Management Philosophies.
CO3: Become familiar with Managing Quality and control.
CO4: Familiar with TQM Tools.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												✓
CO2												✓
CO3						✓						✓

CO4					✓	✓						✓

Course Contents:

Module-I Introduction

Definition of Quality, Small q & Big Q, Quality characteristics- weaves, Dimensions, determinants, Quality Planning, Quality & profitability - idea, Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

Module-II Quality & Management Philosophies

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement: Deming Philosophy- Chain reaction, 14 points for management, triangle theory of variance, deadly diseases & sins, Demings wheel. Juran Philosophy- 10 steps for quality improvement, quality trilogy, and universal breakthrough sequence. Crosby Philosophy- Crosby's 6 C's, Absolutes of quality, Crosby's 14 points for quality, Crosby triangle. Comparison of 3 major quality philosophies, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

Module-III Managing Quality and control

Traditional vs. Modern quality management, the quality planning, road map, the quality cycle. Cost of quality- Methods to reduce cost of quality, Sampling plans, O.C. curve. Objectives of quality control, seven tools of quality, Strategy & policy. Company wise quality control. Quality Assurance- Definition, concepts & objectives. Economic models for quality assurance. Statistical methodology in quality assurance. Process capability ratio, Concept of six sigma, New seven Management tools

Module-IV TQM Tools

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD)–House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA

Module-V Quality Systems

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits.

Text Book:

1. Total Quality Management, Poonia & Sharma, Khanna Publishing House
2. Total Quality Management, Gopal, PHI
3. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.

References:

1. James R.Evans & William M.Lidsay, "The Management and Control of Quality", (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5
2. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers

TITLE OF COURSE: CONSTITUTION OF INDIA/ESSENCE OF INDIAN KNOWLEDGE TRADITION
COURSE CODE: M503
L-T-P: 0-0-0-0
CREDITS: 0

Pre-requisite: Some idea about professional life and society.
Introduction:
The debate on the 'basic structure' of the Constitution, lying somnolent in the archives. According to the Constitution, Parliament and the state legislatures in India.

Course Outcomes (CO):
After completion of this course, the learners will be able to
CO1: Describe different features of Indian constitution.
CO2: Power and functioning of Union, state and local self-government. Structure, jurisdiction and function of Indian Judiciary. Basics of PIL and guideline for admission of PIL.
CO3: Functioning of local administration starting from block to Municipal Corporation.
CO4: Identify authority to redress a problem in the profession and in the society.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓		✓	✓			✓	✓
CO2	✓			✓			✓				✓	✓
CO3	✓	✓	✓	✓			✓	✓			✓	✓
CO4	✓	✓	✓	✓			✓	✓			✓	✓

Course Contents:
Module-1: Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.
Module-2: Union government and its administration: Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha. State government and its administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions
Module-3: Supreme court: Organization of supreme court, procedure of the court, independence of the court, jurisdiction and power of supreme court. High court: Organization of high court, procedure of the court, independence of the court, jurisdiction and power of supreme court. Subordinate courts: constitutional provision, structure and jurisdiction. National legal services authority, Lok adalats, family courts, gram nyayalays. Public interest litigation (PIL): meaning of PIL, features of PIL, scope of PIL, principle of PIL, guidelines for admitting PIL
Module-4: Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Text Books

1. Indian polity, M, Laxmikanth, MC Graw Hill education, 5th Edition.

References

1. DD Basu, "Introduction to the constitution of India", 21st Edition, Lexis Nexis Books Publication ltd, India

TITLE OF COURSE: ESP & SDP-V
COURSE CODE: GSC505
L-T-P: 2-0-2
CREDITS: 2

Pre-requisite: Basic concepts in mathematics and English Language.

Introduction:

This course examines Basic English language and math. The Topics to be covered (tentatively): The course is on GATE exam preparation, logical reasoning, English sentence correction, English, Grammar correction, basic arithmetic, Vocabulary, Verbal Reasoning.

Course Outcomes (CO):

In this course we will study the basic components of math and English language. Students are expected to be capable of understanding the better communication, their advantages and drawbacks, how to implement them in daily life, how their drawbacks can be overcome and what the applications are and where they can be used. To reach this goal, the following objectives need to be met:

CO1: Students would be able to know GATE exam preparation.
CO2: Students would be able to implement verbal and non-verbal communication.
CO3: By analyzing the logic of any arithmetic structure able to solve problem.
CO4: To become an efficient math and English language.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓
CO2	✓			✓								✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓

Course Contents:

Section A: Employment Enhancement Skills-V
Stream wise GATE Preparation

Module-1: Programming in C.

Module-2: Programming and Data Structures

Module-3: Digital Logic Design & Computer Organization & Architecture

Module-4: Formal Language & Automata Theory

Module-5: Database Management Systems

Section B: Skill Development for Professional-V

Module-1: Vocabulary: Vocabulary questions test the candidate's knowledge in English like primary meanings of words, idioms, and phrases, secondary shades of meaning, usage, associated words, antonyms, etc.

Module-2: Grammar: Grammar-based questions test the candidate's capability to mark and correct grammatical errors. Prepositions use of modifiers, subject-verb agreement, parallel construction, phrasal verbs, redundancy, etc.

Module-3: Verbal Reasoning: Verbal Reasoning questions are designed to test the candidate's potential to identify relationships or patterns within sentences or a group of words.

Module-4: Inequalities, Coding – Decoding, Syllogisms, Ranking/ Ordering, Blood Relations, Directions, Input-Output, Seating Arrangement, Puzzles , Decision Making, Analogy, Odd-Man out, Word Formation, Digit Sequence, Critical Reasoning, Statements & Assumptions, Statement & Conclusion, Strong Argument & Weak Arguments.

Learning Materials:

1. Fastrack objective Arithmetic: Arihant
2. Quantitative aptitude for Competitive exam (4th Edition): TATA Mc Graw Hill
3. Quantitative aptitude for Competitive exam (3rd Edition): PEARSON
4. Engineering mathematics-Pearson
5. GATE Mathematics- Willey/McGraw hill

Sixth Semester Syllabus

Sl No.	Type	Subject Code	Topic	L	T	P	S	Credit Points
1	PCC	CSC614	Compiler Design	3	0	3	0	4.5
2	PCC	CSC615	Computer Networks	3	0	3	0	4.5
3	PEC	AIML---	Specialization Elective-II	2	0	2	0	3
4	PEC	AIML---	Specialization Elective-III	3	0	0	0	3
5	OE	---	Open Elective-I	2	0	0	0	3
6	DE	CSD---	Discipline Elective-I	2	0	2	0	3
7.	GSC	GSC606	ESP & SDP-VI	2	0	0	2	2
8.	PTI	INT604	Internship/Industrial Training/Project-II	0	0	0	1	1
9.	NPT	NPT605	(NPTEL/MOOCs)	-	-	-	-	2
			Total	17	0	10	3	26/30

#(NPT605): NPTEL/MOOCs are based on the respective year's offered courses.

Suggestive Choice Based Subjects

Sl No.	Type	Subject Code	Topic	L	T	P	Credit Points
1.	PEC	AIML602	Introduction to Data Analytics	3	0	2	4
2.	PEC	AIML603	Deep Learning & Neural Network	3	0	2	4
3.	OE	BSC607	Numerical Methods & Operation Research	2	0	2	3
4.	OE	BSC608	Operations Research	2	0	2	3
5.	OE	BSC609	Statistics for Data Analysis	2	0	2	3
6.	OE*	CSD601	Blockchain Technology	3	0	0	3
7.	OE**	CSD602	Big Data Analytics	3	0	2	4
8.	DE	CSD603	Web Technology	2	0	2	3
9.	DE	CSD604	Computer Graphics	2	0	2	3
10.	DE	**CSD605**	**Software Project Management**	2	0	2	3
11.	DE	CSD606	E-Commerce	2	0	2	3

TITLE OF COURSE: COMPILER DESIGN
COURSE CODE: CSC614
L-T-P: 3-0-3
CREDITS: 4.5

Pre-requisite: Basic concepts in mathematics and formal language and automata theory.

Introduction:
This course examines compiler design concepts, phases of compiler in detail and cousins of compiler. The Topics to be covered (tentatively) include: Introduction to Compiler, Lexical Analysis, Syntax Analysis, Type Checking, Intermediate Code Generation, Code Optimization and Code Generation.

Course Outcomes (CO):
In this course the students will study the introduction to the major concept areas of language translation and compiler design. To enrich the knowledge in various phases of compiler ant it's use, code optimization techniques, machine code generation, and use of symbol table. To extend the knowledge of parser by parsing LL parser and LR parser. To provide practical programming skills necessary for constructing a compiler. To provide practical programming skills necessary for constructing a compiler.
To reach this goal, the following objectives need to be met:
CO1: To learn different types of compiler.
CO2: To use the knowledge of patterns, tokens & regular expressions for solving a problem in the field of data mining.
CO3: To apply the knowledge of lex tool & yacc tool to develop a scanner & parser.
CO4: To learn the new code optimization techniques to improve the performance of a program in terms of speed & space.
CO5: To design & conduct experiments for Intermediate Code Generation in compiler.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓		✓		✓							✓
CO3	✓		✓		✓							✓
CO4	✓	✓		✓								✓
CO5	✓											✓

Course Contents:
Module-1: Introduction to Compiling-Compilers, Analysis-synthesis model, the phases of the compiler, Cousins of the compiler.
Module-2: Lexical Analysis-The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of tokens, Finite automata, from a regular expression to an NFA, from a regular expression to NFA, from a regular expression to DFA, Design of a lexical analyzer generator (Lex).
Module-3: Syntax Analysis-The role of a parser, Context free grammars, Writing a grammar, Top

down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques. Syntax directed translation-Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

Module-5: Type checking-Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions

Run time environments-Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

Module-6: Intermediate code generation -Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

Module-7: Code optimization -Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, the principle sources of optimization, Loops in flow graph, Peephole optimization.

Module-8: Code generations -Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Text Books

1. Aho, Sethi, Ullman - "Compiler Principles, Techniques and Tools" - Pearson Education.
2. Holub - "Compiler Design in C" – PHI
3. Tremblay and Sorenson Compiler Writing-McGraw Hill International.
4. Chattopadhyay, S- Compiler Design (PHI)

References

1. Des Watson,"A Practical Approach to Compiler Construction", Springer Publication.
2. V. Raghavan,"Principles of Compiler Design", Tata McGraw-Hill Education,

TITLE OF COURSE: COMPILER DESIGN LAB
COURSE CODE: CSC694
L-T-P: 0-0-3
CREDITS: 1.5

Pre-requisite: Basic concepts in mathematics and formal language and automata theory.

Introduction:

This course examines compiler design concepts, phases of compiler in detail and cousins of compiler. The Topics to be covered (tentatively) include: Introduction to Compiler, Lexical Analysis, Syntax Analysis, Type Checking, Intermediate Code Generation, Code Optimization and Code Generation.

- To implement the different Phases of compiler.
- To implement and test simple optimization techniques.
- To give exposure to compiler writing tools.

Course Outcomes (CO): The Student will be able to :

CO1: Implement the techniques of Lexical Analysis and Syntax Analysis.

CO2: Apply the knowledge of Lex & Yacc tools to develop programs.
CO3: Generate intermediate code.
CO4: Implement Optimization techniques and generate machine level code

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓		✓		✓							✓
CO3	✓		✓		✓							✓
CO4	✓	✓		✓								✓

Course Contents:

LIST OF EXPERIMENTS

1. Implementation of lexical analyzer for IF statement and Arithmetic expression.
2. Construction of NFA from Regular Expression.
3. Construction of recursive descent parsing for the grammar.
4. Write a C program to implement operator precedence parsing.
5. Implementation of shift reduce parsing algorithm.
6. Design a code optimizer for implementing constant propagation
7. Write a program to perform loop unrolling for code optimization
8. Implementation Code Generator
9. Write a C program for implementing the functionalities of predictive parser
10. Write a C program for constructing of LL (1) parsing
11. Write a program to Design LALR Bottom-up Parser.
12. Generate YACC specification for a few syntactic categories.
    a) Program to recognize a valid arithmetic expression that uses operator +, – , * and /.
    b) Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.
    c) Implementation of Calculator using LEX and YACC
    d) Convert the BNF rules into YACC form and write code to generate abstract syntax tree
13. Write program to find Simulate First and Follow of any given grammar.
14. Construct a Shift Reduce Parser for a given language.
15. Implement Intermediate code generation for simple expressions.
16. Implement the back end of the compiler which takes the three address code and produces the 8086 assembly language instructions that can be assembled and run using an 8086 assembler. The target assembly instructions can be simple move, add, sub, jump etc

Text Books

1. Aho, Sethi, Ullman - “Compiler Principles, Techniques and Tools” - Pearson Education.
2. Holub - “Compiler Design in C” – PHI
3. Tremblay and Sorenson Compiler Writing-McGraw Hill International.

4. Chattopadhyay, S- Compiler Design (PHI)

References

1. Des Watson,"A Practical Approach to Compiler Construction", Springer Publication.
2. V. Raghavan,"Principles of Compiler Design", Tata McGraw-Hill Education,

TITLE OF COURSE: COMPUTER NETWORKS
COURSE CODE: CSC615
L-T-P: 3-0-3
CREDITS: 4.5

Pre-requisite: Basic idea of computer science, hardware, software etc.

Introduction:

This course is to provide students with an overview of the concepts and fundamentals of data communication and computer networks. Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks (LAN, MAN, WAN and Wireless networks) and their protocols. The course is supplemented by a practical component covered in Lab concurrently.

Course Outcomes (CO):

At the end of the course, the students will be able to:
CO1: Build an understanding of the fundamental concepts of computer networking.
CO2: Familiarize the student with the basic taxonomy and terminology of the computer networking area.
CO3: Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
CO4: Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2	✓			✓								✓
CO3	✓	✓		✓		✓						✓
CO4	✓	✓	✓		✓	✓						✓

Course Contents:

Module 1: Introduction

Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); Networks: distributed processing, network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, internet today; Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Physical layer: Overview of data (analog & digital), signal (analog &digital), transmission (analog & digital) & transmission media (guided & non-guided); TDM, FDM, WDM; Circuit switching: time division & space division switch, TDM bus; Telephone network;

Module 2: Data link layer

Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC;

Medium access sub layer: Point to point protocol, LCP, NCP, FDDI, token bus, token ring; Reservation, polling, concentration; Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, FDMA, TDMA, CDMA; Traditional Ethernet, fast Ethernet;

Module 3: Network layer:

Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : Internet address, classful address, subnetting; Routing : techniques, static vs. dynamic routing, routing table for classful address; Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP, IPV6; Unicast and multicast routing protocols.

Transport layer: Process to process delivery; UDP; TCP; Congestion control algorithm: Leaky bucket algorithm, Token bucket algorithm, choke packets; Quality of service: techniques to improve QoS.

Module 4: Application layer:

DNS; SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography, user authentication, security protocols in internet, Firewalls.

Modern topics:

ISDN services & ATM; DSL technology, Cable modem, SONET. Wireless LAN: IEEE 802.11; Introduction to blue-tooth, VLAN's, Cellular telephony & Satellite network.

Text Books:

1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH
2. A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas

Reference Books:

1. Kurose and Rose – "Computer networking -A top down approach featuring the internet" – Pearson Education
2. Leon, Garica, Widjaja – "Communication Networks" – TMH
3. Walrand – "Communication Networks" – TMH.
4. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" – Pearson Education/PHI

TITLE OF COURSE: COMPUTER NETWORKS LAB
COURSE CODE: CSC615

L-T-P: 0-0-3-0
CREDITS: 1.5

Pre-requisite: Basic idea of Mathematics, computer science, hardware, software etc.

Introduction:
This practical course provides students with hands on training regarding the design, troubleshooting, modeling and evaluation of computer networks. In this course, students are going to experiment in a real and simulation based test-bed networking environment, and learn about network design and troubleshooting topics and tools such as: network addressing, Address Resolution Protocol, basic troubleshooting tools (like ping, ICMP), IP routing (e.g. RIP), TCP and UDP,DHCP,ACL and many others. Student will have the opportunity to build some simple networking models using the tool and perform simulations that will help them evaluate their design approaches and expected network performance.

Course Outcomes (CO):
At the end of the course, the students will be able to:
CO1: Build an understanding of the fundamental concepts of computer networking.
CO2: Familiarize the student with the basic taxonomy and terminology of the computer networking area.
CO3: Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
CO4: Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											✓
CO2	✓			✓								✓
CO3	✓	✓		✓		✓						✓
CO4	✓	✓	✓		✓	✓						✓

Course Contents:
Exercises that must be done in this course are listed below:
Exercise No.1: Study of different types of Network cables and practically implements the cross- wired cable and straight through cable using clamping tool.
Exercise No. 2: Familiarization with some network devices. Exercise No. 3: Study of Network IP.
Exercise No. 4: Connect the computers in LAN. Exercise No. 5: Introduction to Packet Tracer.
Exercise No. 6: Configure network topology using packet tracer.
Exercise No. 7: Configure network topology using packet tracer to find the routing path by IPRoute Command.
Exercise No. 8: Network Configuration using distance vector routing protocol.
Exercise No. 9: Configuration of DHCP Protocol
Exercise No. 10: Telnet Configuration.

Exercise No. 11: Configuration of Access Control List.

Text Book:
1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.)"– TMH

Reference Book:
1. Authorized Self-Study Guide "Interconnecting Cisco Network Devices, Part 1(ICND1), 2nd Edition, January, 2008.

Recommended Systems/Software Requirements:
CAT-5/CAT-6 Cables, RJ 45, Cutter, Clamping Tool, Router, Switch and Hub.
Intel based desktop PC with minimum of 166 MHZ or faster processor with at least 64 MB RAM and 100 MB free disk space.
Turbo C or TC3 complier in Windows XP or Linux Operating System.

TITLE OF COURSE: INTRODUCTION TO DATA ANALYTICS
COURSE CODE: AIML602
L-T-P: 3-0-2
CREDITS: 4

Pre-requisite: Knowledge in artificial intelligence and machine learning.

Introduction:
• Provide you with the knowledge and expertise to become a proficient data scientist
• Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
• Produce Python code to statistically analyse a dataset;
• Critically evaluate data visualisations based on their design and use for communicating stories from data;

Course Outcomes (CO):
After completion of course, students would be able to:
CO1: Explain how data is collected, managed and stored for data science;
CO2: Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists;
CO3: Implement data collection and management scripts using MongoDB.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓	✓	✓	✓	✓	✓						✓
CO3	✓	✓		✓								✓

Course Contents:

Module 1: [Duration: 7 Lectures]
Introduction to Data Science, Different Sectors using Data science, Purpose and Components of Python in Data Science.
Module 2: [Duration: 7 Lectures]
Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDAQuantitative technique, EDA- Graphical Technique, Data Analytics Conclusion and Predictions.
Module 3: [Duration: 11 Lectures]
Feature Generation and Feature Selection (Extracting Meaning from Data)- Motivating application: user (customer) retention- Feature Generation (brainstorming, role of domain expertise, and place for imagination)- Feature Selection algorithms.
Module 4: [Duration: 10 Lectures]
Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects- Exercise: create your own visualization of a complex dataset.
Module 5: [Duration: 7 Lectures]
Applications of Data Science, Data Science and Ethical Issues- Discussions on privacy, security, ethics- A look back at Data Science- Next-generation data scientists.

Lab Work:
1. Python Environment setup and Essentials.
2. Mathematical computing with Python (NumPy).
3. Scientific Computing with Python (SciPy).
4. Data Manipulation with Pandas.
5. Prediction using Scikit-Learn
6. Data Visualization in python using matplotlib

Text Books /References:
1. Joel Grus, Data Science from Scratch, Shroff Publisher Publisher /O'Reilly Publisher Media
2. V.K. Jain, Big Data and Hadoop, Khanna Publishing House
3. V.K. Jain, Data Sciences & Analytics, Khanna Publishing House
4. Annalyn Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff Publisher Publisher
5. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly Publisher Media.
6. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.
7. Jake VanderPlas, Python Data Science Handbook, Shroff Publisher Publisher /O'Reilly Publisher Media
8. Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher Publisher /O'Reilly Publisher Media.

TITLE OF COURSE: DEEP LEARNING & NEURAL NETWORK
COURSE CODE: AIML603
L-T-P: 3-0-2
CREDITS: 4

Pre-requisite: Knowledge in artificial intelligence and machine learning.

Introduction:

• To strengthen important Mathematical concepts required for Deep learning and neural network.
• To get a detailed insight of advanced algorithms of ML.

Course Outcomes (CO):

After completion of course, students would be able:

CO1: To design and implement Artificial Neural networks.

CO2: To decide when to use which type of NN.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓	✓	✓	✓	✓	✓						✓

Course Contents:

Module 1: [Duration: 8 Lectures]

Information flow in a neural network, understanding basic structure and ANN.

Module 2: [Duration: 8 Lectures]

Training a Neural network, how to determine hidden layers, recurrent neural network.

Module 3: [Duration: 10 Lectures]

Convolutional neural networks, image classification and CNN.

Module 4: [Duration: 9 Lectures]

RNN and LSTMs. Applications of RNN in real world.

Module 5: [Duration: 7 Lectures]

Creating and deploying networks using tensor flow and keras.

Lab Work:

1. Introduction to Kaggle and how it can be used to enhance visibility.
2. Build general features to build a model for text analytics.
3. Build and deploy your own deep neural network on a website using tensor flow.

Text Books/References:

1. Rajiv Chopra, Deep Learning, Khanna Publishing House.
2. John Paul Mueller, Luca Massaron, Deep Learning for Dummies, John Wiley & Sons.
3. Adam Gibson, Josh Patterson, Deep Learning, A Practitioner's Approach, Shroff Publisher /O'Reilly Publisher Media.
4.Christopher M. Bishop, Neural Networks for Pattern Recognition, Oxford.
5. Russell Reed, Robert J MarksII, Neural Smithing: Supervised Learning in Feedforward Artificial Neural Networks, Bradford Book Publishers.

Corresponding Online Resources:

1. Fuzzy Logic and Neural Networks, https://swayam.gov.in/nd1_noc20_ge09/preview.

TITLE OF COURSE: NUMERICAL METHODS & OPERATION RESEARCH
COURSE CODE: BSC607
L-T-P: 2-0-2
CREDITS: 3

Pre-requisite: Basic mathematics and statistics.

Introduction:
The aim is to teach the student various topics in Numerical Analysis such as solutions of nonlinear equations in one variable, interpolation and approximation, numerical differentiation and integration, direct methods for solving linear systems, numerical solution of ordinary differential equations. Operational Research models from the verbal description of the real system. Understand the mathematical tools that are needed to solve optimization problems. Use mathematical software to solve the proposed models. Develop a report that describes the model and the solving technique, analyses the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

Course Outcomes (CO):
The students will learn:
CO1: Students are able to understand the nature and operations of Numerical Analysis.
CO2: Student is expected to solve real-life and Engineering applications.
CO3: Formulate and solve mathematical model (linear programming problem) for a physical situations like production, distribution of goods and economics.
CO4: Solve the problem of transporting the products from origins to destinations with least transportation cost.
CO5: Identify the resources required for a project and generate a plan and work schedule.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓		✓		✓							✓
CO3	✓		✓		✓							✓
CO4	✓		✓		✓							✓
CO5	✓		✓		✓							✓

Course Contents:
Numerical Methods
MODULE 1: (6L)
Accuracy and Precision: Error Analysis. Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

MODULE 2: (6L)
Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge- Kutta method, Least square approximation.

Operation Research
Module 3: Linear Programming Problems (10L)
Basic LPP and Applications, LP Problem Formulation, Simultaneous Equations and Graphical Method, Simplex Method, Big-M Method, Duality Theory, Transportation Problems and Assignment Problem.
Module 4: Game Theory (4L)
Introduction; 2-Person Zero – sum Game; Saddle Point; Mini – Max and Maxi – Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.
Module 5: Queuing Theory (6L)
Introduction, Axiomatic Derivation of the Arrival &Departure (Poisson Queue).Poisson Queue Models: (M/M/1:∞/FIFO) and (M/M/1:N/FIFO).

Reference Books

1. Dutta & Jana: Introductory Numerical Analysis (All course).
2. Dr. B. S. Grewal: Numerical Methods in Engineering &science
3. Jain, Iyengar, & Jain: Numerical Methods (Problems and Solution).
4. Baburam: Numerical Methods, Pearson Education.
5. H.A.Taha,"Operations Research", Pearson
6. P. M.Karak–"Linear Programming and Theory of Games", ABS Publishing House
7. Ghosh and Chakraborty,"Linear Programming and Theory of Games",Central Book Agency
8. Ravindran,Philips and Solberg- "Operations Research",WILEYINDIA
9. Kanti Swaroop— "Operations Research", Sultan Chand & Sons

TITLE OF COURSE: NUMERICAL METHODS & OPERATION RESEARCH LAB
COURSE CODE: BSC697
L-T-P: 0-0-2
CREDITS: 1

Pre-requisite: Basic concepts in mathematics and programming languages.
Introduction:
This course provides an introduction to the basic concepts and techniques of numerical solution of algebraic equation, system of algebraic equation, numerical solution of differentiation, integration, statistical and ANOVA methods and their inter- relations and applications to computer science and engineering, and science areas and develops problem solving skills with both theoretical and computational oriented problems.

Course Outcomes (CO):
In this course we will study to develop the mathematical skills in the areas of numerical methods, 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 reach this goal, the following objectives need to be met:

CO1: Apply numerical methods to find our solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations.
CO2: Apply various interpolation methods and finite difference concepts.
CO3: Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.
CO4: Work numerically on the ordinary differential equations using different methods through the theory of finite differences.
CO5: Work numerically on the partial differential equations using different methods through the theory of finite differences
CO6: Identify and develop operational research models from the verbal description of the real system.
CO7: Understand the mathematical tools that are needed to solve optimization problems.
Use mathematical software to solve the proposed models.
CO8: Develop a report that describes the model and the solving technique, analyze the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓	✓								
CO2	✓		✓	✓								
CO3	✓		✓	✓								
CO4	✓		✓	✓			✓					
CO5	✓		✓	✓			✓					
CO6	✓		✓	✓		✓	✓	✓	✓			
CO7	✓	✓	✓	✓	✓	✓	✓	✓	✓			
CO8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Course Contents:
Module-1: Assignments on Newton forward /backward, Lagrange's interpolation.**Module-2:** Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
Module-3: Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
Module-4: Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
Module-5: Assignments on ordinary differential equation: Euler's and Runga-Kutta methods.
Module-6: Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.
Module-7: Nature and development of Operations Research: some mathematical preliminaries, OR and managerial decision making, OR applications in industrial and non-industrial fields.
Module-8: Linear Optimization Models: formulation of linear programming problem, graphical

solution, sensitivity analysis in graphical solution, comparison of graphical and simplex algorithm, simplex algorithm, computational procedure in simplex, penalty method, two phase method, degeneracy, duality and its concept, application of LP model to product mix and production scheduling problems.

Module-9: The transportation model: solution methods, balanced and unbalanced problems, Vogel's approximation method, and degeneracy in transportation problems. Assignment problem, methods for solving assignment problems. The traveling salesman problem. Numerical on transportation, assignment and traveling salesman method. Computer algorithms for solution to LP problems.

Module-10: Dynamic programming problems: model formulation, computational procedures, solution in different stages. Decision making under conditions of risk, assumed certainty.

Module-11: Waiting line models: queuing systems and concepts, various types of queuing situations, single server queues with poison arrivals and exponential service times, finite queue length model, industrial applications of queuing theory.

Module-12: Simulation: advantages and limitations of the simulation technique: generation of random numbers, Monte-Carlo simulation, computer-aided simulation, applications in maintenance and inventory management.

Text Books

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
5. Taha,H A, "Operations Research - An Introduction", Sixth Edition, Prentice Hall of India Private Limited, N. Delhi, 2004.
6. Hillier, F S, "Operations Research", First Indian Edition, CBS Publishers & Distributors, Delhi, 1994.
7. Wagner H M, "Principles of Operations Research", Second Edition, Prentice Hall of India Private Limited, New Delhi, 2003.

References

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.
6. Mustafi C K, "Operations Research", Third Edition, New Age International Pvt. Ltd., New Delhi, 1996.
7. Gupta P K, & Hira D.S., "Operations Research", Third Edition, S Chand & Company Ltd., New Delhi, 2005.

TITLE OF COURSE: OPERATIONS RESEARCH
COURSE CODE: BSC608
L-T-P: 2-0-2
CREDITS: 3

Pre-requisite: Basic concepts in mathematics and programming languages.

Introduction

Objective of this course to identify and develop operational research models from the verbal description of the real system. Understand the mathematical tools that are needed to solve optimization problems. Use mathematical software to solve the proposed models. Develop a report that describes the model and the solving technique, analyze the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

Course Outcomes

CO1: Formulate and solve mathematical model (linear programming problem) for a physical situations like production, distribution of goods and economics.
CO2: Apply the concept of simplex method and its extensions to dual simplex algorithm.
CO3: Solve the problem of transporting the products from origins to destinations with least transportation cost.
CO4: Convert and solve the practical situations into non-linear programming problem.
CO5: Identify the resources required for a project and generate a plan and work schedule.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓		✓		✓							✓
CO3	✓		✓		✓							✓
CO4	✓	✓		✓								✓
CO5	✓	✓		✓								✓

Course Contains

Module: 1: Linear Programming Problems (10 Lectures)

Basic LPP and Applications, LP Problem Formulation, Simultaneous Equations and Graphical Method, Simplex Method, Big-M Method, Duality Theory, Transportation Problems and Assignment Problem.

Module 2: Network Analysis (8 Lectures)

Shortest Path; Floyd Algorithm, Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded).

Module 3: Dynamic Theory (5 Lectures)

Dynamic programming problems and their characteristics; Bellman's principle of optimality; solving (i) Stage coach problem, (ii) Knapsack problem.

Module 4: Game Theory (5 Lectures)

Introduction; 2-Person Zero-sum Game; Saddle Point; Mini – Max and Maxi – Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.

Module 5: Queuing Theory (8 Lectures)

Introduction, Axiomatic Derivation of the Arrival & Departure (Poisson Queue).Poisson Queue Models: (M/M/1:∞/FIFO) and (M/M/1:N/FIFO).

Reference Books

1. H.A.Taha,"Operations Research", Pearson
2. P. M.Karak–"Linear Programming and Theory of Games", ABS Publishing House
3. Kanti Swaroop— "Operations Research", Sultan Chand & Sons
4. Rathindra P.Sen—"Operations Research: Algorithms and Applications", PHI
5. A.M.Natarajan,P.Balasubramani andA.Tamilarasi- "Operations Research", Pearson
6. M.V.Durga Prasad–"Operations Research",CENGAGE Learning

TITLE OF COURSE: OPERATIONS RESEARCH LAB
COURSE CODE: BSC698
L-T-P: 0-0-2
CREDITS: 1

Pre-requisite: Basic concepts in mathematics and programming languages.

Introduction:

Operations research helps in solving problems in different environments that needs decisions. The module cover topics that include: linear programming, Transportation, Assignment, and CPM/ MSPT techniques. Analytic techniques and computer packages will be used to solve problems facing business managers in decision environments.

Course Outcomes (CO):

This module aims to introduce students to use quantitive methods and techniques for effective decisions–making; model formulation and applications that are used in solving business decision problems. To reach this goal, the following objectives need to be met:

CO1: Be able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type.

CO2: Be able to build and solve Transportation Models and Assignment Models.

CO3: Be able to design new simple models, like: CPM, MSPT to improve decision –making and develop critical thinking and objective analysis of decision problems.

CO4: Be able to implement practical cases, by using TORA, WinQSB

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓	✓	✓		✓			✓
CO2	✓	✓	✓			✓	✓		✓			✓
CO3	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓
CO4	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓

Course Contents:

Module-1: Introduction to Operations Research (OR), Introduction to Foundation mathematics and statistics, Linear Programming (LP), LP and allocation of resources, LP definition, Linearity requirement, Maximization Then Minimization problems. Graphical LP Minimization solution,

Introduction, Simplex method definition, formulating the
Simplex model.
Module-2: Linear Programming – Simplex Method for Maximizing. Simplex maximizing example for similar limitations, Mixed limitations. Example containing mixed constraints, Minimization example for similar limitations.
Module-3: Sensitivity Analysis: Changes in Objective Function, Changes in RHS, The Transportation
Model. Basic Assumptions.
Module-4: Feasible Solution: The Northwest Method, The Lowest Cost Method;
Module-5: Optimal Solution: The Stepping Stone Method, Modified; Distribution (MODI) Method.
Module-6: The Assignment Model:- Basic Assumptions. Solution Methods:-Different Combinations Method, Short-Cut Method (Hungarian Method). MSPT:- The Dijkestra algorithm, and Floyd's Algorithm (Shortest Route Algorithm)

Text Books

1. Taha,H A, "Operations Research - An Introduction", Sixth Edition, Prentice Hall of India Private Limited, N. Delhi, 2004.
2. Hillier, F S, "Operations Research", First Indian Edition, CBS Publishers & Distributors, Delhi, 1994.
3. Wagner H M, "Principles of Operations Research", Second Edition, Prentice Hall of India Private Limited, New Delhi, 2003.

References

1. Mustafi C K, "Operations Research", Third Edition, New Age International Pvt. Ltd., New Delhi, 1996.
2. Gupta P K, & Hira D.S., "Operations Research", Third Edition, S Chand & Company Ltd., New Delhi, 2005.

TITLE OF COURSE: STATISTICS FOR DATA ANALYSIS
COURSE CODE: BSC609
L-T-P: 2-0-2
CREDITS: 3

Pre-requisite: This course requires that you are familiar with high-school level linear algebra, and calculus. Knowledge of probability theory, statistics, and programming is desirable.

Introduction:
This course will expose you to the data analytics practices executed in the business world. We will explore such key areas as the analytical process, how data is created, stored, accessed, and how the organization works with data and creates the environment in which analytics can flourish.

Course Outcomes (CO):
CO1: Through studying statistics, you learn a general system of concepts for statistical analysis.
CO2: You learn how to conduct a statistical survey in practice, in a range of concrete situations.
CO3: Carry out data analysis/statistical analysis effectively visualizes the data.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓		✓						✓
CO2	✓	✓		✓	✓	✓						✓
CO3	✓		✓		✓	✓						✓

Course Contents:

Module 1:

Probability: Introduction, Events & Different Types of Events, Addition & Multiplication Law, Conditional Probability, Bay's Theorem.

Probability Distribution: Random Variables, Probability Function, Binomial Poison & Normal Distribution. Statistics: Definition, Function & Scope of Statistics.

Module 2:

Measures of Central Tendency: Arithmetic Mean, Weighted A.M., Median, Mode, Geometric & Harmonic Mean and Their Merits & Demerits.

Measures of Variation: Range, The Inter quartile Range or Quartile Deviation, Average (Mean), Deviation Standard Deviation, Coefficient of Variation, Skewness, Moments & Kurtosis.

Module 3:

Correlation Analysis: Introduction, Karl Pearson's Coefficient of Correlation, Rank Correlation Coefficient. Regression Analysis: Difference between Correlation & Regression, Regression Lines, Regression Equations, Regressions Coefficient.

Module 4:

Sampling Distribution: Chi Square (X2) Distribution and Its Properties, Chi - Square Test, Application of Chi -Square Distribution: Chi-Square Test for Population Variance, Chi Square Test of Goodness of Fit, Independence of Attributes, T- Distribution & Its Properties, Application of T - Distribution to Testing Hypothesis About Population Mean, Difference Between Two Means, Correlation Coefficient, F- Distribution. Null and alternative hypotheses, Type I and Type II error, One sample tests for means and proportions, Tests for difference between means of two populations, and the Chi Square Test for Independence.

Reference Books

1. S.P. Gupta & M.P. Gupta, "Business Statistics", Sultan Chand & Sons.
2. Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2ndEdn. (Reprint) John Wiley and Sons.
3. S.C. Gupta & V.K. Kapoor,"Fundamental of Mathematical Statistics", Sultan Chand & Sons.

TITLE OF COURSE: STATISTICS FOR DATA ANALYSIS LAB
COURSE CODE: BSC699
L-T-P: 0-0-2
CREDITS: 1

Pre-requisite: Basic concepts in mathematics and programming languages.

Introduction:

This course examines data structures and algorithms basics using python. The Topics to be covered

(tentatively) include: an introduction to programming and problem solving in Python with basic concepts such as conditionals, loops, functions, lists, strings and tuples; Time and space analysis of algorithms; Linear Data structures like array, linked list, stack, queue; Non-linear Data structures like graph and tree; Sorting; Searching and Hashing.

Course Outcomes (CO):

Those completing the course will have an understanding of the concepts of statistical design, analysis and graphing methods required in laboratory data analysis and reporting. Attendees will be able to interpret and report results related to design and analysis issues as presented in the scientific literature concerning laboratory data analysis, as well as, quality control methods. To reach this goal, the following objectives need to be met:

CO1: Consult with seasoned experts about your data analysis problems.
CO2: Enhance your ability to extract more meaningful data from your data sets.
CO3: Gain confidence in the use of basic statistical methods.
CO4: Improve your decision-making abilities.
CO5: Learn new ways to look at data.
CO6: Reduce the number of measurements required for certain applications.
CO7: Understand statistical terminology and be able to communicate more easily with statisticians.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓	✓	✓					✓
CO2	✓	✓			✓	✓	✓					✓
CO3	✓	✓			✓	✓	✓					✓
CO4	✓	✓			✓	✓	✓	✓				✓
CO5	✓	✓			✓	✓	✓	✓				✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓				✓
CO7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Course Contents:

Module-1: Statistical Measures and Descriptive Statistics: Central tendency (average or mean, median, mode), dispersion measures such as range, variance, standard deviation, And coefficient of variation, unbiased estimates, measurement summary and precision.

Module-2: Graphical Techniques: Histograms, bar charts, scatter plots. Graphical representation of lab results.

Module-3: Distributions and Formal Statistical Laboratory Tests: Normal, t-distribution (one sample, two sample, paired), one way ANOVA to assess effect and necessity of replication, skewed distributions with applications to experimental results with alternative statistical comparison methodologies.

Module-4: Estimation Statistics: Point and interval estimates, accuracy, precision. Further concepts of method validation such as sensitivity, specificity, selectivity, linearity.

Module-5: Defining Robustness and Ruggedness: Design selection criteria, calculations, interpretation, effects of repeated experimentation, and multiple lab results.

Module-6: Defining Linearity Further: Applications to method comparison and interpretation. Examination of outliers in exploratory analysis of assay results.
Module-7: Alternative Strategy to Linearity: Alternative advanced method for assessing agreement between two methods of laboratory measurements.
Module-8: Limit Strategies: Limit of detection, limit of quantitation.
Module-9: Calibration problem: Techniques involving crude and precise methodologies and measurement of bias.
Module-10: Validation Using Statistical Process Control: Use of quality control charts to determine laboratory process stability and capability.

Text Books
1. Think Stats — by Allen B. Downey
2. Practical Statistics for Data Scientists: 50 Essential Concepts — by Peter Bruce and Andrew Bruce

References
1. Innumeracy: Mathematical Illiteracy and its Consequences — by John Allen Paulos
2. Everybody Lies: Big Data, New Data, and What the Internet Can Tell Us About Who We Really Are — by Seth Stephens-Davidowitz, Tim Andres Pabon, et al.
3. Data Science from Scratch — by Joel Grus
4. Python Data Science Handbook: Essential Tools for Working with Data — by Jake VanderPlas

TITLE OF COURSE: BLOCKCHAIN TECHNOLOGY
COURSE CODE: CSD601
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Computer Networks, Data Structure

Introduction:
Cryptography is an integral part of the inner-workings of blockchain technology. Public-key encryption serves as the basis for blockchain wallets and transactions, cryptographic hash functions provide the trait of immutability, and Merkle trees organize transactions while enabling blockchains to be more efficient.

Course Outcomes (CO):
Upon successful completion of this course, students should be able to:
CO1: Learn the methods for evaluating different Cryptosystems
CO2: Learn different functions of Hash Functions, MAC Codes & Digital Signatur**es** and problem solving techniques.
CO3: Learn the concept of Firewalls and Web Security.
CO4: Learn the ideas of Basic Distributed System concepts & Bitcoin.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓
CO2	✓	✓	✓			✓			✓	✓		✓
CO3	✓	✓	✓	✓								✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓

Course Contents:

Module-1: Introduction:

Need for Distributed Record Keeping, Modeling faults and adversaries,Byzantine Generals problem,Consensus algorithms and their scalability problems,Why Nakamoto Came up with Blockchain based cryptocurrency? Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash etc.

Module-2: Basic Distributed Computing:

Atomic Broadcast, Consensus, Byzantine Models of fault tolerance

Module-3: Basic Crypto primitives:

Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems.

Module-4: Blockchain 1.0:

Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use.

Module-5: Blockchain 2.0:

Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts.

Module-6: Blockchain 3.0 :

Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain

Module-7: Privacy, Security issues in Blockchain:

Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms to prevent these

Text Books

1. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.

References

1. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.

TITLE OF COURSE: BIG DATA ANALYTICS
COURSE CODE: CSD602
L-T-P: 3-0-2
CREDITS: 4

Pre-requisite: To extract the maximum from the course, the following prerequisites are must.

- A strong mathematical background in Probability and Statistics
- Proficiency with algorithms
- Programming skills in C, Python, R, etc.
- Critical thinking and problem solving skills

Introduction:

This course will cover fundamental algorithms and techniques used in Data Analytics. The statistical foundations will be covered first, followed by various machine learning and data mining algorithms. Technological aspects like data management (Hadoop), scalable computation (Map-Reduce) and visualization will also be covered. In summary, this course will provide exposure to theory as well as practical systems and software used in data analytics.

After completing this course, you will learn how to:

- Find a meaningful pattern in data
- graphically interpret data
- Implement the analytic algorithms
- Handle large scale analytics projects from various domains
- Develop intelligent decision support systems

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

CO1: Work with big data tools and its analysis techniques

CO2: Analyze data by utilizing clustering and classification algorithms

CO3: Learn and apply different mining algorithms and recommendation systems for large volumes of data

CO4: Perform analytics on data streams

CO5: Learn No-SQL databases and management.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓	✓	✓	✓	✓							✓
CO3	✓	✓	✓	✓	✓							✓
CO4	✓		✓		✓							✓
CO5	✓	✓		✓								✓

Course Contents:

Module-1: INTRODUCTION TO BIG DATA:

Evolution of Big data, Best Practices for Big data Analytics, Big data characteristics, Validating, The Promotion of the Value of Big Data, Big Data Use Cases - Characteristics of Big Data Applications, Perception and Quantification of Value, Understanding Big Data Storage, A General Overview of High-Performance Architecture, HDFS – Map Reduce and YARN – Map Reduce Programming Model

Module-2: CLUSTERING AND CLASSIFICATION:
Advanced Analytical Theory and Methods: Overview of Clustering, K-means, Use Cases – Overview of the Method, Determining the Number of Clusters, Diagnostics – Reasons to Choose and Cautions, Classification: Decision Trees – Overview of a Decision Tree, The General Algorithm, Decision Tree Algorithms, Evaluating a Decision Tree, Decision Trees in R- Naïve Bayes, Bayes' Theorem – Naïve Bayes Classifier.

Module-3: ASSOCIATION AND RECOMMENDATION SYSTEM:
Advanced Analytical Theory and Methods: Association Rules, Overview, Apriori Algorithm – Evaluation of Candidate Rules, Applications of Association Rules, Finding Association& finding similarity, Recommendation System: Collaborative Recommendation- Content Based Recommendation, Knowledge Based Recommendation, Hybrid Recommendation Approaches.

Module-4: STREAM MEMORY
Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating moments, Counting oneness in a Window, Decaying Window, Real time Analytics Platform(RTAP) applications, Case Studies – Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics

Module-5: NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION NoSQL Databases : Schema-less Models‖: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores, Tabular Stores, Object Data Stores, Graph Databases Hive, Sharding, Hbase, Analyzing big data with twitter, Big data for E-Commerce Big data for blogs Review of Basic Data Analytic Methods using R.

Text Books
1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

References
1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.
2. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer.

TITLE OF COURSE: BIG DATA ANALYTICS LAB
COURSE CODE: CSD692
L-T-P: 0-0-2
CREDITS: 1

Pre-requisite: To extract the maximum from the course, the following prerequisites are must.
- A strong mathematical background in Probability and Statistics
- Proficiency with algorithms
- Programming skills in C, Python, R, etc.
- Critical thinking and problem solving skills

Introduction:
This course will cover fundamental algorithms and techniques used in Data Analytics. The

statistical foundations will be covered first, followed by various machine learning and data mining algorithms. Technological aspects like data management (Hadoop), scalable computation (Map-Reduce) and visualization will also be covered. In summary, this course will provide exposure to theory as well as practical systems and software used in data analytics.

After completing this course, you will learn how to:

- Find a meaningful pattern in data
- graphically interpret data
- Implement the analytic algorithms
- Handle large scale analytics projects from various domains
- Develop intelligent decision support systems

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

CO1: Work with big data tools and its analysis techniques

CO2: Analyze data by utilizing clustering and classification algorithms

CO3: Learn and apply different mining algorithms and recommendation systems for large volumes of data

CO4: Perform analytics on data streams

CO5: Learn No-SQL databases and management.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓	✓	✓	✓	✓							✓
CO3	✓	✓	✓	✓	✓							✓
CO4	✓		✓		✓							✓
CO5	✓	✓		✓								✓

Course Contents:

- Novel Theoretical Models for Big Data
- New Computational Models for Big Data
- Data and Information Quality for Big Data
- New Data Standards
- Big Data Applications in smart cities, Healthcare and Transportation
- Visualization Analytics for Big Data
- Big Data Analytics in Small Business Enterprises (SMEs)
- Big Data Analytics and Metrics

Text Books

1. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.

References

1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.
2. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer.

TITLE OF COURSE: WEB TECHNOLOGY
COURSE CODE: CSD603
L-T-P: 2-0-2
CREDITS: 3

Pre-requisite: Knowledge in Java Programming and web design

Introduction:
This course is related to several java frameworks as Java 2, Enterprise Edition (J2EE) which is used for building web applications. The J2EE platform offers all the advantages of developing in Java plus a comprehensive suite of server-side technologies.

Course Outcomes (CO):
This course related to java and java script frameworks. Java training & J2EE training course provides attendees with the pragmatic, concrete, in depth knowledge, skills and a thorough hands-on exploration of the key J2EE APIs (Servlets & JSPs, JSF, EJB, JMS, JNDI, XML, etc.), other technologies like Struts, Spring, and Hibernate how to leverage the strength of each technology to build rich web applications that are robust, efficient, and maintainable. To reach this goal, the following objectives need to be met:
CO1: Thoroughly understand the J2EE architecture and their basic framework with Servlets, JSP& JSF including when (and when not to) use them.
CO2: Gain the solid working knowledge the component modules of the Spring Framework, Hibernate, and Angular JS.
CO3: Uses of Node/ Express in the backend and React in frontend for developing an application. Express is a framework based on Node JS which is used to create server side for an app

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓							✓
CO2	✓	✓	✓	✓	✓							✓
CO3	✓		✓		✓							✓

Module-1: Java EE Application: Java EE Architecture, Introduction to Java EE Components, Containers and Connectors, Java EE Modules (Web App, EJB JAR, App Client), Structure of Java EE Application (Enterprise Archive), Packaging and Deploying Java EE Applications.
Module-2: Java Persistence API (JPA): JPA introduction, Designing of Persistent Class, Entity Fields and Properties, Entity Instance Creation, Primary Keys and Entity Identity, Entity Relationships, Entity Operations, Entity Manager, Entity Instance Life Cycle, Persistence Context, Hibernate what is Hibernate? Understanding Entity Relationship, Writing Entities Mapping Entities, and Synchronizing with Database using Hibernate with Applications.

Module-3: Java Script pages: JSP Basic JSP Architecture, Life Cycle of JSP (Translation, compilation), JSP Tags and Expressions Role of JSP in MVC-2, JSP with Database, JSP Implicit Objects, Tag Libraries, JSP Expression Language (EL), Using Custom Tag, JSP Capabilities: Exception Handling, Session Management, Directives, JSP with Java Bean

Module-4: Introduction to AngularJS, AngularJS core concepts: way data binding Angular Modules Controller, Scopes and Views, Controllers, scope and root Scope, scope communication, emit, broadcast dependency Injection

Module-5: Introduction to ReactJS, React Components: React component Render function, Component API, Component lifecycle, State, Props, Mixins, JSX

Module-6: Introduction to Node JS Introduction to Node JS, Advantages of Node JS, Node JS Modules: Functions, Buffer, Module, Modules Types, : Node Package Manager: What is NPM, Installing Packages Locally, Installing package globally, Traditional Web Server Model Node, js Process Model

Text Books

1. Pollock, J. (2001). JavaScript: a beginner's guide.
2. Goodman, D. (2004). JavaScript bible. John Wiley & Sons.
3. Morrison, M. (2007). Head first javascript. "O'Reilly Media, Inc.".
4. Jain, N., Bhansali, A., & Mehta, D. (2015). AngularJS: A modern MVC framework in JavaScript. Journal of Global Research in Computer Science, 5(12), 17-23.

Reference Books:

1. Goodman, D. (2004). JavaScript bible. John Wiley & Sons.

TITLE OF COURSE: WEB TECHNOLOGY LAB
COURSE CODE: CSD693
L-T-P: 0-0-2
CREDITS: 1

Pre-requisite: Knowledge in Java Programming and web design

Introduction:

This course is related to several java frameworks as Java 2, Enterprise Edition (J2EE) which is used for building web applications. The J2EE platform offers all the advantages of developing in Java plus a comprehensive suite of server-side technologies.

Course Outcomes (CO):

This course related to java and java script frameworks. Java training & J2EE training course provides attendees with the pragmatic, concrete, in depth knowledge, skills and a thorough hands-on exploration of the key J2EE APIs (Servlets & JSPs, JSF, EJB, JMS, JNDI, XML, etc.), other technologies like Struts, Spring, and Hibernate how to leverage the strength of each technology to build rich web applications that are robust, efficient, and maintainable. To reach this goal, the following objectives need to be met:

CO1: Thoroughly understand the J2EE architecture and their basic framework with Servlets, JSP& JSF including when (and when not to) use them.

CO2: Gain the solid working knowledge the component modules of the Spring Framework, Hibernate, and Angular JS.

CO3: Uses of Node/ Express in the backend and React in frontend for developing an application. Express is a framework based on Node JS which is used to create server side for an app

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓							✓
CO2	✓	✓	✓	✓	✓							✓
CO3	✓		✓		✓							✓

Course Contents:

Module-1: Projects on Java EE Application

Module-2: Java Persistence API (JPA): JPA introduction, Designing of Persistent Class, Entity Fields and Properties, Entity Instance Creation, Primary Keys and Entity Identity, Entity Relationships, Entity Operations, Entity Manager, Entity Instance Life Cycle, Concept of Hibernate

Module-3: Java Script pages: Programs on JSP and Expressions Role of JSP in MVC-2, JSP with Database, JSP Implicit Objects, Tag Libraries, JSP Expression Language (EL), Using Custom Tag, JSP Capabilities: Exception Handling, Session Management, Directives, JSP with Java Bean

Module-4: Projects on AngularJS

Module-5: Introduction to ReactJS, React Components: React component Render function, Component API, Component lifecycle, State, Props, Mixins, JSX

Module-6: Programs and project on Node JS

Text Books

1. Pollock, J. (2001). JavaScript: a beginner's guide.
2. Goodman, D. (2004). JavaScript bible. John Wiley & Sons.
3. Morrison, M. (2007). Head first javascript. " O'Reilly Media, Inc.".
4. Jain, N., Bhansali, A., & Mehta, D. (2015). AngularJS: A modern MVC framework in JavaScript. Journal of Global Research in Computer Science, 5(12), 17-23.

Reference Books:

1. Goodman, D. (2004). JavaScript bible. John Wiley & Sons.

TITLE OF COURSE: COMPUTER GRAPHICS
COURSE CODE: CSD604
L-T-P: 2-0-2
CREDITS: 3

Pre-requisite: Knowledge is also assumed of basic concepts in programming languages mathematics etc.

Introduction:

This course presents an introduction to computer graphics designed to give the student an overview

of fundamental principles. It covers the fundamental concepts in creating graphical images on the computer. Computer graphics uses ideas from Art, Mathematics, and Computer Science to create images. Course work stresses the reduction of concepts to practice in the form of numerous programming assignments. The course will include an overview of common graphics hardware, 2D and 3D transformations and viewing and basic raster graphics concepts such as scan- conversion and clipping. Methods for modeling objects as polygonal meshes or smooth surfaces, and as rendering such as hidden-surface removal, shading, illumination and shadows will be investigated.

Course Outcomes (CO):

After completion of the course the students will able to

CO1: Know and be able to discuss hardware system architecture for computer graphics. This includes, but is not limited to: graphics pipeline, frame buffers, and graphic accelerators/co processors.

CO2: Know and be able to use a current 2D & 3D transformation & viewing

CO3: Know and be able to use the underlying algorithms, mathematical concepts, supporting computer graphics. These include but are not limited to:

- Composite 3D homogeneous matrices for translation, rotation, and scaling transformations.
- Plane, surface normal, cross and dot products.
- Hidden surface detection / removal.
- Scene graphs, display lists.

CO4: Know and be able to select among models for lighting/shading: Color, ambient light; distant and light with sources; Phong reflection model; and shading (flat, smooth, Gourand, Phong) and select among current models for surfaces (e.g., geometric; polygonal; hierarchical; mesh; curves, splines etc. and also be able to design and implement model and viewing transformations, the graphics pipeline and an interactive render loop with a 3D graphics API.

CO5: Be able to design and implement models of surfaces, lights, sounds, and textures (with texture transformations) using a 3D graphics API and discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications. Also be able to discuss future trends in computer graphics and Curves, Hidden surfaces, Ray- tracing etc.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓	✓		✓								✓
CO3	✓	✓	✓	✓	✓							✓
CO4	✓	✓		✓								✓
CO5	✓		✓		✓							✓

Course Contents:

Module-1: Introduction to computer graphics & graphics systems

Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.

Scan conversion:

Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line drawing algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

Module-2: 2D transformation & viewing

Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse. Cohen and Sutherland line clipping algorithm, Sutherland-Hodgeman Polygon clipping algorithm, Cyrus-beck clipping method. 3D transformation & viewing, 3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, view port clipping, 3D viewing.

Module-3: Curves

Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves. Hidden surfaces, Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal-geometry.

Introduction to Ray-tracing

Human vision and color, Lighting, Reflection and transmission models.

Text Books

1. Hearn, Baker – "Computer Graphics (C version 2nd Ed.)" – Pearson education
2. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH

References

1. D. F. Rogers, J. A. Adams – "Mathematical Elements for Computer Graphics (2nd Ed.)" –TMH
2. Mukhopadhyay, Chottopadhyay - "Introduction to Computer Graphics and Multimedia"- VIKAS

TITLE OF COURSE: COMPUTER GRAPHICS LAB
COURSE CODE: CSD694
L-T-P: 0-0-2
CREDITS: 1

Introduction:

This course presents an introduction to computer graphics designed to give the student an overview of fundamental principles. It covers the fundamental concepts in creating graphical images on the computer. Computer graphics uses ideas from Art, Mathematics, and Computer Science to create images. Course work stresses the reduction of concepts to practice in the form of numerous programming assignments. The course will include an overview of common graphics hardware, 2D and 3D transformations and viewing, and basic raster graphics concepts such as scan-conversion and clipping. Methods for modeling objects as polygonal meshes or smooth surfaces, and as rendering such as hidden-surface removal, shading, illumination, and shadows will be investigated.

Objectives:

This course is designed to provide a comprehensive introduction to computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends. A thorough introduction

to computer graphics techniques, focusing on 3D modelling, image synthesis, and rendering. We will look at raster scan graphics including line and circle drawing, polygon filling, anti-aliasing algorithms, clipping, hidden-line and hidden surface algorithms including ray tracing and, of course, rendering - the art of making photo realistic pictures with local and global illumination models. The interdisciplinary nature of computer graphics is emphasized in the wide variety of examples and applications.

Course Outcomes (CO):

After completion of the course the students will able to

CO1: Know and be able to discuss hardware system architecture for computer graphics. This includes, but is not limited to: graphics pipeline, frame buffers, and graphic accelerators/co processors.

CO2: Know and be able to use a current 2D & 3D transformation & viewing

CO3: Know and be able to use the underlying algorithms, mathematical concepts, supporting computer graphics. These include but are not limited to:

- Composite 3D homogeneous matrices for translation, rotation, and scaling transformations.
- Plane, surface normal, cross and dot products.
- Hidden surface detection / removal.
- Scene graphs, display lists.

CO4: Know and be able to select among models for lighting/shading: Color, ambient light; distant and light with sources; Phong reflection model; and shading (flat, smooth, Gourand, Phong) and select among current models for surfaces (e.g., geometric; polygonal; hierarchical; mesh; curves, splines etc. and also be able to design and implement model and viewing transformations, the graphics pipeline and an interactive render loop with a 3D graphics API.

CO5: Be able to design and implement models of surfaces, lights, sounds, and textures (with texture transformations) using a 3D graphics API and discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications. Also be able to discuss future trends in computer graphics and Curves, Hidden surfaces, Ray- tracing etc.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓	✓		✓								✓
CO3	✓	✓	✓	✓	✓							✓
CO4	✓	✓		✓								✓
CO5	✓		✓		✓							✓

Experiments:

1. Study of basic graphics functions defined in “graphics.h”
2. Write a program to draw a any geometrical figure.
3. Write a program to draw a line using Bresenham’s algorithm
4. Write a program to draw a line using DDA algorithm
5. Write a program to draw a line using Midpoint algorithm
6. Write a program to draw a circle using Midpoint algorithm
7. Write a program to draw a Ellipse using Midpoint algorithm

Recommended Systems/Software Requirements:
Intel based desktop PC with minimum of 166 MHZ or faster processor with at least 64 MB RAM and 100 MB free disk space.
Turbo C or TC3 complier in Windows XP or Linux Operating System.

Text Books
1. Hearn, Baker – "Computer Graphics (C version 2nd Ed.)" – Pearson education
2. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH
3. D. F. Rogers, J. A. Adams – "Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH

TITLE OF COURSE: SOFTWARE PROJECT MANAGEMENT
COURSE CODE: CSD605
L-T-P: 2-0-2
CREDITS: 3

Pre-requisite: Software Engineering, Software Project Management, Supply Chain Management.

Introduction:
This course is strongly suggested for any student planning to take an internship in Computer Science. After an overview of the phases of the software lifecycle, current methodologies, tools, and techniques being applied to each phase will be discussed in depth with localized exercises given to reinforce learning of concepts.

Course Outcomes (CO):
This course will serve to broaden the student's understanding of the issues and latest developments in the area of software development and maintenance. To reach this goal, the following objectives need to be met:
CO1: Describe software process maturity framework and discuss
CO2: Explain conventional software management and software projects and project planning.
CO3: Analyze project tracking and control and assess the role of project closure analysis.
CO4: To provide a broad introduction to the field of operations management and explain the concepts, strategies, tools and techniques for managing the transformation process that can lead to competitive advantage.
CO5: Conceptualize supply chain designs, which are aligned with business models for manufacturing and service companies
CO6: Configure logistics networks and assess their performance impacts on efficiency and service levels
CO7: Manage inventory efficiently and pool inventory risks across time, products, channels, and geography.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓		✓		✓							✓
CO3	✓	✓		✓								✓
CO4	✓		✓		✓							✓
CO5	✓	✓		✓								✓
CO6	✓		✓		✓							✓
CO7	✓		✓		✓							✓

Course Contents:

Module-1: Software Process Maturity, Software maturity Framework: Principles of Software Process Change, Software Process Assessment, the Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process, and Process Reference Models.

Module-2: Capability Maturity Model (CMM): CMMi, PCMM, PSP, TSP, IDEAL, Process Definition Techniques, Software Project Management Renaissance: Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way.

Module-3: Managing Software Projects: Project Management and the CMM, Project Management and CMMi, Project Management Process Framework. Project Planning: Software Life Cycle Models, Project Organizations and Responsibilities, Artifacts of the Project Management Process, Cost and Scheduling estimation, Establishing Project Environment, Risk Management, Quality Assurance and Configuration Management.

Module-4: Project Tracking and Control: Defect Tracking, Issue Tracking, Status Reports, Milestone Analysis, Defect Analysis and Prevention Methods, Process monitoring and audit, Reviews, Inspections and Walkthroughs, Seven Core Metrics, Management indicators, Quality Indicators, Project Closure: Project Closure Analysis, Role of Closure Analysis in a project, Performing Closure Analysis, Closure Analysis Report. CCPDS-R Case Study and Future Software Project Management Practices: Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions.

Module-5: Supply Chain definition, Objectives , Types, Various definitions, Drivers , Need for SCM, SCM as a profession, SCM decisions and skills, Strategy formulation in SCM, Value in Supply Chain, Tradeoffs ,CRM Strategy relationship matrix, Strategic Sourcing, Source evaluation, collaborative perspective, Buyer Supplier Relationship, Partner Selection, develop of Partnership – importance of inventory, imbalances , uncertainties, inventory costs, inventory turnover ration

Module-6: SCM software packages, modeling concepts, Vendor analysis model, Coordinated SCM, Simulation modeling, Reverse Vs forward supply chain, types of reverse flows, collaborative SCM's and CPFR, agile systems, sources of variability, characteristics, supplier interface – internal processes

Module-7: Supply Chain Management and profitability, quality management, mass customization and globalization, ethical Supply Chains, e-business and SCM, Balanced Score Card, Benchmarking, Performance measurement

Text Books

1. Watts S. Humphrey: Managing the Software Process, 1st Edition, Pearson Education, 2002.

2. Walker Royce: Software Project Management, A Unified Framework, 1st Edition, Pearson Education, 2002.
3. Mohanty R.P, S.G Deshmuki "Supply Chain Management" Biztantra, New Delhi

References

1. Watts S. Humphrey: An Introduction to the Team Software Process, 1st Edition, Addison- Wesley International Publications, 2000.
2. Watts S. Humphrey, A Discipline to Software Engineering, 1st Edition, Pearson Education, 2008.
3. Pankaj Jalote, Software Project Management in Practice, 1st Edition, Pearson Education, 2011
4. Chris Kemerer, Software Project Management Readings and Cases, 1st Edition, Pearson Edu, 2011

TITLE OF COURSE: SOFTWARE PROJECT MANAGEMENT LAB
COURSE CODE: CSD695
L-T-P: 0-0-2
CREDITS: 1

Pre-requisite: Basic idea of Software Engineering.

Introduction:

The Software Project Management Lab provides a deep insight into the importance of project planning in the software industry. Project management is simply the planning, organizing and managing of tasks and resources to accomplish a defined objective, usually with constraints on time and cost.

Course Outcomes (CO):

This course will serve to broaden the student's understanding of the issues and latest developments in the area of software development and maintenance. To reach this goal, the following objectives need to be met:

CO1: Describe software process maturity framework and discuss
CO2: Explain conventional software management and software projects and project planning.
CO3: Analyze project tracking and control and assess the role of project closure analysis.
CO4: To provide a broad introduction to the field of operations management and explain the concepts, strategies, tools and techniques for managing the transformation process that can lead to competitive advantage.
CO5: Conceptualize supply chain designs, which are aligned with business models for manufacturing and service companies
CO6: Configure logistics networks and assess their performance impacts on efficiency and service levels
CO7: Manage inventory efficiently and pool inventory risks across time, products, channels, and geography.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓		✓		✓							✓
CO3	✓	✓		✓								✓

CO4	✓		✓		✓							✓
CO5	✓	✓		✓								✓
CO6	✓		✓		✓							✓
CO7	✓		✓		✓							✓

Course Contents:

Module 1: Create Project Plan

▪ Specify project name and start (or finish) date. ▪ Identify and define project tasks. ▪ Define duration for each project task. ▪ Define milestones in the plan ▪ Define dependency between tasks

Module 2: Create Project Plan contd.

▪ Define project calendar. ▪ Define project resources. ▪ Specify resource type and resource rates ▪ assign resources against each task ▪ Baseline the project plan

Module 3: Execute and Monitor Project Plan

▪ Update % Complete with current task status. ▪ Review the status of each task. ▪ Compare Planned vs Actual Status ▪ Review the status of Critical Path ▪ Review resources assignation status

Module 3: Generate Dashboard and Reports

▪ Dashboard (Project Overview, Cost Overview, Upcoming Tasks), Resource Reports (Over-allocated Resources, Resource Overview), Cost Reports (Earned Value Report, Resource Cost Overview, Task Cost Overview)

Text Books

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.
2. Robert K. Wysocki Effective Software Project Management – Wiley Publication, 2011.

References

1. Watts S. Humphrey: An Introduction to the Team Software Process, 1st Edition, Addison- Wesley International Publications, 2000.
2. Watts S. Humphrey, A Discipline to Software Engineering, 1st Edition, Pearson Education, 2008.
3. Pankaj Jalote, Software Project Management in Practice, 1st Edition, Pearson Education, 2011
4. Chris Kemerer, Software Project Management Readings and Cases, 1st Edition, Pearson Education, 2011

TITLE OF COURSE: E-COMMERCE
COURSE CODE: CSD606
L-T-P: 2-0-2
CREDITS: 3

Pre-requisite: Knowledge is required in Basic internet and the importance of it. Students must be aware of online transactions.

Introduction:

This course examines E-Commerce concepts, and Business technique basics. The
Topics to be covered (tentatively) include:

- Introduction
- Business to Business E-Commerce
- Legal issues
- Security Issues
- Business to Consumer E-Commerce
- E-business

Course Outcomes (CO):

In this course we will study the basic components of an E-Commerce, their functions, mechanisms, policies and techniques used in their implementation and examples from popular E-Commerce Application. The way different modules in the E-Commerce interact and work together to provide the basic services of an E-Commerce.

CO1: Understand the theory and logic behind the design and construction of E-Business.
CO2: You will differentiate between various E-commerce functionalities in terms of performance.
CO3: Become aware of the issues in the management of resources like EDI, SET, RSA etc.
CO4: Know the problems in the design of E-Commerce and study the probable solutions.
CO5: Understanding various type of Business policies.
CO6: An overview of advanced E-Commerce and compare the technical aspects of all the advanced E Commerce.
CO7: To develop, implement, and debug various VB & ASP, algorithms of EDI, E-Business.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓					✓					✓
CO2	✓	✓		✓			✓					✓
CO3	✓	✓					✓					✓
CO4	✓	✓		✓			✓					✓
CO5	✓	✓	✓	✓			✓					✓
CO6	✓	✓		✓	✓		✓					✓
CO7	✓		✓		✓		✓					✓

Course Contents:

Module-1: Definition, Scope of E-Commerce, Hardware requirements, E-Commerce and Trade Cycle, Electronic Markets, Electronic Data Interchange and Internet Commerce.

Module-2: Electronic Markets, Electronic Data Interchange (EDI): Technology, Standards (UN/EDIFACT), Communications, Implementations, Agreements, Security, EDI and Business, Inter-Organizational Ecommerce.

Module-3: Risks: Paper Document vs. Electronic document, Authentication of Electronic document, Laws, Legal issues for Internet Commerce: Trademarks and Domain names, Copyright, Jurisdiction issues, Service provider liability, Enforceable online contract.

Module-4: Security Solutions: Symmetric and Asymmetric Cryptosystems, RSA, DES, and Digital Signature, Protocols for secure messaging, Secure Electronic Transaction (SET) Protocol, Electronic

cash over internet, Internet Security.
Module-5: Consumer trade transaction, Internet, Page on the Web, Elements of E-Commerce with VB, ASP, SQL.
Module-6: Internet book shops, Software supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the net, E-Diversity, Case studies through internet.

Text Books:
1. E- Commerce-Strategy, Technologies & Applications by David Whitley, TMH.
2. Beginning E-Commerce with VB, ASP, SQL Server7.0 & MTS by Mathew Reynolds, Wrox Publishers.

References:
1. E-Commerce-The cutting edge of business by Kamlesh K.Bajaj, TMH.

TITLE OF COURSE: E-COMMERCE LAB
COURSE CODE: CSD696
L-T-P: 0-0-2
CREDITS: 1

Pre-requisite: Knowledge is required in Basic internet and the importance of it. Students must be aware of online transactions.

Introduction:
This course examines E-Commerce concepts, and Business technique basics. The
Topics to be covered (tentatively) include:
• Introduction
• Business to Business E-Commerce
• Legal issues
• Security Issues
• Business to Consumer E-Commerce
• E-business

Course Outcomes (CO):
In this course we will study the basic components of an E-Commerce, their functions, mechanisms, policies and techniques used in their implementation and examples from popular E-Commerce Application. The way different modules in the E-Commerce interact and work together to provide the basic services of an E-Commerce.
CO1: Understand the theory and logic behind the design and construction of E-Business.
CO2: You will differentiate between various E-commerce functionalities in terms of performance.
CO3: Become aware of the issues in the management of resources like EDI, SET, RSA etc.
CO4: Know the problems in the design of E-Commerce and study the probable solutions.
CO5: Understanding various type of Business policies.
CO6: An overview of advanced E-Commerce and compare the technical aspects of all the advanced E Commerce.
CO7: To develop, implement, and debug various VB & ASP, algorithms of EDI, E-Business.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓					✓					✓
CO2	✓	✓		✓			✓					✓
CO3	✓	✓					✓					✓
CO4	✓	✓		✓			✓					✓
CO5	✓	✓	✓	✓			✓					✓
CO6	✓	✓		✓	✓		✓					✓
CO7	✓		✓		✓		✓					✓

Course Contents:

Experiment 1: Creating E-Commerce Site:

- Designing and maintaining Web Pages.
- Advertising in the website, Portals and Vortals.

Experiment 2: E-Commerce Interaction:

- Comparison Shopping in B2C,
- Exchanges Handling in B2B,
- Interaction Examples: Virtual Shopping Carts.

Experiment 3: E-Commerce Applications:

- Online Store,
- Online Banking,
- Credit Card Transaction Processing.

Text Books:

1. E- Commerce-Strategy, Technologies & Applications by David Whitley, TMH.
2. Beginning E-Commerce with VB, ASP, SQL Server7.0 & MTS by Mathew Reynolds, Wrox Publishers.

References:

1.E-Commerce-The cutting edge of business by Kamlesh K.Bajaj, TMH.

TITLE OF COURSE: ESP & SDP-VI
COURSE CODE: GSC606
L-T-P: 2-0-2
CREDITS: 2

Pre-requisite: Basic concepts in mathematics and English Language.

Introduction:

This course examines basic English language and math. The Topics to be covered (tentatively): The course is on GATE exam preparation, logical reasoning, English sentence correction, English, Grammar correction, basic arithmetic, Vocabulary, Verbal Reasoning.

Course Outcomes (CO):

In this course we will study the basic components of math and English language. Students are expected to be capable of understanding the better communication, their advantages and drawbacks, how to implement them in daily life, how their drawbacks can be overcome and what the applications are and where they can be used. To reach this goal, the following objectives need to be met:

CO1: Students would be able to know GATE exam preparation.
CO2: Students would be able to implement verbal and non-verbal communication.
CO3: By analyzing the logic of any arithmetic structure able to solve problem.
CO4: To become an efficient math and English language.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓
CO2	✓			✓								✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓

Course Contents:

Section A: Employment Enhancement Skills-VI
Stream wise GATE Preparation

Module-1: Software Engineering.

Module-2: Computer Networks

Module-3: Digital Logic Design & Computer Organization & Architecture

Module-4: Operating System

Section B: Skill Development for Professional-VI
Module-1
Revision and Advanced Problems in Quantitative Aptitude
1) Numbers (+, -, x, etc), Percentages, Ratio, Partnership, Linear Equations, Profit & Loss
2) Averages, Mixtures & Allegations, Number System, Time and Work
3) Simple & Compound Interest, Other / Misc Quantitative Apt., Indices and Surds, Quadratic Equations
4) Permutations & Combinations, Probability, Geometry, Mensuration
5) Data Interpretation, Various Charts, Diagrams, Tables
Module-2
Revision and Advanced Problems in Reasoning
1) Coding, Series & Numbers, Blood Relations, Analogy
2) Cubes, Data Sufficiency, Non-Verbal Reasoning
3) Syllogisms, Puzzles, Machine I/O, Inequality
4) Seating Arrangement, Calendar / Clock
5) Statements, Other / Misc Logical Reasoning, Decision Making (Ethics)
Module-3

Revision and Advanced Questions in Verbal English
1) Grammar,
2) Clauses,
3) Spotting errors,
4) Sentence Correction,
5) Blanks,
6) Reading Comprehensions,
7) Vocabulary
Newspaper reading: The Hindu & Economic Times.

Learning Materials:

1. Fastrack objective Arithmetic: Arihant
2. Quantitative aptitude for Competitive exam (4th Edition): TATA Mc Graw Hill
3. Quantitative aptitude for Competitive exam (3rd Edition): PEARSON
4. Engineering mathematics-Pearson
5. GATE Mathematics- Willey/McGraw hill

Seventh Semester Syllabus

Sl No.	Type	Subject Code	Topic	L	T	P	Credit Points
1	PEC	AIML---	Specialization Elective-IV	3	0	0	3
2	PEC	AIML---	Specialization Elective -V	3	0	0	3
3.	OE	--	Open Elective-II	3	0	0	3
4.	BSC	BSC710	Biology	2	1	0	3
5.	GSC	GSC707	ESP & SDP-VII	2	0	2	2
6.	PTI	INT705	Internship/Industrial Training/Project-III	0	0	8	4
			Total	13	1	8	18/21

#Students will undergo project/training/internship in the industry / research organization / reputed Institute during the vacation

Suggestive Choice Based Subjects

Sl No.	Type	Subject Code	Topic	L	T	P	Credit Points
1.	PEC	AIML704	Special Topics in AI	3	0	0	3
2.	PEC	AIML705	Application of AI	3	0	0	3
3.	CSD*	CSD707	Cyber Law, IPR & Ethics	3	0	0	3
4.	CSD**	CSD708	Natural Language Processing	3	0	0	3
5.	OE	CSD709	Wireless Sensor Network & Network Security	3	0	0	3
6.	OE	CSD710	Neural Network and Application	3	0	0	3
7.	OE	CSD711	Real Time Operating System	3	0	0	3
8.	OE	CSD712	Distributed System	3	0	0	3
9.	BSC	BSC711	Statistics For Data Analytics	3	0	0	3
10.	BSC	BSC712	Statistical Methods For Decision Making	3	0	0	3
11.	BSC	BSC713	Exploratory Data Analysis	3	0	0	3

TITLE OF COURSE: SPECIAL TOPICS IN AI
COURSE CODE: AIML704
L-T-P: 3-0-0
CREDITS: 3

Pre-Requisites: Knowledge in Mathematics and Python programming

Introduction:
To give fundamental knowledge to the students so that they can understand what the AI is and study important topics related to the field.

Course Outcomes (CO):
After completion of course, students would be able:
CO1: To understand various AI techniques.
CO2: To decide when to use which type of AI technique.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓											

Course Contents:
Module 1:
Bayesian Filtering; Recurrent Neural Networks, Deep Neural Networks, Deep Reinforcement Learning.
Module 2:
Self-Play Networks, Generative Adversarial Networks, Learning from Concept-Drifting Data Streams.
Module 3:
Audio Signal Processing Basics, mirtoolbox contains many useful audio processing library functions, VOICEBOX: Speech Processing Toolbox for MATLAB, Audio processing in Matlab.
Module 4:
Architectures for second generation knowledge based systems, Distributed AI and its applications.
Module 5:
An introduction to neurocomputing and its possible role in AI, The role of uncertainty measures and principles in AI.

Text Books
1. Dr. Nilakshi Jain, Artificial Intelligence: Making a System Intelligent, John Wiley & Sons.
2. M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna Publishing House, Delhi.
3. Artificial Intelligence & Soft Computing for Beginners, 3rd Edition-2018, by Anindita Das, Shroff Publisher Publisher.

References

1. Artificial Intelligence: A Modern Approach, 3rd Edition, by Stuart Russell and Peter Norvig, Pearson Publisher.
2. New Artificial Intelligence (Advanced), Takashi Maeda and Fumio Aoki, Ohmsha Publisher.

TITLE OF COURSE: APPLICATION OF AI
COURSE CODE: AIML705
L-T-P: 3-0-0
CREDITS: 3

Pre-Requisites: Knowledge in Mathematics and Python programming

Introduction:
To give deep knowledge of AI and how AI can be applied in various fields to make the life easy.

Course Outcomes (CO):
After completion of course, students would be able:
CO1: To correlate the AI and solutions to modern problem.
CO2: To decide when to use which type of AI technique.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓											

Course Contents:
Module 1:
Linguistic aspects of natural language processing, A.I. And Quantum Computing, Applications of Artificial Intelligence (AI) in business.
Module 2:
Emotion Recognition using human face and body language, AI based system to predict the diseases early, Smart Investment analysis, AI in Sales and Customer Support.
Module 3:
Robotic Processes Automation for supply chain management.
Module 4:
AI-Optimized Hardware, Digital Twin i.e. AI Modelling, Information Technology & Security using AI.
Module 5:
Recent Topics in AI/ML: AI/ML in Smart solutions, AI/ML in Social Problems handling, Block chain and AI.

Text Books

1. Sameer Dhanrajani, AI and Analytics, Accelerating Business Decisions, John Wiley & Sons.

2. Life 3.0: Being Human in the Age of Artificial Intelligence by Max Tegmark, published July 2018.
3. Homo Deus: A Brief History of Tomorrow by Yuval Noah Harari, published March 2017.

References

1. Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems, Bernard Marr, Matt Ward, Wiley.

TITLE OF COURSE: CYBER LAW, IPR & ETHICS
COURSE CODE: CSD707
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Knowledge is also assumed of basic concepts of Computer networks, Security algorithms and mobile computing.

Introduction:

Information has never been so ubiquitous, valuable, or available. However, with the significant growth in information created, stored, processed and transmitted across Information Technology (IT) systems and networks – often of a sensitive or personal nature – comes the need to protect that information from a range of threats. Similarly the infrastructure that we come to rely on in business, government and society – whether it be for communications, utility, public or business service – must be protected from these threats as it is typically controlled by information that is processed and transmitted across IT systems, IT-enabled control systems and networks. The threats can range from professional criminals making their living from stealing information to well- intentioned employees or individuals making mistakes in the way they use applications or IT, or acts of social protest and terrorism. Protecting information along with the IT systems, control systems, networks and devices processing that information is now recognized as an industry, a profession and an academic discipline in its own right. However, IT systems, control systems, networks, websites and applications are typically designed or built by people who do not give adequate consideration for this need. As a result, IT systems, control systems, networks, websites and applications typically: contain well-known errors; are deployed with well-known default settings that leave the systems open to exploit; and leave the information and organizations they support vulnerable to compromise. This situation has given rise to an acknowledged and growing prevalence of attack, compromise and loss, fuelling recognition for the need to develop cyber security knowledge and skill within the disciplines responsible for networks and IT systems, including within the academic courses that lead or prepare students to pursue a career in these areas. (ISC)2 , the largest not-for-profit membership body of certified information and software security professionals worldwide, with over 100,000 members and The Council of Professors and Heads of Computing (CPHC), brought together a wide-ranging group of industry and academic experts to identify the key concepts related to cyber security that can be embedded across undergraduate computing science and IT-related (e.g. business information systems and IT management for business) degree courses. This guide is the result of this effort, designed to help enrich those computing courses by providing the key cyber security principles and suggested learning outcomes. The concepts covered here are outlined for five themes: information and risk; threats and attacks; cyber security architecture and operations; secure systems and products; and cyber security management, to satisfy Level 4 requirements as stated in The framework for higher education qualifications in England, Wales and Northern Ireland August 2008. Advanced concepts and further

learning outcomes are also provided for each theme, so that academic institutions can develop or enhance their courses to meet Level 5 and 6 requirements of the framework. The descriptors for all three levels (4 – 6) are presented in Annex A. They are developed to support accreditation guidelines used by BCS, The Chartered Institute for IT (BCS) and Institution of Engineering and Technology (IET).

Course Outcomes (CO):

CO1: Q is an organizational asset that has utility, and a value which may be relative depending on the perspective taken, and therefore can be classified to reflect its importance to an organization or individual Q is vulnerable.

CO2: why that protection must occur (for example, legal and regulatory drivers, customer rights or organization objectives)

CO3: Student able to understand Downloading/copying/extraction of data or extracts any data, Introduction of computer contaminant, or computer virus, Causing damage either to the computer resource or data residing on it, Disruption, Denial of access, Facilitating access by an unauthorized person, Charging the services availed of by a person to the account of another person, Destruction or diminishing of value of information, Stealing, concealing, destroying or altering source code with an intention.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓			✓		✓				✓
CO2	✓	✓	✓			✓		✓				✓
CO3	✓	✓	✓			✓		✓				✓

Course Contents:

Module 1:

Introduction of Cybercrime: What is cybercrime? Forgery, Hacking, Software Piracy, Computer Network intrusion

Module 2: Category of Cybercrime: how criminals plan attacks, passive attack, Active attacks, cyber stalking.

Module 3: Cybercrime Mobile & Wireless devices: Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cell phones, Theft, Virus, and Hacking. Bluetooth; Different viruses on laptop

Module 4: Tools and Methods used in Cybercrime: Proxy servers, password checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow Detailed Syllabus of Computer Science & Engineering

Module 5: Phishing & Identity Theft: Phising methods, ID Theft; Online identity method.

Module 6: Cybercrime & Cyber security: Legal aspects, Indian laws, IT act, Public key certificate.

Text Books:

1. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India.

References:

1. E-Commerce- The cutting edge of business by Kamlesh K. Bajaj, TMH
2. Cyber Law of Information Technology And Internet by Anirudh Rastogi, First Edition

3. Open Source and The Law by Priti Suri & Associates, First Edition

TITLE OF COURSE: NATURAL LANGUAGE PROCESSING
COURSE CODE: CSD708
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Knowledge is also assumed of basic concepts in programming languages mathematics etc.

Introduction:
This course introduces the theory and methods of natural language processing (NLP). NLP systems understand and produce human language for applications such as information extraction, machine translation, automatic summarization, question-answering, and interactive dialog systems. The course covers knowledge-based and statistical approaches to language processing for syntax (language structures), semantics (language meaning), and pragmatics/discourse (the interpretation of language in context).

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
CO1: To tag a given text with basic Language features.
CO2: To design an innovative application using NLP components.
CO3: To implement a rule based system to tackle morphology/syntax of a language.
CO4: To design a tag set to be used for statistical processing for real-time applications.
CO5: To compare and contrast the use of different statistical approaches for different types of NLP applications.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓		✓		✓							✓
CO2	✓		✓		✓							✓
CO3	✓	✓	✓	✓	✓							✓
CO4	✓		✓		✓							✓
CO5	✓	✓	✓	✓	✓							✓

Course Contents:
Module-1: Introduction
Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.
Module-2: Word Level Analysis
Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part- of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS

tagging – Hidden Markov and Maximum Entropy models.

Module-3: Syntactic Analysis

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

Module-4: Semantics and Pragmatics

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

Module-5: Discourse Analysis and Lexical Resources

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Text Books

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper,-Natural Language Processing with Python, First Edition, OReilly Media, 2009.

References

3. Breck Baldwin, —Language processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
4. Richard M Reese, —Natural Language Processing with Java, OReilly Media, 2015.
5. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
6. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

TITLE OF COURSE: WIRELESS SENSOR NETWORK & NETWORK SECURITY
COURSE CODE: CSD709
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Basic idea of computer networks.

Introduction:

This course will cover the latest research in the area of Wireless Sensor Networks. We will cover all aspects of these unique and important systems, from the hardware and radio architecture through protocols and software to applications. Topics will include sensor network architectures, hardware platforms, physical layer techniques, medium access control, routing, topology control, and quality of service (QoS) management, localization, time synchronization, security, storage, and other advanced topics. Each student must complete a semester-long course project related to wireless sensor networks.

Course Outcomes (CO):

The student should be made to:

CO1: Learn Ad hoc network and Sensor Network fundamentals
CO2: Understand the different routing protocols
CO3: Have an in-depth knowledge on sensor network architecture and design issues
CO4: Understand the transport layer and security issues possible in Ad hoc and Sensor networks
CO5: understand the security process.
CO6: Learn different Encryption methods.
CO7: Understand IP, Web, Network security process.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓	✓		✓								✓
CO3	✓	✓		✓								✓
CO4	✓	✓	✓	✓	✓	✓						✓
CO5	✓	✓		✓		✓						✓
CO6	✓	✓	✓	✓	✓	✓						✓
CO7	✓	✓	✓	✓	✓	✓						✓

Course Contents:

Module 1: AD HOC NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS

Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).

Module 2: SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture – Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

Module 3: WSN NETWORKING CONCEPTS AND PROTOCOLS

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts – S-MAC, The Mediation Device Protocol, Contention based protocols – PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols, Energy Efficient Routing, Challenges and Issues in Transport layer protocol.

Module 4: SENSOR NETWORK SECURITY

Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering,

black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.

Module 5: SECURITY IN COMPUTING ENVIRONMENT:

Need for Security, Security Attack, Security Services, Information Security, Methods of Protection. Terminologies used in Cryptography, Substitution Techniques, and Transposition Techniques.

Encryption and Decryption: Characteristics of Good Encryption Technique, Properties of Trustworthy Encryption Systems, Types of Encryption Systems, Confusion and Diffusion, Cryptanalysis.

Module 6: SYMMETRIC KEY ENCRYPTION:

Data Encryption Standard (DES) Algorithm, Double and Triple DES, Security of the DES, Advanced Encryption Standard (AES) Algorithm, DES and AES Comparison.

Public Key Encryption:

Characteristics of Public Key System, RSA Technique, Key Exchange, Diffie-Hellman Scheme, Cryptographic Hash Functions, Digital Signature, Certificates, Certificate Authorities.

Protection of Computing Resources:

Secure Programs, Non-malicious Program Errors, Viruses and Other Malicious Code, Targeted Malicious Code, Methods of Control.

MODULE 7: SECURITY FEATURES IN OPERATING SYSTEM:

Objects to be Protected, Protection Methods of Operating Systems, Memory Protection, File Protection, and User Authentication.

MODULE 8: DESIGNING TRUSTED OPERATING SYSTEMS:

Types of Security Policies, Models of Security, Design of OS.

Network Security:

Network Concepts, Threats in Networks, Network Security Controls.

IP Security:

Overview of IP Security (IPSec), IP Security Architecture, Modes of Operation, Security Associations (SA), Authentication Header (AH), Encapsulating Security Payload (ESP), Internet Key Exchange.

Web Security:

Web Security Requirements, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Electronic Transaction (SET).

Text Books

1. William Stallings: Cryptography and Network Security, seventh edition ISBN 978-1-292-15858-7 or sixth edition ISBN 978-0-273-79335-9.
2. Protocols and Architectures for Wireless Sensor Networks, H. Karl and A. Willig, Wiley Publishers, 2005.
3. Russ Housley, Tim Polk, " Planning for PKI: Best Practices Guide for Deploying Public Key Infrastructure," Wiley, March 2001, 352 pages.
4. John E. Canavan, “The Fundamentals of Network Security," Artech House, February 2001.

References

1. Andrew Mason, Mark J. Newcomb, " Cisco Secure Internet Security Solutions," Cisco Press, May 2001, 528 pages.
2. Warwick Ford, Michael S. Baum, " Secure Electronic Commerce: Building the Infrastructure for Digital Signatures and Encryption (2nd Edition)," Prentice Hall, December 2000, 620 pages.

TITLE OF COURSE: NEURAL NETWORK AND APPLICATION
COURSE CODE: CSD710
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Basic concept of Artificial Intelligence, Machine Learning

Introduction: To introduce some of the fundamental techniques and principles of neural computation. To investigate some common models and their applications.

Course Outcomes (CO):
On completion of this course, a student should be able to:
CO1: Understand the learning and generalization issue in neural computation.
CO2: Understand the basic ideas behind most common learning algorithms and essentials of artificial neural networks.
CO3: Implement common learning algorithms using an existing package.
CO4: Apply neural networks to classification and recognition problems.
CO5: Understand the basic ideas of associative memories.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓	✓		✓								✓
CO3	✓		✓		✓							✓
CO4	✓		✓		✓							✓
CO5	✓	✓		✓								✓

Course Contents:
Module-1: INTRODUCTION TO NEURAL NETWORKS
Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.
Module-2: ESSENTIALS OF ARTIFICIAL NEURAL NETWORKS
Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN–Connectivity, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules.
Module-3: SINGLE LAYER FEED FORWARD NETWORKS
Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Limitations of the Perceptron Model
Module-4: MULTI- LAYER FEED FORWARD NETWORKS
Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.
Module-5: ASSOCIATIVE MEMORIES

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function. Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis. Neural network applications: Process identification, control, fault diagnosis.

Text Books

1. Satish Kumar, "Neural Networks, A Classroom Approach", Tata McGraw -Hill, 2004.
2. Simon Haykin, "Neural Networks, A Comprehensive Foundation", 2nd Edition, Addison Wesley Longman, 2001.

References

1. Martin T.Hagan, Howard B. Demuth and Mark Beale, "Neural Network Design", Thomson Learning, 2003.
2. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications and Programming Techniques", Pearson Education, 2003.

TITLE OF COURSE: REAL TIME OPERATING SYSTEM
COURSE CODE: CSD711
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Basics of Operating System.

Introduction:

In several software applications, especially in embedded application, the operating system is required to support the application to meet the timing constraints. The operating system achieves this by deploying suitable scheduling algorithms. A major problem arises, when the real-time tasks share resources. Priority inversions can take place in this case, unless suitable techniques are deployed. Starting with a brief introduction to real-time operating systems, we first discuss the important real-time task/thread scheduling algorithms and resource sharing protocols. An effort towards standardization of real-time operating systems has come to be known as POSIX-RT. We review POSIX-RT requirements. Besides, we review several commercial and open source real-time operating systems.

Course Outcomes (CO):

CO1: Student will be able to summarize the issues in real time computing
CO2: Student will be able to explain and give examples of real time operating systems.
CO3: Student will be able to solve scheduling problems and can apply them in real time applications in industry.
CO4: Student can also design an RTOS and will be able to interpret the feasibility of a task set to accomplish or not.
CO5: Analyze the situation of fault occurrence and will be able to apply solutions accordingly

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓

CO2	✓	✓	✓	✓	✓							✓
CO3	✓		✓		✓							✓
CO4	✓		✓		✓							✓
CO5	✓	✓		✓								✓

Course Contents:

Module 1: Introduction to Real time systems

Issues in real time computing, Structure of real time system, Need for RTOS, Task classes, Performance measures for real time system: Properties, traditional performance measures, performability, cost functions and hard deadlines, and Estimating program run times. Introduction LINUX/ UNIX OS

Module 2: Embedded software and Task Scheduling

Examples of embedded system their characteristics and their typical hardware components, embedded software architectures, Scheduling algorithms: round robin, round robin with interrupts, function queue scheduling, real time operating system selection, CPU scheduling algorithms: Rate monotonic, EDF, MLF. Priority Scheduling, Priority Ceiling and Priority inheritance, Real time operating system: Tasks and task states, shared data and reentrancy semaphores and shared data, use of semaphores, protecting shared data

Module 3: Features of Real Time Operating System

Messages. Queues, mailboxes, pipes, timer function, events, memory management. Interrupt basic system design using an RT (OS design principles, interrupt routines, task structures and priority.), Current research in RTOS, Case Studies: Vx Works and Micro OS-II

Module 4: Real Time Databases

Real time v/s general purpose databases, main memory databases, transaction priorities transaction aborts, concurrency control issues: pessimistic concurrency control and optimistic concurrency control, Disk scheduling algorithms.

Module 5: Fault Tolerance Techniques

Causes of failure, Fault types, Fault detection, Fault and error containment, Redundancy: hardware redundancy, software redundancy, Time redundancy, information redundancy, Data diversity, Integrated failure handling.

Text Books:

1. An Embedded Software Primer, David E. Simon Pearson Education Asia Publication ISBN-13: 9780201615692

2. Real Time Systems, C.M. Krishna and Kang G. Shin, TMH Publication ISBN 13: 9780070701151

Reference Books:

Embedded system: Architecture Programming and Design, Raj kamal, TMH Publication ISBN 13: 9780070667648

TITLE OF COURSE: Distributed System
COURSE CODE: CSD712
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Knowledge in Computer Networks and Operating System

Introduction:
1. Understand foundations of Distributed Systems.
2. Introduce the idea of peer to peer services and file system.
3. Understand in detail the system level and support required for distributed system.
4. Understand the issues involved in studying process and resource management.

Course Outcomes (CO):
At the end of the course, the student should be able to:
CO1: Discuss trends in Distributed Systems.
CO2: Apply network virtualization.
CO3: Apply remote method invocation and objects.
CO4: Design process and resource management systems

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓		✓		✓							✓
CO3	✓		✓		✓							✓
CO4	✓		✓		✓							✓

Course Contents:
Module 1: INTRODUCTION
Examples of Distributed Systems–Trends in Distributed Systems – Focus on resource sharing – Challenges. Case study: World Wide Web.
Module 2: COMMUNICATION IN DISTRIBUTED SYSTEM
System Model – Inter process Communication – the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation and Objects: Remote Invocation – Introduction – Request-reply protocols – Remote procedure call – Remote method invocation. Case study: Java RMI – Group communication – Publish-subscribe systems – Message queues – Shared memory approaches – Distributed objects – Case study: Enterprise Java Beans -from objects to components.
Module 3: PEER TO PEER SERVICES AND FILE SYSTEM
Peer-to-peer Systems – Introduction – Napster and its legacy – Peer-to-peer – Middleware – Routing overlays. Overlay case studies: Pastry, Tapestry- Distributed File Systems –Introduction
– File service architecture – Andrew File system. File System: Features-File model -File accessing models – File sharing semantics Naming: Identifiers, Addresses, Name Resolution – Name Space

Implementation – Name Caches – LDAP.

Module 4: SYNCHRONIZATION AND REPLICATION

Introduction – Clocks, events and process states – Synchronizing physical clocks- Logical time and logical clocks – Global states – Coordination and Agreement – Introduction – Distributed mutual exclusion – Elections – Transactions and Concurrency Control– Transactions -Nested transactions – Locks – Optimistic concurrency control – Timestamp ordering – Atomic Commit protocols - Distributed deadlocks – Replication – Case study – Coda.

Module 5: PROCESS & RESOURCE MANAGEMENT 9 Process Management: Process Migration: Features, Mechanism – Threads: Models, Issues, Implementation. Resource Management: Introduction- Features of Scheduling Algorithms –Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.

Text Books

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.

References

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.
3. Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004.
4. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, USA, 2003.

Detailed Syllabus of Computer Science & Engineering

TITLE OF COURSE: BIOLOGY
COURSE CODE: BSC710
L-T-P: 2-1-0
CREDITS: 3

Introduction: Biology is the natural science that studies life and living organisms, including their physical structure, chemical processes, molecular interactions, physiological mechanisms, development and evolution.

Course Outcomes (CO):

CO1: Students will demonstrate an understanding of Mendelian and molecular genetics, cell structure, cell physiology, and molecular processes of cells.

CO2: Students will demonstrate an understanding of organismal form, function, and diversity.

CO3: To provide students with technical and analytical skills used in modern biological research.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓						✓			✓	✓

CO2	✓	✓		✓							✓	✓
CO3	✓	✓	✓	✓							✓	✓

Course Contents:

Module 1: Introduction:

To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Module 2: Classification:

Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

Module 3: Genetics:

Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Module 4: Biomolecules:

To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

Module 5: Enzymes:

Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyzereactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

Module 6: Information Transfer:

The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

Module 7: Macromolecular analysis:

Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

Module 8: Metabolism:

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

Text Books:

1. Microbiology: Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.
2. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd

References:

1. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
2. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company

TITLE OF COURSE: STATISTICS FOR DATA ANALYTICS
COURSE CODE: BSC711
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Basic concepts Data base management system and SQL Query Language.

Introduction:

This statistics and data analysis course will pave the statistical foundation for our discussion on data science. You will learn how data scientists exercise statistical thinking in designing data collection, derive insights from visualizing data, obtain supporting evidence for data-based decisions and construct models for predicting future trends from data.

Course Outcomes (CO):

The students will be able to:

CO1: Data collection, analysis, and inference.
CO2: Data classification to identify key traits and customers.
CO3: Conditional Probability-How to judge the probability of an event, based on certain conditions.
CO4: How to use Bayesian modeling and inference for forecasting and studying public opinion.
CO5: Basics of Linear Regression.
CO6: Data Visualization: How to create use data to create compelling graphics.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	✓	✓	✓		✓			✓				✓
CO2	✓			✓								✓
CO3	✓		✓									✓
CO4	✓	✓							✓			✓
CO5	✓	✓	✓									✓
CO6	✓				✓						✓	✓

Course Contents:

Module-1: Statistics and Big Data: What are Statistics and what is Big Data. How are Big Data problems being tackled? Why is it important for statistics to be one of the key disciplines for Big Data?, What does statistics bring to Big Data and where are the opportunities?

Module-2: Introduction Statistical Thinking, Examples of Statistical Thinking, Numerical Data, Summary Statistics, From Population to Sampled Data, Different Types of Biases, Introduction to Probability, Introduction to Statistical Inference.

Module-3: Association and Dependence, Association and Causation, Conditional Probability and Bayes Rule, Simpsons Paradox, Confounding, Introduction to Linear Regression, Special Regression Models.

Module-4: Exploratory Data Analysis and Visualization, Goals of statistical graphics and data visualization, Graphs of Data, Graphs of Fitted Models, Graphs to Check Fitted Models, what makes a good graph, Principles of graphics.

Module-5: Introduction to Bayesian Modeling, Bayesian inference: combining models and data in a forecasting problem, Bayesian hierarchical modeling for studying public opinion, Bayesian modeling for Big Data.

Textbooks:

1. Statistics for Data Science, James D. Miller
2. Statistical Techniques for Data Analysis, By John K. Taylor, Cheryl Cihon

Reference Books:

1. An Introduction to Statistical Learning: with Applications in R By Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani
2. Statistical Models for Data Analysis, edited by Paolo Giudici, Salvatore Ingrassia, Maurizio Vichi

TITLE OF COURSE: STATISTICAL METHODS FOR DECISION MAKING
COURSE CODE: BSC712
L-T-P: 3-0-0

CREDITS: 3

Prerequisites: The students are expected to have knowledge of basic mathematics at the plus two level

Introduction:

Introduction to probabilistic and statistical techniques for decision making, including inferential statistics, hypothesis tests, analysis of variance, regression analysis, and statistical quality control. Using computer software and data in statistical analysis. Emphasis on formal modeling and the use of data for managerial decision making and problem solving.

Course Outcome:

CO1: Understand and appreciate the most widely used tools of business statistics which form the basis for rational and sound business decisions

CO2: Focus on problem recognition and test hypothesis/model in the context of managerial decision-making.

CO3: Develop skills in analysis and interpretation of data

CO4: Handle challenging problems using appropriate analysis tool

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓
CO2	✓			✓								✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓						✓	✓

Course Content:

Module 1: Introduction to Descriptive Statistics, Descriptive and Inferential Statistics, Types of measurements, Descriptive Statistics (Using Graphs), Descriptive Statistics (Using Numbers), Measures of location, variability, and relative standing

MODULE 2: PROBABILITY AND SAMPLING APPLICATIONS, AND RULES, CONDITIONAL PROBABILITY, DISCRETE DISTRIBUTIONS (BINOMIAL, POISSON, HYPERGEOMETRIC, GEOMETRIC), CONTINUOUS DISTRIBUTION, NORMAL AND STANDARD NORMAL DISTRIBUTION, SAMPLING DISTRIBUTIONS, SAMPLING DISTRIBUTION PARAMETERS, CENTRAL LIMIT THEOREM, APPLYING SAMPLING DISTRIBUTION THEORY

MODULE 3: CONFIDENCE INTERVALS & HYPOTHESIS TESTING: ESTIMATION AND HYPOTHESIS TESTING, POINT ESTIMATORS, INTERVAL ESTIMATION, T-DISTRIBUTION, HYPOTHESIS TESTING, P-VALUES, ESTIMATION OF POPULATION PROPORTION.

MODULE 4: STATISTICAL PROCESS/QUALITY CONTROL: COMMON CAUSES AND SPECIAL CAUSES OF VARIATION, X-BAR CHART, R CHART, P CHART, COMPARING TWO POPULATION MEANS (CONFIDENCE INTERVALS)

MODULE 5: REGRESSION ANALYSIS: SIMPLE AND MULTIPLE LINEAR REGRESSION, RELATIONSHIP BETWEEN TWO(SIMPLE), THREE OR MORE(MULTIPLE) VARIABLES, MODEL ESTIMATION, MODEL INFERENCE

Textbooks:

1. Anderson, Sweeney, and Williams, Statistics for Business and Economics, Seventh Edition, West Publishing Co., available at Hammes Bookstore.
2. Statistical Techniques for Data Analysis, By John K. Taylor, Cheryl Cihon

Reference Books:

1. An Introduction to Statistical Learning: with Applications in R By Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani
2. Statistical Models for Data Analysis, edited by Paolo Giudici, Salvatore Ingrassia, Maurizio Vichi

TITLE OF COURSE: EXPLORATORY DATA ANALYSIS
COURSE CODE: BSC713
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Calculus, Probability and Statistics for Computer Science

Introduction:

Learn how to use graphical and numerical techniques to begin uncovering the structure of your data. When your dataset is represented as a table or a database, it's difficult to observe much about it beyond

its size and the types of variables it contains. In this course, you'll learn how to use graphical and numerical techniques to begin uncovering the structure of your data. Which variables suggest interesting relationships? Which observations are unusual? By the end of the course, you'll be able to answer these questions and more, while generating graphics that are both insightful and beautiful. To learn the essential exploratory techniques for analyzing and visualizing data, and to gain hands-on experience of using software tools for data analytics.

Course Outcomes (CO):

After completion of the course the students will able to

CO1: Describe exploratory data analysis and visualization concepts

CO2: Describe data analysis and visualization models and algorithms

CO3: Describe applicability of different data analysis and visualization models techniques to solve real world problems

CO4: Acquire and pre-process data

CO5: Apply exploratory data analysis to some real data sets and provide interpretations via relevant visualization

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									✓
CO2	✓			✓								✓
CO3	✓		✓									✓
CO4	✓				✓							✓
CO5	✓			✓							✓	✓

Course Contents:

Module 1: Introduction to Exploratory Data Analysis and Visualization, Overview of the exploratory aspect of data analysis, Data acquisition from on-line data sources and preprocessing techniques.

Module 2: Pattern Discovery, Dimensionality Reduction – Linear and Non-Linear Model, Clustering and Classification, Smoothing Scatterplots and Regression.

Module 3: Graphical Visualization, Visualizing Clusters, Visualization Data Distributions, Multivariate Visualization, Graph Data Visualization.

Module 4: Case Studies in Exploratory Data Analysis for Different Application Domains

Text Books

1. W.L. Martinez and A.R. Martinez. Exploratory Data Analysis with MATLAB, Chapman & Hall/CRC, 2011
2. B. Everitt. An Introduction to Applied Multivariate Analysis with R (Use R!), Springer, New York, 2011

References Books

1. W. McKinney. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, O'Reilly, 2012
2. M.A. Russell. Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub and More, O'Reilly, 2013

TITLE OF COURSE: ESP & SDP-VII
COURSE CODE: GSC707
L-T-P: 2-0-2
CREDITS: 2

Pre-requisite: Basic concepts in mathematics and English Language.
Introduction:
The course is on GATE exam preparation, revision and advanced problems in quantitative aptitude, reasoning, Verbal English etc.

Course Outcomes (CO):
In this course we will study the basic components of math and English language. Students are expected to be capable of understanding the better communication, their advantages and drawbacks, how to implement them in daily life, how their drawbacks can be overcome and what the applications are and where they can be used. To reach this goal, the following objectives need to be met:
CO1: Students would be able to know GATE exam preparation.
CO2: Students would be able to implement verbal and non-verbal communication.
CO3: By analyzing the logic of any arithmetic structure able to solve problem.
CO4: To become an efficient math and English language.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓
CO2	✓			✓								✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓

Course Contents:

Section A: Employment Enhancement Skills-VII
Module-1
Stream wise GATE & IES syllabus.

Section B: Skill Development for Professional-VII
Module-1
Miscellaneous Problems on Verbal English [CAT level-4].
Module-2
Miscellaneous Problems on quantitative aptitude [CAT level-4].
Module-3
Miscellaneous Problems on Logical Reasoning [CAT level 4].
Newspaper reading: The Hindu & Economic Times.

Learning Materials:

1. Fastrack objective Arithmetic: Arihant
2. Quantitative aptitude for Competitive exam (4th Edition): TATA Mc Graw Hill
3. Quantitative aptitude for Competitive exam (3rd Edition): PEARSON
4. Engineering mathematics-Pearson
5. GATE Mathematics- Willey/McGraw hill

Eighth Semester Syllabus

Sl No.	Type	Subject Code	Topic	L	T	P	Credit Points
1.	PEC	AIML---	Specialization Elective-VI	3	0	0	3
2.	OE	---	Open Elective-III	3	0	0	3
3.	OE	---	Open Elective-IV	3	0	0	3
4.	GSC	GSC808	ESP & SDP - VIII	2	0	2	2
5.	PTI	INT806	Internship Industrial Training/Project-IV	0	0	12	6
6.	CC	CSC881	Grand Viva	0	0	0	2
			Total	11	0	14	19/25

#Students will undergo project/training/internship in the industry / research organization / reputed Institute during the vacation.

Suggestive Choice Based Subjects

Sl No.	Type	Subject Code	Topic	L	T	P	Credit Points
1.	PEC	AIML806/807	Computer Vision/Human Computer Interaction	3	0	0	3
3.	OE	CSD813	Data Mining & Data Ware Housing	3	0	0	3
4.	OE	CSD814	Information Theory & Coding	3	0	0	3
5.	OE	CSD815	Advanced Algorithms	3	0	0	3
6.	OE	CSD816	Digital Image Processing	3	0	0	3

 # Students must take the Specialization Subject from the following table:

Subject Code	Artificial Intelligence & Machine Learning
AIML501	Introduction to AI & Machine Learning
AIML602	Introduction to Data Analytics
AIML603	Deep Learning & Neural Network
AIML704	Special Topics in AI
AIML705	Application of AI
AIML806	Computer Vision
AIML807	Human Computer Interaction

TITLE OF COURSE: COMPUTER VISION
COURSE CODE: AIML806
L-T-P: 3-0-0
CREDITS: 3

Pre-Requisites: Knowledge in Mathematics and Python programming

Introduction:
This course provides an introduction to computer vision including fundamentals of image formation, camera imaging geometry, feature detection and matching, stereo, motion estimation and tracking, image classification and scene understanding. We'll develop basic methods for applications that include finding known models in images, depth recovery from stereo, camera calibration, image stabilization, automated alignment, tracking, boundary detection, and recognition. The focus of the course is to develop the intuitions and mathematics of the methods in lecture, and then to learn about the difference between theory and practice in the projects.

Course Outcomes (CO):
Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us. This requires understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.
CO1: Appreciate the detailed models of image formation.
CO2: Analyze the techniques for image feature detection and segmentation
CO3: Apply various algorithms for pattern recognition
CO4: Examine various clustering algorithms analysis
CO5: Analyze structural pattern recognition and feature extraction techniques

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓											
CO3		✓	✓	✓								
CO4	✓	✓										
CO5				✓								

Course Contents:
Unit-1: Digital Image Formation and low-level processing
Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.
Unit-2: Depth estimation and Multi-camera views

Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. apparel

Unit-3: Feature Extraction

Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

Unit-4: Image Segmentation

Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.

Unit-5: Pattern Analysis

Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

Unit-6: Motion Analysis

Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

Unit-7: Shape from X

Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.

Text Books

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

References

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.
3. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.

TITLE OF COURSE: HUMAN COMPUTER INTERACTION
COURSE CODE: AIML807
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Basic concept of Artificial Intelligence, Machine Learning

Introduction:

Human-computer interaction is an emerging field of study at present, due to the proliferation of large number of consumer electronic products. The key issue in this field is to make the products usable to lay-persons. In order to do that, we need to take care of the (creative) design aspects (the look-and-feel of the interface) and also the system design aspect (both software and hardware). The field is interdisciplinary with inputs required from various other fields. However, the computer science and engineering plays the central role in the design of such systems.

Course Outcomes (CO):

After completion of the course, student will understand the

CO1: engineering life cycles for design of interactive systems,
CO2: computational design framework (as part of the life cycle),
CO3: components of the framework including the computational models of users and systems, and evaluation of such systems (with or without users).

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓											
CO3												

Course Contents:
Unit 1: Introduction to user-centric design, historical evolution, issues and challenges and current trend, Components of HCI Types of interfaces Design process
Unit 2: Engineering user-centric systems – relation with software engineering, iterative life-cycle, prototyping, guidelines, Contextual inquiry Importance of users / talking to users Task analysis
Unit 3: Sketching Low & hi fidelity prototyping, mental models, Usability evaluation think aloud, observing users Modelling users, expert evaluations
Unit 4: Information visualization, Empirical research – research question formulation, experiment design, data analysis, statistical significance test
Unit 5: HCI & mobility New faces of HCI, Refresher for all modules seen in the course, User-centric design evaluation – overview of evaluation techniques, expert evaluation, user evaluation, model-based evaluation with case studies

Text Books
a. Samit Bhattacharya (July, 2019). Human-Computer Interaction: User-Centric Computing for Design, McGraw-Hill India, Print Edition: ISBN-13: 978-93-5316-804-9; ISBN-10: 93-5316-804-X, E-book Edition: ISBN-13: 978-93-5316-805-6; ISBN-10: 93-5316-805-8
b. Alan Dix, Janet E. Finlay, Gregory D. Abowd and Russel Beale. (2003). Human-Computer Interaction (3rd Edition), Pearson.

References
1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen and Steven Jacobs. (2009). Designing the User Interfaces: Strategies for Effective Human-Computer Interaction (5th Edison), Pearson

TITLE OF COURSE: DATA MINING & DATA WARE HOUSING
COURSE CODE: CSD821
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Knowledge is also assumed of basic concepts in data base management system, and mathematics.

Introduction:

The recent years have generated explosive expansion of digital data stored in computer databases as well as increased pressure on companies to keep competitive advantage. This has put Data Mining (DM) as a

key method for extracting meaningful information from the flood of digital data collected by businesses, government, and scientific agencies.

Course Outcomes (CO):

This course will serve to broaden the student's understanding of the issues and latest developments in the area of data mining. To reach this goal, the following objectives need to be met:

CO1: To understand the basic principles, concepts and applications of data warehousing and data mining

CO2: To introduce the task of data mining as an important phase of knowledge recovery process.

CO3: Ability to do Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment.

CO4: Have a good knowledge of the fundamental concepts that provide the foundation of data mining.

CO5: Design a data warehouse or data mart to present information needed by management in a form that issuable for management client.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓			✓								✓
CO2	✓	✓		✓							✓	✓
CO3	✓	✓	✓		✓				✓		✓	✓
CO4	✓											✓
CO5	✓				✓					✓		✓

Course Contents:

Module 1:

Overview of Data warehousing, Strategic information and the need for Data warehousing, Defining a Data warehouse, Evolution of Data warehousing, Data warehousing and Business Intelligence.

Module 2:

The Building Blocks of Data warehouse, Defining features – Subject-oriented data, Integrated data, Time-variant data, Nonvolatile data, Data granularity, Data warehouses and Data marts, Architectural Types – Centralized, Independent data marts, Federated, Hub-and-Spoke, Data mart bus, Overview of components - Source Data, Data Staging, Data Storage, Information Delivery, Metadata, and Management and Control components. Definition and architecture in the areas of Data acquisition, Data storage, and Information delivery Distinguishing characteristics – Different objectives and scope, Data content, Complex analysis for faster response, Flexible and Dynamic, Metadata-driven etc Architectural Framework – supporting flow of data, and the Management and Control module Technical architecture – Data acquisition, Data storage, and Information delivery.

Module 3:

Business Requirements and Data warehouse: Dimensional nature of Business data and Dimensional Analysis, Dimension hierarchies and categories, Key Business. Metrics (Facts), Requirement Gathering methods and Requirements Definition Document (contents). Distinction between architecture and infrastructure, understanding of how data warehouse infrastructure supports its architecture Components of physical infrastructure, Hardware and Operating systems for data warehouse, Database Software,

Collection of Tools, Data warehouse Appliances – evolution and benefits. Business Requirements and Data Design – Structure for Business Dimensions and Key Measurements, Levels of detail. Business Requirements and the Architecture plan, Business Requirements and Data Storage Specifications, Business Requirements and Information Delivery Strategy.

Module 4:

Understanding the importance of Metadata, Metadata types by functional areas – Data acquisition, Data storage, and Information delivery, Business Metadata – overview of content and examples, Technical Metadata – overview of content and examples, Metadata Requirements, Sources of Metadata, Metadata management – challenges, Metadata Repository, Metadata, integration and standards.

Module 5:

Concepts of Data warehouse architecture – Definition and architecture in the areas of Data acquisition, Data storage, and Information delivery, Distinguishing characteristics – Different objectives and scope, Data content, Complex analysis for faster response, Flexible and Dynamic, Metadata-driven etc Architectural Framework – supporting flow of data, and the Management and Control module. Technical architecture – Data acquisition, Data storage, and Information delivery. Design decisions, Basics of Dimensional modeling, E-R modeling versus Dimensional modeling, The STAR schema – illustration, Dimension Table, Fact Table, Factless Fact Table, Data granularity, STAR schema keys – Primary, Surrogate, and Foreign, Advantages of the STAR schema, STAR schema examples. Overview of ETL, Requirements of ETL and steps Data extraction – identification of sources and techniques Data transformation – Basic tasks, Transformation types, Data integration and consolidation, Transformation for dimension attributes, Data loading – Techniques and processes, Data refresh versus update, Procedures for Dimension tables, Fact tables : History and incremental loads ETL Tool options.

Module 6:

Distinction between architecture and infrastructure, Understanding of how data warehouse infrastructure supports its architecture Components of physical infrastructure, Hardware and Operating systems for data warehouse, Database Software, Collection of Tools,Overall concept of Online Analytical Processing (OLAP), OLAP definitions and rules, OLAP characteristics Major features and functions of OLAP – General features, Dimensional analysis, Hypercubes, Drill Down and Roll Up, Slice and Dice, Rotation, Uses and Benefits Familiarity with OLAP models – Overview of variations, MOLAP, ROLAP, HOLAP, DOLAP, Database OLAP, Web OLAP. Web-enabled Data Warehouse – adapting data warehouse for the web Web-based information delivery – Browser technology for data warehouse and Security issues OLAP and Web – Enterprise OLAP, Web-OLAP approaches, OLAP Engine design. Data warehouse Appliances – evolution and benefits

Module 7:

Overview of Data mining – Definition, Knowledge Discovery Process (Relationships, Patterns, Phases of the process), OLAP versus Data mining, Some aspects of Data mining – Association rules, Outlier analysis, Predictive analytics etc), Concepts of Data mining in a Data warehouse environment, Major Data Mining techniques – Cluster Detection using R Language, Decision Trees, Memory-based Reasoning, Link Analysis, Neural, Networks, Genetic Algorithms etc, Data Mining Applications in industry – Benefits of Data mining using R Language, Discussion on applications in Customer Relationship, Management (CRM), Retail, Telecommunication, Biotechnology, Banking and Finance etc.

Textbooks:

1. Data Mining Technology, Third Edition by Arun K Pujari, Universities Press, India
2. Data Warehousing Fundamentals for IT Professionals, Second Edition by Paulraj Ponniah, Wiley India
3. Alex Berson, Stephen J. Smith, “Data Warehousing Data Mining & OLAP”, Tata McGrow- Hill

References

References:

1. Data Warehousing, Data Mining, & OLAP – Second Edition by Alex Berson and Stephen J. Smith, Tata McGraw Hill
2. Data warehouse Toolkit by Ralph Kimball, Wiley India
3. Gajendra Sharma,"Data Mining Data Warehousing and OLAP", S.K.KATARIA & SONS

TITLE OF COURSE: INFORMATION THEORY & CODING
COURSE CODE: CSD822
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Probability and Random Processes, Digital Communications.

Introduction:

It can be subdivided into source coding theory and channel coding theory. Using a statistical description for data, information theory quantifies the number of bits needed to describe the data, which is the information entropy of the source.

Course Outcomes (CO):

After completion of the course, the student is able to

CO1: Design the channel performance using Information theory.
CO2: Comprehend various error control code properties
CO3: Apply linear block codes for error detection and correction
CO4: Apply convolution codes for performance analysis & cyclic codes for error detection and correction.
CO5: Design BCH & RS codes for Channel performance improvement against burst errors.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓	✓		✓								✓
CO3	✓		✓		✓							✓
CO4	✓		✓		✓							✓
CO5	✓		✓		✓							✓

Course Contents:

Module-1: Information Theory:

Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long

dependent sequences, Markov Statistical Model of Information Sources, Entropy and Information rate of Mark off Sources

Module-2: Source Coding:

Source coding theorem, Prefix Codes, Kraft McMillan Inequality property – KMI
Encoding of the Source Output, Shannon's Encoding Algorithm.
Shannon Fano Encoding Algorithm, Huffman codes, Extended Huffman coding, Arithmetic Coding, Lempel – Ziv Algorithm

Module-3: Information Channels:

Communication Channels (Section 4.4 of Text 1).Channel Models, Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies, Mutual Information, Channel Capacity, Channel Capacity of :Binary Symmetric Channel, Binary Erasure Channel, Muroga's Theorem, Contineuos Channels

Module-4: Error Control Coding:

Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Single Error Correcting hamming Codes, Table lookup Decoding using Standard Array.

Binary Cyclic Codes:

Algebraic Structure of Cyclic Codes, Encoding using an (n-k) BitShift register, Syndrome Calculation, Error Detection and Correction

Module-5: Some Important Cyclic Codes:

Golay Codes, BCH Codes.

Convolution Codes:

Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm)

Text Books

1. Elements of Information Theory by Thomas Cover, Joy Thomas
2. Channel Codes: Classical and Modern by William Ryan, Shu Lin
3. John Proakis, "Digital Communications", TMH, 5th Ed., 2008.

References

1. Information Theory and Reliable Communication by Robert Gallager

TITLE OF COURSE: ADVANCED ALGORITHMS
COURSE CODE: CSD823
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Knowledge is also assumed of basic concepts in data structures, programming languages, and analysis of algorithm.

Introduction:

The advanced algorithm will cover several advanced topics not studied in typical introductory courses on algorithms The Topics to be covered (tentatively) include: Complexity Analysis, Advanced data structure, Divide and Conquer, Priority queue, Dynamic Programming, Branch and Bound, Backtracking, Greedy Method, Graph traversal algorithm, Computational geometry, Notion of NP-

completeness, Approximation Algorithms, Randomized algorithm, Multithreaded algorithm and Parallel algorithm.

Course Outcomes (CO):

The need for efficient algorithms arises in nearly every area of computer science. But the type of problem to be solved, the notion of what algorithms are "efficient", and even the model of computation can vary widely from area to area. In advance algorithms course, we will survey many of the techniques that apply broadly in the design of efficient algorithms, and study their application in a wide range of application domains and computational models. Techniques to be covered include randomized algorithm, multithreaded algorithm, parallel algorithm, and approximation algorithms. To reach this goal, the following objectives need to be met:

CO1: Understand the different complexity analysis according different problem. You will examine the algorithms used for various operations on operating systems.

CO2: Understand the advanced data structure like 2-3 tree, red- black tree, B tree, B+ tree, tries, spatial data representation using k-d tree, quad tree.

CO3: Visualize different types of algorithm techniques.

CO4: Understand the Computational geometry.

CO5: Understand the pattern matching of a text.

CO6: Understand the basic principle of different classes of problems like P,NP,NP-complete and concepts of randomized algorithm, multithreaded algorithm, parallel algorithm, and approximation algorithms.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓	✓	✓	✓	✓							✓
CO3	✓	✓		✓								✓
CO4	✓	✓		✓								✓
CO5	✓	✓	✓	✓	✓							✓
CO6	✓	✓	✓	✓	✓							✓

Course Contents:

Module-1: Complexity Analysis of an algorithm, Different Asymptotic notations – their mathematical significance, Amortized Analysis.

Module-2: Advanced data structure-2-3 tree, red- black tree, B tree, B+ tree, tries, spatial data representation using k-d tree, quad tree.

Module-3: Basic method, use, Examples of Divide and Conquer algorithm, Dynamic Programming, Greedy Method, Backtracking and their complexity, Basic method and example of Graph traversal algorithm.

Module-4: Computational geometry- robust geometric primitives, convex hull, triangulation, voronoi diagrams, nearest neighbor search, range search, point location, intersection detection, bin packing, medial-axis transform, polygon partitioning, simplifying polygons, shape similarity,

motion planning, maintaining line arrangements, minkowski sum.

Module-5: Set and string problems: set cover, set packing, string matching, approximate string matching, text compression, cryptography, finite state machine minimization, longest Common substring/subsequence, shortest common superstring

Module-6: Advanced areas: notion of NP-completeness: P class, NP-hard class, NP-complete class, circuit satisfiability problem. Approximation algorithms, randomized algorithms, multithreaded algorithms, parallel algorithms and its applications,

Text Books

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms", 3rd edition, PHI.
2. Chvatal, V. Linear Programming. New York, NY: W.H. Freeman and Company, 1983, appendix. ISBN: 9780716715870. [An easy to read description without all the details.]
3. Korte, B. H., and J. Vygen. Combinatorial Optimization. New York, NY: Springer-Verlag, 2002, chapter 4. ISBN: 9783540431541. [A detailed description.]
4. Boyd, Stephen, and LievenVandenberghe. Convex Optimization .Cambridge, UK: Cambridge Univ. Press, 2005. ISBN: 9780521833783
5. Nemirovski, Arkadi. "Lectures on Modern Convex Optimization." (PDF - 2.7MB)
6. Approximation algorithms. Vazirani, V. Approximation Algorithms. NewYork, NY: Springer-Verlag, 2004. ISBN: 9783540653677.
7. Computational Geometry. 3rd ed. New York, NY: Springer-Verlag, 2008. ISBN:978354077973

References

1. E.Horowitz and Shani "Fundamentals of Computer Algorithms", 2nd edition, Orient Black Swan.
2. A. Aho, J.Hopcroftand J.Ullman "The Design and Analysis of computer Algorithms", Pearson.7. Fundamentals of Software Engineering: Ghezzi, Jazayeri, Mandriol, PHI

TITLE OF COURSE: DIGITAL IMAGE PROCESSING
COURSE CODE: CSD816
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Knowledge is also assumed of basic concepts in data structures, programming languages, and analysis of algorithm.

Introduction:

The student should be made to:
Learn digital image fundamentals.
Be exposed to simple image processing techniques.
Be familiar with image compression and segmentation techniques.
Learn to represent image in form of features.

Course Outcomes (CO):

Upon successful completion of this course, students will be able to:

CO1: Discuss digital image fundamentals.
CO2: Apply image enhancement and restoration techniques.
CO3: Use image compression and segmentation Techniques.
CO4: Represent features of images.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓	✓	✓	✓	✓							✓
CO3	✓	✓		✓								✓
CO4	✓	✓		✓								✓

Course Contents:

Module-1: DIGITAL IMAGE FUNDAMENTALS

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – color models.

Module-2: IMAGE ENHANCEMENT

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

Module-3: IMAGE RESTORATION AND SEGMENTATION

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering Segmentation: Detection of Discontinuities–Edge Linking and Boundary detection – Region based segmentation- Morphological processing- erosion and dilation.

Text Books

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.

References

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
3. Willliam K Pratt, “Digital Image Processing”, John Willey, 2002.
4. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.

TITLE OF COURSE: ESP & SDP - VIII
COURSE CODE: GSC808
L-T-P: 2-0-2
CREDITS: 2

Pre-requisite: Basic concepts in mathematics and English languages.

Introduction:

This course examines current event of national importance. The Topics to be covered (tentatively): The course is on Mock tests of UPSC Prelims CSAT-I & UPSC CSAT-II etc, Indian & World Geography, Indian Polity & Governance, Economic & Social Development, General issues on Environmental ecology.

Course Outcomes (CO):

In this course we will study the basic components of world Geography. Students are expected to be capable of understanding the Indian Polity & Governance, their advantages and drawbacks, how to implement them in Economic & Social Development, how their drawbacks can be overcome and what the applications are and where they can be used. To reach this goal, the following objectives need to be met:

CO1: Students would be able to know Indian Economic & Social system.
CO2: Students would be able to know Indian Polity & Governance.
CO3: By analyzing the logic of national importance and policy.
CO4: To become an efficient citizen of India.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓							✓
CO2	✓			✓								✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓		✓							✓

Course Contents:

Section A: Employment Enhancement Skills-VIII

Module-1

Stream wise GATE, IES, UPSE syllabus
Mock tests of IES, UPSC Prelims CSAT-I

Section B: Skill Development for Professional-VIII

Module-1: Current events of National & International importance, History of India & Indian National Movement.

Module-2: Indian & World Geography – Physical, Social, Economic Geography of India & the World.

Module-3: Indian Polity & Governance – Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, etc.

Module-4: Economic & Social Development – Sustainable Development, Poverty, Inclusion, Demographics, Social Sector Initiatives, etc.

Module-5: General issues on Environmental ecology, Bio-diversity & climate change – that do not require subject specialization. General Science.

Some other important subjects

TITLE OF COURSE: QUANTUM COMPUTING
COURSE CODE: CSC818
L-T-P: 3-0-0
CREDITS: 3

Pre-requisite: Basics of computer science, Electronics.

Introduction:
Quantum computing is the use of quantum-mechanical phenomena such as superposition and entanglement to perform computation. Computers that perform quantum computations are known as quantum computers

Course Outcomes (CO):
On successful completion, students will gain understanding of:
CO1: The basic principles of quantum computing.
CO2: The fundamental differences between conventional computing and quantum computing.
CO3: Several basic quantum computing algorithms.
CO4: The classes of problems that can be expected to be solved well by quantum computers.

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓		✓									✓
CO3	✓		✓									✓
CO4	✓	✓							✓			

Course Contents:
Module-1: Introduction to Quantum Computation:
Quantum bits, Bloch sphere representation of a qubit, multiple qubits
Module-2: Background Mathematics and Physics:
Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.
Module-3: Quantum Circuits:
single qu bit gates, multiple qu bit gates, design of quantum circuits.
Module-4: Quantum Information and Cryptography:
Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem.
Module-5: Quantum Algorithms:
Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.

Module-6: Noise and error correction:
Graph states and codes, Quantum error correction,fault-tolerant computation.

Text Books
1. Nielsen M. A., Quantum Computation and Quantum Information,Cambridge University Press.
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific.

References
1. Pittenger A. O. An Introduction to Quantum Computing Algorithms

TITLE OF COURSE: RECOMMEND SYSTEM
COURSE CODE:
L-T-P: 3-0- 0
CREDITS: 3

Pre-requisite: Basics of Data Structures and Algorithm, Design and Analysis of Algorithm

Introduction:
Recommender system functions, Linear Algebra notation: Matrix addition, Multiplication, transposition, and inverses; covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system

Course Outcomes (CO):
To develop state-of-the-art recommender systems
CO1: that automate a variety of choice-making strategies
CO2: goal of providing affordable, personal, and high-quality recommendations

Mapping of Course Outcomes (CO) and Program Outcomes (PO):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓			✓							✓
CO2	✓	✓			✓							✓

Course Contents:
Unit 1:
Neighborhood-Based Collaborative Filtering - Key Properties of Ratings Matrices, Predicting Ratings with Neighborhood-Based Methods, Clustering and Neighborhood-Based Methods, Dimensionality Reduction and Neighborhood Methods, A Regression Modeling View of Neighborhood Methods, Graph Models for Neighborhood-Based Methods.
Model-Based Collaborative Filtering - Decision and Regression Trees, Rule-Based Collaborative Filtering, Naive Bayes Collaborative Filtering, Using an Arbitrary Classification Model as a Black-Box, Latent Factor Models, Integrating Factorization and Neighborhood Models.

Unit 2:
Content-Based Recommender Systems - Basic Components, Preprocessing and Feature Extraction, Feature Representation and Cleaning, Collecting User Likes and Dislikes, Supervised Feature Selection and Weighting, Learning User Profiles and Filtering, Content-Based Versus Collaborative

Recommendations.Knowledge-Based Recommender Systems - Constraint-Based Recommender Systems, Case-Based Recommenders, Persistent Personalization in Knowledge-Based Systems.

Unit 3:

Ensemble-Based and Hybrid Recommender Systems - Ensemble Methods from the Classification Perspective, Weighted Hybrids, Switching Hybrids, Cascade Hybrids, Feature Augmentation Hybrids, Feature Combination Hybrids, Mixed hybrids.Evaluating Recommender Systems - Evaluation Paradigms, General Goals, Design Issues, Accuracy Metrics in Offline Evaluation,Limitations of Evaluation Measures.Context-Sensitive Recommender Systems - The Multidimensional Approach, Contextual Pre-filtering: A Reduction-Based Approach, Post-Filtering Methods, Contextual Modelling.

Unit 4:

Time- and Location-Sensitive Recommender Systems-Temporal Collaborative Filtering, Discrete Temporal Models, Location-Aware Recommender Systems, Structural Recommendations in Networks - Ranking Algorithms, Recommendations by Collective Classification, Recommending Friends: Link Prediction, Social Influence Analysis and Viral Marketing.Social and Trust-Centric Recommender Systems - Multidimensional Models for Social Context, Network-Centric and Trust-Centric Methods, User Interaction in Social Recommenders.

Unit 5:

Attack-Resistant Recommender Systems - Understanding the Trade-Offs in Attack Models, Types of Attacks, Detecting Attacks on Recommender Systems, Strategies for Robust Recommender Design.Learning to Rank, Multi-Armed Bandit Algorithms, Group Recommender Systems, Multi-Criteria Recommender Systems, Active Learning in Recommender Systems, Privacy in Recommender Systems, Some Interesting Application Domains

Text Books

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press(2011), 1st ed.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st ed.

References

1. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st ed.

TITLE OF COURSE: COGNITIVE ANALYTICS
COURSE CODE:
L-T-P: 3-0-2
CREDITS: 4

Pre-requisite: Basics of Artificial Intelligence, Big Data analytics, Machine Learning

Introduction:

This course explores the area of cognitive computing and its implications for today's world of big data analytics and evidence-based decision making. Topics covered: cognitive computing design principles, natural language processing, knowledge representation, advanced analytics, as well as IBM's Watson DeepQA and Google's TensorFlow deep learning architectures. Students will have an opportunity to build cognitive applications, as well as explore how knowledge-based artificial intelligence and deep learning are impacting the field of data science.

Course Outcomes (CO):

After taking this course, students will be able to:

1. Understand and discuss what cognitive computing is, and how it differs from traditional approaches.
2. Plan and use the primary tools associated with cognitive computing.
3. Plan and execute a project that leverages cognitive computing.
4. Understand and discuss the business implications of cognitive computing.

Course Contents:

Unit-1 (Introduction to Cognitive Computing): Building Cognitive Applications, Building Deep Learning Applications

Unit-2 (Cognitive Systems Fundamentals): Introduction to Knowledge-Based AI, Semantic Nets, Generate and Test, Means-Ends Analysis, Production Systems, Frames, Learning by Recording Cases, Case-Based Reasoning

Unit-3 (Cognitive Systems and Learning): Concept Learning, Classification Logic, Planning, Understanding, Common Sense Reasoning, Scripts

Unit-4 (Cognitive Systems and Reasoning): Explanation-Based Learning, Analogical Reasoning, Version Spaces, Constraint Propagation, Diagnosis, Meta-Reasoning

Unit-5 (Cognitive System Design Principles): Machine Learning, Hypothesis Generation and Scoring, Natural Language Processing, Representing Knowledge, Taxonomies and Ontologies

Unit-6 (IBM's Watson): DeepQA Architecture, UIMA – Unstructured Information Management Architecture, Structured Knowledge

Text Books

1. Hurwitz, Kaufman, and Bowles, Cognitive Computing and Big Data Analytics, Wiley, Indianapolis, IN, 2005, ISBN: 978-1-118-89662-4.

 # Students must take the Specialization Subject from the following table:

Subject Code	Artificial Intelligence & Machine Learning
AIML501	Introduction to AI & Machine Learning
AIML602	Introduction to Data Analytics
AIML603	Deep Learning & Neural Network
AIML704	Special Topics in AI
AIML705	Application of AI
AIML806	Computer Vision
AIML807	Human Computer Interaction

Total Credit of B.Tech (1st Sem to 8th Sem): 172
Total Credit of MOOCs (3rd Sem to 6th Sem): 10
Total Credit of B.Tech(Hons) (1st Sem to 8th Sem): 182