UNDERGRADUATE DEGREE PROGRAMME

B.Tech. in Electrical & Computer Engineering

School of Electrical Engineering

Curricula & Syllabi

ACADEMIC CURRICULA 2024- 2025

Kalinga Institute of Industrial Technology (KIIT)

Deemed to be University U/S 3 of UGC Act, 1956

Bhubaneswar, Odisha, India

ACADEMIC CURRICULA

UNDERGRADUATE DEGREE PROGRAMME

B.TECH. IN ELECTRICAL & COMPTER ENGINEERING

SCHOOL OF ELECTRICAL ENGINEERING

[2024-2025]

Course Structure and Detailed Syllabi
For B.Tech Students Admitted in the
Academic Session
2024-2025

Kalinga Institute of Industrial Technology (KIIT)
Deemed to be University U/S 3 of UGC Act, 1956
Bhubaneswar, Odisha, India

Vision

To deliver world-class education and research in Electrical Engineering, with particular regard to their application in industry, healthcare and commerce in a diverse society.

Mission

1. To prepare students for professional career, higher studies and entrepreneurship.
2. To facilitate students in Electrical Engineering for utilization of technical knowledge and skills, to analyze, solve problems and generate new ideas and products in academia and industry.
3. To motivate students in multi disciplinary research work through continuous learning and to build skills beyond curriculum in the areas of emerging Technologies.
4. To impart the essential skills of leadership, teamwork, communication and ethics.

Programmes Offered by the School: B.Tech in Electrical and Computer Engineering (Honours/Research)

Programme Education Objectives(PEOs)

The Program Educational Objectives for the B. Tech program in Electrical and Computer Engineering are:

1. Graduates will have a solid foundation in math, science, and engineering to solve complex Electrical and Computer Engineering problems. They will build successful careers in industry, research, or academia with technical and leadership skills. Their expertise will span areas like power systems, communication networks, embedded systems, and automation.
2. Graduates will lead responsibly and ethically, contributing to societal development, sustainability, and technological progress. They will apply their knowledge and skills to develop innovative engineering solutions, communicate and collaborate effectively in diverse, multidisciplinary, and global environments.
3. Graduates will engage in lifelong learning, continuously upgrading their skills to adapt to rapidly evolving technologies, emerging trends, and global challenges in the field of electrical and computer engineering.

ProgrammeOutcome(PO)

The Program Outcomes and Program Specific Outcomes are:

1. Engineering knowledge: Ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Ability to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/Development of solutions: Ability to design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations on complex problems: Ability to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Ability to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Ability to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Ability to understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team: Ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Ability to communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Ability to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs):

1. Ability to design and implement sustainable energy management systems to support technological advancement and improve quality of life.
2. Ability to analyze and address complex technical challenges using modern software engineering tools, and innovative problem-solving approaches.
3. Ability to develop integrated electrical and computer engineering solutions for societal and industrial applications through teamwork, group discussions, and professional report writing.

Guidelines for UG Engineering Curriculum – 2022

The curricula for B.Tech. courses have been designed following the general principles of curricular design and developing certain guiding strategies in order to build in the engineering graduate attributes in the courses.

Principles in Designing the Curricula

The overriding principles in designing the new curricula are that the curricula must (1) Impart specialized and interdisciplinary knowledge and creative problem-solving skills; (2) Reflect aspirations of the society to turn out technology-ready and socially conscious graduates to anticipate and avoid future problems; (3) Leverage the strengths and help making up the weaknesses of the university; (4) Inform the students about new technologies and the emerging social, environmental, and global forces, and (5) Give students the confidence to work in teams and in multi-cultural settings.

Key Graduate Attributes

Engineers are agents of social change. They interact with the common man to know and define the current and the looming future problems, develop sustainable design solutions using their science and engineering skills, and implement sustainable solutions. Thus, the graduating students must (1) Acquire knowledge and skills—both technical and soft skills such as communication, leadership, and skills of working in multi-cultural, interdisciplinary teams; (2) Develop the mental disposition to understand, conceptualize, and define complex, real-world problems; (3) Be independent, critical thinkers to inquire into the root causes of the problems; (4) Analyse the relevant data and social, economic, and political forces influencing these problems; (5) Synthesize knowledge and diverse perspectives and approaches to find technically and financially viable, sustainable, creative, ethical solutions by evaluating novel alternatives; (6) Use project planning and scheduling methods, establish institutional mechanisms, and communicate the plans and schedules and inspire the concerned individuals to implement the solutions; (7) Imbibe professional values and ethics, and (8) Be life-long learners with empathy for others.

Strategies for Curriculum Design

Strategies to design the curricula include (1) Understanding the dominant technological and social changes in the world, (2) Incorporating recommendations of the National Education Policy 2020 with respect to design of curricula, (3) Adding the novel features and best curricular practices of leading universities and institutes in India and abroad, (4) Recognizing the UGC and AICTE guidelines and ABET recommendations; (5) Using the opportunities that KIIT offers for multi- and inter-disciplinarity education, and (6) Delivering the key attributes and skills which the graduating students should be equipped with.

The Structure of the Curricula

The undergraduate engineering curricula are designed to inculcate in the students the graduate attributes indicated above. The curricula include (1) foundational subjects in the fields of humanities, social sciences, science, engineering science, and vocational courses, (2) depth subjects—both core and electives related to the respective disciplines, (3) open electives in diverse fields of humanities, arts, science, engineering, social science, management, law, public policy, media studies, etc., and (4) practice-based subjects. These subjects reflect a mix of theory, hands-on laboratory practice, short- and long-duration projects, field visits, internship, and extra- and co-curricular activities. The Institute has created many avenues for students to organize, lead, and actively participate in social, cultural, and techno-management functions to develop soft social and behavioural skills.

UG Programmes Offered by the Schools of Technology

The B. Tech. (Hons.) and B. Tech. (Res.) programmes offered by various Schools of Technology are tabulated below.

Name of the School	B. Tech. (Hons.) and B. Tech. (Res.) Programmess Offered
School of Civil Engineering	Civil Engineering
School of Computer Engineering	Computer Science and Engineering Information Technology Computer Science and Communication Engineering Computer Science and Systems Engineering
School of Electrical Engineering	Electrical Engineering Electrical and Computer Engineering
School of Electronics Engineering	Electronics and Telecommunication Engineering Electronics and Computer Science Engineering Electronics and Electronics Engineering

School of Mechanical Engineering	Mechanical Engineering Mechanical (Automobile Engineering) Mechatronics Engineering Aerospace Engineering

Highlights of the Curricula

1. The curricula allow the students to opt for either a B. Tech. (Hon.) degree or a B. Tech. (Res.) degree.
2. All the B. Tech. curricula have total of 160 – 165 credits.
3. The curricula provide for a Minor in selected areas if students fulfil additional credit requirements.
4. With the inclusion of many Humanities, Arts, and Social Science (HASS) subjects, the curricula are HASS-rich.
5. The curricula provide flexibility in many forms. The students can choose subjects from a large number science, HASS, and engineering electives. They can also choose subjects from lists of professional electives and open electives. The professional electives allow the students to concentrate in selected areas, whereas the open electives allow the students to opt for minors.
6. To ensure an all-round development of students, the curricula have included subjects like Yoga, Universal Human Values, a Community/Environment-based Project, a Vocational Elective, Industry 4.0 Technologies, and K-Explore that consider students' co- and extra-curricular activities for evaluation.
7. The curricula have included subjects like Scientific and Technical Writing and Research Methods and Ethics to instill research and research communication skills in the students.
8. The curricula have also provided for independent projects in the last three semesters to train the students in the art and science of identifying pressing problems and finding their sustainable solutions.

Notes and Guidelines

<u>Science Core</u>

Science forms the foundation of engineering. Subjects related to physical, chemical, biological, environmental, and mathematical sciences are covered in the first four semesters in the form core and elective subjects. The core subjects in science are the following:

Semester I/II: Physics, Chemistry, Science of Living Systems, Environmental Science, Differential Equations and Linear Algebra, Transform Calculus and Numerical Analysis, Physics Lab, and Chemistry Lab.

Semester III: Probability & Statistics

Semester IV: Selected Topics in Mathematics (Syllabi to be different for different Schools)

Engineering Science Core

Engineering science subjects provide a bridge between science and engineering. The related subjects are included as both core and electives. The semester-wise distribution of the core engineering science subjects is given below.

Semester I/II: Basic Electronics, Programming & Data Structures or Programming Lab, Engineering Drawing & Graphics, Workshop Practice, and Engineering Lab

Half the number of experiments in Engineering Lab will relate to Basic Electronics and the other half to the subject the student picks from the list of Engineering Elective I subjects.

Semester III: Industry 4.0 Technologies

HASS Core

The curricula include HASS subjects as both core and electives. The HASS subjects that improve the written and rhetoric skills, life skills and research skills of students are included as core subjects. Semester-wise distribution of these subjects are given below:

The semester-wise distribution of language- and human values-related subjects is given below:

Semester I/II: English (to develop language skills and skills for making critical analysis of English literature)

Semester I/II: Communication Lab (to develop skills of Listening, Speaking, and Writing)

Semester I/II: Yoga (to bring about unity of mind and body)

Semester III: Scientific and Technical Writing (to develop skills of writing varieties of scientific and technical documents)

Semester VI: Universal Human Values (to develop and respect human values) and Engineering Professional Practice (to understand roles and responsibilities of engineers and the ethical and selected legal issues)

Semester VIII: Research Methods and Ethics (for B. Tech. (Res.) students)

Professional Core

Professional core subjects form the backbone of an engineering discipline. Every School of Technology decides the list of core subjects that its students must credit. These can be theory and laboratory subjects. These subjects are diffused in Semester III through Semester VI.

Engineering Professional Practice, a professional core subject, is included as a HASS Elective but will be taught by engineering faculty.

Research Core

Students pursuing B. Tech. (Res.) programme have to go through a course on Research Methods and Ethics, which is offered in Semester VII.

Science, Engineering Science, and HASS Electives

Options are available to the students to choose subjects from lists of science, engineering science, and HASS electives. Their distributions in the curricula are as under:

Semester I/II: Science Electives, Engineering Electives I and II, and HASS Electives I.

Semester IV: HASS Electives II

Semester V: HASS Electives III

Semester VI: HASS Electives IV

HASS Elective I includes Community/Environment-based project as one of the subjects. Done as a group work, the subject gives the students an opportunity to connect with the community and the environment, learn and prioritize their problems, and define them in ways that make them amenable to scientific analysis and pragmatic solution.

The lists of Science, Engineering Science, and HASS electives will be available in the ERP. Before a semester begins the Institute will announce the subjects that will be offered in that semester and the students will have to give their choice of electives out of the offered subjects.

Vocational Elective

Vocational Elective courses provide engineering students a deeper appreciation of the practical aspects of engineering and allow them to relate their theoretical knowledge with practical skills. This subject is included in Semester III. A student must opt for one of the vocational electives which will be announced at the beginning of a semester.

Open Electives

Open electives allow students to choose subjects from lists of subjects offered by all the Schools. It is through these subjects that a student can pursue his or her latent interests in specific areas and work towards earning a Minor in an area which is outside his (or her) major engineering branch (if the subjects are selected in specific designated areas). These subjects are offered in Semester V through Semester VIII:

Semester V:	K-Explore—Practice-based Open Elective I
Semester VI – VIII:	Open Electives II, III, and IV

K-Explore is a 1-Credit Practice-based Open Elective that allows the students to use the scope that the Clubs and the Societies of KIIT University provides to learn the skills of Dance, Music, Photography, etc. and of conducting seminars and conferences through training, practice, and direct involvement.

Minor

The curricula allow a student to earn a Minor in an area outside the core discipline in which he (or she) has registered. For example, a student doing B. Tech in Mechanical Engineering (his/her parent branch) can choose to have a Minor in Computer Science Engineering. To get a Minor, a student must

(i) Get the fourth semester CGPA of 7.0 or more,

(ii) Successfully fulfill the coursework requirement for at least six theory subjects and two credit Lab/project subjects in an area or discipline other than the one for which he (or she) is registered, and

(iii) Complete at least 20 Credits of coursework in that area.

Thus, if a student has taken three Open Electives in one area other than his (or her) own then he (or she) must choose three theory subjects and two Lab/project subjects in that area in the Fourth year.

If no Lab subject is available in that Minor, then the student must choose an additional theory subject with at least 2 Credits. Students having no backlogs till the end of Semester 4 and a minimum CGPA of 7.0 will only be allowed to opt for the Minor scheme. Students opting for Minor have to mandatorily attend a minimum of 75% Theory and Lab classes (as the case may be) failing which the Minor option will be withdrawn.

Professional Electives

Professional elective subjects provide the students the opportunity to concentrate in certain specific areas of their interest. These subjects are offered in Semester V through Semester VIII for B. Tech. (Hons.) students (total 15 credits) and in Semester V through Semester VI for B. Tech. (Res.) students (total 9 credits). The distribution of these subjects is given below:

Semester V:	Professional Electives (6),
Semester VI:	Professional Electives (3),
Semester VII:	Professional Electives Theory (3 Credits) for only B. Tech (Hons.) students
Semester VIII:	Professional Core Theory (3 Credits) for only B. Tech (Hons.) students

Research Electives

The students pursuing B. Tech. (Res.) degree may need specialized knowledge in the areas of their theses. For this reason, the curriculum provides for two research electives to be selected in Semester VII and Semester VIII. Every School prepares a list of Research Electives and announces, at the beginning of every semester, the subject which will be offered in that semester. The student is required to select the electives from out of these offered lists.

Summer Internship

Internship exposes the students to the realities of engineering systems. Every student must go through at least 60 days of internship. It can be taken in an industrial organization or at an institute of higher learning in the summer breaks after the second year and/or after the third year. Internship carries 2 Credits. And the grade secured by a student appears in the Semester VII Grade Sheet of the student.

Projects

Projects allow the students to work under the supervision of a faculty advisor and apply their acquired knowledge to solve the real-world problems. They define problems, mine information from past works, conceptualize forces and factors that impact the problems, develop design solutions, and demonstrate the effectiveness of the solutions. Semester-wise distribution of this subject is given below:

Semester VI: Mini Project (2 Credits)

Semester VII: Project I (5 Credits)

Semester VIII: Project II (9 Credits for B. Tech. (Hons.) and 12 Credits for B. Tech. (Res.))

Semester-away Provision for Project II

The Institute sometimes allows a student to carry out the fourth-year project (Project II) away from the University campus if the following conditions are satisfied:

- This provision applies to Project II.
- That means a student can avail of this provision in Semester VIII.
- The project must be done either in an industrial unit or in an academic institution.
- The organization in which the student wishes to carry out the project must give in writing that it will provide all facilities (office space, equipment, instrument, data, and travel and stay facilities, if possible) for the student to do the project. In addition, it will also identify a senior and competent employee of the organization to whom the student will report.
- The faculty supervisor must recommend the student's application for availing the semester-away provision.
- A co-supervisor from the organization may be appointed for the project.
- The intending student gives an undertaking that he (or she) will
  - Remain in constant touch with the faculty supervisor,
  - Send monthly progress reports to the supervisor,
  - Give seminar presentations, whenever required.

- Collect class notes, read books, and prepare for and appear at the examinations (online, if necessary). The student must also do and submit all home assignments given by the teachers and give seminar presentation (online) if necessary.

- Since Semester VIII curricula have one theory subject (B. Tech. (Res.)) and two theory subjects (B. Tech. (Hons.)) students, a student applying for this provision will be exempted from attending the lectures on these subjects. But the student must give an undertaking that it will be his (or her) responsibility to collect class notes, read books and other reading materials, submit all home assignments, give seminar presentations (online if required) and prepare for and appear at the examinations.

SCHEME I
FIRST SEMESTER

Sl. No.	Course Code	Subject	L	T	P	Total	Credit
Theory							
1	PH10001	Physics	3	0	0	3	3
2	MA11001	Differential Equations and Linear Algebra	3	1	0	4	4
3		Science Elective	2	0	0	2	2
4		Engineering Elective	2	0	0	2	2
5	LS10001	Science of Living Systems	2	0	0	2	2
6	CH10003	Environmental Science	2	0	0	2	2
Total Credit (Theory Subjects)						**15**	**15**
Practical							
1	PH19001	Physics Lab	0	0	2	2	1
2	CS13001	Programming Lab	0	2	4	6	4
Sessional							
1	CE18001	Engineering Drawing and Graphics	0	0	2	2	1
Total Credit (Practical & Sessional subject)						**10**	**6**
Total Credit (Semester)						**25**	**21**

SCHEME I

SECOND SEMESTER (Computer Science and Electronics)

Sl. No.	Course Code	Subject	L	T	P	Total	Credit
Theory							
1	CH10001	Chemistry	3	0	0	3	3
2	MA11002	Transform Calculus and Numerical Analysis	3	1	0	4	4
3	HS10001	English	2	0	0	2	2
4	EC10001	Basic Electronics	2	0	0	2	2
5	EE10002	Basic Electrical Engineering	2	0	0	2	2
6		HASS Elective I	2	0	0	2	2
Total Credit (Theory Subjects)						**15**	**15**
Practical							
1	CH19001	Chemistry Lab	0	0	2	2	1
2	EX19001	Engineering Lab	0	0	2	2	1
Sessional							
1	ME18001	Workshop	0	0	2	2	1
2	YG18001	Yoga	0	0	2	2	1
3	HS18001	Communication Lab	0	0	2	2	1
Total Credit (Practical & Sessional subject)						**10**	**5**
Total Credit (Semester)						**25**	**20**

SCHEME I

SECOND SEMESTER (Civil, Mechanical and Electrical)

Theory							
Sl. No.	**Course Code**	**Subject**	**L**	**T**	**P**	**Total**	**Credit**
1	CH10001	Chemistry	3	0	0	3	3
2	MA11002	Transform Calculus and Numerical Analysis	3	1	0	4	4
3	HS10001	English	2	0	0	2	2
4	EC10001	Basic Electronics	2	0	0	2	2
5	ME10001	Engineering Mechanics	2	0	0	2	2
6		HASS Elective I	2	0	0	2	2
Total Credit (Theory Subjects)						**15**	**15**
Practical							
1	CH19001	Chemistry Lab	0	0	2	2	1
2	EX19001	Engineering Lab	0	0	2	2	1
Sessional							
1	ME18001	Workshop	0	0	2	2	1
2	YG18001	Yoga	0	0	2	2	1
3	HS18001	Communication Lab	0	0	2	2	1
Total Credit (Practical & Sessional subject)						**10**	**5**
Total Credit (Semester)						**25**	**20**

SCHEME II

FIRST SEMESTER

Theory							
Sl. No.	**Course Code**	**Subject**	**L**	**T**	**P**	**Total**	**Credit**
1	CH10001	Chemistry	3	0	0	3	3
2	MA11001	Differential Equations and Linear Algebra	3	1	0	4	4
3	HS10001	English	2	0	0	2	2
4	EC10001	Basic Electronics	2	0	0	2	2
5	EE10002	Basic Electrical Engineering	2	0	0	2	2
6		HASS Elective I	2	0	0	2	2
Total Credit (Theory Subjects)						**15**	**15**
Practical							
1	CH19001	Chemistry Lab	0	0	2	2	1
2	EX19001	Engineering Lab	0	0	2	2	1
Sessional							
1	ME18001	Workshop	0	0	2	2	1
2	YG18001	Yoga	0	0	2	2	1
3	HS18001	Communication Lab	0	0	2	2	1
Total Credit (Practical & Sessional subject)						**10**	**5**
Total Credit (Semester)						**25**	**20**

SCHEME II
SECOND SEMESTER

Theory							
Sl. No.	**Course Code**	**Subject**	**L**	**T**	**P**	**Total**	**Credit**
1	PH10001	Physics	3	0	0	3	3
2	MA11002	Transform Calculus and Numerical Analysis	3	1	0	4	4
3		Science Elective	2	0	0	2	2
4		Engineering Elective	2	0	0	2	2
5	LS10001	Science of Living Systems	2	0	0	2	2
6	CH10003	Environmental Science	2	0	0	2	2
Total Credit (Theory Subjects)						**15**	**15**
Practical							
1	PH19001	Physics Lab	0	0	2	2	1
2	CS13001	Programming Lab	0	2	4	6	4
Sessional							
1	CE18001	Engineering Drawing & Graphics	0	0	2	2	1
Total Credit (Practical & Sessional subject)						**10**	**6**
Total Credit (Semester)						**25**	**21**

LIST OF ELECTIVES

Engineering Elective							
Sl. No.	Course Code	Subjects	L	T	P	Total	Credit
1	CE10001	Basic Civil Engineering	2	0	0	2	2
2	ME10003	Basic Mechanical Engineering#	2	0	0	2	2
3	EE10001	Elements of Machine Learning*	2	0	0	2	2
4	EC10003	Biomedical Engineering	2	0	0	2	2
5	EE10003	Basic Instrumentation	2	0	0	2	2

#Not for student of Mechanical Engineering
*Not for students of Computer Engineering

Science Elective							
Sl. No.	Course Code	Subjects	L	T	P	Total	Credit
1	CH10005	Nanoscience	2	0	0	2	2
2	PH10003	Smart Materials	2	0	0	2	2
3	LS10003	Molecular Diagnostics	2	0	0	2	2
4	PE10002	Science of Public Health	2	0	0	2	2
5	MA10003	Optimization Techniques	2	0	0	2	2

HASS Elective I							
Sl. No.	Course Code	Subjects	L	T	P	Total	Credit
1	HS10013	Society, Science, and Technology	2	0	0	2	2
2	HS10202	Essential of Management	2	0	0	2	2
3	HS10121	Shades of Economics	2	0	0	2	2
4	HS10123	Indian Economy Post Liberalisation	2	0	0	2	2
5	SO10043	Socio-Political Environment	2	0	0	2	2
6	PS10043	Thinking Perspectives	2	0	0	2	2
7	PS10045	Creativity, Innovation and Entrepreneurship	2	0	0	2	2
8	EX17001	Community/Environment-based Project	2	0	0	2	2

SEMESTER- III

Sl. No	Course Code	Subject	L	T	P	Total	Credit
Theory							
1	EX20003	Scientific and Technical Writing	2	0	0	2	2
2	MA21001	Probability and Statistics	3	1	0	4	4
3	EE20001	Network Theory	3	0	0	3	3
4	EE20010	Electrical Machines	3	0	0	3	3
5	ES20001	Data Structure and Algorithms	3	0	0	3	3
6	EE20007	Analog and Digital Electronics Circuit	3	0	0	3	3
Total credit (Theory Subjects)						**18**	**18**
Practical							
1	EE29002	Electrical Machines Laboratory	0	0	2	2	1
2	ES29001	Data Structure and Algorithms Lab	0	0	2	2	1
3	EE29005	Analog and Digital Circuit Design Laboratory	0	0	2	2	1
Total credit (Practical Subjects)						**06**	**03**
Sessional/Vocational							
1		Vocational Electives	0	0	2	2	1
Total credit (Vocational Subjects)						**02**	**01**
Total Practical & Sessional/Vocational						**08**	**04**
Total Credit (Semester)						**26**	**22**

SEMESTER- IV

Sl. No	Course Code	Subject	L	T	P	Total	Credit
Theory							
1		HASS Elective II	3	0	0	3	3
2	MA21006	Vectors, Differential Equations and Complex Analysis	3	1	0	4	4
3	EE20004	Linear Control System	3	0	0	3	3
4	ES20002	Computer Organization	3	0	0	3	3
5	ES20004	Introduction to Data Base Management System	3	0	0	3	3
6	EX20001	Industry 4.0 Technologies	2	0	0	2	2
Total credit (Theory Subjects)						**18**	**18**
Practical							
1	ES29002	Data Base Management System Lab	0	0	2	2	1
2	EE29004	Control System Laboratory	0	0	2	2	1
Total credit (Practical Subjects)						**04**	**02**
Sessional/Vocational							
1	EE28002	Electrical System Modeling Using MATLAB	0	0	2	2	1
Total credit (Vocational Subjects)						**02**	**01**
Total Practical & Sessional/Vocational						**06**	**03**
Total Credit (Semester)						**24**	**21**

SEMESTER- V

Theory							
Sl. No	**Course Code**	**Subject**	**L**	**T**	**P**	**Total**	**Credit**
1	HS30101	Engineering Economics	3	0	0	3	3
2		HASS Elective II	3	0	0	3	3
3	EE31003	Power Electronics and Drives	3	1	0	4	4
4	ES30001	Operating Systems Concept	3	0	0	3	3
5		Professional Elective-I	3	0	0	3	3
6	HS30401	Universal Human Values	3	0	0	3	3
Total credit (Theory Subjects)						**19**	**19**
Practical							
1	ES39001	Power Electronics and Drives Laboratory	0	0	2	2	1
Total credit (Practical Subjects)						**02**	**01**
Sessional/Vocational							
1	ES38001	Python Programming	0	0	2	2	1
2	ES38003	Sensor Modeling and Simulation	0	0	2	2	1
3	ES38005	Embedded System Design and Interfacing	0	0	2	2	1
4		K-Explore (Practice-oriented Open Elective I)	0	0	0	0	1
Total credit (Vocational Subjects)						**06**	**04**
Total Practical & Sessional/Vocational						**08**	**05**
Total Credit (Semester)						**27**	**24**

SEMESTER- VI

Theory							
Sl. No	**Course Code**	**Subject**	**L**	**T**	**P**	**Total**	**Credit**
1	ES30002	Signal Processing	3	0	0	3	3
2	ES30004	Data Communication and Computer Networks	3	0	0	3	3
3	EE31004	Power System Engineering	3	1	0	4	4
4		Professional Elective-II	3	0	0	3	3
5		Professional Elective-III	3	0	0	3	3
6		Open Elective II/(MI-1)	3	0	0	3	3
Total credit (Theory Subjects)						**19**	**19**
Practical							
1	ES39002	Power System Engineering Laboratory	0	0	2	2	1
2	ES39004	Data communication and computer networks Laboratory	0	0	2	2	1
Total credit (Practical Subjects)						**04**	**02**

Sessional/Vocational							
1	EE38002	IOT in Engineering	0	0	2	2	1
2	ES37002	Mini Project	0	0	4	4	2
Total credit (Vocational Subjects)						**06**	**03**
Total Practical & Sessional/Vocational						**10**	**05**
Total Credit (Semester)						**29**	**24**

SEMESTER- VII (For Honours Options Students)

Theory							
Sl. No	**Course Code**	**Subject**	**L**	**T**	**P**	**Total**	**Credit**
1		Professional Elective-IV	3	0	0	3	3
2		Open Elective III/(MI-2)	3	0	0	3	3
3	EX40003	Engineering Professional Practice	2	0	0	2	2
4		(MI-3)	3	0	0	3	3
5		(MI-4)	3	0	0	3	3
Total credit (Theory Subjects)						**08**	**08**
Sessional/Vocational							
1	ES48001	Internship	0	0	0	0	2
2	ES47001	Project-1	0	0	10	10	5
3		(Project/Lab-Minor)	0	0	4	4	2
Total credit (Practical Subjects)						**10**	**07**
Sessional/Vocational							
Total Practical & Sessional/Vocational						**10**	**07**
Total Credit (Semester)						**18**	**15**

SEMESTER- VIII (For Honours Options Students)

Theory							
Sl. No	**Course Code**	**Subject**	**L**	**T**	**P**	**Total**	**Credit**
1		Professional Elective-V	3	0	0	3	3
2		Open Elective IV/(MI-5)	3	0	0	3	3
3		(MI-6)	3	0	0	3	3
Total credit (Theory Subjects)						**06**	**06**
Sessional/Vocational							
1	ES47002	Project-II	0	0	18	18	9
Total credit (Vocational Subjects)						18	9
Total Practical & Sessional/Vocational						**18**	**09**
Total Credit (Semester)						**24**	**15**

SEMESTER- VII (For Research Options Students)

Theory							
Sl. No	**Course Code**	**Subject**	**L**	**T**	**P**	**Total**	**Credit**
1		Research Elective-I	3	0	0	3	3
2		(MI-2)	3	0	0	3	3
3	EX40003	Engineering Professional Practice	2	0	0	2	2
	EX40001	Research Methods and Ethics					
4		(MI-3)	3	0	0	3	3
5		(MI-4)	3	0	0	3	3
Total credit (Theory Subjects)						**08**	**08**
Sessional/Vocational							
1	ES48001	Internship	0	0	0	0	2
2	ES47003	Project-1	0	0	10	10	5
3		(Project/Lab-Minor)	0	0	4	4	2
Total credit (Practical Subjects)						**10**	**07**
Sessional/Vocational							
Total Practical & Sessional/Vocational						**10**	**07**
Total Credit (Semester)						**18**	**15**

SEMESTER- VIII (For Research Options Students)

Theory							
Sl. No	**Course Code**	**Subject**	**L**	**T**	**P**	**Total**	**Credit**
1		Professional Elective II	3	0	0	3	3
2		(MI-5)	3	0	0	3	3
3		(MI-6)	3	0	0	3	3
Total credit (Theory Subjects)						**03**	**03**
Sessional/Vocational							
1	ES47004	Research Project-II	0	0	24	24	12
Total credit (Vocational Subjects)						24	12
Total Practical & Sessional/Vocational						24	12
Total Credit (Semester)						**27**	**15**

Professional Electives:

PE-I

Sl. No	Code	Subject	Credit
1	EE30011	Electromagnetic Field Theory	3
2	EE30004	Microprocessors and Embedded System	3
3	EE30012	Sensors and Actuators	3
4	ES30011	Computational Intelligence Techniques	3
5	ES30013	Principles of Algorithm Analysis (DAA)	3
6	ES30015	Machine Learning	3

PE-II

Sl. No	Code	Subject	Credit
1	EE40042	Robotics and Control	3
2	EE30016	Renewable Energy Resource	3
3	EE30002	Principles of Communication Engineering	3
4	ES30012	Theory of Computation	3
5	ES30014	Web Technology	3
6	ES30016	Data Mining	3

PE-III

Sl. No	Code	Subject	Credit
1	EE30014	Power Generation and Control	3
2	EE30042	Energy Storage Technology	3
3	EE40009	Industrial Automation	3
4	ES30018	Cyber Security	3
5	ES30020	Compiler Design	3
6	ES30022	Deep Learning	3

PE-IV

Sl. No	Code	Subject	Credit
1	EE40053	Hybrid Electric Vehicles	3
2	EE30006	Power System Operation and Control	3
3	EE30020	Energy Audit and Accounting	3
4	ES40011	Principle of Software Engineering	3
5	ES40013	Cloud Computing	3
6	ES40015	High Performance Computing	3

PE-V

Sl. No	Code	Subject	Credit
1	EE40012	Smart Grid	3
2	EE30021	Semiconductor Fabrication Design and Technology	3
3	EE40054	Numerical Relay and Digital Protection	3
4	ES40012	Quantum Computing	3
5	ES40014	Artificial Intelligence	3
6	ES40016	Big Data	3

Research Elective-I

Sl. No	Code	Subject	Area
1	EE40019	Power Converter Analysis and Design	Drives and Electric Vehicle
	EE40021	Battery Management System	
2	EE40023	Power Quality	Power system
	EE40025	State estimation and security	
3	EE40027	Renewable Energy resources assessment and forecasting	Renewable energy
	EE40029	Wind Turbine and Aerodynamics	

Research Elective-II

Sl. No	Code	Subject	Area
1	EE40020	Digital System Design using FPGA	Drives and Electric Vehicle
	EE40022	Vehicle Charging Technology	
2	EE40024	Distributed generation of Microgrid	Power system
	EE40026	Synchrophasors Application to Power System	
3	EE40028	Grid Integration and Control	Renewable energy
	EE40030	Energy Systems Modelling and Analysis	

HASS ELECTIVE

HASS Elective II

Sl. No	Code	Subject	Credit
1	HS 20220	Organizational Behaviour	3
2	HS20222	Human Resource Management	3
3	HS 20120	Economics of Development	3
4	HS 20122	International Economic Cooperation	3

HASS Elective III

Sl. No	Code	Subject	Credit
1	HS 30225	Business Ethics and Corporate Social Respo nsibility	3
2	HS 30227	Leadership and Team Effectiveness	3
3	HS 30125	Market Structure and Pricing Policies	3
4	HS 30127	Pragmatic Inquiry	3
5	HS 30129	Economic Analysis of Decision Rules	3
6	HS 30131	Economics of Health and Education	3
7	HS30421	Gender Studies	3
8	HS30423	Tribal Resource Management	3
9	HS30425	Indian Knowledge System	3

Vocational courses offered by School of Civil Engineering

Sl. No.	Course Code	Subjects
1	CE28001	Building Drawing, Estimation & Costing (for Civil Engineering Students)
2	CE28003	GIS & GPS Applications (For other branch students)

Vocational courses offered by School of Computer Science Engineering

Sl. No.	Course Code	Subjects
1	CS28001	Web Design

Vocational courses offered by School of Electrical Engineering

Sl. No.	Course Code	Subjects
1	EE28011	Industrial wiring and control panel design
2	EE28013	Installation, operation and maintenance of solar power system
3	EE28015	Domestic wiring and home automation
4	EE28017	Cyber physics application in industrial IOT
5	EE28019	Industrial Control and Remote Monitoring
6	EE28021	MATLAB Applications

Vocational courses offered by School of Electronics Engineering

Sl. No.	Course Code	Subjects
1.	EC28001	Computational Photography
2.	EC28003	Sound Engineering
3.	EC28005	Sensors for Automation
4.	EC28007	PCB Design

Vocational courses offered by School of Mechanical Engineering

Sl. No.	Course Code	Subjects
1	ME28011	Additive Manufacturing(3-D Printing)
2	ME28013	Die development by CNC milling
3	ME28015	Concept Car Manufacturing
4	ME28017	Development of Autonomous Wheeled Robots
5	ME28019	Modelling of Micro-Wind turbine by 3D CAD Design

K-EXPLORE OPEN ELECTIVE COURSES OFFERD KSAC

Sl. No.	Course Code	Subjects
1	SA38001	Robotics
2	SA38003	Web Designing
3	SA38005	Civil-Tech
4	SA38007	Circuit Design & Control
5	SA38009	Indian Classical, Folk and Bollywood Dance
6	SA38011	Indian Classical & Western Music
7	SA38013	Graphic Designing & Editing
8	SA38015	Art & Craft
9	SA38017	Theatre & Street Play
10	SA38019	Film Making
11	SA38021	Debating, Public Speaking& Anchoring
12	SA38023	Creative Writing
13	SA38025	Photography & Videography
14	SA 38027	Fashion Styling
15	SA 38029	Culinary Arts
16	SA 38031	Quiz Activity
17	SA 38033	Social Outreach
18	SA 38035	Health and Emergency Care

OPEN ELECTIVES AND MINORS

Civil Engineering

SEMESTER – VI						
Course Code	**Open Elective Courses**	**Pre-requisite**	**Minor in**			
			Water Resources Management	**Urban Environmental Management**	**Geohazard Mitigation and Management**	**Urban Transportation Management**
CE30072	Fundamentals of Project Management	Nil				
CE30074	Elements of Surface Hydrology	Nil				
CE30076	Environmental Pollution and Control	Nil				
CE30078	Municipal Solid Waste Management	Nil				
CE30052	Surface & Groundwater Hydrology	Nil	X			
CE30054	Water Supply & Quality Management	Nil		X		
CE30056	Geomaterial characterization	Nil			X	
CE30058	Highway Material Characterization	Nil				X
SEMESTER – VII						
CE40081	Disaster Management	Nil				
CE40083	Coastal Management	Nil				
CE40085	Basic Groundwater Hydrology	Nil				
CE40087	Clean water & Sanitation	Nil				
CE40065	Geo-hazards Risk Management	Nil			X	
CE40051	Basic Fluid Mechanics & Hydraulics	Nil	X			
CE40053	Remote Sensing & GIS	Nil	X	X		
CE40055	Irrigation Water Management	Nil	X			
CE40057	Urban Waste Management	Nil		X		
CE40059	Urban Storm Water Management	Nil		X		
CE40061	Landslide hazards and protection	Nil			X	
CE40063	Earthquake hazards and	Nil			X	

	mitigation					
CE40067	Traffic Analysis and Management	Nil				X
CE40069	Railway and Airport Planning	Nil				X
CE40071	Road Safety Analysis	Nil				X
SEMESTER – VIII						
CE40082	Global Warming & Climate Change	Nil				
CE40084	Construction Materials & Specifications	Nil				
CE40086	Natural Resources Management	Nil				
CE40088	Basic Transportation Engineering	Nil				
CE40050	Gender & Legal Aspects in Water Resources Management	Nil	X			
CE40052	Environmental Impact Assessment & Auditing	Nil	X	X		X
CE40054	Air Pollution Control & Management	Nil		X		
CE40056	Groundwater contamination and remediation	Nil			X	
CE40058	Geotechnical instrumentation and monitoring	Nil			X	
CE40060	Fundamentals of Urban Transportation Planning	Nil				X

Minor Lab / Project (Students pursuing 4 years B.Tech. Hons or B.Tech. Research program along with Minor program)

Course Code	Course	Pre-requisite	Minor Specialization			
			Water Resources Management	**Urban Environmental Management**	**Geohazard Mitigation and Management**	**Urban Transportation Management**
CE49001	Water Resources Lab	Nil	X			
CE49003	Environmental Quality Lab	Nil		X		

CE49005	Geomaterial Lab	Nil			X	
CE49007	Highway Infrastructure Lab	Nil				X

Computer Science and Engineering

Semester VI			
Course Code	**Open Elective Courses**	**Pre-requisite**	**Minor in Computer Science**
CS30001	Design and Analysis of Algorithms	Nil	
CS30018	Software Engineering Fundamentals	Nil	
CS30020	Essentials of Computer Science	Nil	
CS30022	Object Oriented Programming	Nil	
CS30024	Fundamentals of Data Structures	Nil	
CS30011	Computational Intelligence	Nil	
CS40002	Nature Inspired Computing	Nil	

Semester VII			
Course Code	**Open Elective Courses**	**Pre-requisite**	**Minor in Computer Science**
CS30001	Design and Analysis of Algorithms	Nil	
CS30018	Software Engineering Fundamentals	Nil	
CS30020	Essentials of Computer Science	Nil	X
CS30022	Object Oriented Programming	Nil	
CS30024	Fundamentals of Data Structures	Nil	X
CS30011	Computational Intelligence	Nil	
CS40002	Nature Inspired Computing	Nil	

Semester VIII			
Course Code	**Open Elective Courses**	**Pre-requisite**	**Minor in Computer Science**
CS30001	Design and Analysis of Algorithms	Nil	X
CS30018	Software Engineering Fundamentals	Nil	
CS30020	Essentials of Computer Science	Nil	
CS30022	Object Oriented Programming	Nil	
CS30024	Fundamentals of Data Structures	Nil	
CS30011	Computational Intelligence	Nil	
CS40002	Nature Inspired Computing	Nil	

Minor Lab / Project (Students pursuing 4 years B.Tech. Hons or B.Tech. Research program along with Minor program)

Course Code	Courses	Pre-requisite
CS39008	Computing Laboratory	Nil

Electrical Engineering

SEMESTER – VI					
Course Code	**Open Elective Courses**	**Pre-requisite**	**Minor in**		
			Electrical Engineering	**Smart Electric Vehicles**	**Industrial IoT**
EE30034	Network Analysis	Nil	X	X	X
EE30016	Renewable Energy Resources	Nil	X	X	
EE30036	Solar Power Technology	Nil			
EE30038	Introduction to Electrical Machines	Nil	X	X	X
EE30040	Energy and Environment	Nil			
EE20007	Analog and Digital Electronics Circuits	Nil	X	X	
EE20005	Measurements and Sensors Technology	Nil	X		
SEMESTER – VII					
EE40031	Fuel Technology	Nil			
EE40033	Energy Audit and Management	Nil	X		
EE20004	Linear Control System	Nil	X	X	X
EE30012	Sensors and Actuators	Nil		X	X
EE40035	Energy Storage Technology	Nil	X	X	
EE30004	Microprocessors and Embedded System	Nil	X		
EE40020	Digital System Design using FPGA	Nil		X	X
EE30022	Special Machines and control	Nil		X	
EE40044	Hybrid Electric Vehicles	Nil		X	
EE40042	Robotics and Control	Nil			X
EE40047	Cyber security	Nil			X
EE40048	Wireless network systems	Nil			X
SEMESTER – VIII					
EE30007	Power Transmission and	Nil	X		

	Distribution				
EE30001	Power Electronics	Nil	X		
EE30024	Electric Drives and Control	Nil	X		
EE40041	Power System Protection	Nil	X		
EE40046	IoT in Electric Vehicles	Nil		X	
EE40022	Vehicle Charging Technology	Nil		X	
EE40045	Hydrogen and fuel cell technology for Electric and hybrid Vehicle	Nil		X	
EE40049	IoT in Industry	Nil			X
EE40050	Smart Bio-Medical Instruments	Nil			X
EE40051	Bio-Inspired Algorithm	Nil			X
EE40052	IoT Sensors and Protocols	Nil			X

Minor Lab / Project (Students pursuing 4 years B.Tech. Hons or B.Tech. Research program along with Minor program)

Course Code	Course	Pre-requisite	Minor Specialization		
			Electrical Engineering	**Smart Electric Vehicles**	**Industrial IoT**
EE29002	Electrical Machines Laboratory	Nil	X		
EE39001	Power Electronics Laboratory	Nil	X		
EE49001	Power System Protection Lab	Nil	X		
EE49005	Electric Vehicles Laboratory	Nil		X	
EE49003	IoT Laboratory	Nil		X	X
EE49002	Sensors and Control Laboratory	Nil		X	X
EE39007	PLC Laboratory	Nil			X

Electronics Engineering

SEMESTER – VI

Course Code	Open Elective Courses	Pre-requisite	Minor in			
			Minor in Communication and Networking	Minor in VLSI and Embedded System	Minor in Applied Machine Learning	Minor in Cyberphysical Systems
EC30014	Circuits, Signals and Communication	NIL	X	X	X	X
EC30016	Introduction to Sensor Technology	EC10001				X
EC30018	Evolution of Communication Technology	NIL				
EC30020	Electronics and PCB Design	NIL				
EC40001	Optimization Techniques in Engineering	NIL				

SEMESTER – VII

Course Code	Open Elective Courses	Pre-requisite	Minor in			
			Minor in Communication and Networking	Minor in VLSI and Embedded System	Minor in Applied Machine Learning	Minor in Cyberphysical Systems
EC40031	Principles of Opto-Electronics	EC30014/ EC10001				
EC40033	Principle of Modern Communication Systems	EC30014/ EC10001				
EC40023	Consumer Electronics	EC30014/ EC10001				
EC40025	Fundamentals of Data Acquisition Systems	NIL				
EC40027	Embedded System Design and Applications	EC10001		X	X	X
EC40029	Communication Network Fundamentals	EC21002/ EC20008/ EC30014	X			
EC20007	Semiconductor Technology	Nil		X		
EM30011	Data Mining	Nil			X	
EM30009	Data Analytics	Nil				X
EC300013	Optical and Satellite	EC21002/	X			

	Communication	EC20008				
EC30011	Digital System Design with Verilog	EC10001		X		
EC30010	Information Theory and Coding	EC20008/ EC30014	X			
EM40006	Cybersecurity	Nil				X
EM40008	Bioinformatics	LS10001			X	

SEMESTER – VIII

Course Code	Open Elective Courses	Pre-requisite	Minor in			
			Minor in Communication and Networking	Minor in VLSI and Embedded System	Minor in Applied Machine Learning	Minor in Cyberphysical Systems
EC40004	Quantum Engineering	NIL		X		
EC40020	Essence of Biomedical Signal Processing	MA11001 MA11002				
EC40022	Imaging Techniques	NIL				
EC30019	Mobile Ad Hoc Network	EC21002/ EC20008	X			
EM40010	Optimization Methods in Machine Learning	MA11001 MA11002 MA21001			X	
EC30021	Industrial IoT	EC20002/ EC30004				X
EM30004	Machine learning based Signal Processing	MA21001 / EC20001	X	X	X	X

Minor Lab / Project (Students pursuing 4 years B.Tech. Hons or B.Tech. Research program along with Minor program)

Course Code	Course	Pre-requisite	Minor Specialization			
			Minor in Communication and Networking	Minor in VLSI and Embedded System	Minor in Applied Machine Learning	Minor in Cyberphysical Systems
EC39002	Wireless Communication and Networking Lab	Nil	X			
EC29002	Communication Engineering Lab	Nil	X			
EC39001	VLSI Design Lab	Nil		X		
EC29005	Digital System Design Lab	Nil		X		
EC39004	Electronics Design Lab	Nil				X
EM47003	Project	Nil			X	X

Mechanical Engineering

SEMESTER – VI					
Course Code	Open Elective Courses	Pre-requisite	Minor in		
			Mechanical Engineering	Manufacturing Engineering	Industrial Engineering and Management
ME30050	Kinematics and Dynamics of Machinery	Nil	X		
ME20005	Material Science and Engineering	Nil		X	
ME30016	Supply Chain Management	Nil			X
ME30052	Introduction to Fluid Mechanics and Heat Transfer	Nil			
ME30054	Renewable Energy Sources	Nil			
ME30056	Finite Element Method for Engineers	Nil			
ME30058	Introduction to Composite Materials	Nil			
SEMESTER – VII					
ME40061	Engineering Metrology	Nil		X	
ME30005	Industrial Engineering and Operations Research	Nil	X	X	
	Manufacturing Processes	Nil	X	X	

ME40063	Quality Engineering	Nil			X
ME40065	Project Management	Nil			X
ME40067	Operations Research	Nil			X
ME40069	Thermodynamics and Hydraulic Devices	Nil	X		
ME40071	Biomechanics	Nil			
ME40073	Fundamentals of Computational Fluid Dynamics	Nil			
ME40075	Automobile Technology	Nil			
SEMESTER – VIII					
ME40062	Work System Design	Nil			X
ME30018	Power Plant Engineering	Nil	X		
ME40064	Mechanical System Design	Nil	X		
ME30015	Additive Manufacturing	Nil		X	
ME40066	Industrial Automation and Robotics	Nil		X	
ME40068	Production, Planning and Control	Nil			X
ME40070	Mechatronic Systems	Nil			
ME40072	Robotics	Nil			
ME40074	Computer Controlled Manufacturing Systems	Nil			

Minor Lab / Project (Students pursuing 4 years B.Tech. Hons or B.Tech. Research program along with Minor program)

Course Code	Open Elective Courses	Pre-requisite	Minor Specialization		
			Mechanical Engineering	Manufacturing Engineering	Industrial Engineering and Management
ME49011	Thermo fluids Lab	Nil	X		
ME28003	Manufacturing Practices	Nil	X	X	
ME49013	Metrology and Instrumentation Lab	Nil		X	
ME48011	Operations Research Sessional	Nil			X
ME49016	Work System Design Lab.	Nil			X

Humanities

SEMESTER – VI			
Course Code	**Open Elective Courses**	**Pre-requisite**	**Minor in** Financial Economics (Using Data Analytics)
HS30150	Foundations of Modern Macroeconomics	Nil	
HS30152	Money and Financial Markets	Nil	X
HS30154	Poverty to Prosperity	Nil	
HS30250	Organizational Change and Development	Nil	
HS30050	Indian Literature in Translation (ILT)	Nil	
HS30052	Climate Change Fiction	Nil	
HS30054	Introduction to Science Fiction	Nil	
SEMESTER – VII			
HS40151	Econometrics for Business Data Analysis	Nil	X
HS40153	Financial Economics	Nil	X
HS40155	Corporate Finance	Nil	X
HS40157	Employment, Employability and Growth	Nil	
SEMESTER – VIII			
HS40156	Public Economics	Nil	X
HS40158	Advanced Econometrics	Nil	X
HS47160	PROJECT	Nil	X
HS40162	Economic Inequality	Nil	

SEMESTER – VI			
Course Code	**Minor Courses**	**Pre-requisite**	**Minor in** Sustainable Development
CE30078	Municipal Solid Waste Management	Nil	
EE30032	Sustainable Energy and Applications	Nil	
HS30154	Poverty to Prosperity	Nil	X
EE30030	Solar Energy Utilization	Nil	
SEMESTER – VII			
CE40087	Clean Water & Sanitation	Nil	X
CE40065	Geo-Hazards Risk Management	Nil	X
EE40013	Wind and Biomass Energy	Nil	X
HS 40157	Employment, Employability and Growth	Nil	X
SEMESTER – VIII			
LS40002	Industrial Ecology and Design for Sustainability	Nil	X
EE40018	Waste Management and Energy Recovery	Nil	
HS40162	Economic Inequality	Nil	X

OPEN ELECTIVE COURSES OFFERD BY SCHOOL OF APPLIED SCIENCE

Theory							
Sl. No.	**Course Code**	**Subjects**	**L**	**T**	**P**	**Total**	**Credit**
1	MA30002	Advanced Numerical Techniques	3	0	0	3	3
2	CH40002	Composite Materials And Structures	3	0	0	3	3
3	MA40001	Finite Element Analysis	3	0	0	3	3
4	LS30002	Industrial Ecology And Design For Sustainability	3	0	0	3	3
5	PH40001	Quantum Computing	3	0	0	3	3
6	CH30002	Sustainable Energy And Environment	3	0	0	3	3
7	CH40001	Solid Waste Management	3	0	0	3	3

OPEN ELECTIVE COURSES OFFERD BY SCHOOL OF LAW

Sl. No.	Course Code	Subjects	L	T	P	Total	Credit
1	LW30910	Law of Patent	3	0	0	3	3
2	LW30904	Law of Contract	3	0	0	3	3
3	LW30908	Intellectual Property Rights Law	3	0	0	3	3
4	LW30914	Environmental Law	3	0	0	3	3
5	LW30918	Copyright Law	3	0	0	3	3
6	LW30920	Information Technology Law	3	0	0	3	3

OPEN ELECTIVE COURSE OFFERD BY SCHOOL OF PUBLIC HEALTH

Sl. No.	Course Code	Subjects	L	T	P	Total	Credit
1	PE30002	Health and Wellbeing	3	0	0	3	3

PEN ELECTIVE COURSES OFFERD BY SCHOOLOF RURAL MANAGEMENT

Sl. No.	Course Code	Subjects	L	T	P	Total	Credit
1	RM30152	Sustainable Rural Development	3	0	0	3	3
2	RM20152	Food Security	3	0	0	3	3

OPEN ELECTIVE COURSES OFFERD BY SCHOOL OF MANAGEMENT

Sl. No.	Course Code	Subjects	L	T	P	Total	Credit
1	BM30102	Training and Development	3	0	0	3	3
2	BM30202	Financial Management	3	0	0	3	3
3	BM30302	Marketing Management	3	0	0	3	3
4	BM30602	Basics of Management Information System	3	0	0	3	3
5	BM30702	Entrepreneurship	3	0	0	3	3
6	BM30802	Production and Operations Management	3	0	0	3	3

Theory Subjects (1st year)

PHYSICS

Course Code :PH10001

Credit :3

L-T-P :3-0-0

Prerequisite :Nil

COURSE OBJECTIVE

This subject is designed to enrich the basic knowledge of engineering students in the field of physics and to support the engineering and research programs. The subject will also help the students to develop mathematical models to understand the behavior of physical systems and phenomena.

COURSE OUTCOMES

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

CO1 :Learn the basic concepts of oscillation, waves, wave function and fields,

CO2 :Understand the principles of wave phenomena in light and matter, and the quantum mechanics,

CO3 :Apply the principles of oscillation, superposition of waves, electromagnetic theory, and quantum mechanics in different fields,

CO4 :Analyze different types of particle motion in different media,

CO5 :Evaluate the problem-solving skills for the topics learnt, and

CO6 :Develop critical thinking ability supported by the learned concepts of Physics.

COURSE CONTENT

Oscillation

Damped Harmonic Oscillation (underdamped, overdamped and critically damped), Energy decay, Relaxation time, Quality factor, Forced oscillation, Resonance, Coupled oscillations, Applications.

Waves and Interference

Wave equation, Superposition of waves, Interference of light, Types of interference: Division of wavefront and division of amplitude.

Interference in thin films

Wedge shaped thin film, Newton's rings and their applications, Michelson interferometer, Applications.

Diffraction

Diffraction and its applications, Types of diffraction, Fraunhofer diffraction by a single slit, Plane diffraction grating (condition of maxima, minima), Maximum order of observable spectra, Absent spectra, and Dispersive power, Applications.

Quantum Mechanics

Dual nature of radiation and matter, de Broglie hypothesis for matter waves, Phase velocity and Group velocity, Heisenberg's uncertainty principle and applications, Wave function and its interpretation, Concepts of operators, Schrodinger's time-dependent and time-independent equations, Postulates of Quantum mechanics, Particle in one-dimensional box and applications, Quantum tunnelling and applications.

Electromagnetic Theory

Vector calculus: scalar and vector field, Gradient, divergence and curl, Line, surface and volume integrals, Gauss divergence and Stoke's theorem, Maxwell's equations in differential and integral form with necessary derivations. Electromagnetic wave equations, Transverse nature of electromagnetic waves.

Laser and Fiber Optics

LASER: Properties and applications, Spontaneous and stimulated emission, Meta-stable state, Population inversion, Pumping, Three and four-level Laser, Ruby Laser.

Optical fiber

Principle, Construction, Types of optical fiber, Acceptance angle, Numerical aperture, Applications.

Text Books

1. B. K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Publication, New Delhi, 2nd Edition 2022, ISBN-13: 978-81-953536-7-5.

Reference Books

1. D J Griffiths, Introduction to Electrodynamics, Pearson Education, 4th Edition, 2015.
2. L. I. Schiff and J. Bandhyopadhyay, Quantum Mechanics, Tata McGraw-Hill Publications, 4th Edition, 2014, ISBN-9781259062865.
3. A K Ghatak, Optics, Tata McGraw-Hill Publications, 4th Edition, 2008, ISBN: 9780070262157.
4. A. Beiser, Concepts of Modern Physics ,Tata McGraw-Hill Publications, 6th Edition, 2002, ISBN 10: 0071234608.
5. R K Gaur and S. L. Gupta, Engineering Physics, Dhanpat Rai Publications, New Delhi, 2nd Edition, 2012, ISBN-10: 8189928228.

CHEMISTRY

Course Code: CH10001

Credit : 3

L-T-P :3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

This course is designed to enrich the students with the basic concepts in Chemistry and to strengthen their fundamentals which will support them to pursue education and research in engineering. The course will help the students to conceptualize alternative sources of energy by electrochemical means and use the instrumental techniques to explore chemical products.

COURSE OUTCOMES

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

CO1 : Rationalize bulk properties and processes using thermodynamic consideration and apply the knowledge to decide the feasibility of a given process,

CO2 : Analyze the kinetics of multistep reactions as well as the theories of reaction rates,

CO3 :Understand the importance of catalysis and their mechanism of action and applications,

CO4 : Apply the principles of electrochemistry to evaluate properties, such as pH, solubility Product, etc. and understand the working principle of modern batteries,

CO5 :Apply different spectroscopic techniques, such as UV-Vis, IR and NMR, for structural Elucidation, and

CO6 : Differentiate between smart and intelligent materials.

COURSE CONTENT

Chemical Equilibrium and Thermodynamics

Introduction, Internal energy, Enthalpy, Entropy and free energy, Dependence of free energy on temperature and pressure, Gibbs-Helmholtz equation, Free energy change and equilibrium constants, Van't Hoff isotherm and isochore, Clapeyron- Clausius equation, Partial molar properties, Chemical potential, and Gibbs-Duhem equation.

Chemical Kinetics

Rate of reaction and rate laws of multiple reactions (steady-state approximation), and of parallel, opposing and consecutive reactions; Theories of reaction rate: Collision theory, Lindemann modification, Absolute reaction rate; Catalysis: Types, theories, and kinetics of enzyme catalysis (Michaelis-Menten mechanism).

Spectroscopy

UV-Vis spectroscopy: Beer-Lamberts law, Types of transition, Concept of auxochrome and chromophores, Factors affecting λ_{max} and, Woodward-Fieser rules for calculation of λ_{max} in diene systems; IR spectroscopy: Types of vibration, Hooks law, detection of functional groups like C=C, -OH, $-NH_2$ and -C=O;

NMR Spectroscopy

Basics of NMR Spectroscopy: Theory, Chemical shift, Shilding-deshilding effect, Structural elucidation of simple compounds.

Electrochemical Energy Systems

Types of electrodes, electrode/cell potential; Nernst equation and application to: find electrode and cell potential, equilibrium constant, solubility product and pH; Modern batteries: Fuel cells (AFCs, PEMFs, SOFCs, MCFCs), Zn-air battery, Li-ion battery, Na-ion battery, Ni-MH battery.

Smart and Intelligent Materials

Introduction to smart materials, Properties and types of smart materials, Structures, System intelligence- components and classification of smart structures, Common smart materials and associated stimulus-response, Application areas of smart systems.

Text Book

1. S Chawala, Engineering Chemistry, Dhanpat Rai and Co, 4th Edition, ISBN: 9788177001938.

Reference Books

1. S Agarwal, Engineering Chemistry: Fundamentals and Applications, Cambridge University Press, ISBN: 9781107476417.
2. S. Chakroborty, S. Sen, and S. Mittal, Engineering Chemistry, Cengage Learning India Pvt. Ltd., ISBN: 9386668645.
3. B.R. Puri, L.R Sharma, and M. S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 47th Edition, ISBN: 978-9382956013.
4. R M. Silverstein, Fransis X, Webster, D J Kiemle, Spectrometric Identification of Organic compounds, -Jhon Wiley& Sons, INC, 7th Edition.
5. S Glasstone, Elements of Physical chemistry-, Macmillan publishers, 2nd Edition ISBN: 978-0333038437.
6. D.J. Leo, Engineering Analysis of Smart Material Systems, Wiley 2007, 1st Edition ISBN: 978-0471684770.

ENVIRONMENTAL SCIENCE

Course Code :CH10003

Credit :2

L-T-P :2-0-0

Prerequisite :Nil

COURSE OBJECTIVE

This course is designed to create awareness in the students on monitoring, assessment, and management of environmental pollutants. The subject will also make the students aware of more benign chemistry, i.e.,green chemistry, and help them to understand the implementation of Environmental Impact Assessment (EIA).

COURSE OUTCOMES

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

CO1 : Understand the components and composition of the environment along with the radiation balance model,

CO2 : Rationalize the different types of pollutants, their sources, effects, and control measures,

CO3 : Develop the idea of water purification strategies,

CO4 : Identify toxic wastes and conceptualize the principles of solid waste management,

CO5 : Conceptualize the principles of green chemistry and implement them in the synthesis of advanced material, to reduce pollution, and

CO6 :Provide for Environmental Impact Assessment (EIA) requirements before planning a project.

COURSE CONTENT

Overview of the Environment

Overview of the environment, terminologies, Components of Earth: Lithosphere, atmosphere, hydrosphere and biosphere, Concept of black body radiation and albedo, eZro-dimensional energy balance model.

Air Pollution and Control

Primary and secondary air pollutants, CFC, Smog (oxidizing and reducing), Important environmental issues: Depletion of the ozone layer, Acid Rain, Greenhouse effect and global warming, Control measures: Baghouse filter, Cyclone separator, Electrostatic precipitator, Catalytic converter, and Scrubber.

Water Pollution and Control

Types and sources of water pollutants, wastewater treatment techniques: Ultrafiltration, aerobic and anaerobic treatment, Reverse osmosis, Electrodialysis, Ddisinfection by chlorination, Ozonization, Modern water purification system, Water quality parameters like hardness, Water softening process (permutit), WHO guidelines for drinking water.

Soil Pollution and Solid Waste Management

Soil pollution: Sources of pollutants and mitigation measures. Types of solid wastes: Heavy metal, bio-medical and radioactive wastes, Toxic and biochemical effects of solid wastes, Solid waste management (landfilling, incineration, and composting).

Green Chemistry and EIA

Basic principles of green chemistry with examples, Matrices to explain greenness, R^4M^4 model, life cycle analysis. Importance, scope and principles of EIA with a case study.

Text Book

1. A. K. De, Environmental Chemistry, New Age International Publishers, 9th Edition.

Reference Books

1. S. Chakroborty, D. Dave, and S. S. Katewa, Environmental Chemistry-, Cengage Learning India Pvt. Ltd., 1st Edition.
2. Aloka Debi,Environment Science and Engineering, Universities Press,2nd Edition.
3. Erach Bharucha, Textbook of Environment studies for undergraduate courses, Universities Press, 2nd Edition.
4. D. De and D. De, Fundamentals of Environment and Ecology, S. Chand &Co, 2013.
5. Jain and Jain, Engineering Chemistry, Dhanpat Rai,Publishing Company.
6. S.C. Santra, Environmental Science,New Central Book Agency, ISBN: 9788173814044.

DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA

Course Code :MA11001

Credit :4

L-T-P :3-1-0

Prerequisite :Nil

COURSE OBJECTIVE

The objective of this course is to familiarize the prospective engineers with techniques in ordinary differential equations and linear algebra. It aims to equip the students to tackle advanced level of mathematics and applications that they would find useful in their disciplines.

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COURSE OUTCOMES

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

CO1 : Understand the concept of modelling and formulation of Differential equation of physical problems,

CO2 : Apply different methods to solve ODE problems involving growth-decay, cooling effects and electrical circuits etc,

CO3 : Develop an ability to solve $2^{nd}$and higher order ODEs,

CO4 : Apply the knowledge of special function in engineering problems,

CO5 : Use the essential tool of matrices and linear algebra in a comprehensive manner, and

CO6 : Apply the knowledge of Eigen value and Eigen vector in the field of engineering and also get the concept of complex matrices.

COURSE CONTENT

Ordinary Differential Equations of First Order

Introduction and formation of differential equations, Overview: Variable separable, homogeneous, equations reducible to homogeneous form.Exact differential equations, equations reducible to exact form, linear differential equations, equations reducible to linear form (Bernoulli's equation). Applications of differential equations: Growth-Decay Problem, Newton's Law of Cooling, Mixing problem, Orthogonal trajectories.

Linear Differential Equations of second order

Second order linear homogeneous equations with constant coefficients; differential operators; solutions of homogeneous equations; Euler-Cauchy equation; linear dependence and independence; Wronskian; Solutions of non-homogeneous equations: general solution, complementary function, particular integral; solution by variation of parameters; undetermined coefficients. Applications of 2nd order differential equations in Electric circuit.

Special Functions

Improper Integrals for one variable, some test for convergence of improper integrals, Gamma function, Properties, Beta function, Relation between Gamma and Beta functions. Radius of convergence of power series, Legendre equation. Legendre polynomial. Recurrence relations and Orthogonality property of Legendre polynomial. Bessel's equation, Bessel's function, Recurrence relation.

System of Linear Equations and Vector Space

Linear system of equations; rank of matrix; consistency of linear systems; Solution of system of linear equations: Gauss elimination, inverse of a matrix by Gauss Jordan method, Vector Space, Sub-space, Basis and dimension, linear dependence and independence, Linear transformation.

Matrix-Eigen value problems

Eigen values, Eigen vectors, Eigen basis, quadratic form; Hermitian, Skew-Hermitian forms; similar matrices; Diagonalization of matrices.

Text Book

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley INC, 10th Edition,2011.

Reference Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition.
2. H.K. Das, Introduction to Engineering Mathematics, S.Chand & Co Ltd, 11th Edition.
3. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publications 2007.
4. J. Sinha Roy and S. Padhy, A course on ordinary & partial differential Equation, Kalyani Publication, 3rd Edition.

TRANSFORM CALCULUS AND NUMERICAL ANALYSIS

Course Code :MA11002
Credit :4
L-T-P :3-1-0
Prerequisite :Nil

COURSE OBJECTIVE

The objective of this course is to familiarize the students with the methods of Laplace and Fourier transformation and various numerical techniques to solve engineering problems.

COURSE OUTCOMES

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

CO1 : Apply Laplace Transform to problems in the field of science and engineering,
CO2 : Use Fourier series and Transform as a tool to solve differential equations,
CO3 : Estimate the error in the results obtained in the numerical methods,
CO4 : Solve nonlinear equations that arise in engineering problems and interpolation,
CO5 : Know various numerical methods of differentiation and integration, and
CO6 :Apply numerical solution of differential equations and systems of linear equations.

COURSE CONTENT

Laplace Transforms
Laplace Transform, Inverse Laplace Transform, Linearity, Transform of derivatives and integrals, Unit Step function, Dirac delta function, Second shifting theorem, Differentiation and integration of transforms, Convolution, Solution of ODEs and integral equation by Laplace transform.
Fourier Series and Transform: Fourier series, Arbitrary periods, Even and odd functions, Half range expansions, Fourier integral, Cosine and sine transforms, Fourier Transform, Inverse Fourier Transform, Linearity, Fourier Transform of derivative, Convolution.

Approximations and Errors

Approximation of numbers by truncation and rounding-off, Types of errors.

Numerical solution of Nonlinear equations: Solutions by Bisection Method, Fixed Point Iteration Method, Newton-Raphson Method, Regula-Falsi and Secant Method, Rate of Convergence of Secant & Newton-Raphson Method.

Interpolation and Approximation Finite Differences, Operators and Relation between them. Interpolation: Newton's forward and backward difference interpolation, Newton's divided difference interpolation and Lagrange interpolation.

Numerical Differentiation and Integration: Numerical differentiation of first- and second-order equations using difference table. Trapezoidal rule, Simpson's 1/3rd and 3/8th rules, Gauss-Legendre's two-point and three -point formulae. Error in Numerical Integration.

Numerical Solution to ODE

Taylor's (OK?) series Method, Euler's Method, Modified Euler's Method, Runge-Kutta Methods of order 2 and 4, Reduction of second-order ODE to system of first-order ODEs and its solution by R-K method of order four.

Solution of System of Linear Equations,Solutions by Gauss-Seidel and Gauss-Jacobi methods.

Text Books

1. E Kreyszig,Advanced Engineering Mathematics by Wiley, INC, 10th Edition.
2. Jain, Iyenger and Jain, Numerical Methods for Scientific and Engineering Computation, New age International (P) Ltd., 6th Edition.

Reference Books

1. .S. Grewal, Khanna ,Higher Engineering Mathematics, Publishers, 44th Edition.
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publications, 2007.
3. A, Thangapandi and Somasundaram, Numerical Methods, Scitech Publishers, 2nd Edition.

CIENCE OF LIVING SYSTEMS

Course Code :LS10001
Credit :2
L- T-P :2-0-0
Prerequisite :Nil

COURSE OBJECTIVE

The objective of the course is to enrich the basic knowledge of students in the field of biology and use that knowledge to support the engineering and research programs. Besides, the course also helps to learn methodology to establish models for various biological phenomena and apply the aforementioned models to predict/analyse the functionality of various systems.

COURSE OUTCOMES

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

CO1 : Learn the typical characteristics that distinguish life forms and analyze life process at cellular level,

CO2 : Apply concepts on structure and function of simple biomolecules in life processes

CO3 : Understand different process involved in life and analyse their effects,

CO4 : Analyse different biological phenomena and relate them to engineering applications,

CO5 : Comprehend different physiological functions and relate them to computer-based techniques, and

CO6 : Implement concepts of biology and their relevance to engineering and technology.

COURSE CONTENT

Cellular Organization of a Living Organism

Biology in engineering, The Living World: Biodiversity of living world, Microorganisms, Cell as the basic unit of life, Cell theory, Structure and function of Prokaryotic and Eukaryotic cells, Cell growth and reproduction, Homeostasis, Concept of gene, Basic structure and function of chromosomes.

Molecular and Biochemical Basis of an Organism

Chemical Context of Life: Water, Carbon, Structure and Function, Types of bonding, Bio-macromolecules (Carbohydrates, Proteins, Amino acids, Lipids and Nucleic acids), Protein synthesis, Cell differentiation, Stem cells and their applications.

Enzymes, Photosynthesis, Metabolism and Bioenergetics

Enzymes: Introduction, structure, properties, Classification, Mechanism of enzyme actions, Factors affecting enzyme action, Strategies utilized by enzymes to affect catalysis. Photosynthesis: Introduction, pigments, process of photosynthesis, Mechanism of photosynthesis (light reaction and dark reaction). Metabolism and Bioenergetics: Anabolism and catabolism.

Nervous system, Immune system and Cell Signaling

Nervous system: Introduction, History of neuroscience, Types of glial cells, Nerve cells - Neurons, Organization of the nervous system, Action potential, Diseases of the nervous system, Computer-based Neural Networks. Immune system: Introduction, Innate Immunity, Adaptive or acquired immunity, Diseases of the immune system, Immune engineering. Cell signaling: General principles of cell signaling.

Molecular Machines, Biosensor and Bioremediation

Molecular Machines: Introduction, Molecular motors and Machines, F0F1-ATP synthase motors, Cytoskeleton associated motors. Biosensors: Concept of biosensor, Working principle, Types of biosensors, Glucose biosensors, Bio-detectors: DNA detection biosensor, Detection of pollutants, Biosensor in food industry. Bioremediation: Introduction, Role of microorganisms, Factors determining bioremediation, Types – *in situ/ex situ*, Advantages and disadvantages, Biofuel.

Text Book

1. S. Thyagarajan, N. Selvamurugan, M.P Rajesh, R.A Nazeer, Richard W. Thilagarajan, S. Bharathi and M.K. Jaganathan, Biology for Engineers, McGraw Hill Education (India),7thEdition, 2022.

Reference Books

1. P. H. Raven and G.B. Johnson. Biology (Indian Edition), Tata McGraw Hill Education Publication,13th Edition, 2023.
2. E D. Enger, Feederick C, Ross and David B. Bailey. Concepts of Biology,Tata McGraw-Hill Publication, 14th Edition, 2011.
3. Neil A. Campbell and Jane B. Recee, Biology, Pearson Education, 8th Edition , December 2007.
4. Cecie Starr, Biology Concepts and Application, Thomson Books, 6th Edition, January 2006.

ENGLISH

Course Code : HS10001
Credit :2
L-T-P :2-0-0
Prerequisite :Nil

COURSE OBJECTIVE

The objective of the course is to develop and improve, in the students, the skills of active listening, speaking, reading, and writing in English, through lecture classes and practice sessions, and improve their professional communication abilities. The course will help the students to enhance their critical thinking and situational communicative skills through the study of contemporary social issues depicted in literature.

COURSE OUTCOMES

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

CO1 : Apply verbal and non-verbal modes of communication effectively in practical Situations,
CO2 : Retain a grammatically correct and logical flow while drafting reports and other technical pieces of writing,
CO3 : Develop competence in reading and comprehension,
CO4 :Implement active listening responses in professional practice,
CO5 :Utilize neutral accent in English pronunciation successfully, and
CO6 :Understand situational and conversational English used for different purposes and contents.

COURSE CONTENT
Professional Communication

Process of Communication: Definition, Explanation & Diagram, Difference Between General and Technical Communication; Methods of Communication (Verbal & Non-Verbal); Non-Verbal Communication (Kinesics, Proxemics, Chronemics, Oculesics, Olfactics, Gustorics, Haptics, and Iconics); Paralanguage; Flow of Communication (Formal & Informal); Levels of

Communication; and Barriers of Communication (Intrapersonal, Interpersonal, and Organizational).

Basics of Grammar and Writing Skills

Error Detection in Sentences: Articles, Prepositions, Tense, Subject-Verb Agreement, Active and Passive Voice; Use of Punctuation: Full Stop, Comma, Colon, Semi-colon, Single & Double Inverted Commas, Exclamation & Interrogation Marks, Hyphens and Dashes, and Ampersand;

Paragraph Writing – Components; Writing Bias-free English; Business Letters: Enquiry, Claim/Complaint, and Order; Technical Reports: Formats, Style & Referencing; and Reading Techniques: Skimming, Scanning, Intensive & Extensive Reading.

Basic Sounds of English

Hearing & Listening: Types of Listening – Appreciative, Empathetic, Critical, Comprehensive, Superficial, Differences between Listening & Hearing; Introduction to Basic Sounds of IPA: Symbols of IPA, Types of Vowels & Consonants; and Problem Sounds & Mother Tongue Influence: Concept of MTI with Examples.

English Literature

Short Story – O. Henry: 'Gift of the Magi;'Short Story – Ismat Chughtai: 'Sacred Duty;'; Poem – Robert Frost: 'Stopping by Woods on a Snowy Evening;'Poem – Tennessee Williams: 'We Have Not Long to Love;' and Drama: William Shakespeare: Merchant of Venice.

Text Book

1. M. Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hill Education Publication, 2005.

Reference Books

1. Sidney Greenbaum. The Oxford Grammar (English). Oxford University Press, 1st Edition. 2005.
2. S Verma,Technical Communication for Engineers, Vikas Publishing House,2015.
3. R Dove,The Penguin Anthology of 20th Century American Poetry,Penguin Books. 2013.
4. The Merchant of Venice (The New Cambridge Shakespeare). Mahood & Lockwood eds. CUP. 2018.

BASIC ELECTRONICS

Course Code :EC10001

Credit :2

L-T- P :2- 0- 0

Prerequisite :Nil

COURSE OBJECTIVE

The subject is designed to familiarize students of all branches to the all-pervasive field of Electronics, enable them to carry out research in interdisciplinary fields involving semiconductor devices, and utilize the knowledge in solving practical problems in real life in today's age of electronics.

COURSE OUTCOMES

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

CO1 :Understand the properties of semiconductor and current conduction mechanism,
CO2 :Comprehend the working of P-N junction diodes; identify different diode circuits and analyze them,
CO3 :Understand the working of different types of transistors,
CO4 : Know about OP-AMP and its applications,
CO5 : Analyze the working of op-amp using either inverting or non-inverting configurations, timing circuit, regulated power supply ICs, and their applications, and

CO6 : Realize the importance of various analog and digital electronic systems and electronic devices.

COURSE CONTENT

Semiconductors, Diodes and Transistors

Properties of semiconductor materials, Applications of semiconductors as p-n junction diode, Diode characteristics and breakdown mechanisms, Half-wave and full-wave rectifiers with filters, Zener diode, Transistor constructions, operations and their characteristics. Transistor biasing, amplifiers, and load line analysis, Concepts of JFET and MOSFET.

Operational Amplifier (Op-amp) and applications

Introduction to Op-amp and its Characteristics. Application of Op-Amp as Inverting amplifier, Non-inverting Amplifier, Summing, Difference amplifier and comparator

Introduction to Digital Electronics

Different number systems and its conversions, Logic gates and truth tables of OR, AND, NAND, EX-OR. Combinational circuit and Sequential circuit.

Miscellaneous Electronic Devices

SCR, Opto-electronic devices and fiber techniques, Introduction and description of sensor performance, Fundamentals of analog communication techniques (AM and FM).

Text Book

1. J Millman, Christos C. Halkias & C D. Parikh, Integrated Electronics: Analog and digital circuits and Systems , 9th Edition, 2021.

Reference Books

1. R. L. Boylestad & L. Nashelsky, Electronic Devices & Circuits,PHI,7th Edition,2021
2. D. A. Bell. Electronic Devices and Circuits.(Oxford)5th Edition,2021.
3. D. Chattopadhyay and P. C. Rakshit. Fundamentals & Applications ,New Age International, 15th Edition 2021.

BASIC ELECTRICAL ENGINEERING

Course Code :EE10002
Credit :2
L-T-P :2-0-0
Prerequisite :Nil

COURSE OBJECTIVE

The course is designed to provide to the students a comprehensive overview of the basics of the electrical engineering discipline. In particular, the course includes fundamental aspects of DC, AC and magnetic circuit analysis, working principles and applications of machines, and safety measures used in various electrical apparatus and appliances.

COURSE OUTCOMES

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

CO1 : Familiar with the concept of DC circuit,

CO2 : Understand the concepts of AC circuits,

CO3 : Analyze the three phase circuit,

CO4 : Interpret the behavior of magnetic circuits,

CO5 : Remember the principles and operation of electrical machines, and

CO6 : Know the concepts of electrical safety and protection systems.

COURSE CONTENT

D. C. Circuits

Kirchhoff's law, Source transformation, Star-delta transformation and equivalent resistance of the circuits, Mesh and Nodal analysis, Superposition theorem, Maximum Power Transfer theorem, Thevenin's Theorem and Norton's theorem.

A.C. Circuits

Peak, average, R.M.S. values of sinusoidal quantities, Peak factor, Form factor, Phase difference,Phasor representation ,AC through R, L, C, AC Series Circuit (RL, RC, RLC), Three-phase AC circuits: Voltage, current and powerin star and delta connections.

Electromagnetic Circuits

Magnetizing Force, Reluctance, Permeance, Magnetic field, Magnetic permeability, Analogy between Electric Circuits and Magnetic Circuits. Series magnetic circuit, BH curve.

Electrical Machines and Rating

Electrical Energy Scenario in India, Principle of transformer and Application , Three-phase and single-phase induction Motors and application, Power ratings of air conditioners, PCs, laptops, printers, refrigerator, washing machine, different lamps, electricity tariff, calculation of electricity bill for domestic consumer.

Personal Safety Measures

Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Equipment Safety Measures

Working principles of fuse and miniature circuit breaker (MCB), Residual Current Circuit Breaker (RCCB).

Text Books

1. V K Mehta, Rohit Mehta, Principles of Electrical Engineering and Electronics S Chand and Company, New Delhi ,Revised Edition 2013.
2. D.C. Kulshreshtha, Basic Electrical Engineering Tata Mcgraw publication, 1st Edition 2011.

Reference Books

1. Sanjeev Sharma, Basics Electrical Engineering I.K.International, New Delhi ,Third Reprint 2010.
2. T.K. Nagasarkar and M.S. Sukhija Basic Electrical Engineering, , Oxford University press, 3rd Edition 2017.

ENGINEERING MECHANICS

Course Code :ME10001
Credit :2
L-T-P :2-0- 0
Prerequisite :Nil

COURSE OBJECTIVE

Engineering Mechanics is a specialized need-based extension of Applied Physics and uses the principles of Statics and Dynamics. The objective of this course is to build the foundational knowledge of the students which is required for the design of mechanical systems. In particular, the course will cover aspects of analysis of rigid body, frame and machine under the action of force system, and analysis of free body diagram of a system whether at rest or in motion

COURSE OUTCOMES

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

CO1 : Draw complete and correct free-body diagrams and write the appropriate equations from the free-body diagram,

CO2 : Use scalar analytical techniques for analyzing forces and moments in mechanical systems,

CO3 : Analyze forces in statically determinate structures such as trusses, frames and problems related to friction,

CO4 : Determine the centroid and second moment of area,

CO5 : Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple and practical problems, and

CO6 : Solve real life problems by using mathematics, physical laws and theorems.

COURSE CONTENT

Concurrent Forces in a Plane

Introduction to Engineering Mechanics, Free-body diagrams,Composition and resolution of forces, Methods of moments. Friction:Concept of friction, Wedge friction.

Force Analysis of Plane Trusses

Methods of joints, Method of Sections,Centroid: Parallel forces in a plane, Centroid of plane figures, Theorem of Pappus, and Centroid of composite plane figures.

Moment of Inertia

Moment of Inertia of plane figures, Parallel axis theorem, Perpendicular axis theorem, and Moment of Intertia of composite figures.

Principle of Virtual Work

Equilibrium of Ideal Systems, Virtual work.

Dynamics of Particles

Differential equations of rectilinear motion, Free vibration, D'Alembert's Principle, Momentum and Impulse, Work & Energy, Conservation of energy, Impact.

Curvilinear Motion

Normal and tangential acceleration, Motion of a projectile, Work and Energy in curvilinear motion.

Rotation of a Rigid Body

Kinematics of rotation, Rotation under the action of a constant moment.

Text Book

1.S Timoshenko, D. H Young & J.V. Rao, Engineering Mechanics, Tata McGraw-Hill Publication 5th Edition, 2017.

Reference Books

1. IH Shames .,Engineering Mechanics (Statics and Dynamics) , Prentice Hall, 4th Edition, 2005.
2. S.S. Bhavikatti, Engineering Mechanics –New Age International,8th Edition, 2021.
3. S. Rajasekaran and G. Sankarasubramanian Engineering Mechanics (Statics and Dynamics),Vikas publishing House, 3rd Edition, 2017.

Laboratory and Sessional Subjects (1^{st} Year)

PHYSICS LABORATORY

Course Code : PH19001

Credit : 1

L- T-P : 0-0-2

Prerequisite : Nil

COURSE OBJECTIVE

This lab course covers different measurement techniques of various parameters using the instruments i.e. interferometer, spectrometer, spherometer, screw gauge, vernier calliper, microscope, and telescope. It includes the application of photoelectric effect and photovoltaic effect in photo cell and solar cell respectively. Evaluation of the mechanical strength of materials by calculating elastic constants such as Young's modulus, rigidity modulus and Poisson's ratio are also included. This course provides hands on training for the usage of electrical, optical and mechanical systems for various measurements with precision and analysis of the experimental data by graphical interpretation and error calculation.

COURSE OUTCOMES

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

CO1 : Understand the wave nature of light through experiments based on interference and diffraction Phenomena,

CO2 : Apply the laws of quantum physics to understand the photoelectric emission using the particle nature of light,

CO3 : Characterize photovoltaic cells to find out efficiency in terms of power output,

CO4 : Evaluate mechanical properties of materials using their elastic properties,

CO5 : Apply the principles of optics such as refraction, total internal reflection to calculate refractive index and related parameters,and

CO6 : Use the principles of oscillation to understand phenomena such as damping, resonance and to determine the factors (such as gravity, elasticity etc) affecting the time period of various oscillators.

COURSE CONTENT

Topics

- Measurement by vernier callipers, screw gauge, spherometer: A review

- Determination of wavelength (λ) of a monochromatic light by Newton's ring experiment.

- Determination of wavelength (λ) and difference (dλ) between wavelengths of sodium D-lines by Michelson's interferometer.
- Determination of grating element (e+d) of a plane diffraction grating.
- Determination of Planck's constant using photocell.
- Study of the characteristics of a photo cell.
- Study of the characteristics of a solar cell.
- Determination of Young's modulus (Y) of a material by bending of beam method.
- Determination of Poisson's ratio (σ) of rubber.
- Determination of rigidity modulus (η) of a material by dynamic method.
- Determination of refractive index (μ) of a transparent liquid by Boy's method.
- Determination of numerical aperture of optical fibre.
- Determination of acceleration due to gravity (g) by bar pendulum.
- Determination of damping coefficient, relaxation time and quality factor of damped harmonic oscillation by simple pendulum.
- Measurement of velocity of sound in air using resonance column method.
- Studies on dielectric/multi-ferroic materials (Open ended)
- Diffraction studies using Laser sources (Open ended)

Reference Materials

1. Physics laboratory instruction manual, School of Applied Sciences, Department of Physics, KIIT Deemed to be University, Bhubaneswar.
2. S. L. Gupta and V. Kumar, 2018, Practical Physics, Pragati Prakashan, 33rd Edition, ISBN: 978-93-87151-58-1.

CHEMISTRY LABORATORY

Course Code : CH19001

Credit : 1

L-T-P : 0-0-2

Prerequisite : Nil

COURSE OBJECTIVE

This lab course covers different types of chemical experiments ranging from volumetric analysis to spectroscopic techniques. This course provides the students with hands-on training in many of the advanced spectroscopic and analytical techniques in chemistry. The experiments in the course span over diverse applications in chemistry. It contains experiments dealing with environmental chemistry, volumetric analysis, organic and inorganic synthesis, electrochemistry, and spectroscopy.

COURSE OUTCOMES

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

CO 1 : Handle different chemicals with proper safety protocols in an advanced Chemistry laboratory,

CO 2 :Learn and apply basic techniques used in Chemistry laboratory for preparation, purification and identification,

CO 3 : Analyze the kinetics of 1st order reactions and estimate the rate constant,

CO 4 : Use different instrumental techniques such as Conductometry, pH-metry, Potentiometry and Colorimetry,

CO 5 : Analyse basic water quality parameters like hardness, dissolved oxygen, alkalinity, chloride, ferrous iron contents etc,and

CO 6 : Rationalize and learn the spectroscopic and synthesis techniques in chemistry.

COURSE CONTENT

Topics

- Estimation of total hardness in a given water sample in terms of calcium and magnesium hardness by EDTA method.
- Estimation of the amount of NaOH and Na_2CO_3 present in a given mixture solution
- (a) Determination of the strength of $KMnO_4$ solution by using standard sodium oxalate solution. (b) Determination of the amount of Ferrous (Fe^{2+}) ions present in the Mohr's salt solution by using standard $KMnO_4$ solution.
- Determination of the amount of dissolved oxygen present in a given water sample by Winkler's method.
- Finding the strength of Fe^{2+} present in the supplied Mohr's salt solution by potentiometric titration.
- Determination of the rate constant of acid-catalyzed hydrolysis of ethyl acetate.
- Determination of the chloride ion (Cl^-) present in a given water sample by the argentometric method.
- Finding the strength of supplied acid by pH-metric titration against a standard alkali.
- Finding the strength of a given hydrochloric acid solution by titrating it against standard sodium hydroxide solution conducto-metrically.
- Verification of Beer Lambert's Law and application of this law to determine the unknown concentration of a given solution.
- Determination of the concentration of ferric ions (Fe^{3+}) in a given water sample by a spectrometric method using KCNS as color developing agent.
- Determination of the Isoelectric point (pI) of glycine amino acid.
- Synthesis of transition metal complexes and characterization by using IR and ^{1}H-NMR. (Open ended)
- Determination of the concentration of different ions (cations and anions) in a given water sample by colorimetry. (Open ended).
- Application of potentiometric titrations (Open ended).

Reference Materials

1. Chemistry laboratory Instruction manual, School of Applied Sciences, KIIT Deemed to be University
2. Vogel's Quantitative Chemical Analysis, J. Mendham, R.C. Denney J. D. Barnes, M.J.K. Thomas, 6th Edition, Longman
3. Standard methods for examination of water and wastewater, 23rd Edition, APHA.

COMMUNICATION LABORATORY

Course Code: HS18001

Credit : 1

L-T-P : 0-0-2

Prerequisite : NIL

COURSE OBJECTIVE

This subject is designed to enrich the basic knowledge of engineering students in the field of communication and to support the engineering and research programs.

COURSE OUTCOMES

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

CO1 : Use English grammar correctly and unambiguously in technical writing,
CO2 : Apply verbal and non-verbal modes of communication effectively in practical situations,

CO3 : Have a basic understanding of the communication process and to know the practical implementations in the workplace,

CO4 : Retain a logical flow while drafting reports and other technical pieces of writing,

CO5 : Develop competence in reading and comprehension, and

CO6 : Be familiar with English pronunciation and use neutral accent successfully.

COURSE CONTENT

Reading Comprehension

Understanding meaning and sequence of ideas in written language

Activity based on matching, multiple choice questions, open close, appropriate headings.

Time & Tense + Subject-Verb Agreement

Applying correct grammar in everyday writings.

Vocabulary Building (Mind Mapping/PhrasalVerbs)

Developing vocabulary through associating key ideas, and learning idioms and phrases.

Listening Comprehension

Interpreting meaning and syntax in spoken language.

E-mailWriting

Formulating appropriate e-mails with relevant salutation, language &conclusion

Resume Writing/ Video Resume

Creating suitable, job-orientedresume

Thematic Speaking:

Practising and implementing theme-based individual speaking skills.

Power Point Presentation

Developing skills to design and deliver engaging, informative and impactful presentations

Class Participation.

WORKSHOP

Course Code : ME18001

Credit : 1

L-T-P : 0-0-2

Prerequisite(s) : Nil

COURSE OBJECTIVE

This workshop practice is designed to impart students the basic knowledge on manufacturing or developing a given object irrespective of their branch of engineering. While furnishing the given object, students will familiar with various mechanical operations and the respective tools or machines. This course involves four different sections namely Fitting, Welding, Turning and Sheet metal which cover both conventional and advanced tools to provide students the updated manufacturing experience. Students are also advised with various safety precautions to be followed during a specific manufacturing practice. At the end, students will also gain knowledge on different advanced machines such as CNC machine tools and 3D printing.

COURSE OUTCOMES

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

CO1 : Practice different operations related to fitting shop,

CO2 : Use different welding tools to prepare a given type of joint,

CO3 : Demonstrate various turning operations including taper turning and knurling using a conventional lathe machine,

CO4 : Design a tray and prepare it using sheet metal equipment involving soldering,

CO5 : Appraise different operations using a CNC machines,and

CO6 : Interpret different advanced machines such as 3D printing/additive manufacturing.

COURSE CONTENT

Topics

- Turning operations
- Sheet metal operations
- Fitting
- Welding

ENGINEERING DRAWING & GRAPHICS

Course Code : CE18001

Credit : 1

L T P : 0 0 2

Prerequisite : Nil

COURSE OBJECTIVE

The objective of this course is to provide students with knowledge and abilities to design a 3D object on 2D paper by hand sketching method and by means of computer aided drafting software.

COURSE OUTCOMES

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

CO1 : Use common drafting tools properly,
CO2 : Select, construct and interpret appropriate drawing scale as per the situation,
CO3 : Draw orthographic projections of points, lines and planes,
CO4 : Draw orthographic projection of solids like cylinders, cones, prisms and pyramids,
CO5 : Develop the section of solids for practical situations, and
CO6 : Communicate ideas effectively using Computer Aided Drafting.

COURSE CONTENT

Topics

- Introduction to Engineering graphics
- Lettering
- Projection of points & lines
- Line inclined to both the planes
- Projection of planes
- Introduction to Computer Aided Drafting
- Projection of solids
- Section of solids
- Development of surface

Textbook

1. K. Venugopal,Engineering Drawing + AutoCAD New Age Publishers, 1st Edition, 2011.

Reference Book

1. S. N. Lal Engineering Drawing with an Introduction to AutoCAD, Cengage India Private Limited, 1st Edition, 2017.

PROGRAMMING LABORATORY

Course Code :CS13001
Credit : 4
L-T-P : 0-2-4
Prerequisite(s) :Nil

COURSE OBJECTIVE

The course aims to provide exposure to problem-solving through programming. It aims to train the student to the basic concepts of the C-programming language. This course involves lab component which is designed to give the student hands-on experience with the concepts.

COURSE OUTCOMES

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

CO1 : Have fundamental knowledge of computers hardware and number systems with commands in Linux,
CO2 : Write, compile and debug programs in C language.
CO3 : Design programs involving decision structures, loops, and functions.
CO4 : Construct arrays to store, manipulate, search and display data.
CO5 : Apply the dynamics of memory by the use of pointers.
CO6 : Use different data structures and create/update basic data files.

COURSE CONTENT

Topics

- Basic linux commands
- Operators and Expressions
- Branching statements (if-else, switch).
- Control statements (looping - for, while, do-while).
- Arrays
- Character Arrays (strings).
- Functions.
- Pointers and Dynamic Memory Allocation.
- Structures and Unions
- File Handling

SCIENCE ELECTIVE

NANOSCIENCE

Course Code :CH10005
Credit :2
L-T-P :2-0-0
Prerequisite :Nil

COURSE OBJECTIVE

This course is designed to educate, inspire, and motivate young students about nanoscience, nanotechnology, and their applications. The course provides information on the latest innovations in this field to get insights into the nanomaterials synthesis/fabrication and applications that can be achieved at a nanoscale.

COURSE OUTCOMES

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

CO1 : Learn fundamental aspects of nanoscience,

CO2 : Classify different types of nanomaterials based on their dimension and composition

CO3 : Understand different synthesis techniques to grow nanomaterials,

CO4 : Analyse nanomaterials using different characterisation techniques,

CO5 : Apply the acquired knowledge to design new materials, and

CO6 : Evaluate the importance of nanoscience in engineering applications.

COURSE CONTENT

Introduction

Concept and Classifications based on dimensions and compositions, Significance of nanosize: Surface area to volume changes; Properties changing with size (reactivity, melting point, catalytic,

electrical, optical),Nanoscience in nature,and Quantum dots as data storage.

Synthesis of nanomaterials

Top-down synthesis (Mechanical method-ball milling, Photolithography, Laser ablation, sputtering), Bottom up (pyrolysis, sol-gel, CVD, self-assembly), Green synthesis (metallic nanoparticles, metal oxides), Biosynthesis.

Characterization

XRD-X-ray generation, Working principle (Bragg's law), Peak broadening in nanomaterials (Scherrer formula), Electron microscopy (SEM, TEM)—high energy electron generation, electron optics, Scanning Electron Microscopy (SEM)—secondary, back scattered, EDX, Transmission Electron Microscopy (TEM)—bright field imaging, dark field imaging, and Selected area diffraction pattern.

Applications

Cosmetics—ZnO, SiO_2, TiO_2 Nanoparticles in cosmetics, SiO_2 TiO_2 in toothpaste, silver, gold, copper nanoparticles in skin care product; *Medical Fields*—MRI, CT scan contrast enhancement agent, Drug and gene delivery system, Magnetic hyperthermia treatment; *Agriculture*—Nano-pesticides, herbicides, and fungicides, Food packaging; *Aerospace and Aviation Industries*—Carbon nanotubes (CNT)nanocomposites, Metal Nanoparticle-Polymer composites, SiC Nanoparticle reinforced alumina (high temperature strength, creep resistance); and *Nanomaterials for Environmental Remediation*—Degradation/removal of pollutants.

Text Book

1. B S Murty, P Shankar, Baldev Raj, B B Rath and James Murday,Textbook of Nanoscience and Nanotechnology, 1st Edition, 2012, ISBN-13: 978-8173717383.

Reference Books

1. Luisa Filipponi and Duncan Sutherland.,Nanotechnologies: Principles, Applications, Implications and Hands-on Activities, Edited by the European Commission Directorate-General for Research and Innovation Industrial technologies (NMP) program, 2012, ISBN: 978-92-79-21437-0.
2. Charles P. Poole Jr., Frank J. Owens., Introduction to Nanoscience and Nanotechnology, An Indian Adaptation,3rd Edition, 2020, ISBN-13: 978-9354240201.
3. P. I. Varghese, T. Pradeep. A Textbook of Nanoscience and Nanotechnology,Tata McGraw Hill Education, 2017, ISBN: 9781259007323.

SMART MATERIALS

Course Code :PH10003
Credit :2
L-T-P :2-0-0
Prerequisite :Nil

COURSE OBJECTIVE

This course is designed with the objective of enabling engineering students to get a flavour of advances in materials science. The knowledge of smart materials learnt by the students in the course will let them to realize the usefulness of various new-age materials for technological advances and allow them to explore further in their higher semesters. This course will help them bridge the gap between traditional text book science put into physics, chemistry, etc. and the state-of-the-art science of materials.

COURSE OUTCOMES

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

CO1 : Learn about smart materials, their properties and applications,

CO2 : Understand types of smart material based on their electrical and magnetic properties,

CO3 : Characterize piezoelectric, and multiferroic materials,

CO4 : Identify novel functions of smart materials,

CO5 : Apply the acquired knowledge of smart materials in different applications, and

CO6 : Evaluate the importance of smart materials in day-to-day life.

COURSE CONTENT

Introduction to Smart Materials

common smart materials and associated stimulus-response, Classification: active and passive, Piezoelectric, Shape-memory alloys, Photo-responsive polymers, Electroactive polymers, Magnetostriction and Electro-strictriction, Thermo-responsive polymers, Dielectric elastomers, Halochromic, Thermoelectric materials; Application areas of smart materials: Space, health care and biomedical sectors.

Piezoelectric Materials: Piezoelectric Effect

Direct and Converse, Piezoelectric coefficients, Piezoceramics, Piezopolymers, Piezoelectric Materials as Sensors, Actuators etc.

Shape-memory Alloys

Shape memory alloys (SMAs) and properties, Phase change in SMAs, Shape memory effect: One-way and two-way, binary, and ternary alloy systems, Applications.

Chromic Materials

Photochromic, Thermochromic, Electrochromic, Magneto-chromic and Piezo-chromic Materials.

Multiferroic Materials

Multiferroics definitions, Ferroic phases, Magnetoelectric coupling; Type-I and Type-II multiferroics, Mechanism: Charge ordering, lone pair, geometric effect, and spin driven mechanism; Multiferroic materials, Applications.

Text Book

1. B. K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Publication, New Delhi, 2nd Edition 2022, ISBN-13: 978-81-953536-7-5.

Reference Books

1. Mohsen Shahinpoor, Fundamentals of Smart Materials, 2020, Royal Society of Chemistry, ISBN**:** 9781782626459.
2. M. Schwartz, Smart Materials, 1st Edition, 2008, CRC Press, ISBN 9781420043723.

MOLECULAR DIAGNOSTICS

Course Code :LS10003
Credit : 2
L-T-P :2- 0-0
Prerequisite :Nil

COURSE OBJECTIVE

The objective of the course is to understand methods and techniques that are used to study biological processes in living beings. They include experimental and methodological approaches, protocols and tools for biological research.

COURSE OUTCOMES

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

CO1 : Learn the basics of Genes, Chromosomes, DNA, RNA and proteins along with their Aberrations,

CO2 : Understand the principles and working mechanisms of various instruments used in the study of biological processes in living things,

CO3 : Apply the knowledge of different diagnostics methods for quantitative estimation of xenobiotics (drugs and their metabolites) and biotics (proteins, DNA, metabolites) in biological systems,

CO4 : Analyze the recent developed techniques which are required for gene editing and their Applications,

CO5 : Evaluate the role of various bio-analytical techniques in environmental studies, biomedical sciences, life sciences, molecular biology, and biotechnological research, and

CO6 : Implement the knowledge of diagnostics in designing point-of-care instruments for different diseases.

COURSE CONTENT

Biomolecules

Overview of DNA, RNA, and Proteins, Chromosomal structure & mutations, DNA polymorphisms; and Gene and Genetic errors.

Molecular Basis of Diseases

Infectious, non-infectious; Diagnosis- traditional, modern tools, Concepts of molecular diagnostics.

Molecular Diagnosis and Techniques

DNA fingerprinting, Auto-antibody fingerprinting, Southern blotting, PCR, Real-time PCR and variations; Nucleic acid sequencing: New generations of automated sequencers, CRISPR technology and its use in diagnostics and gene editing.

Protein Diagnostics Techniques

Antigen-antibody reactions, ELISA, variations of ELISA; Western blotting.

Point-of-Care Devices

Biosensors and nano-biosensors for disease and metabollites detection.

Text Book

1. M K. Campbell, S O. Farrell, O M. McDougal, AE Biochemistry, Cengage Publisher,9th Edition 2017, ISBN-13: 9789814846448.

Reference Books

1. N Rifai, Andrea Rita Horvath and Carl T. Wittwer, Principles and Applications of Molecular Diagnostics,2018, Elsevier Publisher, 1st Edition, 2018.
2. K G Ramawat & Shaily Goyal, Molecular Biology and Biotechnology, ISBN9788121935128 Publisher S Chand & Co., 2nd Edition, 2010.
3. H Lodish, Arnold Ber, Molecular Cell Biology, WH Freeman Publisher, 8th Edition, 2016, ISBN-10 9781464187445.

SCIENCE OF PUBLIC HEALTH

Course Code :PE10002
Credit :2
L-T-P :2-0-0
Prerequisite :Nil

COURSE OBJECTIVE

The objective of this course is to orient the students to core scientific disciplines in public health practice.

COURSE OUTCOMES

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

CO1 : Understand and enlist the scientific approaches in public health,
CO2 : Understand and apply the epidemiologic and biostatistical science in evidence synthesis,
CO3 : Understand and apply the environmental health science in public health practice,
CO4 : Understand and apply the social and behavioral science in public health practice,
CO5 : Understand and apply the health economic and health management principles in setting priority for resource allocation, and
CO6 : Understand and apply the health economic and health management principles in health system optimization.

COURSE CONTENT

Scientific Approaches to Public Health

Health and public health concepts, Science and practice of applied public health: Scientific disciplines as part of interdisciplinary public health, Examples of use of behavioral model in changing the community perception of public health interventions

Social and Behavioral Sciences in Public Health

Social and behavioral determinants of health and disease, WHO and CDC models of social determinants of health, Disease and social status, Disease and poverty, Social interventions for good health.

Health behavior change models for public health interventions, Health Belief Model, Transtheoretical Model. The theory of planned behavior, Health communication to improve the outcome of public health interventions

Environment Health Sciences in Public Health
Environment & climate change, Ecosystem, Lifestyle anddietary effects on health, food safety and sanitation, Environmental pollution, waste disposal andtreatment.

Epidemiology and Data Science in Public Health

Epidemiology and achievements in public health, Measurements in Epidemiology— Incidence and prevalence, Causation and association, and Measures of association.

Outline of study designs (including cross-sectional study design, case-control study design, cohort study design and randomized control trials); Introduction to confounding and bias; Screening tests- validity and reliability methods.

Management and Economic Sciences in Public Health

Systems approach (input, process and outcome) in public health. Health management information system, Horizontal and vertical integration of public health interventions, Public-Private mix.

Understanding community, Community health related needs assessment, Community orientation and Community mobilization, Introduction to digital health.

Text Books

1. R Detal, Oxford Textbook of Global Public Health, Oxford, 7th Edition, 2021.
2. K Parks, Textbook of Preventive and Social Medicine, M/S Banarsidas Bhanot Publishers, . 26th Edition, 2021.

Reference Books

1. Robert H. Friis,. Essentials of Environmental Health, Jones & Bartlett Publishers, 2018
2. Warrier S,. InformationandCommunicationTechnologiesin PublicHealthASociologicalStudy,CBS Publishers,2020.
3. BakerJJ.BakerRW,DworkinNR, HealthCareFinance:BasicToolsforNon-financialManagers., JonesandBartlettPublishers,Inc,5thedition.2017.
4. RossTK, PracticalBudgetingForHealthCare:AConciseGuide, JonesandBartlettPublishers,Inc,2020.

OPTIMIZATION TECHNIQUES

Course Code :MA10003
Credit :2
L-T- P :2-0-0
Prerequisite :Nil

COURSE OBJECTIVE

To familiarise the students with a few rudimentary and popular optimization techniques to enable them to solve resource-constrained real world problems.

COURSE OUTCOMES

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

CO1 :Know the concept of Linear programming problem (LPP) and will able to formulate linear programming problem,
CO2 :Understand the basic terminology and concepts of solving LPP,
CO3 :Solve LPP by simplex method,
CO4 :Know the concept of duality in Optimization technique,
CO5 :Apply optimization technique to solve transportation problem, and
CO6 :Solve assignment problem.

COURSE CONTENT

Linear Programming

Mathematical foundations and basic definitions, Linear optimization: Formulation and graphical solution of linear programming problems, Simplex method, Duality.

Transportation:

General structure of a transportation problem, Finding initial basic feasible solution by North-West corner rule, Least-Cost method and Vogel's Approximation Method, and Testing for optimality.

Assignment Problem

Hungarian assignment method, Unbalanced assignment problems, Restrictions in assignment, Travelling Salesman model.

Text Book

1. H.A. Taha, Operation Research, An Introduction, Pearson Education, 10th Edition.

Reference Books

1. K. Gupta, Kanti Swarup, and Man Mohan .,Operations Research, P., S.Chand &Co, 2004.
2. N. S. Kambo, Mathematical Programming Techniques.,East West Press, 1997.
3. R. Fletcher., Practical Methods of Optimization, 2nd Ed., John Wiley, 1987.
4. Hanif D, Sherali, M. S. Bazarra. & J.J. Jarvis, Linear Programming and Network Flows, Wiley Publication. 2nd Edition.

ENGINERING ELECTIVE

BASIC CIVIL ENGINEERING

Course Code :CE10001
Credit :2
L-T-P :2 0 0
Prerequisite :Nil

COURSE OBJECTIVE

The course is designed to provide an overview of different aspects of civil engineering profession , namely, surveying, materials, structural, and geotechnical engineering, hydraulics and water resources, environmental engineering, and transportation engineering and their roles in the societal development.

COURSE OUTCOMES

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

CO1 :Understand the importance and practical applications of different types of surveying,
CO2 :Learn about the different construction materials and understand the philosophy of structural analysis and design,
CO3 :Understand engineering behaviour of soil and types of foundations,
CO4 :Understand different hydraulics, hydrological and water resources engineering applications,
CO5 :Learn about the management strategies of wastewater and solid waste, and
CO6 :Understand the basics of different types of highways, railways, ports and harbours.

COURSE CONTENT

Introduction

Role of civil engineers in designing, building, and maintaining infrastructure and improving quality of life,Specializations in the civil engineering and their specific roles.

Surveying

Plans, maps, scales, divisions of surveying, classification of surveying, leveling, and advanced methods of surveying.

Construction Materials & Structural Engineering

Different construction materials and their uses, structural analysis and design philosophy.

Geotechnical Engineering

Overview on origin of soil, engineering properties and their classification; Soil exploration; Foundations: Their importance and purpose; Factors to consider in foundation design and stability of slopes; and Improving site soils for foundation use.

Hydraulics & Water Resources Engineering

Overview of fluid properties, open channel flow, surface and groundwater hydrology, and irrigation infrastructures.

Environmental Engineering

Types of waste water, Principles of wastewater management, Types of solid waste, and Principles of solid waste management.

Transportation Engineering
Classification of highways, Typical construction methods of roads, traffic surveys and their applications in traffic planning, Railways, Ports and Harbours.

Text Book

1. Er. Shrikrishna A. Dhale and Er. Kiran M. Tajne, Basics of Civil Engineering, S. Chand & Co., 1st Edition, 2014.

Reference Books

1. S. S. Bhavikati, “Basic Civil Engineering” by New Age International Publisher, 1st Edition, 2021.
2. M. S. Palanichamy “Basic Civil Engineering”, Tata McGraw-Hill Publication.

BASIC MECHANICAL ENGINEERING

Course Code :ME10003
Credit :2
L-T-P :2-0-0
Prerequisite :Nil

COURSE OBJECTIVE

The course is designed to give an overview of the fundamental aspects of mechanical engineering so that a student pursuing any branch of engineering will realize the possibilities that the branch of mechanical engineering offers.

COURSE OUTCOMES

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

CO1 : Understandthe basic principles of thermodynamics,

CO2 : Develop an understanding of fluid machines like turbine and pump,

CO3 : Determine stress and strains in a component subject to a load,

CO4 : Understand the working and design aspect of power drives,

CO5 : Recognize appropriate material for a particular engineering application, and

CO6 : Understand the fundamentals of manufacturing processes.

COURSE CONTENT

Concepts of Thermodynamics

Systems, properties, state, and cycle, Thermodynamic equilibrium and quasi-static process, First law of thermodynamics for closed system, First law of thermodynamics for open/flow systems, Second law of thermodynamics, Kelvin Plank statement, Clausius statement, and Basic concept of entropy

Fluid Mechanics and Hydraulic Machines

Introduction to fluids, Properties of fluids, Pressure variation with depth, Bernoulli's equation and its applications, and Introduction to hydraulic turbines and pumps.

Mechanics of Materials

Stress, Strain, Stress-Strain diagrams for ductile and brittle materials, Elastic constants, Hooks Law, Factor of Safety, One-dDimensional loading of members of varying vross sections.

Power Transmission

Gear, , Belt, and Chain Drives, Shaft under varying loading conditions, Introduction to robots, Applications of robotics, Basic robot motions, Sensors and Actuators.

Manufacturing Processes

Introduction to engineering materials, Types and classification of materials, Properties of materials, Introduction to casting, forming, forging, rolling, extrusion and welding, Introduction to machine tools, NC, CNC, and 3-D Printing.

Text Book

1. P Kumar, Basic mechanical Engineering, Pearson Education, 2nd Edition, 2018

Reference Books

1. J K Kittur and G D Gokak, Elements of Mechanical Engineering Willey, 1st Edition, 2015.

2. B Agrawal, C M Agrawal ,Basic Mechanical Engineering, Willey, 1st Edition, 2011.

ELEMENTS OF MACHINE LEARNING

Course Code :EE10001
Credit :2
L-T-P :2- 0-0
Prerequisite :Nil

COURSE OBJECTIVE

Today, we have access to massive data which get generated through information and computer technology in our connected world. Most of these data lie unused and often overwhelm us due to their size and variety. The objective of this course is to introduce to the students to the field of learning from data, discovering data patterns, converting them into knowledge, and applying it to solve real-world problems.

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO1 : Demonstrate fundamentals of machine learning,
CO2 : Identify data types, apply suitable processing and visualize using suitable methods,
CO3 : Describe Unsupervised Learning and apply clustering techniques,
CO4 : Describe Supervised Learning and apply classification techniques,
CO5 : Demonstrate perceptron and Multi-layer Perceptron models, and
CO6 :Apply machine learning techniques for real world requirement.

COURSE CONTENT

Introduction

Importance and Applications of Machine Learning, Supervised, Unsupervised, Reinforcement Learning and Evolutionary Learning.

Data Analysis

Measurement Scales and Data Types; Visualization, Pre-processing and Transformation of Data; Dimensionality Reduction; and Data (Dis)Similarity.

Unsupervised Learning

K-means and Density-based,Clustering Methods.

Supervised Learning

K-Nearest Neighbour, Decision Tree by Qualitative and Quantitative(information Gain method); Evaluation by Confusion Matrixof Supervised Learning Methods.

Learning with Neural Networks

Perceptron, Multi-layer Perceptron and, Error Backpropagation Learning.

Textbooks

1. Gopal, M., Applied Machine Learning, McGraw Hill Education, 2018

2. Pradhan, M. and U. D. Kumar,Machine Learning Using Python,Wiley India Pvt.Ltd, 2019.

Reference Books

1. Alpaydin, E., Introduction to Machine Learning, 3rd Edition, The MIT Press, 2014.
2. Bishop. C M, Pattern Recognition and Machine Learning, Springer, 2006.
3. Jain, V. K., Big Data Science Analytics and Machine Learning, Khanna Publishers, 2021
4. Mitchell, T. M.,Machine Learning, McGraw Hill, 1997.
5. Müller, A. C.,Introduction to Machine Learning with Python, O'Reilly Media, Inc, 2016
6. Raschka, S. and V. Mirjalili, Python Machine Learning, 3rd Edition, Packt Publishing, 2019.
7. Shalev-Shwartz, S. and S. Ben-David ,Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, 2014.

BASIC INSTRUMENTATION

Course Code : EE10003
Credit : 2
L-T-P : 2-0-0
Prerequisite : Nil

COURSE OBJECTIVE

The course is designed to impart, to the students, the principles of analog and digital measuring instruments which include the working mechanisms of sensors and transducers and their applications in industrial and biomedical systems.

COURSE OUTCOMES

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

CO1 : Know the basics of measuring instruments,

CO2 : Measure different electrical quantities,

CO3 : Understand the working principles of optical and electrical transducers and sensors,

CO4 : Understand the working of electrical transducers and sensors,

CO5 : Apply the transducers in industrial applications, and

CO6 : Use instruments in biomedical applications.

COURSE CONTENT

Analog and Digital Instruments

Basics of measuring instruments, Types of analog instruments, Measurement of voltage, current, power and energy in single and three phase circuits; Digital Instruments: Digital voltmeter, Digital multimeter, Timer/counter, and Time, phase and frequency measurements in oscilloscope.

Sensors and Transducers

Optical sources and detectors: LED, photo-diode, light dependent resistor; Basics of fiber optic sensing, IR Sensors.Resistive, capacitive, inductive, piezoelectric, and Hall effect sensors, Temperature transducers: Thermocouple, RTD , and thermistor.

Transducers in Industrial Applications

Measurement of displacement (linear and angular), velocity, acceleration, force, torque, vibration, shock, pressure, flow, liquid level, pH, conductivity and viscosity.

Instruments in biomedical applications

ECG, Blood Pressure measurement, CT Scan, and Sonography

Text Book

1. R. K. Rajput ,Electrical and Electronic Measurements and Instruments,S Chand Publication, 4th Edition, 2015,William David Cooper,Electronic Instrumentation and Measurement Techniques, by PHI, 2010.

Reference Books

1. Er. R.K. Jain, Mechanical and Industrial Measurements (Process Instrumentation and Control), Khanna Publishers, 1995.
2. A.K Sawhney, A course in Electrical and Electronics Measurements and Instrumentation Dhanpat Rai Publication, 10th Edition, 2012.
3. D Patranabis, Sensors And Tranducers, PHI Publication, 2nd Eedition, 2017.

BIOMEDICAL ENGINEERING

Course Code :EC10003
Credit :2
L-T-P :2-0- 0
Prerequisite :Nil

COURSE OBJECTIVE

Biomedical Engineering is a multidisciplinary field that combines knowledge available in a wide range of disciplines such as engineering, medicine, and societal science. The course focuses on innovating newer equipment and technologies to improve human health and enhance health care facilities in a holistic manner.

COURSE OUTCOMES

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

CO1 : Apply knowledge of basic engineering and biology to solve the problems,

CO2 : Knowledge of human body about cell, potential and organs of body,

CO3 : Develop a thorough understanding on principles of bio-instrumentation,

CO4 : Explain the role of bio-potential electrodes, and design of sensors,

CO5 : Differentiate and analyse the biomedical signal sources, and

CO6 : Knowledge about imaging techniques used in hospital.

COURSE CONTENT

Introduction and Overview

Introduction to biomedical engineering, Applications of biomedical engineering.

The Human Body

cCll-structure and function, Tissue & organs, Bio-potentials, Action potential, Major human systems (musculoskeletal, circulatory, nervous, and respiratory system)

Bio-instrumentation

Instruments in medical practice, Man-instrumentation system, Basic components, Linear network analysis, Bioelectric amplifier (OpAmp, isolation amplifier, instrumentation amplifier), Bio-instrumentation design, and Intelligent medical instrumentation.

Biomedical Electrodes and Sensors

Ssignal acquisition, Bio-potential measurements, Active and passive sensors, and Electrodes for biophysical sensing (Ag-AgCl, surface electrodes, microelectrodes), transducers, sensors.

Biomedical Signals, Imaging and Informatics

Bioelectric phenomena, Sources of biomedical signals, Origin of biopotentials, Basics of bio-signal processing, noise, Interference, Electrical safety issues, Principle of medical imaging techniques, such as X-ray, US, MRI, CT scan, and nuclear imaging, and Fundamentals of bio-informatics.

Text Book

1. John D. Enderle & Joseph D. Bronzino Introduction to Biomedical Engineering, Academic press, 3rd Edition, 2012.

Reference Books

1. Joseph D. Bronzino, Donald R. Peterson,The Biomedical Engineering Handbook, CRC press, 4th Edition 2015.
2. G.S. Sawhney, Fundamentals of Biomedical Engineering, New Age International (P) Ltd, 2011.

HASS ELECTIVE I

SOCIETY, SCIENCE AND TECHNOLOGY

Course Code : HS10013
Credit : 2
L-T-P : 2-0 -0
Prerequisite : Nil

COURSE OBJECTIVE

There is a circular relationship between society, science, and technology. Society creates a need and an ambience to develop science and technology, and science and technology create means to meet societal needs and new opportunities to make human life better. Studying this relationship is the objective of this subject. The subject will expose, before the students, the past developments of science and technology and the social forces that played a dominant role in making these developments possible and the way these were used in the society. The subject will also present the ethical principles that underlie the development and use of science and technology in the society.

COURSE OUTCOMES

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

CO1 : Understand the forces that shape the development of science and technology,

CO2 : Understand the major milestones of scientific discoveries have impacted human thought processes,

CO3 : Understand the effect of technological developments in societal transformation,

CO4 : Analyse the contribution of Science and Technology in solving societal and Environmental problems,

CO5 : Evaluate the ethical issues related to abuse of science and technology, and

CO6 : Apply the skills learned to suggest solutions to global problems linked to science and Technology.

COURSE CONTENT

Introduction

Human Curiosity to Know the Truth of Nature, Need to Improve Quality of Life, Emergence of Science and Technology, Characteristics of Society, Science, and Technology, and Impact of Science and Technology on the Society.

Scientific Discoveries

Milestone Scientific Discoveries of the Past and the Ways They Impacted Human Thought Process and Culture; Scientific Method, Developing a Theory, and Making of a Discovery; Discoveries in the Physical, Biological, and Mathematical Sciences; Normal Science, Paradigms, Anomalies, Crisis and Emergence of Scientific Theories, and Scientific Revolutions.

Technological Developments

Milestone Developments of Technologies and the Ways They Transformed the Society. Stories of Technological Developments such as Steam Engines, Electricity, Semiconductors, and IoT.

Science and Technology in the Service of the Society

Contributions of Science and Technology to Solving Societal, Environmental, and Global Problems.

Successes and Limitations, and Abuses and Control of Science and Technology; Ethical Considerations.

Text Book

1. Bucchi, M., Science In Society: An Introduction to Social Studies of Science, Routledge Publication, 1st Edition,2004.

Reference Books

1. Collins, H. and T. Pinch, The Golem: What You Should Know about Science, 2nd Edition, New York: Cambridge University Press,1998.
2. Collins, H. and T. Pinch,The Golem: What You Should Know about Technology, 2nd Edition. New York: Cambridge University Press, 2014.

3. Kuhn, T. S.,The Structure of Scientific Revolutions, 4th Edition, Chicago University Press, 2012.
4. Hatton, J. and P. B. Plouffe, Eds., Science and Its Ways of Knowing, New Jersey: Prentice Hall,1997.
5. Moskovites, M., Ed., Science and Society, Ontario: House of Anansi Press Limited,1997
6. Sismondo, S. An Introduction to Science and Technology Studies, 2nd Edition. Maldon, MA: Blackwell Publishing, 2009.
7. Sarukkai, S. What Is Science?, New Delhi: National Book Trust, India, 2012.
8. USSR Academy of Sciences Science and Society, Moscow: Nauka Publishers, 1989.

SOCIO-POLITICAL ENVIRONMENT

Course Code : SO10043
Credit : 2
L-T-P : 2-0-0
Prerequisite : Nil

COURSEOBJECTIVE

The objective of this paper include providing basic knowledge on socio-political environment of India and to equip the students with an understanding of their roles, duties and responsibilities in a democratic set up.

COURSE OUTCOMES

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

CO1: Understand contemporary Indian social problems,

CO2: Understand the roles and functions of the three political institutions in our democratic

CO3: Familiarize the students with the Rights and Duties enlisted in the Indian Constitution,

CO4: Grasp the interrelationships among political, social and economic issue,

CO5: Visualize contemporary changes in Political Institutions, and

CO 6: Realize the importance of equity, equality, and dignity in a democratic system.

COURSE CONTENT

Social Problem in India

Meaning and Definition of Social Problems, Characteristics, Causes and Consequences, Problems of Poverty, Unemployment, Population growth, Problems of Women and Aged, Corruption and Nepotism, Illiteracy, Substance Abuse, and Terrorism.

Social Stratification

Equity and Equality, Caste, Religion, Class, Gender Discrimination, Urban Slums.

Political Institutions

Meaning and Basic Concepts of Political Institutions: Legislative, Executive and Judiciary Systems of the Indian Constitution.

Fundamental Rights and Duties

Fundamental Rights and Duties in Indian Constitution, Directive Principles of State Policy.

Contemporary Changes in Political Institutions

Changing Role of the Government in Contemporary India, Role of Government in the Formation of National and International Policies and Their Impact on Business and Trade.

TextBooks

1.C. N. Shankar Rao, S.Chand., Indian Social Problems, by S.cahand Publication,2017

2. M. Laxmikanth., Constitution of India,Cengage Learning,2020.

3. Himanshu Roy &M.PSingh Indian Political System, Pearson publisher,4th Edition,2018.
4. Ram Ahuja ,Social Problems inI ndia, Rawat publisher,4th Edition,2014.

Reference Books

1. Our Parliament, Subhash C Kashyap, NBT, 2021.
2. Social Stratification, Dipankar Gupta (Ed), Oxford India Publication, 1997.
3. Modernisation of Indian Tradition, Yogendra Singh, Rawat Publication, 1986.

THINKING PERSPECTIVES

Course Code : PS10043
Credit : 2
L-T-P : 2-0-0
Prerequisite : Nil

COURSE OBJECTIVE

Cognition plays a significant role in accumulation and processing of information. This subject provides an in-depth understanding of some of the cognitive processes in terms of current theories, models and applications. It helps learners to understand the importance of these cognitive processes and the rationale behind cognition, problem solving, critical thinking, and scientific thinking. It facilitates students to identify and analyze the key conceptual and theoretical frameworks underpinning cognitive process.

COURSE OUTCOMES

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

CO1: Understand the definition and scope of cognition, problem solving, and creativity
CO2: Understand the theories related to cognition, decision making, and critical thinking
CO3: Understand the classic and current experimental research in cognitive processes
CO4: Develop skills essential in designing and conducting experiments in cognition reasoning, and problem solving
CO5: Understand various aspects of critical thinking, scientific thinking, and design thinking process.
CO6: Apply the knowledge of cognitive processes to one's own personal life and to real life issues.

COURSE CONTENT

Basics of Cognition

A Brief History, Emergence of Modern Cognitive Approach, Thinking, Basic Elements of Thought: Forming Concepts, Propositions, Images.
Reasoning, some Basics sources of error, Information-processing approach, connectionist approach, evolutionary approach, ecological approach.

Memory Processes and Critical Thinking

Organization of Long Term Memory, Forgetting, Retrieval and Metamemory; Proactive and Retroactive inference; Amnesia and Retrieval, Flashbulb Memory, Eyewitness Memory, Traumatic Memory, False Memories.

Phases of Critical Thinking: Intellectualization, Suggestion, Hypothesis, Reasoning, and Testing, Critical Thinking Abilities: Thinking, Observational, and Questioning and Dispositions, Critical Thinking Skills: Analysis, Communication, Creativity, Problem-solving Skills, and Open-mindedness.

Systems Thinking and Scientific Thinking

System Definition and Characteristics, Approaches to System Modelling, Causal-Loop Diagramming, System Archetypes, Micro world and Learning Laboratory, The Learning Organization and the Fifth Discipline, Systems Thinking Study, Examples.

Characteristics of Science: Systematic observation and experimentation, Inductive and deductive reasoning, Lessons from Scientific Thinking: Empirical Evidence, Logical Reasoning.

Creativity and Designing Thinking

Creative Thinking, Stages in Creative Thinking, Nature of Creative Thinking, Features of Creativity—Novelty, Originality and Usefulness, Guilford's Measure of Creativity—Fluency, Flexibility, and Originality, Barriers to Creativity, Enhancing Individual and Organizational Creativity.

Designing Thinking as a Process of Problem Solving: Defining Problems, Challenging Assumptions, Developing Concepts, identifying Alternative Strategies and Solutions, Prototyping, and Experimenting Problem Solving through Innovative Solutions, Stages of Design Thinking—Empathize, Define, Ideate, Prototype and Test.

Text Books

1. Solso, R. L.,Cognitive Psychology, Pearson Education, 6th Edition. 2004.
2. Baron, R. A. Psychology,Pearson Education, 5th Edition, 2002
3. Rathus, S.A. Introductory Psychology Wadsworth Cengage,5th Edition, 2016.
4. Ciccarelli, S. & White, N.J, Psychology 5th Edition, Pearson Education.2017
5. The Fifth Discipline: The Art & Practice of the Learning Organization, Cengage Publication,2nd Edition, 2006.
6. Cross, N., Design Thinking: Understanding How Designers Think and Work, Berg Publishers.

Reference Books

1. Baddley, A.,Human memory: Theory and practice. New York Psychology Press,1997.
2. Treror, A.,The psychology of language: From data to theory. Taylor Francis,2002
3. Smith, E.E. &Kosslyn, Cognitive psychology: Mind and brain. Prentice Hall,2007.
4. Tripathi, A.N. &Babu, Nandita (2008). Cognitive processes. In Misra, G. Psychology in India: Advances in Research, Vol. 1,Pearson Education.
5. Vaid, J., & Gupta, Ashum,Exploring word recognition in a semi-alphabetic script: the case of Devanagari. Brain and Language, 81, 679-690.

CREATIVITY, INNOVATION AND ENTREPRENEURSHIP

Course Code : PS10045
Credit : 2
L-T-P : 2 0 0
Prerequisite : Nil

COURSE OBJECTIVE

The course is designed for students who want to enhance their creative and innovative skills and apply them to prepare business plans to form entrepreneurial enterprises. More specifically, the course is designed to help students to stimulate creativity in themselves and learn the impact of innovation on growth creation and design thinking in real-world business situations. In this course, the concepts of entrepreneurship and the environment in which the entrepreneurs act will be developed along with business plans and business models for start-ups.

COURSE OUTCOMES

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

CO1 : Understand the key elements of creativity and innovation,
CO2 : Visualize the impact of innovation on growth creation,
CO3 : Apply creative and design thinking to real-world business situations,
CO4 :Create a foundation of entrepreneurship development and its theories,
CO5 : Develop business plans and business models to start entrepreneurial enterprises, and
CO6 :Analyze the business plan and implement it in real field.

COURSE CONTENT

Introduction

Definitions, Importance, and Relationships among Creativity, Innovation, and Entrepreneurship; Examples.

Creativity

Definitions, Importance, and Relationships among Creativity, Innovation, and Entrepreneurship; Examples, Creative Thinking and Stages of Creative Thinking, Barriers to Creativity, Enhancing Individual Creativity, Guilford's Usual Unusual Test, Psychometric Approaches to Tests of Creativity, Structured tools of Creativity (Developing Creative Focus, Exercising Mind, Setting Directions, Suspending Rules, Thinking Differently, Establishing Formatted Work Space, Stimulating Mechanisms, Utilizing Experiences.

Innovation

Innovation, Benefits, Keys to Successful Innovations, Types of Innovation, Barriers to Innovation, Methods of Generating Ideas, Design Thinking. Creative Problem Solving, and Measures of Innovation.

Entrepreneurship

Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneur, Intrapreneur, Social Entrepreneur, Case Study on the Entrepreneurial Excellence of N. R. Narayan Murthy, Introduction to Agricultural, Rural, Tourism, Social and Digital Entrepreneurship, Entrepreneurial Motivational Behavior (Creativity, Self-Efficacy, Locus of Control, Risk Taking, Leadership, Communication),

Converting Ideas into Products/Services with Differentiating Features, Niche Market, Design of the Products/Services, Bootstrap Marketing, Formulation of Business Plan, Business Model, Financial Planning, and Sources of Finance.

Practical classes will be devoted to organizing practicing sessions on creativity, case study discussion sessions and market analysis sessions on generating novel ideas, and developing and presenting business plans. Students, in groups, will design a new product/service, do a bootstrap market study, develop a business plan, and make an elevator pitch.

Text Books

1. Khanka, S. S. Creativity, Innovation, and Entrepreneurship, S.Chand .
2. Praveen Gupta, Business Innovation, S. Chand , 2007

Reference Books

1. Barringer B. R. and R. Duane, Entrepreneurship: Successfully Launching New Ventures: Pearson Prentice Hall, Ireland, 3rd Edition 2009.
2. Duening, T. N., R. D. Hisrich, and M. A. Lechter , Technology Entrepreneurship: Taking Innovation to the Marketplace, Elsevier, Amsterdam, 2nd Edition 2015.
3. Harrington, H. J., Creativity, Innovation, and Entrepreneurship: The Only Way to Renew Your Organization, Routledge, 2019.

ESSENTIALS OF MANAGEMENT

Course Code : HS10202

Credit : 2

L-T-P : 2-0-0

Prerequisite : Nil

COURSE OBJECTIVE

This course explores the basic concepts and processes of management. Students will learn the importance of management in their professional life from the stories on the evolution and practices of management. Students will examine the fundamental roles and processes of planning, organizing, staffing, directing and controlling that comprise the managers' role. This course also examines the fundamentals of marketing and financial management for the success of the organization. This course will make an attempt to introduce students to the business environment and strategic management process to understand the nuances of business. Students will develop skills related to the manager’s function as required in today’s competitive environment.

COURSE OUTCOMES

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

CO1 :Learn different approaches, theories and stories of various practitioners of management and know how such knowledge could be applied to achieve goals of Organizations within the changing environment,

CO2 : Understand the core functions of management in order to facilitate efficient and effective decision making both at individual and organizational level,

CO3 :Identify the human resource requirement of the organization for achieving its objective effectively,

CO4 :Synthesize various marketing and financial skills and techniques in order to be successful in corporate world,

CO5 :Assess the business environment and understand the importance of various types of business environment for better decision making, and

CO6 : Acquire the lesson learnt in strategic management process for strategic decision making by leveraging the core competencies of the organization.

COURSE CONTENT

Evolution of Management Thoughts

Concept, Scope and Significance of Management; Classical Approach; Scientific, Bureaucratic & Administrative theory of Management; Neo-classical and Modern Approach; Contribution of Management Practitioners

Functions of Management (Part I)

Nature, scope and significance of Planning; Types of Planning; Process of Planning; Barriers to effective planning; Decision making: concept, types and process; Organizing: concept and significance; Delegation of authority; Authority vs. Responsibility; Structure of Organization: departmentalization, Centralization vs. Decentralization

Functions of Management (Part II)

Concept of Staffing, Manpower planning and Job design; Recruitment and selection; Training and development; Performance Appraisal; Directing: Concept, Direction and Supervision; Controlling: Concept, Importance and levels; Process and types of controlling

Marketing and Financial Management

Marketing Mix (Product, place, price, Promotion); Market Segmentation; Introduction, scope, importance and functions of Financial management; Introduction to Financial statements: Profit and loss account; balance sheet

Business Environment and Strategic Management

Business environment: concept, importance, elements; Types of business environment; Strategic Management: Concept, Importance and levels of strategy; Process of Strategic Management

Text Books

1. S.A. Sherlekar & V.S. Sherlekar, Modern Business Organization & Management (Systems Approach) by Himalya Publishing House, 2018.

2. Harold Koontz and Heinz Weihrich ,Essentials of Management: an International Perspective by, McGraw Hills, 2020

Reference Books

1. K. Ashwathappa, Essentials of Business Environment, Himalaya Publishing House, 2017.
2. Joseph L. Massie, Essentials of Management Pearson Education India, Fourth edition, 2015.
3. Azhar Kazmi & Adela Kazmi, Strategic Management, McGrawHill, 5th edition 2020.

SHADES OF ECONOMICS

Course Code : HS 10121
Credit : 2
L -T-P :2- 0-0
Prerequisite : Nil

COURSE OBJECTIVE

This course will provide technical students with knowledge in concepts of environmental economics, resource economics, and circular economy, allowing prosperity for present and future generations. The course will equip future engineers with skill to handle resources efficiently and effectively. Acquaint them with the contemporary trends in business settings and thereby innovate novel solutions to existing problems.

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO1 : Understand the economic drivers that shape the future of India,
CO2 : Understand sustainability issues related to usage of factor endowment,
CO3 : Ability to create linkage between Economics, Science and Technology,
CO4 : Apply knowledge, reasons and the need for regulating circular economy,
CO5 : Assess and analyses scope for global market opportunities, and
CO6 : Explore yet to be unearthed employment opportunities.

COURSE CONTENT

Purple Economy: Economics of *Glocalization*

Introduction to colours and world of economics (including White, Blue, Black, Green, Purple, Grey, Red, Pink, Silver); Concept and definition of purple economy; Cultural footprint; Local and global cultural economy; Culture and well being; Rethinking employment and training in the purple economy; Vocal for Local; Make in India.

Grey Economy: Economics of Informal Sector

Concept and definition of grey economy; Introduction to formal and informal Sector; Formal and informal sector linkage; Labour absorption and dualism in economy; Theoretical and policy issues; Migration in informal sector.

Green Economy: Economics of Reduce, Reuse, and Recycle

Concept and definition of green economy; Green investment and green bond; Green technology and renewable resources; Carbon footprint; Waste management.

Blue Economy: Economics of Ocean Resources

Concept and definition of blue economy; The marine environment; Fisheries and aquaculture; Tourism; Ocean-based renewable sources of energy; Transportation and the blue economy; ; Pollution of water resources; Water resource management.

Black Economy: Economics of Unsanctioned Sector

Concept and definition of black money; Causes and consequences of black economy; Global black income generation; Extent of black money in India. Government measures to curb black money.

Text Book

1. S.K Mishra and V. K. Puri, Indian Economy. Himalaya Publishing House,2022, ISBN: 978-93-5596-423-6

Reference Books

1. Uma Kapila. Indian Economy:Economic Development and Policy. Academic Foundation ISBN-10 : 9332705550 and ISBN-13 : 978-9332705555,2022.
2. Taneja and Myer :Economics of development and Planning, Vishal Publishing Co. ISBN-13 : 978-9382956068.
3. Datt Gaurav & Mahajan Ashwani , Indian Economy,S Chand & Company Limited. 2017.
4. Adrian C. Newton, Elena Cantarello, An Introduction to the Green Economy. Science, Systems and Sustainability,2014
5. Shalini Goyal Bhalla. Circular Economy- (Re) Emerging Movement.,2020.
6. Somnath Hazra & Anindya Bhukta,The Blue Economy. An Asian Perspective. The Informal Economy: an Employer's Approach. The Informal Economy: an Employer's Approach. 2021.
7. The Purple Economy: An Objective, An Opportunity, 2013.
8. Tom Tietenberg, Lynne Lewis, Environmental and Natural Resource Economics. 2018.

INDIAN ECONOMY POST LIBERALISATION

Course Code :HS10123

Credit :2

L-T-P :2-0-0

Prerequisite : Nil

COURSE OBJECTIVE

Study of this course provides an extensive understanding of changing structure of Indian economy over time. This course targets to put emphasis on inclusive growth, reducing poverty, inequality and creating decent employment in the economy. This course will give an understanding about the issues faced by an economy in achieving sustainable development.

COURSE OUTCOMES

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

CO1 : Interpret the changing structure of Indian economy,

CO2 : Perceive the issues and challenges faced by Indian economy,

CO3 : Evaluate the policies and programmes required to achieve inclusive growth,

CO4 : Realise the importance of human capital in triggering economic development,

CO5 : Comprehend the state and role of external sector in strengthening Indian economy,and

CO6 : Help in achieving sustainable development for the economy.

COURSE CONTENT

Introduction and features

Changing structure of the Indian economy Changing paradigms of Development Strategies and Economic Reforms.

Poverty, Inequality and Employment

Various concepts and estimates of poverty; Income inequality; Problem of unemployment; Interface among growth, poverty and employment; Inclusive growth and Human Development; Sustainable Development Goals—Targets for reduction in Poverty, Inequality and Decent Employment.

Demographic Issues

Demographic trends, size and structure of population; Health and Education; Skill challenges and demographic dividends; Sustainable Development Goals—Targets forGreater Wellbeing and Better Human Capital.

Perspectives in Agriculture, Industry and Services

Agricultural growth performance and food security; Growth, trends and changing pattern of Indian industries, industrial reforms and policies; Services in India's growth process; Sustainable Development Goals—Targets for Inclusive and Sustainable Growth.

External Sector and Issues in Indian Public Finance

Foreign trade and trade policy; fiscal devolution,Indian Union Budget and Tax System

Text Book

1. Uma Kapila, Indian Economy Perfomance and Policies,academic foundation, 2020,ISBN:978-933270545

Reference Books

1. S.K. Mishra, and V. K. Puri, Indian Economy, Himalaya Publishing House,2022, ISBN: 978-93-5596-423-6
2. Gaurav Datt and Ashwani Mahajan,Indian Economy, GENERIC. Classic Edition,2022 ISBN-10 : 9352531299 ISBN-13 : 978-9352531295

COMMUNIT/ENVIRONMENT-BASED PROJECTS

Course Code :EX17001
Credit :2
L- T-P :0-0-4
Prerequisite :Nil

COURSE OBJECTIVE

This course is offered to give the students an opportunity to connect with the community and the environment, learn and prioritize their problems, and define the problems in ways that make them amenable to scientific analysis and pragmatic solution. Appreciating the community problems, visualizing and experiencing them in person, self-learning, applying to realities, searching for and finding implementable solutions are the primary benefits of this project-based subject.

COURSE OUTCOMES

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

CO1 :Identify need of the community,

CO2 :Formulate objective of a project,

CO3 :Communicate orally and through formal technical write-ups,

CO4 :Analyze and interpret data wherever essential,

CO5 :Provide an implementable solution to the problem, and

CO6 :Work in team following ethical manners.

COURSE CONTENT

The projects will be applied to problems uppermost in the minds of the community regarding the problems that they confront regularly. The problems may range from social inequality and social justice to lack of common services such as health, education, water, power, banking, and from lack of access to government subsidies and policies to deforestation and environmental problems.

NETWORK THEORY

Subject Code :EE20001

Credit :3

L-T-P : 3-0-0

Prerequisites : Basic Electrical Engineering (EE10002)

COURSE OBJECTIVE

To familiarize the concepts of network theorems, explain the concept of coupling in electric circuits and analyze the transient response of circuits with dc and ac inputs. Understand the concept of two port network, network topology and able to design filters.

COURSE OUTCOMES

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

CO1: Analyze different electrical circuits using network theorems.

CO2: Understand the magnetic couple circuits.

CO3: Apply the transients in DC/AC circuits.
CO4: Evaluate different parameters and functions of one port and two port networks
CO5: Know the concept of network topology
CO6: Design different passive filters

COURSE CONTENT

Network Theorems (for DC and AC Circuit)

Superposition theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem.

Magnetic coupled circuits

Self and Mutual Inductance, Dot convention for coupled circuits and coefficient of coupling.

Transient Response

Duality of circuits, Transient response for R-L, R-C and R-L-C circuits with both DC and AC excitation in time domain and Laplace transformation method.

Two-Port Networks

Network Configurations, Open Circuit, Short circuit, transmission and hybrid parameters, Condition of symmetry and reciprocity in two port network, Interconnection of two port networks (Series, Parallel &Cascade).Inter-relationship between parameters of two port network.

Network Function

Concept of complex frequency, driving point and transfer functions of one port and two port network.

Network Topology

Concepts of Network graph, Tree, Co-Tree, Links and Twigs, Formation of incidence matrix [A] and loop matrix [B] Formation of Fundamental Cut-Set Matrix [QF], Tie-Set Matrix. Relation between branch voltage and current, loop current network topology analysis.

Filter Design

Passive filters, Design of low pass, high pass, band pass, and band elimination filter.

Textbooks:

1. Network AnalysisbyM. E. Van Valkenburg, Pearson Education, 3rd Edition, 2006.
2. Fundamentals of Electric Circuits, Charles K. Alexander, Matthew N.O. Sadiku, McGraw Hill Education; 5 edition (1 July 2013).

Reference Books:

1. Circuits and Networks Analysis and Synthesis (Second Edition) A Sudhakar ShyammohanSPalli, Tata McGraw-Hill, 2011.
2. Basic Circuit Analysis(Second Edition), John O'Malley, Schaum'sOutlines, Tata McGraw-Hill, 2010(Reprint).
3. Network Theory Analysis and Synthesis by Ravish R Singh, S. Chand Publication 1st edition 2023.
4. Engineering circuit analysis by William Hart Hayt Jack E Kemmerly Steven M Durbin
5. Networks and systems by D.Roy Choudhury, New Age Publication, 2nd Edition, June 2013.

ELECTRICAL MACHINES

Course Code : EE20010

Credit : 3

L-T-P : 3-0-0

Prerequisite :Network Theory (EE20001)

COURSE OBJECTIVE

To understand construction, working principles, testing and control of different electrical machines and their industrial and domestic applications.

COURSE OUTCOMES

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

CO1: Know the Construction, principle, efficiency and control of DC machines.

CO2:Understand the principle, Phasor diagram, losses, efficiency and regulation of transformers.

CO3: Analyze the three phase transformers through vector grouping.

CO4: Comprehend the operation and characteristics of Synchronous machines.

CO5: Investigate the operation and characteristics of Induction Motor.

CO6: Study the construction, principle of operation and application of single phase induction motors.

COURSE CONTENT

DC Machine:

Principle of Operation, emf equation of DC machine, Types and its characteristics. Concepts of back emf, armature and shaft torque, Speed control of DC shunt motor, efficiency, Necessity of starter, 3-point starter.

Transformer:

Single phase transformer, Construction , Principle of operation, emf equation, equivalent circuit and phasor diagram, open circuit and short circuit test, regulation, losses and efficiency. Three phase transformer with different vector group.

Three-phase Synchronous Machine:

Construction, Principle of operation, Pitch factor, distribution factor, winding Factor, winding diagram, EMF equation, armature reaction, equivalent circuit V-curves, method of starting and application, voltage regulation of three phase alternator (synchronous impedance and mmf method), power stage and efficiency.

Three-Phase Induction Motor:
Construction, squirrel cage and slip ring type, principle of operation, equivalent circuit and phasor diagram, Torque slip characteristics, starting torque and maximum torque, losses and efficiency, method of starting, speed control and application.

Single-phase Induction Motor
Construction, Staring method and application

Textbooks

1. Electrical Machinery, P. S Bimbhra, 7th Edition, Khanna Publishers, 2008.
2. Electrical Technology, Volume -II. B. L. Theraja, S .Chand Publications. 2010.
3. Electrical Machines, Ashfaq Hussain, Dhanpat Rai, Delhi, 2nd Edition, 2008.

Reference Books

1. Electric Machines, C. I. Hubert, , Pearson Education, 2003.
2. Electric Machines, by Kothari. D P and I J Nagrath, , 3rd Edn, Tata McGraw-Hill, New Delhi. 2004

DATA STRUCTURE AND ALGORITHMS

Course code:ES20001

Credit: 3

L-T-P: 3-0-0

Prerequisite: Programming Laboratory (CS13001)

COURSE OBJECTIVE: To understand linear and nonlinear data structures and perform complexity analysis.

COURSE OUTCOME:

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

CO1: Know the concepts of data structure, data type and abstract data type (ADT).

CO2: Comprehend algorithms and determine their time complexity.

CO3: Implement linked data structure to solve various problems.

CO4: Analyze various data structures such as arrays, stacks, queues, trees and graphs to solve various computing problems.

CO5: Evaluate the utilities of standard algorithms for searching and Sorting.

CO6: Analyze the data structure that efficiently models the solution to a problem.

COURSE CONTENT

Introduction: Basic Concepts of Data Structures, Memory Allocation, Notationsandanalysis, Abstract Data Types, Dynamically Allocated Arrays, Two-Dimensional Arrays, Address Calculation, and Sparse Matrix in array.

Linked Lists, Stacks, and Queues: Singly Linked Lists and Chains, Representing Chains in C, Polynomials, Doubly Linked Lists, Circular & Header Linked Lists. Stacks: Stacks using Dynamic Arrays and Linked Lists. Queues: Queues using Dynamic Arrays and Linked Lists, Deque,Circular Queues using Dynamic Arrays and Linked Lists, Evaluation and conversion of Arithmetic Expressions.

Tree and Graph: ADT Binary Tree - Binary Trees, Binary Search Trees, Tree Traversals, AVL Trees, Concept of B-Trees, Graph ADT, Graph Operations - DFS, BFS.

Sorting and Searching: Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Bubble Sort, Selection Sort, Linear Search, Binary Search, Hashing – Hash Function.

Textbooks:

1. Data Structures, Schaum's OutLines, Seymour Lipschutz, TATA McGraw Hill
2. Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahani Anderson-Freed, Universities Press. Pearson, 2nd Edition

Reference Books:

1. Data Structures using C by Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein. Pearson, 1st Edition
2. Data Structures A Pseudocode Approach with C, 2nd Edition, Richard F. Gilberg, Behrouz Forouzan, CENGAGE Learning, India Edition
3. Data Structures Using C, Second Edition, Reema Thereja, Oxford University Press
4. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education, 2nd Edition.

ANALOG AND DIGITAL ELECTRONICS CIRCUIT

Course Code : EE20007

Credit :3

L-T-P :3-0-0

Prerequisite : Basic Electronics (EC10001)

COURSE OBJECTIVES

The course gives an introduction to analysis of elementary analog and digital circuits. This course is intended to develop an understanding power amplifiers, tuned amplifiers and behavior of noise in an amplifier and their applications. It also provides the basic knowledge of digital logic levels to understand digital electronics circuits including Boolean algebra, logic gates, combinational logic, sequential logic concepts and their applications.

COURSE OUTCOMES

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

CO1: Understand different applications of P-N Junction diode.

CO2: Develop biasing circuits for BJT.

CO3: Apply Field Effect Transistor as an amplifier.

CO4: Analyze different power Amplifier circuit and different application of OP-AMP circuit.

CO5: Identify and understand various digital circuits.

CO6: Design basic combinational and sequential circuits.

COURSE CONTENT

Diode applications

Limiters, clippers, clampers, Zener diode applications: Voltage stabilizers.

Bipolar junction transistor

Analysis of transistor amplifier in CE configuration using BJT small signal model.

Field Effect Transistors

JFET structure and characteristics, MOS structure and characteristics, MOS as a switch CMOS as an inverter.

Power Amplifier and Feedback circuit

Types of amplifier and their equivalent circuit (VA, CA, Trans conductance and Trans resistance amplifier), Class A, B amplifier, Concept and types of feedback topology, Analysis of practical feedback amplifiers, Barkhausen criterion, RC and LC phase shift oscillator(qualitative description), output frequency of the oscillator.

Operational Amplifier

OP-AMP as differentiator and integrator circuit, OP-AMP as comparator, square wave generator using OP-AMP, Schmitt trigger, 555 timer.

Introduction to Digital Circuits

Logic Gates preview

Boolean Algebra:Logic operations**,** Axioms and Laws of Boolean Algebra, Duality, Reducing Boolean Expressions, Boolean Functions and their representation, Expansion of a Boolean Expression in SOP form and POS form.

Minimization of Switching Functions: Introduction, Two-variable K-Map, Three-variable K-Map, Four Variable K-Map, Don't care Combinations.

Combinational Logic Design: Introduction, Adders, Subtractors, Encoders, Decoders,Priority Encoder, Multiplexer, Demultiplexer.

Sequential Logic Design

Flip Flops: Latches and Flip Flops, Race Around Condition, Master Slave (Pulse-Triggered) Flip Flops, Flip Flop Excitation tables, Shift Registers and Counters

ADC and DAC

Introduction, Digital to Analog converter (Weighted Resistor type and R-2R ladder type), Analog to Digital converter (Flash type, Counter type and Successive approximation type).

Textbooks:

1. Integrated Electronics- Analog and Digital Circuits and Systems, J. Millman&Halkias, C.D. Parikh, Mc-Graw Hill India, 2nd Edition, 2013 (10th Reprint).
2. Op-Amps and Linear Integrated Circuits - Ramakant A. Gayakward , Pearson, 4th Edition, May 2015.
3. Digital Logic and Computer Design – M. Morris Mano – PHI, 2011
4. Fundamentals of Digital Logic – Anand Kumar - PHI, 4th Edition, 2017

Reference Books:

1. Digital Principles and Applications – Malvino & Leach –TMH, 7th edition, 2011
2. Digital Fundamentals – T. L. Floyd & Jain – Pearson Education, 10th edition, 2011
3. Microelectronics circuits- A. S. Sedra and K. C. Smith- 5th Edition, 2011 - Oxford University Press.
4. Linear Integrated Circuits - D. Roy Choudhury and Shail B. Jain- 5th Edition- New Age International Publishers, 2018.
5. Foundations Of Analog and Digital Electronic Circuits:-Anant Agarwal, Elsevier India (2013)

LINEAR CONTROL SYSTEM

Course Code : EE20004

Credit : 3

L-T-P : 3-0-0

Prerequisite : Network Theory(EE20001)

COURSE OBJECTIVE

To understand the control system model of physical systems, and to employ time domain and frequency domain analysis to determine the system stability, the steady state and transient response, also to realize the response of multi input and multi output system.

COURSE OUTCOMES

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

CO1: Illustrate different terminology of control system.

CO2: Develop the mathematical model of physical systems.

CO3: Analyze the time domain response of different systems.

CO4: Evaluate the stability of a system by classical methods.

CO5: Analyze frequency domain response of different linear dynamic system.

CO6: Understand the state space modeling and different types of compensators.

COURSE CONTENT

Introduction

Basic concept of control system: open loop and closed loop control system, differential equations and transfer function, Effect of feedback on gain, stability, sensitivity and noise of the system, order and type of the system.

Modeling of physical system

Mathematical modeling of mechanical system and electrical system, Analogous system, Translational and rotational mechanical system, Transfer function by block diagram reduction technique, Developing block diagram from a mathematical model, Signal flow graph terminology, construction & procedure, Transfer function from signal flow graph using Mason’s gain formula, Time delay control system.

Time domain analysis

Time response of first order system, Response to the unit step input, unit ramp input, Time response of second order system for unit step input, Time response specification, steady state error & design specification, Error constant of second order system, Minimization of Errors through P, PI and PID controllers.

Concept of stability

The concept of stability, necessary condition for stability, Routh- Hurwitz stability criterion, Relative-stabilityanalysis.

Root Locus Technique

Root locus concept, construction of root locus, construction rules, Determination of gain from root locus.

Frequency domain analysis

Introduction, Polar plots, Bode plots, Nyquist stability criterion, Stability analysis.

Compensators

Realization of basic compensators, Cascade compensation and Feedback compensation.

State Space

Concept of state, State variable, State model, State space model for LTI system, Computation of State transition matrix.

Textbooks:

1. Control System Engineering by Noran S Nise, John Wiley Publication, 6^{th} Edition, 2012.
2. Modern Control Engineering by K. Ogata PHI publication, 5th Edition, 2010.

Reference Books:

1. Control Systems Engineering by R. Anandnatarajan and P. Ramesh Babu, SCITECH,4th edition, 2016.
2. Control Systems: Theory and applications by Smarajit Ghosh, Pearson. Publication 2012
3. Automatic control system by Hasan Saeed, 6th revised edition 2008, S.K. Kataria and Sons.
4. Modern Control Engineering. By D. Roy Choudhury PHI publication, 5th Edition,2009.
5. Automatic Control Systems by Benjamin C. Kuo, Prentice-Hall,7th Edition,2009.
6. Control System Engg, by I. J. Nagrath and M Gopal ,New age international publication, 4th Edition,2011.
7. Control System by D N Manik, Cengage Learning India Pvt, 2012.
8. Automatic control systems by Prof. B.S. Manke and S. N. Verma , Khanna publication, 2012

COMPUTER ORGANIZATION

Course code : ES20002
Credit : 3
L-T-P : 3-0-0
Prerequisite : NIL

COURSE OBJECTIVE

This course provides a foundational understanding of computer architecture and organization, covering key topics such as computer structure, machine instructions, processor and memory organization, and I/O systems. It explores architectures like Von-Neumann and Harvard, memory hierarchies, and CISC vs. RISC designs. Students will gain the skills to analyze and optimize computer systems for various applications.

COURSE OUTCOMES

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

CO1: Recognize the components of a computer and various computer architectures.

CO2: Explain instruction formats and various addressing modes.

CO3: Demonstrate the working of control units and address sequencing in practical scenarios.

CO4: Differentiate between memory types and evaluate their performance.

CO5: Assess the performance of various I/O techniques in improving system efficiency.

CO6: Design a basic processor or memory architecture incorporating bus systems and control units for specific applications.

COURSE CONTENT

Structure of computers

Computer types, Functional units, Basic operational concepts, Von- Neumann Architecture and Harvard Architecture, Bus structures and types, Computer performance

Machine instructions and programs

Instruction codes, Computer Registers (GPR and SPR), Instruction cycle, Timing and Control, Instruction Formats, Addressing Modes, Types of instructions, Stack organization, sub-routine, Complex Instruction Set Computer (CISC) Reduced Instruction Set Computer (RISC), CISC vs RISC

Processor organization

Bus architecture- Single Bus, Multi bus, Common bus, Hardwired Control unit, Micro-programmed control unit- Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit.

Memory organization

Memory Hierarchy, Semiconductor Memories, RAM(Random Access Memory), Read Only Memory (ROM), RAM and ROM Architecture, Cache Memory, Performance considerations, Virtual memory, Address translation techniques

Input output and multiprocessors

I/O interface, Programmed IO, Memory Mapped IO, Interrupt Driven IO, DMA, introduction to MP and MCA

Textbooks

1. Carl Hamacher, Zvonks Vranesic, SafeaZaky (2002), Computer Organization, 5th edition, McGraw Hill, New Delhi, India.

Reference books

1. M. Moris Mano (2006), Computer System Architecture, 3rd edition, Pearson/PHI, India.
2. William Stallings (2010), Computer Organization and Architecture- designing for performance, 8th edition, Prentice Hall, New Jersy.
3. Anrew S. Tanenbaum (2006), Structured Computer Organization, 5th edition, Pearson Education Inc,
4. John P. Hayes (1998), Computer Architecture and Organization, 3rd edition, Tata McGrawHill

INTRODUCTION TO DATABASE MANAGEMENT SYSTEM

Course Code: ES20004

Credit: 3

L-T-P: 3-0-0

Prerequisite: Data Structure and Algorithm (ES20001).

OBJECTIVES

This course aims at enabling the students to grasp the concepts of database schemas, structured queries, relational algebra, normalization so that the learners can deal with SQL and creation of databases.

COURSE OUTCOMES

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

CO1: Understand Database concepts and Query languages.

CO2: Comprehend the utility of the ER diagram.

CO3: Apply the normalization to build schemas for DBMS.

CO4: Analyze the efficacy of the concepts of SQL in DBMS.

CO5: Evaluate the benefits of functional dependencies in DBMS.

CO6: Design a Database to incorporate transactions and recovery.

COURSE CONTENT

Fundamental of Database Management Systems and Entity Relationship Model

Introduction to Database and Database Users, Database System Concepts and Architecture: data Models, schema, and instances, Conceptual Modeling and Database Design: Entity Relationship (ER) Model: Entity Types, Entity Sets, Attributes, Keys, Relationship Types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, ER Naming Conventions. Enhanced Entity-Relationship (EER) Model.

Functional Dependencies and Normalization

Database Design Theory and Normalization: Functional Dependencies, Theory of Dependencies-Functional Dependency, Armstrong's axioms, closure of a set and minimal covers; Normal Forms based on Primary Keys, Second and third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form.

Relational Data Model and SQL

Relational Model Concepts, Basic SQLs, SQL Data Definition and Data types, Constraints in SQL, Retrieval Queries in SQL, INSERT, DELETE, UPDATE Statements in SQL, Relational Algebra and Relational Calculus: Unary Relational Operations: SELECT and PROJECT, Binary Relation: JOIN and DIVISION.

Introduction to Transaction and Recovery

Introduction to Transaction Processing Concepts and Theory: Introduction to Transaction Processing, Transaction and System Concepts, Properties of Transactions, Recoverability, Serializability, Concurrency Control Techniques, Locking techniques for Concurrency Control, Concurrency Control based on Time-Stamp Ordering.

Textbooks:

1. Fundamentals of Database system by R. Elmasari & SB Navathe, 7th Edition, 2018, Pearson Education
2. Database System Concepts by A. Silberschatz, HF Korth & S. Sudarshan, 7th Edition, 2019, Mc Graw-Hill Education.

Reference books:

1. Database Management Systems by R. RamKrishna & J. Gehrke, 3rd Edition, 2018, Mc-Graw-Hill Education.
2. Database System concepts by P. Rob & CM Coronel, Indian Edition, 2011, Cengage Learning
3. Fundamentals of Relational Database Management Systems by S. Sumathi & S. Esakkirajan, 2007, Springer.

Reference: Syllabus of Database Management Systems of Massachusetts Institute of Technology, US

https://ocw.mit.edu/courses/6-830-database-systems-fall-2010/pages/syllabus/

POWER ELECTRONICS AND DRIVES

Course code:EE31003

Credit: 4

L-T-P: 3-1-0

Prerequisite:Network Theory (EE20001), Electrical Machines (EE20010)

COURSE OBJECTIVE

This course aim to equip students with the knowledge and skills to understand, analyze, and design power electronic circuits and systems, particularly in the context of electrical drives.

COURSE OUTCOMES

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

CO1: Understand the working principles of different power electronics devices.

CO2: Analyze the concepts of single phase and three phase controlled rectifiers.

CO3: Know the control techniques and operation of DC to DC and DC to AC converters.

CO4: Able to know a proper converter configuration suitable for industry.

CO5: Understand the dynamics of electrical drives.

CO6: Know the use of solid state devices for speed control of DC and AC electrical drives.

COURSE CONTENT

Power Switching Devices:

Introduction to Power Electronics, Thyristor characteristics , Turn ON methods, Dynamic Characteristics of thyristors, Thyristor Ratings- Average, RMS & surge ratings, Thyristor Protection. Characteristics & construction of Power MOSFETS, Comparison between Power MOSFET & Power BJT, Characteristics & construction of IGBT, Forward & Reverse Blocking Capability, Switching characteristics, Safe operating area, snubber protection, GTO – turn on and turn off methods, TRIAC and DIAC Characteristics and applications.

AC to DC Converters:

Single Phase Converters – Half Wave, with R, RL load, Single Phase Converters – Half Wave, with RLE load, Single Phase Converters – Half Wave, with RL load & Free Wheeling diode, 1 Phase Full Wave converters with R & RLE Load, concept of Line Commutated Inverters, Single Phase Semi Converters, 3 Phase converters, Single Phase Dual converters.

DC to DC Converters:

Step Up and Step Down choppers, Buck-Boost Convertor, 4 Quadrant Choppers. Concept of Switch Mode Power Supply, Forward and Flyback Converter.

DC to AC Converters:

Single Phase Half Bridge & Full Bridge Inverters, 3-phase inverters, 180° and 120° conduction, Voltage control of inverter, Sinusoidal Pulse Width Modulation, concept of multilevel inverter.

AC to AC Converters:

Single phase AC to AC phase control, with R and RL load.

4 Hrs

Electric Drives:

Basic elements of electric drives, 4 quadrant operation of electric drives. Review of characteristics of DC motors, and induction motors. Calculation of equivalent moment of inertia of a drive system and load equalization. Phase controlled and Chopper controlled DC drive. Control of Induction Motor by AC –AC Voltage controller, PWM Inverter fed induction motor drives. Concept of V/f control. Concept of Stepper motors and control. AC and DC servo motors.

Text Books:

1.Power Electronics by P. S. Bimbhra, Khanna Publishers, 4th edition, 2012

2.Fundamentals of Electric Drives by G K Dubey, Narosa Publishers, 2nd edition 2007.

Reference Books:

1.Power Electronics By M. H. Rashid, Pearson Education, 3rd Edition, 2014.

2.Power Electronics, Converters, Applications and Design N. Mohan, Undeland and Robbins, John Wiely and Sons , Third Edition, 2002.

3.Fundamental of Power Electronics by S K Bhattacharya, Vikas Publishing, 1st edition-2005.

4.S. K. Pillai : A First Course On Electrical Drives, Second Edition, New Age International Publishers 2007.

5.N. K. De, P. K. Sen: Electric Drives, 7th Edition, PHI Learning Pvt. Ltd., 2004.

6.Modern Power Electronics and AC Drives by Bimal. K. Bose, PHI Publisher, 1st Edition, 2013.

OPERATING SYSTEMS CONCEPT

Course code:ES30001

Credit: 3

L-T-P: 3-0-0

Prerequisite: Data Structure & Algorithms(ES20001)

COURSE OBJECTIVE

To realize basic architecture of Operating System and different operations on Processes, Main memory, Secondary memory, Virtual memory, Files & Disks.

COURSE OUTCOMES

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

CO1. Interpret the basic functions of operating system, process concept and operation on processes.

CO2. Identify the difference between process & thread, issues of scheduling of user-level processes / threads.

CO3. Implement locks, semaphores, monitors for synchronization in multiprogramming/ multithreaded systems.

CO4. Analyse the cause and effect related to deadlocks and avoidance of deadlock.

CO5. Evaluate the issues and challenges associated with main memory, virtual memory and file system.

CO6. Investigate the concept of Disk scheduling and Virtualization techniques based on certain case studies.

COURSE CONTENT

Introduction to operating systems:

Review of computer organization, operating system structures, system calls, system programs, virtual machine, Process concept, Operations on processes, Cooperating processes, Inter-Process-Communication (IPC), Communication in client-server systems, Context Switching. Case study on UNIX and WINDOWS Operating System.

CPU Scheduling:

Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Real time scheduling, Algorithm evaluation

Process Synchronization:

The critical section problem, Synchronization hardware, Semaphores, Classical problems of synchronization.

Deadlock:

Methods for handling deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Memory Management:

Swapping, Contiguous memory allocation, Paging, Segmentation, Virtual memory - Background, Demand Paging, Process Creation, Page replacement, Allocation of frames, Thrashing.

File System Interface:

File Concept, Access methods, Directory Structure, Allocation methods, Free space management, Disk Scheduling & Management.

Virtualization: Motivation and techniques, Case studies of operating systems

Operating System Protection & Security

Textbooks:

1. Galvin, P. B., Gagne, G., & Silberschatz, A. (2003). *Operating system concepts*. John Wiley & Sons.

2. William Stallings, Operating Systems, Internals and Design Principles, Pearson Education.

Reference Books:

1. Deitel, H. M., Deitel, P. J., & Choffnes, D. R. (2004). Operating systems. Delhi.: Pearson Education: Dorling Kindersley.

2. Andrew S. Tanenbaum and Herbert Bos, Modern Operating Systems, 5th edition, Pearson, 2023.

SIGNAL PROCESSING

Course code:ES30002

Credit: 3

L-T-P: 3-0-0

Prerequisite: Network Theory (EE20001), Analog and Digital Electronics Circuit(EE20007)

COURSE OBJECTIVE

To explore various signal processing techniques for real time applications

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO1: Understand analog and digital signals and system
CO2. Analyze the discrete time systems in time domain.
CO3. Evaluate characteristics of signals and systems in frequency domain
CO4: Understand the concept z-transform and inverse z transform
CO5: Design IIR filter using impulse invariance and bilinear transformation techniques.
CO6: Design of FIR filter using different windowing techniques.

COURSE CONTENT

Introduction

Characterization and classification of signals, Analog and digital signals, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power. Elementary signals/Functions: exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sync functions.

Systems: Definition, Classification: linear and nonlinear, time variant and invariant, causal and non- causal, static and dynamic, stable and unstable, invertible, Sampling theorem, Quantization of signals.

Discrete time Signals & Systems

Analysis of discrete time LTI system: Operation on Discrete Time Signals, Convolution sum and de-convolution, Properties of convolution, Applications of convolution

Fourier Transform, DTFT, DFT, IDFT and FFT

Introduction to Fourier Series and Fourier Transform, Discrete Time Fourier Transform, Discrete Fourier Transform, Inverse Discrete Fourier Transform, Fast Fourier Transform and their properties.

Z-Transform
Introduction to Z-Transform, ROC of the Z-Transform, Properties of ROC, Properties of Z-Transform, Inverse Z-Transform, Long division method, Partial Fraction Expansion Method, Stability analysis of Discrete Time Systems.

Digital filters (IIR & FIR FILTERS)

Introduction to Digital Filter, Design of IIR filter using impulse invariance technique, Design of IIR filter using Bilinear transformation, Design of FIR Filter using different windowing techniques.

Textbooks:
1. Digital Signal Processing- J.G. Proakis & D. G. Manolakes, 5th Edition, Pearson Education, 2021
2. Principle of Signal Processing and Linear System: B.P. Lathi, 5th Edition, Oxford University Press, 2009.

Reference Books:

1. Signals and Systems – A.V. Oppenheim, A.S. Willsky and S.H. Nawab, 2nd Edition, Pearson, 2015.
2. Digital Signal Processing - Computer Based Approach: S. K . Mitra, Second Edition, McGraw-Hill Higher Education, 2001

DATA COMMUNICATION AND COMPUTER NETWORKS

Course code:ES30004

Credit: 3

L-T-P: 3-0-0

Prerequisite:Operating Systems Concept (ES30001)

Course Objectives:
The main objective of data communication and computer networks is to enable the efficient and reliable exchange of data between two or more devices. This involves facilitating communication and collaboration, sharing resources and providing access to centralized data and applications. Essentially, it aims to connect users and devices, regardless of their physical location, to share information and resources.

Course Outcomes: Upon completing this course, the student will be able to

CO1. Know the Categories and functions of various Data communication Networks

CO2. Analyze various error detection techniques.

CO3. Demonstrate the mechanism of routing the data in network layer

CO4. Know the significance of various Flow control and Congestion control Mechanisms

CO5: Trace the flow of information from one node to another node in the network
CO6.Know the Functioning of various Application layer Protocols.

Introduction to computer networks and Internet:

Understanding of network and Internet, The network edge, The network core, Understanding of Delay, Loss and Throughput in the packet-switching network, protocols layers and their service model, History of the computer network

Application Layer:
Principles of computer applications, Web and HTTP, E-mail, DNS, Socket programming with TCP and UDP

Transport Layer:
Introduction and transport layer services, Multiplexing and Demultiplexing, Connection less transport (UDP), Principles of reliable data transfer, Connection oriented transport (TCP), Congestion control.

Network Layer:
Introduction, Virtual and Datagram networks, study of router, IP protocol and addressing in the Internet, Routing algorithms, Broadcast and Multicast routing

The Link layer and Local area networks:
Introduction and link layer services, error-detection and correction techniques, Multiple access protocols, addressing, Ethernet, switches.

TEXT BOOKS:

1. Kurose James F, Keith W- Computer Networking A Top-Down Approach, 6th Edition, Pearson.

2. Behrouz A. Forouzan - Data Communications and Networking, 4th Edition, McGraw-Hill Education

3. Computer Networks: A. S. Tannenbum, D. Wetherall, Prentice Hall, Imprint of Pearson 5th Ed

Reference Books: .

1. Computer Networks:A system Approach:Larry L, Peterson and Bruce S. Davie, Elsevier, 4th Ed
2. Computer Networks: Natalia Olifer, Victor Olifer, Willey India
3. Data and Computer Communications: William Stallings, Prentice Hall, Imprint of Pearson, 9th Ed.
4. Data communication & Computer Networks: Gupta, Prentice Hall of India
5. Network for Computer Scientists & Engineers: Zheng, Oxford University Press
6. Data Communications and Networking: White, Cengage Learning

POWER SYSTEM ENGINEERING

Course Code: EE31004

Credit: 4

L-T-P: 3-1-0

Pre-requisite: Network Theory (EE20001) and Linear Control System (EE20004)

Course Objective:
This subject provides the basic knowledge about the key parameters of transmission and distribution system,mechanically design the components and analyze the performance of transmission lines. It also provides the knowledge of analyzing a power system by different studies and know the philosophy of protection and the methods to protect power system components.

COURSE OUTCOMES

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

CO1: Evaluate the line constants in different configuration of overhead lines
CO2: Analyze the performance of transmission lines and voltage distribution in different distribution modules
CO3: Design the mechanical parameter of overhead transmission system
CO4: Solve load flow problems.
CO5: Analyze the mathematical calculation of different types of fault and power system stability
CO6: Comprehend the Circuit interruption devices of power system

Course content

Power Transmission System:

Electrical Design of Overhead transmission lines Constants of transmission line, skin effect, inductance of 1-ph and 3-ph overhead lines, concept of self GMD and mutual GMD. Capacitance of 1-ph and 3-ph overhead lines.

Substations, Principals of Operation: Types of Substations & Substation Design

Performance of Transmission Lines: Classification of overhead transmission lines, performance of short transmission lines, medium transmission lines- nominal pi & T methods, end condenser method. Long Transmission lines-generalized constants of a transmission line.

Mechanical Design of Overhead transmission lines: Main components of overhead lines, Different types of Insulators, String efficiency, methods to improve SE, Corona and factors affecting corona, methods of reducing corona effect, sag calculation.

Power Distribution System:

Classification of Distribution system Types of DC distributors, DC distribution calculation ring distributor, 2 wire & 3 wire DC system. Distribution system voltage regulation. AC Distribution calculation, 3 ph 3 wire and 4-wire balanced and unbalanced load.

Representation of Power System:

Single line diagram, per unit quantities and its advantages, Impedance and Reactance diagram, bus admittance(Y bus) matrices and their formation.

Load Flow Studies: Power flow in a transmission system, bus classification, data for load flow studies, power system equation , solution techniques-Gauss iterative method, Gauss-Seidel method, Newton-Raphson method, Fast decoupled load flow (FDLF) method, comparison of load flow solution techniques.

Power System Stability : Steady state stability and transient stability- stability problem, rotor dynamics and swing equation, power angle equation and diagram, equal area criterion and its application, critical clearing angle, fault clearing time, stepby-step solution of swing curve, factors influencing transient stability, methods of improving stability.

Symmetrical and Unsymmetrical Faults: Symmetrical Components of unbalanced phasors, power in terms of symmetrical components, sequence impedances and sequence networks. Analysis of single line to ground fault, line-to-line fault, Double Line to ground fault and Symmetrical Fault on an unloaded generators and power system network with and without fault impedance .

Circuit interruption devices : Current in the arc, definitions of sub-transient, transient, steady states definitions of making current, breaking current, recovery voltage, prospective current, reignition and restrike. Low and high resistance interruption, resistance switching. Air break circuit breaker, air blast CB, Oil CBs, SF6 CB and vacuum CB.

Text books

1. I.J.Nagrath and D.P.Kothari,"Power System Engineering", Tata McGraw Hill 1994.
2. Wadhwa, C.L. "Electric Power Systems". Second Edition, Wiley Eastern Ltd., 1985.

Reference books

1. "Power System Engineering" by A. Chakraborti, M.L. Soni, P.V.Gupta, U.S. Bhatnagar, Published by Gagan Kapur for Dhanpat Rai & Co., (P) Ltd. Edn.2003
2. Hadi Saadat, "Power System Analysis". McGraw Hill,1999.
3. W.D. Stevenson, Jr. "Elements of Power System Analysis",McGraw

COMPUTATIONAL INTELLIGENCE TECHNIQUES

Course Code:ES30011

Credit-3

Course Outcomes (CO): At the end of the course, the students will be able to

CO1: Know the soft computing techniques, paradigms for building intelligent systems.
CO2: Analyze the different learning technique of ANN
CO3: Understand the concept of supervisory neural network and apply to real world problem by supervisory neural network .
CO4: Know the concept of unsupervisory neural network and apply it to real world problem.
CO5: Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules
CO6: Apply Evolutionary algorithms to optimization problems.

Introduction

Why Computational Intelligence? – Computational intelligence concept – Importance of tolerance of imprecision and uncertainty, Difference between Hard and Soft computing, fundamental concepts, Biological neuron, Artificial neuron, activation functions, setting of weights, typical architectures, Single layer Perceptron, Multilayer Perceptron, learning/training laws and algorithms, Hebbian learning, error correction learning, competitive learning, Boltzman learning, supervised learning, unsupervised learning, Perceptron, linear separability- XORfunction.

ANN Paradigms

Back propagation learning, self organizing map (SOM), competitive learning, kohonen maps, Hopfield Network, Neural networks as associative memories, Bidirectional Associative Memory.

Fuzzy Logic

Introduction, fuzzy versus crisp, fuzzy sets, membership function, basic fuzzy set operations, properties of fuzzy sets, fuzzy Cartesian product, operations on fuzzy relations, fuzzyfication, fuzzy quantifiers, fuzzy inference, fuzzy rule based system, defuzzification methods.

Genetic Algorithms

Introduction, encoding, fitness function, reproduction operators, genetic modeling, genetic operators, crossover, single site crossover. two point crossover, multi point crossover, uniform crossover, matrix crossover, crossover rate, inversion & deletion, mutation operator, mutation, mutation rate, bit–wise operators, generational cycle, convergence of genetic algorithm.

Text Books:

1. S. Rajasekaran and G. A. V. Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, PHI, New Delhi,2003.
2. D. E. Goldberg, Genetic Algorithm in search, optimization and machine learning, Addition Wesley Publication,NY.

Reference Books:

1. Zimmermann H. J., "Fuzzy Set Theory and Its Applications", Allied Publishers Ltd.,1999.
2. KlirG. J., Folger T., "Fuzzy Sets, Uncertainty and Information", Prentice Hall of India, 5th. Indian reprint,2002.
3. ZuradaJ. M., "Introduction to Artificial Neural Systems", Jaico Publishing House,2006.
4. Mohammad H. Hassoun, "Fundamentals of Neural Networks", Prentice Hall of India, 2002.

CYBER SECURITY

Course code:ES30018
Credit: 3
L-T-P: 3-0-0
Prerequisite: Programming Lab(CS13001)

COURSE OBJECTIVE

This course offers a comprehensive introduction to cyber security, covering essential concepts, principles, and practices vital for protecting information systems in today's digital landscape. Through a blend of theory and practical applications, students will gain insights into cyber threats, security measures, cryptographic techniques, and legal and ethical considerations.

COURSE OUTCOMES

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

CO1 Understanding fundamental of cyber security concepts and terminology.

CO2 Analyze various types of cyber threats and their impact.

CO3 Implement security principles and measures effectively.

CO4 Apply digital signature concepts .

CO5 Evaluate cryptographic methods and their applications.

CO6 Discuss legal, ethical, and privacy issues in cyber security.

COURSE CONTENT

Introduction to Cyber Security

Overview of cyber security, Importance of cyber security in today's digital world, Key terminology and concepts, Types of cyber threats (malware, phishing, etc.), Cyber attack vectors and case studies, Introduction to threat intelligence, DoS, DDoS.

Security Principles

Confidentiality, Integrity, and Availability (CIA Triad), Security policies and procedures, Risk management fundamentals, Basics of network security, Firewalls, intrusion detection systems, and VPNs , Securing wireless networks, Risk identification and analysis.

System Security

Security features of operating systems, User authentication and access control, Patch management and system hardening, Application Security, Software vulnerabilities and security best practices, Secure software development life-cycle (SDLC), Web application security fundamentals and smart grid potential threat.

Cryptography

Introduction to cryptography and encryption, Symmetric vs. asymmetric encryption, Public key infrastructure (PKI). Block ciphers and modes of operation, Digital signature schemes (e.g. RSA, ECDSA), Certificate authorities and trust models, Public-key cryptography and certificate authorities.

Legal and Ethical Issues

Overview of cyber laws and regulations (e.g., GDPR, CCPA), Ethical hacking and responsible disclosure, Privacy considerations in cyber security.

TEXT BOOK:

1. Michael E. Whitman, Herbert J. Mattord : “Principles of Information Security” Cengage, 6th Edition 2017.

REFERENCE BOOKS:

1. Network Security Essentials: Applications and Standards" by William Stallings, 6th Edition 2018, Pearson Education.
2. The Web Application Hacker's Handbook" by Dafydd Stuttard and Marcus Pinto, wily 2nd edition 2011.
3. Cyber Security Essentials" by Charles J. Brooks, Christopher Grow, and Philip Craig, Sybex Illustrated edition, 2018.
4. Cybersecurity for Executives: A Practical Guide" by Gregory J. Touhill, Wiley-AIChE 1st edition 2014.

COMPILER DESIGN

Course code:ES30020

Credit: 3

L-T-P: 3-0-0

Prerequisite: Theory of Computation(ES30012)

COURSE OBJECTIVE

To introduce the major concept areas in compiler design and know the various phases of the compiler . To understand the various parsing algorithms and comparison of the same .To provide practical programming skills necessary for designing a compiler .To gain knowledge about the various code generation principles .To understand the necessity for code optimization

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO1: Identify the phases of a compiler to translate from source code to executable code
CO2: Apply the knowledge of LEX & YACC tool to develop a scanner and parser
CO2: Design and develop software system for backend of the compiler
CO3: Suggest the necessity for appropriate code optimization techniques
CO4: Conclude the appropriate code generator algorithm for a given source language
CO5: Identify the effectiveness of optimization and learn various machine independent and machinedependent optimization techniques.

CO6: Design a compiler for any programming language

COURSE CONTENT

Introduction to Compilation:

Compilers, Analysis of the source program, Phases of a compiler, Cousins of the Compiler, Grouping of Phases, Compiler construction tools, Lexical Analysis, Role of Lexical Analyzer, Input Buffering, Specification ofTokens. Lab Component: Tutorial on LEX / FLEX tool, Tokenization exercises using LEX.

Syntax Analysis:

Role of the parser, Writing Grammars, Context, Free Grammars, Top Down parsing, Recursive Descent Parsing, Predictive Parsing, Bottom-up parsing, Shift Reduce Parsing, Operator Precedent Parsing, LR Parsers, SLR Parser, Canonical LR Parser, LALR Parser. Lab Component: Tutorial on YACC tool, Parsing exercises using YACC tool.

Intermediate Code Generation:

Intermediate languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, Backpatching, Procedure calls.

Lab Component: A sample language like C-lite is to be chosen.

Intermediate code generation exercises for assignment statements, loops, conditional statements using LEX/YACC.

Code Optimization and Run Time Environments:

Introduction, Principal Sources of Optimization, Optimization of basic

Blocks, DAG representation of Basic Blocks, Introduction to Global Data Flow Analysis, Runtime Environments, Source Language issues, Storage Organization, Storage Allocation strategies, Access to non-local names, Parameter Passing, Error detection andrecovery.

Lab Component: Local optimization to be implemented using LEX/YACC for the sample language.

Code Generation:

Issues in the design of code generator, The target machine, Runtime Storage management, Basic Blocks and Flow Graphs, Next-use Information, A simple Code generator, DAG based code generation, Peephole Optimization. Lab Component: DAG construction, Simple Code Generator implementation, DAG based code generation using LEX/YACC for the sample language.

Textbook:

1. Alfred V. Aho, Jeffrey D Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education,2012.

Reference Books:

1. Allen I. Holub, "Compiler Design in C", Prentice Hall of India, 2003.
2. C. N. Fischer, R. J. LeBlanc, "Crafting a compiler with C", Benjamin Cummings, 2003.
3. Henk Alblas, Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001.
4. Kenneth C. Louden, "Compiler Construction: Principles and Practice", Thompson Learning, 2003

CLOUD COMPUTING

Course code:ES40013
Credit: 3
L-T-P: 3-0-0
Prerequisite: NIL

COURSE OBJECTIVE

To explore various highly scalable cloud-based applications by creating and configuring virtual machines on the cloud and to build the private cloud for different Electrical Engineering Problems

COURSE OUTCOMES

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

CO1: Understand Cloud Computing concepts, technologies, architecture and applications

CO2. Analyze the underlying principle of cloud virtualization, cloud storage, data management and data visualization.

CO3. Learn about different cloud programming platforms and tools for developing and deploying applications on cloud.

CO4: Develop highly scalable cloud-based applications by creating and configuring virtual machines on the cloud.

CO5: Familiar with Globally available Cloud Computing Service Platforms

CO6: Apply cloud computing techniques for solutions of Electrical Engineering problems.

COURSE CONTENT

Introduction -

Overview of Computing Paradigms: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing Cloud Computing (NIST Model) Properties and Characteristics of Cloud.

Cloud Computing Architecture -

Cloud computing stack Service Models (XaaS): Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS) Deployment Models: Public cloud, Private cloud, Hybrid cloud. Data Center Architecture.

Enabling Technologies:

Networks: ISPs, Connectionless Packet Switching, Router-based Interconnectivity, Technical and Business Considerations, Data Center: Standardization and Modularity, Automation, Remote Operation, High Availability.

Cloud Resource Virtualization -

Introduction to virtualization Different approaches to virtualization Hypervisors Machine Image Virtual Machine(VM) Process VM vs System VM Resource Virtualization: Server, Storage, Network Full Virtualization vs Para Virtualization Operating System Support for Virtualization Virtual Machine(resource) Provisioning and Manageability VM Placement, VM Migration.

Service Management in Cloud Computing -

Service Level Agreements (SLAs) Billing & Accounting Economics of scaling Managing Data: Database & Data Stores in Cloud, Large Scale Data Processing.

Global Cloud Platforms:-

Globally available public clouds (Microsoft Azure, Amazon Web Services, Google Cloud Platform): Overview and Comparison, Instances, Images, Networking and Security, Storage, Monitoring and Automation.

Load Balancing in Cloud –

Importance of Load Balancing in Cloud, Categories and Parameters for Load Balancing, Algorithms, Capacity Planning, Resource Pooling, Sharing and provisioning.

Cloud Security -

Cloud Security Risks, Trust, Operating System Security, VM Security, Security of Virtualization, Security Risks Posted by Shared Images, Security Risks Posted by Management OS, Data privacy and security Issues, Identity & Access Management, Access Control, Authentication in cloud computing.

Cloud Computing Applications in Electrical Engineering:

Case Studies: Smart Grid Applications, Electric Power Utility, Electrical Load Forecasting, Applications in Renewable Energy Industries.

Textbooks:

1. Sandeep Bhowmik, Cloud Computing, Cambridge University Press, 2017

2. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 2011.

Reference Books:

1. Barrie Sosinsky, Cloud Computing Bible, Wiley, 2011.

2. Tim Mather, Subra Kumaraswamy, Shahed Latif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance”, O'Reilly, 2009.

DATA MINING

Course code:ES30016

Credit: 3

L-T-P: 3-0-0

Prerequisite:NIL

Course Objective:

The objective of this data mining course is to equip students with foundational knowledge and practical skills in discovering patterns, associations, and meaningful insights from large datasets. Students will learn key data mining techniques such as data pre-processing, association rule mining, classification, and clustering, using methods like decision trees, neural networks, and K-means. Emphasis is placed on understanding both the theoretical principles and the real-world applications of data mining, preparing students to effectively analyse and interpret data across various domains.

Course Outcome:

1. Differentiate between data mining and knowledge discovery in databases by analysing their principles, tasks, and associated challenges.
2. Apply appropriate data pre-processing techniques to transform and prepare raw datasets for effective data mining tasks.
3. Implement association rule mining algorithms such as Apriori and FP-Growth to analyse transactional data and extract meaningful patterns.
4. Evaluate various classification techniques—such as decision trees, neural networks, and Bayesian classifiers—by measuring and comparing classifier accuracy on given datasets.
5. Apply clustering algorithms like K-Means and K-Medoids to real-world data, and analyse their effectiveness in solving partitioning and hierarchical clustering problems.
6. Explore advanced data mining techniques—including web, spatial, temporal, and text mining—by designing application-specific solutions in domains such as electrical engineering.

Introduction

Fundamentals of data mining, Basic Data Mining Tasks, Classification of Data Mining systems, Data Mining Versus Knowledge Discovery in Data Bases, Data Mining Issues, Data Mining Matrices, Social Implications of Data Mining, Data Mining from Data Base Perspective.

Data Pre-processing:

Need for Pre-processing the Data, Types of attributes, properties of attribute values, Sampling, Data Normalization, Data Cleaning, Similarity Measures, Data Integration &Transformation, Data Reduction, Discretization and Concept Hierarchy Generation

Association Rules

Problem Definition, Association Rule Mining, Market Basket Analysis, The Apriori Algorithm: Finding Frequent Itemsets Using Candidate Generation, Generating Association Rules from Frequent Item sets, Improving the Efficiently of Apriori, Mining, The Partition Algorithms, FP-Growth Algorithms, Compact Representation of Frequent Item Set- Maximal Frequent Item Set, Closed Frequent Item Set.

Classification:

Classification: Problem Definition, General Approaches to solving a classification problem, Evaluation of Classifiers , Classification techniques, Decision Trees-Decision tree Construction, Methods for Expressing attribute test conditions, Measures for Selecting the Best Split, Algorithm for Decision tree Induction ; Classification, Classification by Backpropagation, A Multilayer Feed-Forward Neural Network, Naive-Bayes Classifier, Bayesian Belief Networks; K- Nearest neighbour classification-Algorithm and Characteristics. Prediction: Linear and Multiple Regression, Nonlinear Regression, Other Regression Models, Classifier Accuracy

Clustering:
Clustering Overview, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Partitioning Clustering-K-Means Algorithm, K-medoids PAM Algorithm; Hierarchical Clustering-Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering Algorithm, Key Issues in Hierarchical Clustering, Strengths and Weakness, Outlier Detection.

Advanced Data Mining Techniques:
Web Mining, Spatial Mining, Temporal Mining, Text Mining, Multimedia Mining. Application of Data mining in electrical Engineering.

Textbooks:

1. Han, Jiawei, & Kamber, Micheline , "Data Mining: Concepts and Techniques" (4th Edition). Morgan Kaufmann Publishers, 2015.

Reference Books:

1. Tan, Pang-Ning, Steinbach, Michael, & Kumar, Vipin, "Introduction to Data Mining" (2nd Edition). Pearson Education, 2018.
2. Pujari, Arun K "Data Mining Techniques" (3rd Edition). Universities Press, 2013.
3. Pudi, Vikram, & Krishna, Radha P."Data Mining" (1st Edition). Oxford University Press, 2009.
4. Hand, David, Mannila, Heikki, & Smyth, Padhraic. "Principles of Data Mining". The MIT Press, 2001.

PRINCIPLES OF ALGORITHM ANALYSIS

Course code:ES30013

Credit: 3

L-T-P: 3-0-0

Prerequisite: Data Structure & Algorithms(ES20001)

COURSE OBJECTIVE

To understand the importance of algorithm .To analyze the complexity of an algorithm in terms of time and space complexities .To understand various problem solving techniques .To learn about amortized analysis of algorithms .To design and implement various programming paradigms and its complexity

COURSE OUTCOMES

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

CO1: Analyze the time and space complexity for any algorithm

CO2: Compare and contrast different algorithm techniques

CO3: Apply the design techniques of algorithm in solving real world problems

CO4: Perform amortize analysis for any algorithm

CO5: Modify existing algorithms to apply in common engineering design

situations

CO6: Use NP class of problems to propose approximation algorithms

COURSE CONTENT

Introduction:

Concepts in algorithm analysis & design motivation, Space and Time

Complexity of algorithm, Asymptotic Notations (Big Oh, Omega, Theta),

Analysis of time complexity of Insertion Sort by step count method, Solving recurrences using Iterative, Substitution, Recurrence Tree, Master theorem

Divide & Conquer and Greedy Approaches:

Divide and Conquer method, Greedy method, Huffman code, Minimum spanning trees, Dijkstra algorithm, Knapsack problem, Job sequencing with deadlines.

Dynamic Programming Approaches:

Dynamic Programming, Knapsack problem, Matrix Chain Multiplication, longest common subsequence Multistage graphs, All pair's shortest paths,Optimal binary search trees, Travelling salesman problem.

Amortization:

Randomized Algorithms and Amortized Analysis, Las Vegas and Monte Carlo types, Randomized quick sort andits analysis, Min-Cutalgorithm.

NP Problems:

NP-Hard and NP-complete problems, Basic concepts, Reducibility, Vertex cover, 3CNF_SAT, clique, Hamiltonian cycle, TSP, Approximation algorithms, Vertex cover, TSP.

Textbooks:

1. T. Cormen, C. Lieserson, R. Rivest, C. Stein, "Introductions to

Algorithms", Third Edition, Prentice-Hall/India, 2009.

Reference Books:

1. A. M. Tenenbaum, Y. Langsam, M. J. Augestien, "Data Structures using

C", First Edition, Pearson Education, 2007.

2. E. Harowitz, S. Sahni, S. Rajsekaran, "Fundamentals of Computer

Algorithms", Universities press.

MACHINE LEARNING

Course code:ES30015
Credit: 3
L-T-P: 3-0-0
Prerequisite:Differential Equations and Linear algebra (MA11001), Transform Calculus & Numerical Analysis (MA11002)

COURSE OBJECTIVE:

To provide a comprehensive understanding of the fundamental concepts, techniques, and applications of Machine Learning (ML) in different domains

COURSE OUTCOME: At the end of the course, the students will be able to:

CO1: Understand the fundamental issues and challenges of machine learning.
CO2: Apply supervised learning algorithms to solve real-world problems.
CO3: Evaluate model performance using error analysis, confusion matrices, and regularization techniques.
CO4: Implement unsupervised learning techniques for data exploration.
CO5: Apply various neural network architectures in a range of real-world applications.
CO6: Demonstrate the application of machine learning in practical scenarios and case studies.

COURSE CONTENT

Foundations for ML:
Introduction to Machine Learning, Types of Machine Learning, Overview of ML Techniques, KNN Regression, Linear Regression, Multiple Linear Regression, Gradient Descent Methods-Batch, Stochastic, Mini-Batch; Normalization, Standardisation, Overfitting, Underfitting, Tradeoff between Bias and Variance, Regularization- Ridge and LASSO.

Supervised Learning:
Classification Algorithms, KNN Classification, Logistic Regression, Naïve Bayes Classifier, Decision Tree using ID3, Support Vector Machine for classification, KKT Condition, Different Kernels , Error Analysis, Confusion Matrix, Tree Map, Heat Map, Ensemble Learning, Dimensionality Reduction-Principal Component Analysis, Subset Selection-BSS, FSS, Comparison of Classification Algorithms on a Real-world Dataset using Python and appropriate libraries.

Unsupervised Learning:
Different clustering methods (Distance, Density, Hierarchical), K-means Clustering,K-medians clustering, DBSCAN Clustering, Hierarchical Clustering - Agglomerative Clustering, Divisive hierarchical clustering, Mean Shift Clustering, Implement and analyze different clustering algorithms using Python.

Neural Network:
Introduction Neural networks, McCulloch-Pitts Neuron, Perceptron Model, Feed Forward Neural Networks, Multilayer Networks and Hidden layer representation, Non-linear problem solving, Activation Functions, Back Propagation Algorithms , Exploding Gradient Problem, Vanishing Gradient Problem, Introduction to CNN, Implement and experiment with core neural network components and training mechanisms using Python.

Application:
Applications of ML in fault classification, forecasting, case studies, ML Tools-NumPy, Pandas, Scikit Learn, PyTorch, TensorFlow, Capstone Project.

Text Book:

1. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Jonathan Taylor “An Introduction to Statistical Learning with Applications in Python”, Springer, July 5,2023.
2. Tom Mitchell, Machine Learning, McGraw Hill, 2006.

Reference Books:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006
2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
3. Duda, Hart and Stork, Pattern Classification (2nd ed.), Wiley Interscience, 2000
4. Dr. R. Nageswara Rao, "Machine Learning in Data Science Using Python",New Delhi Dreamtech Press 2022.
5. Shai Shalev-Shwartz and Shai Ben-David "Understanding Machine Learning" Cambridge University Press. 2017.

THEORY OF COMPUTATION

Course code:ES30012

Credit: 3

L-T-P: 3-0-0

Prerequisite: Machine Learning (ES30015)

COURSE OBJECTIVE

To know about Chomsky hierarchy for organizing languages .To introduce concepts in automata theory and theory of computation .To identify different formal language classes and their relationships .To design grammars and recognizers for different formal languages .To understand undecidability and decide on languages that are undecidable

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO1: Acquire a fundamental understanding of the core concepts in automata theory and formal languages
CO2: Design finite automata or regular expression for any tokenization task
CO3: Construct a context free grammar for parsing any language
CO4: Design Turing machine for any language
CO5: Conclude the decidable / undecidable nature of any language
CO6: Apply mathematical and formal techniques for solving real-world problems

Course Contents:
Finite Automata:

Alphabets, Strings and Languages, Automata and Grammars, Deterministic Finite Automata (DFA), Formal Definition, Simplified notation: State transition graph, Transition table. Language of DFA, Non-deterministic Finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata

Regular Expression (RE):

Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Regular expression to FA, DFA to Regular expression,Non Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages,Applications and Limitation of FA.

Context Free Grammar (CFG) and Context Free Languages:

Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.

Push Down Automata (PDA):

Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of acceptance by empty stack and final state, Conversion of CFG to PDA.

Turing Machines (TM) and Undecidability:

Basic model, definition and representation, Instantaneous Description,

Language acceptance by TM, Variants of Turing Machine,Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs, Postcorrespondence problem (PCP), Modified PCP and undecidable nature of post correspondence problem

Textbook:

1. Peter Linz, "An Introduction to Formal Language and Automata", Jones and Bertlett, 2011.

Reference Books:

1) John Hopcroft, Rajeev Motwani, and Jeffrey Ullman, "Introduction to Automata Theory, Languages and Computation", Third Edition, Pearson Education, 2014.
2) John Hopcroft, Jeffrey Ullman, "Introduction to Automata Theory, Languages and Computation", Nineteenth Reprint, Narosa Publishing House, 2002.
3) Martin J. C., "Introduction to Languages and Theory ofComputations", Fourth Edition, TMH, 2010.
4) Papadimitriou C., Lewis C. L., "Elements of the Theory of Computation", Pearson, 1997.

WEB TECHNOLOGY

Course code:ES30014

Credit: 3

L-T-P: 3-0-0

Prerequisite: Programming Lab (CS13001), Introduction to Data Base Management System(ES20004)

COURSE OBJECTIVE

The World Wide Web is a dynamic platform driving innovative technologies that support diverse applications in both private and public sectors. This course equips students with the skills to design, develop, and deploy modern web applications, covering essential technologies, frameworks, and best practices from planning to implementation.

COURSE OUTCOMES

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

CO1: Develop well-structured and responsive web pages using HTML and CSS.
CO2: Create interactive and dynamic user interfaces utilizing JavaScript.
CO3: Implement server-side logic for the generation of dynamic web content.
CO4: Design web applications that effectively interact with databases.
CO5: Apply the principles of client-server architecture in web applications.
CO6: Evaluate of scalability and functionality of web applications.

COURSE CONTENT

Introduction to Web Technologies

Explain the fundamental concepts and terminologies of web technologies. Analyze the historical development of the World Wide Web and its influence on modern digital environments.

HTML and CSS Mastery

Design structurally sound and semantically rich web pages using HTML, and apply advanced styling techniques with Cascading Style Sheets (CSS).

Client-Side Scripting Proficiency (JavaScript)

Develop dynamic and interactive user interfaces using JavaScript, including client-side validation and manipulation of web page elements.

Server-Side Scripting Competence

Introduce server-side programming languages such as PHP and Node.js, and implement server-side logic for dynamic content generation and data processing.

Web Application Architecture Understanding

Understand and analyze the architecture of web applications with a focus on the client-server model, and explore modern web development frameworks and libraries.

TEXT BOOKS:

1. Web Technologies, Uttam K Roy, Oxford University Press, Illustrated edition 22 November 2010

2. The Complete Reference PHP – Steven Holzner, Tata McGraw-Hill, Illustrated edition 1st July 2017

REFERENCE BOOKS:

1. Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dreamtech, 2002

2. Beginning Web Programming-Jon Duckett, Publisher WROX. Programming world wide web, R.W. Sebesta. Fourth Edition, 2011 Pearson.

DEEP LEARNING

Course code:ES30022

Credit: 3

L-T-P: 3-0-0

Prerequisite: Machine Learning(ES30015)

COURSE OBJECTIVE

To explore and provide students with a comprehensive understanding of deep learning principles, architectures, and techniques to solve real-world problems.

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO1:Explore the evolution and scope of AI, ML, and DL

CO2: Develop feedforward neural networks using activation functions, loss, and optimization techniques.

CO3: Analyze CNNs and RNNs for sequence modeling

CO4 Evaluate PCA, and Auto-encoders for feature extraction and data representation.

CO5: Implement generative models and transfer learning in deep learning.

CO6: Develop deep learning models using Keras, TensorFlow, and PyTorch for real world Applications.

Course Contents:

Deep Networks:
Overview of AI, Machine Learning, and Deep Learning, History and evolution of deep learning, Applications of deep learning, Differences between traditional machine learning and deep learning, Neurons and Perceptron model, Activation functions (Sigmoid, ReLU, Tanh) Feedforward neural networks (FNN), Introduction to gradient descent and backpropagation. Learning XOR, Gradient Based learning,Data preprocessing, Introduction to training, validation, and testing datasets, Loss functions (Mean Squared Error, Cross-Entropy) Hidden Units, Back-propagation and other Differential Algorithms (Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam), Regularization for Deep Learning (L1, L2 regularizations, Early stopping, and Dropout).

Convolutional Networks:
Convolution operation, Motivation, Pooling, Convolution and Pooling as strong prior, Efficient convolution algorithms, Sequence Modeling: Recurrent and Recursive Nets, LSTM Networks.

Linear factor Models:
PCA,Autoencoders and relation to PCA, Regularization in autoencoders, Representational Power, Layer size and Depth, Stochastic Auto encoders.

Representation Learning:
Domain Adaptation and Transfer learning in Deep Neural Networks, Principle of Generative Modeling, Adversarial Autoencoders.

Deep Learning with Python:
Introduction to Keras ,Tensor flow, and PyTorch, CNN for fault Analysis in power system, convnets, recurrent models like LSTMs for time-series analysis in load forecasting, Identify and classify disturbances like voltage sags, swells, and harmonics in power systems.

Textbook:
1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, The MIT Press, 2016.
Reference Books:
1. Francois Chollet, “Deep Learning with Python”, Manning Publications, 2017.
2. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems”, First Edition, O'Reilly Media, 2017.
3. Josh Patterson, “Deep Learning: A Practitioner's Approach”, First Edition, O'Reilly Media.

PRINCIPLE OF SOFTWARE ENGINEERING

Course code:ES40011

Credit: 3

L-T-P: 3-0-0

Prerequisite:Programming Lab (CS13001), Introduction to Data Base Management System (ES20004)

COURSE OBJECTIVE

The course aims to provide a comprehensive understanding of techniques for estimation, design, testing, and quality management in large software development projects.

COURSE OUTCOMES

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

Co1: Distinguish different software processes models and use a suitable model for solving a socially relevant problem.
Co2: Create SRS document from a given problem description.
Co3: Create analysis model and design model from a given problem descriptions.
Co4: Distinguish and apply different testing methodologies and metrics.
Co5: Apply basic project management practices in real life projects.
Co6: Understand the relevance of quality models and metrics in the software development process.

COURSE CONTENT

Software Process Models

Introduction to software engineering, Software Product, Software crisis,Handling complexity through Abstraction and Decomposition, Overview of software development activities, Process Models, Classical waterfall model, iterative waterfall model, prototyping model, evolutionary model, spiral model, RAD model,Agile model, XP, Scrum.

Requirements analysis and specification

Requirements gathering and analysis,Review and Management of User Needs, Feasibility Study, Software Requirements Specification (SRS) document.

Software Design

Software Design: Outcome of a design process, cohesion and coupling, layered arrangement of modules, approaches to software design, function-oriented software design: overview of SA/SD methodology, structured analysis, DFDs, structured design, detailed design, design review, UML Use case, Class diagram, Sequence diagram.

Coding and Testing

Coding standards and guidelines, code review, software documentation, unit testing, black-box testing, white-box testing, debugging, integration testing, system testing, mutation testing, Regression testing.

Software Project Management

Responsibilities of a Software project manager, project planning, project estimation, Lines of Code, Function Point, COCOMO models, project scheduling, staffing, Organization and team structure.

Software reliability and Quality management

Software reliability, software quality, ISO 9000 series, SEI CMM,Software maintenance, Software reuse.

Text Books:

1. Fundamentals of Software Engineering, RajibMall , PHI, 2018.

2. R. S. Pressman, "Software Engineering: A Practitioners Approach", Ninth Edition, McGraw Hill, 2023

Reference Books:

1. Software Engineering- Sommerville, 9th edition, Pearson Education.

2. Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.

HIGH PERFORMANCE COMPUTING

Course code:ES40015

Credit: 3

L-T-P: 3-0-0

Prerequisite: Computer Organization(ES20002)

COURSE OBJECTIVE

The objective of this course is to offer advanced pipelining techniques, current state of art in memory system design, working principle of I/O devices and memory management techniques.

COURSE OUTCOMES

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

CO1 : Choose performance metrics to find the performance of systems

CO2 : Identify the program block that requires parallelism for any program

CO3: Comprehend the concept of different types of hazards along with

The structural implementation and applications.

CO4: Elaborate the criteria to enhance the performance of the pipelined processors.

CO5: Design algorithms for memory management techniques for

multiprocessor system

CO6: Identify various parallel architecture like centralized and distributed memory architecture require for real life application

COURSE CONTENT

Fundamentals of Quantitative Design and Analysis

Introduction, Classes of computers,Trends in Technology, Trends in Power and Energy in Integrated Circuits,Trends in Cost, Dependability, Measuring, Reporting and Summarizing Performance, Quantitative Principles of Computer Design

Instruction Level Parallelism and its Exploitation

Instruction, Level Parallelism: Concepts and Challenges, Basic Compiler Techniques for Exposing ILP, Reducing Branch Costs with Prediction, Overcoming Data Hazards with Dynamic Scheduling, Dynamic Scheduling, Hardware, Based Speculation, Exploiting ILP Using Multiple Issue and Static Scheduling, Exploiting ILP, Advanced Techniques for Instruction Delivery and Speculation, Studies of the Limitations of ILP.

Data Level Parallelism in Vector, SIMD and GPU Architectures

Vector Architecture, SIMD Instruction Set Extensions for Multimedia,

Graphics Processing Units, Detecting and Enhancing Loop-Level Parallelism, Centralized Shared-Memory Architectures, Performance of Shared-Memory Multiprocessors, Distributed Shared Memory, Models of Memory Consistency, Multicore Processors and their Performance.

Memory Hierarchy Design

Review of Memory Hierarchy Design, Cache Performance, Basic Cache

Optimizations, Virtual Memory, Protection and Examples of Virtual Memory, Advanced Optimizations of Cache Performance, Memory Technology and Optimizations, Protection: Virtual Memory and Virtual Machines, Crosscutting Issues: The Design of Memory Hierarchies.

Parallel Processing Basics and Applications

OpenMP, MPI, CUDA, Applicaton to time series forecasting of Solar power.

Textbook:

1. David. A. Patterson, John L. Hennessy, "Computer Architecture: A Quantitative approach", Sixth Edition,Morgan Kaufmann, 2012.

Reference Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian,

"Computer Organization and Embedded Systems", Sixth Edition, McGraw Hill Inc, 2022.

2. William Stallings "Computer Organization and Architecture", Eleventh Edition, Pearson Education, 2006.

QUANTUM COMPUTING

Course code:ES40012

Credit: 3

L-T-P: 3-0-0

Prerequisite: Differential Equations and Linear Algebra (MA11001)

COURSE OBJECTIVE

The Quantum Computing course provides a foundational understanding of quantum mechanics and its computing applications. Students will explore quantum principles, apply mathematical tools, design quantum circuits, and implement key algorithms like Grover's and Shor's. The course covers quantum error correction, real-world applications in cryptography and optimization, and quantum hardware platforms. Additionally, students will assess challenges and future trends in quantum computing.

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO1: Understand quantum principles such as qubits, superposition, and entanglement.
CO2: Apply linear algebra and tensor operations to model quantum systems.
CO3: Design quantum circuits using basic and multi-qubit gates.
CO4: Implement key quantum algorithms like Grover's and Shor's.
CO5: Analyse quantum noise and apply error correction techniques.
CO6: Evaluate real-world applications and current quantum hardware platforms.

COURSE CONTENT

Introduction to Quantum Mechanics

Classical vs Quantum Systems, Quantum States and Qubits, Quantum Superposition and Entanglement

Mathematical Foundations

Complex Numbers and Linear Algebra Review, Tensor Products and Hilbert Spaces, Quantum Operators and Observables, Measurement in Quantum Systems

Quantum Gates and Circuits

Basic Quantum Gates (Pauli-X, Y, Z; Hadamard; Phase), Multi-Qubit Gates (CNOT, Toffoli, SWAP), Quantum Circuits: Introduction and Representation

Quantum Algorithms

Quantum Parallelism, The Deutsch-Jozsa Algorithm, Grover's Search Algorithm, Shor's Algorithm for Prime Factorization

Quantum Error Correction and Noise

Quantum Error Correction Codes (QECC), Quantum Decoherence, Fault-tolerant Quantum Computing

Quantum Computing Applications

Quantum Cryptography (Quantum Key Distribution)**,** Quantum Simulation**,** Applications in battery and Optimization

Current Trends and Quantum Hardware

Quantum Computing Platforms: Superconducting Qubits, Ion Traps**,** Quantum Cloud Platforms (IBM Q, Google Quantum AI)**,** Challenges and Future of Quantum Computing

Textbooks:

1. Quantum Computation and Quantum Information by Michael A. Nielsen and Isaac L. Chuang, Edition: 10th Anniversary Edition, Publisher: Cambridge University Press. ISBN: 978-1107002173, (2010).

2. Quantum Computing: A Gentle Introduction by Eleanor Rieffel and Wolfgang Polak, Publisher: MIT Press, ISBN: 978-0262526678, (2014).

Reference Books:

1. An Introduction to Quantum Computing" by Phillip Kaye, Raymond Laflamme, and Michele Mosca, Publisher: Oxford University Press, ISBN: 978-0198570493, (2007).

2. Quantum Algorithms via Linear Algebra: A Primer by Richard J. Lipton and Kenneth W. Regan, Publisher: MIT Press, ISBN: 978-0262039253,(2014).

ARTIFICIAL INTELLIGENCE

Course Code : ES40014

Credit : 3

L-T-P : 3-0-0

Prerequisite :Principles of Algorithm Analysis (ES30013)

COURSE OBJECTIVE

To understand the various characteristics of Intelligent agents .To learn the different search strategies in AI .Apply knowledge in solving AI problems .To understand the ways of planning and acting in the real world .To explore about the models behind the AI application

COURSE OUTCOMES

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

CO1: Discover the concepts, applications, and the theory underlying AI.

CO2: Identify problems that are amenably solved by AI methods

CO3: Analyze the issues of knowledge representation and search techniques.

CO4: Analyze the engineering issues underlying the design of AI systems.

CO5: Discuss the uncertain knowledge on reasoning concepts in AI.

CO6: Apply AI techniques to develop programs to solve real life problems in different domains.

COURSE CONTENT

Introduction:

Introduction, Definition, Future of Artificial Intelligence, Characteristics of Intelligent Agents, Typical Intelligent Agents, Problem Solving Approach to Typical AI problems.

Problem Solving Methods:

Problem solving Methods, Search Strategies, Uninformed, Informed,

Heuristics, Local Search Algorithms and Optimization Problems, Searching with Partial Observations, Backtracking Search, Performance of search algorithms.

Knowledge Representation:

First Order Predicate Logic, Unification, Forward Chaining, Backward

Chaining, Resolution, Knowledge Representation using First order Predicate logic, Reasoning Systems.

Planning:

Planning with state-space search, Partial-order planning, Planning graphs, planning and acting in the real world,Plan generation systems.

Uncertain Knowledge and Reasoning:

Uncertainty, Review of probability, Probabilistic Reasoning, Bayesian

networks, Inferences in Bayesian networks, Temporal models, Hidden Markov models.

Textbooks:

1. Stuart Russel, Peter. Norvig, “Artificial Intelligence – A Modern

Approach”, Fourth Edition, Pearson Education, 2022

Reference Books:

1. Introduction to Artificial Intelligence and Expert Systems, Dan W.

Patterson, Pearson Education

BIG DATA

Course code: ES40016

Credit: 3

L-T-P: 3-0-0

Prerequisite: Introduction to Data Base Management System (ES20004)

COURSEOBJECTIVE:

This course provides an overview of data basics, big data analysis, and applications. It covers tools for storage and processing, and develops concepts and techniques applicable to industry and real-world scenarios.

COURSEOUTCOMES

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

CO1. Understand the concepts and principles of big data.

CO2. Implement various bigdata technology foundations.

CO3. Analyze and process the big data.

CO4. Analyze the optimization and storage of data in databases.

CO5. Explore the basics of data analysis.

CO6. Formulate techniques for industry and real-time applications.

COURSECONTENTS:

Overview of Big Data

Review of Big Data, History of Data Management Evolution of Big Data, Structuring Big Data, Elements of Big Data, Big Data analytics, Future of Big Data, Use of Big Data in Social Networking, Use of Big Data in Preventing Fraudulent Activities, Use of Big Data in Detecting Fraudulent Activities in Insurance Sector, Use of Big Data in Retail Industry.

Big Data Technology Foundations

Exploring the Big Data Stack, Data Sources Layer, Ingestion Layer, Storage Layer, Physical Infrastructure Layer, Platform Management Layer, Security Layer, Monitoring Layer, Analytics Engine, Visualization Layer, Virtualization and BigData, Virtualization Approaches, Distributed and Parallel Computing for BigData, Hadoop Ecosystem, Hadoop Distributed Filesystem, Map reduce, YARN, Hive, Pig and Pig Latin, Zookeeper - HBase.

Basic Data Analysis

Introduction to Streams Concepts – Stream data model and architecture,Data Models, RDBMS and Hadoop, Non-Relational Database, Introduction to NoSQL, Types of NoSQL, Polyglot Persistence, Sharding. The Eight Axioms of Big Data Analytics, Basic Models, Complexity of Data Analytics, Statistical Models, Advanced Analytics Methods. Key Considerations in Data Analytics Reports, Key performance Indicators (KPIs), The Four Pillars of a Real-World Data Analytics Program,

Big Data applications

Brief uses of Big Data in the Health Sector, basic perspectives of Big Data Analytics Integration in the Business Strategy of Amazon Inc, Big Data Analysis and Its Role in power system, Monitoring and Tracking Applications, Practical Implementation of Big Data in power systems, transportation and Sustainable energy Applications.

TextBooks

1. Big Data and Analytics, Seema Acharya, Subhashini Chellappan, Infosys Limited, Publication: Wiley India Private Limited,1st Edition 2015.
2. Paul Zikopoulos, Dirk DeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

Reference Books

1. Chris Eaton, Dirk Deroos et. al., “Understanding Big data”, Indian Edition, McGraw Hill, 2015.
2. Big Data, Anil Maheshwari, McGraw Hill Education, 2017.
3. Big Data--A New Medium? Natasha Lushetich (Editor), Routledge 2021.
4. Arghandeh R, Zhou Y, editors. Big data application in power systems. Elsevier; 2017 Nov 27.
5. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data
   EMC Education Services (Editor) January 2015 (ISBN: 978-1-118-87613-8).

ELECTROMAGNETIC FIELD THEORY

Course Code : EE30011

Credit : 3

L-T-P : 3-0-0

Prerequisite : Physics (PH10001)

COURSE OBJECTIVE

Knowledge of physical interpretation, and ability to apply Maxwell's equations to determine field waves, potential waves, energy and charge conservation conditions.

COURSE OUTCOMES

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

CO1: Understand the concept of different coordinate systems.
CO2: Apply the different laws in Static Electric Field.
CO3: Apply Maxwell’s equation for both static and time varying fields.
CO4: Derive the wave equation for lossless dielectric and determine Poynting vector.
CO5: Determine Standing-Wave Ratio in plane wave for normal and oblique incidence.
CO6: Calculate the parameters of transmission line.

COURSE CONTENT

Coordinate System and Vector Calculus

Rectangular, Cylindrical and Spherical Coordinate Systems, Gradient, Divergence and Curl operation.

Static Electrical Field

Coulomb's Law, Electric field intensity due to continuous line charge, surface charge and volume charge, method of images, Electric potential, equipotential surface , Gauss's law, Maxwell's Equation.

Electric Field in Different Materials

Continuity equation, Uniqueness Theorem, Poisson's and Laplace Equation.

Steady Magnetic Fields

Magnetic scalar and vector potential, Energy stored in magnetic field, Magnetic forces, Biot-Savart's law, Ampere's circuital law.

Time Varying Fields

Charged particle moving in a static magnetic field, Moving conductor in a static magnetic field, Faraday's law.

Electromagnetic Waves and Transmission Line Helmholtz's wave equation, wave propagation in lossless dielectric, Plane wave in free space, Poynting vector, Reflection and Refraction in plane wave, normal and oblique incidence, Transmission-line equations.

.Text Books

1. Engineering Electromagnetic by W.H. Hayt &John A. Buck, 7th Edition TMH, 2006
2. Elements of Electromagnetic by M. N. O Sadiku, 4th Edition, Oxford, 2010.

Reference Books

1. Electromagnetic waves and radiating Systems E.C Jordan & Balmin, 2nd Edition, PHI,2009
2. C. R. Paul, K.W. Whites, S. A. Nasor, Introduction to Electromagnetic Fields, 3rd Edition, TMH, 2011
3. Electromagnetic Field Theory by S. Salivahanan & S Karthie, Vikas Publisher 2016.
4. Electromagnetic Field Theory by Rohit Khurana, Vikas Publisher, 2015.

MICROPROCESSORS AND EMBEDDED SYSTEM

Course Code : EE30004

Credit :3

L-T-P : 3-0-0

Prerequisite : Analog and Digital Electronics Circuit (EE20007)

COURSE OBJECTIVE

The objective of this course is to teach students the fundamentals of microprocessors and microcontrollers. Additionally, the course discusses the fundamentals of advanced microcontrollers and different processor-related industrial applications.

COURSE OUTCOMES

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

CO1: Distinguish between 8 bit and 16 bit Microprocessors.

CO2: Practice in assembly language programs in 8085 and 8086 microprocessors.

CO3: Describe the architecture of 8051 microcontroller.

CO4: Analyze the different programs of 8051 microcontroller.

CO5: Acquire the knowledge of the AVR microcontrollers.

CO6: Demonstrate different applications of microprocessors and microcontrollers.

COURSE CONTENT

8085 and 8086 Microprocessors

History of microprocessor, Architecture of 8085, Fetchand execute operation,Addressing mode of 8085, Data Transfer Instruction, Arithmetic, Logical, remote, branch and machine control instructions, Development of 8085 assembly language programs, Interrupts of 8085, Memory and I/O interfacing, Architecture of 8086, Minimum and maximum mode configurations of 8086, Addressing modes of 8086, Instructions set of 8086, Assembly language programming of 8086.

8051 Microcontroller

Introduction, Architecture of 8051, Instruction-sets of 8051, Assembly language programming of 8051.

AVR Microcontroller

Introduction, Overview of AVR family, Architecture of AVR, Addressing modes of AVR, Assembly language programs of AVR.

Industrial Application of Microprocessors

ADC, DAC interfacing, Automation and control application, Digital PID controller, PWM control of a DC motor, Stepper motor control.

Text Book

1. B. Ram, “Fundamentals of Microprocessors and Microcontrollers ", 7th Edition, Dhanpat Rai publications, 2010.
2. Douglas V Hall Microprocessor and Interfacing, TMH publication.

Reference Books

1. Muhammad Ali Mazidi, Sepehr Naimi,"Sarmad Naimithe AVR Microcontroller And Embedded Systems Using Assembly and C" PHI,1st Edition, Inc, 2017.
2. R. Theagarajan "Microprocessors and Microcontrollers"-1st Edition, SCITECH publications (India) Private limited, 2004.
3. Desmukh , "Microcontrollers –Theory and Application"- 1st Edition, TMH Publication, 2005.
4. A. P. Mathur, "Introduction to microprocessors" e-TMH Publication – 3rd edition, 2011
5. Md. Rafiquzzaman, "Microprocessors & Microcomputer based System Design",2nd edition,1995.

SENSORS AND ACTUATORS

Course Code :EE30012

Credit : 3

L-T-P : 3-0-0

Prerequisite :Nil

COURSE OBJECTIVE

This course helps the students to have an exposure to sensors and its importance in the real world. Student will be able to understand basics of sensors, actuators and their operating principle and also have knowledge about simulation and characterization of different sensors.

COURSE OUTCOMES

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

CO1: Understand components of sensor and its selection criteria.

CO2: Select suitable sensors for measuring displacement and velocity.

CO3: Apply suitable sensor for force, weight and pressure measurement.

CO4: Choose suitable sensor for measurement of temperature, level and flow.

CO5: Know about different actuators and Electrical actuating systems.

CO6: Use micro sensor and micro actuators in different applications.

COURSE CONTENT

Introduction

Definition of sensor and transducer, classification, characteristics. Selection criteria of transducers. Smartsensor: Blockdiagram, features.

Displacement and velocity Measurement

Linear and rotary displacement sensors: Potentiometer, capacitive, inductive. Positionmeasurement: OpticalEncoder, proximitysensors.

Velocity measurement: Tachometer types, Stroboscope, Encoder

Measurement of Force, Weight and Pressure Force and weight measurement : Strain gauge, load cell. Pressure measurement: Manometer types, Strain gauge, diaphragm gauge, capsule, bellows, bourdon tube, piezoelectric sensor.

Temperature measurement

Temperature scales, Mechanical thermometers: Filled insystems, Metallic expansion, Electrical thermometers: RTD, Thermo-couple, Semiconductor temperature sensors.

Level and Flow measurement

Mechanical methods: float and displacer. Electrical methods: Resistance,inductive, capacitance type.Ultrasonic level gauging. Basic principles of flow measurement. Differential pressure devices: orifice, venturi, flow nozzle, pitot tube, annubar.

Actuators

Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria.

Electrical actuating systems

Solid-state switches, Solenoids, Electric Motors- Principle of operation and its application: D.C motors - AC motors - Single phase and 3 Phase Induction Motor; Synchronous Motor; Stepper motors - Piezoelectric Actuator.

Micro Sensors

Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors. Simulation and characterization of various sensors using COMSOL Multiphysics.

Micro actuators

Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of microactuators: Electrostatic, magnetic, fluidic, inversepiezoeffect.

Text Book

1. Industrial instrumentation and control, S.K.Singh, 3rd Edition,TMH

Reference Books

1. Transducers and Instrumentation, Murthy.D.V.S,2001,Prentice Hall of India.
2. Sensors and transducers, Patranabis.D,2003,PHI.
3. Microsystem Technology and Microrobotics, Sergej Fatikowand Ulrich Rembold, 1st edition, Springer-Verlag Berlin Heidelberg.
4. Shape memory actuators, Manfred Kohl, first edition, Springer.

ROBOTICS AND CONTROL

Course Code : EE40042

Credit :3

L-T-P : 3-0-0

Prerequisite :Network Analysis (EE30034), Linear Control System (EE20004)

COURSE OBJECTIVE

This course helps the student to basic idea of Robots. Students are introduced to the basic design consideration of robots. Concepts like trajectory planning, obstacle avoidance, kinematics and dynamics of robotic manipulators are introduced. Industrial applications of robotic manipulators are also included as part of the course to get an overall idea on robotics

COURSE OUTCOMES

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

CO1: Gain knowledge about configuration of robot.
CO2: Analyze the kinematics and dynamics of robot.
CO3: Understand the trajectory planning of robot.
CO4: Design controller for robot.
CO5: Apply robot to solve industrial issues.
CO6: Know about various sensors in robotics.

COURSE CONTENT

Introduction to Robotics

Basic Structure of Robots, Robot Anatomy, Classification of Robots, Fundamentals about Robot Technology, Factors related to use Robot Performance, Basic Robot Configurations and their Relative Merits and Demerits, the Wrist & Gripper Sub-assemblies.Kinematics of Robot Manipulator: Direct Kinematics problem, Geometry Based Direct kinematics problem, Co-ordinate and vector transformation using matrices, Rotation matrix, Inverse Transformations, Problems, Composite Rotation matrix, Homogenous Transformations, Robotic Manipulator Joint Co-Ordinate System, Euler Angle & Euler Transformations, Roll-Pitch-Yaw (RPY) Transformation, D-H Representation & Displacement Matrices for Standard Configurations, Jacobian Transformation in Robotic Manipulation.

Trajectory Planning

Joint space trajectory planning- cubic polynomial, linear trajectory with parabolic blends, trajectory planning with via points; Cartesian space planning, Point to point vs continuous path planning. Obstacle avoidance methods based on classical techniques (e.g. Artificial Potential field, A* algorithms). Dynamics of Robotic Manipulators: Lagrange's formulation – Kinetic Energy expression, velocity Jacobian and Potential Energy expression, Generalized force, Euler-Lagrange equation, Dynamic model of planar and spatial serial robots up to 2 DOF. Control design for Robotic System: Control Loops of Robotic Systems, trajectory, velocity and force control, Computed Torque control, Linear and Nonlinear controller design of robot. Design of controller for robot in Matlab programming.

Industrial Applications of Robotics

Material handling, welding, Spray painting, Machining. Case study for a typical industrial application including robot selection considerations such as number of axes, work volume, capacity & speed, stroke &reach, Repeatability, Precision and Accuracy, Operating environment. Applications of robotics in active perception, medical robotics, autonomous vehicles, and other areas. Sensors for Robotics: Wheel/motor sensors, Heading sensors, Accelerometers, Inertial measurement unit (IMU), Ground beacons, Active ranging, Motion/speed sensors, Vision sensors. art systems.

Text Books

1. Robert. J. Schilling , "Fundamentals of robotics – Analysis and control", Prentice Hall of India,1990, (Latest reprint).
2. Introduction to Robotics- John J. Craig, Addison Wesley Publishing, 3rd edition, 2010.

Reference Books

1. R K Mittal & I. J. Nagrath, Robotics and Control, McGraw Hill Publication, 201.
2. Groover, M.P. Weiss, M. Nagel, R.N. & Odrey, N.G., Ashish Dutta, Industrial Robotics, Technology, Programming & Applications, Tata McGraw Hill Education Pvt. Ltd. New Delhi.
3. Introduction to Robotics by S K Saha, Mc Graw Hill Education

RENEWABLE ENERGY RESOURCES

Course Code :EE30016
Credit : 3
L-T-P : 3-0-0
Prerequisite :Nil
COURSE OBJECTIVE

To facilitate the students to achieve a clear conceptual understanding of technical aspects of Renewable Sources of Energy.

COURSE OUTCOMES

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

CO 1: Understand the need of renewable energy sources for future requirements.

CO 2: Demonstrate on various solar thermal system applications.

CO 3: Apply the concept of solar PV for maximizing the energy efficiency.

CO 4: Describe the process of extraction of power from wind energy and biomass energy.

CO 5: Analyze the scope of Geothermal and Ocean energy.

CO 6: Reflect the concept of principle of operation of fuel cell and its applications.

COURSE CONTENT

Fundamentals of Energy

Energy Consumption and standard of living, Classification of Energy Resources, Importance of Non-Conventional Energy Sources, Common Forms of Energy, Advantages and Disadvantages of Conventional energy Sources, Environmental aspects of energy, Environment–economy-energy and sustainable development, Energy densities of fuels, Energy scenario in world and India.

Basics of Solar Energy, Solar Thermal and Photovoltaic Systems

Basics of Solar Energy: Extraterrestrial and Terrestrial Radiations, Depletion of Solar Radiation, Solar Time, Solar Radiations Measurement.

Solar Thermal Systems: Solar Collectors: Classification, Performance indices, Working of Flat plate collector and Evacuated Tube collector, various other types of Collectors, Solar Passive Space – Heating and Cooling Systems, Solar thermal energy applications in Water Heater, Cookers, Furnaces, Green House, Dryer and Distillation**.**

Solar Photovoltaic Systems: Solar Cell Fundamentals, P-N Junction, Generation of electron hole pair, Photoconduction, Solar Cell Characteristics, Effect of variation of isolation and temperature, Energy payback period, Solar Cell Classification, Solar Cell, Module, Panel and Array Construction, Cell mismatch and Effect of shadowing. Maximizing the Solar PV Output and Load Matching, Maximum Power Point Tracker (Perturb and Observance method and Incremental conductance method).

Wind and Biomass energy

Wind Energy: Origin of Winds, Nature of Winds, Wind Turbine Siting, Major Application of Wind Power, Power extraction from wind, Wind Turbine Types and Their Construction, Speed control strategies for wind turbine, Power versus wind speed Characteristics, Wind Energy Conversion Systems (WECS), Environmental aspects of wind energy, Wind energy programme in India.

Biomass Energy: Usable Forms of Biomass, their Composition and Fuel Properties, Biomass Resources, Energy Farming, Biomass Conversion Technologies, Urban Waste to Energy Conversion, Biomass Gasification, Biomass Liquefaction, Biomass to Ethanol Production.

Geothermal and Ocean energy, Fuel cells

Geothermal Energy: Applications, Origin, and Distribution of Geothermal Energy, Types of Geothermal Resources, Environmental aspects of Geothermal energy, Geothermal Energy in India

Ocean Energy: Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Environmental impact, Tidal Energy: Energy from tides, Tidal energy conversion scheme: single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy.

Wave energy: Power from wave, wave energy conversion devices, advantages and disadvantages of wave energy, Environmental impact

Fuel cells:Principle of working of various types of fuel cells and their working, performance and limitations, MHD (Magneto hydro dynamics) generation principles, advantages and disadvantages.

Text Books

1. B. H. Khan, “Non – Conventional Energy Resources” Tata Mc Graw Hill, 2nd edition 2009.
2. N. K. Bansal, Manfred Kleemann, Michael Meliss, “Renewable energy sources and conversion technology", Tata Mc Graw Hill, 1990.

Reference Books

1. Kothari D.P., “Renewable energy resources and emerging technologies”, Prentice Hall of India Pvt. Ltd, 2006.
2. Rai G.D, "Non-Conventional Energy Sources", Khanna Publishers, 4th Edition 2000.
3. Ashok V. Desai, "Nonconventional Energy", New Age International Publishers Ltd, Reprint 2003.

PRINCIPLES OF COMMUNICATION ENGINEERING

Course Code :EE30002
Credit : 3
L-T-P : 3-0-0
Prerequisite : Signal Processing (ES30002)

COURSE OBJECTIVE

The course aims at building fundamental concepts on the operation of analog and digital communication systems and their application in industries as well as research.

COURSE OUTCOMES

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

CO1: Understand the importance of Fourier analysis in communication systems.

CO2: Explain the fundamental concepts of analog and digital communication systems.

CO3: Develop the ability to compare the strengths and weaknesses of various communication systems.

CO4: Classify different types of AM (Analog Modulation) techniques and their principles.
CO5: Analyze different types of angle modulation schemes (FM and PM), their generation and detection.

CO6: Apply signal space representation in analysis of digital communication systems.

COURSE CONTENT

Application of probability and statistics in Communication

Random variables, Probability density function, Fourier transform of normal distribution and application in communication, signal to noise ratio, digital quantization and SNR, Power spectral density. Parseval’s theorem, Power and energy transfer through a network.

Amplitude Modulation Systems

Frequency translation, recovery of baseband signals, amplitude modulation, maximum allowable modulation, the square law demodulator, spectrum of AM signal, balanced modulator, SSB modulation and generation, VSB, FDM, noise in AM.

Frequency Modulation System

Phase and frequency modulation and their relationship, frequency deviation, narrowband FM, wideband FM, Carson's rule for bandwidth, Armstrong and parameter variation methods of FM generation, noise in FM.

Digital Communication

Pulse modulation systems, sampling theorem, pulse amplitude modulation, quantization of signals, quantization error, pulse code modulation (PCM) system, companding, time-division multiplexing (TDM), DPCM, DM, ADM. Basic Digital Modulation Techniques: DM, ADM, DPCM, and ADPCM for speech, ASK, PSK, QAM, FSK, etc. Baseband Communication: Line coding, matched filter, correlation receiver, basics of inter-symbol interference, equalization.

Text Books

1. H. Taub, D. L Schilling, G. Saha, Principles of Communication System, Tata McGraw Hill, 3rd Edition 2008
2. A. B. Carlson, Communication Systems, McGraw-Hill , 5th Edition 2017

Reference Books

1. B.P. Lathi, Zhi Ding, Modern Analog and Digital communication Systems, Oxford , 4th Edition 2011
2. Michael Moher Simon Haykin, Communications Systems, Wiley , 5th Edition 2009

POWER GENERATION AND CONTROL

Course Code :EE30014

Credit : 3

L-T-P :3-0-0

Prerequisite : Network Theory (EE20001)

COURSE OBJECTIVE

This subject provides the basic knowledge of various types of power generating stations. Students will be able to know the know the philosophy of components of generating power stations, generation control, substations, tariff, and power factor improvement.

COURSE OUTCOMES

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

CO1: Understand various energy sources and their applications to power stations.

CO2: Discuss the requirement and description of various components used in different power generation station

CO3: Compare various sources of power generation and evaluate their power output.

CO4: Analyze the performance of the speed governing system

CO5: Elaborate on the process of testing and commissioning for different substation components.

CO6: Measure power factor and tariff in electrical power system.

COURSE CONTENT

Introduction

Introduction to different sources of Energy. Discussion on application of energy sources to power station.

Thermal Power Plant

Layout of thermal power plant, Main Equipment, Coal Handling plant, Boiler, Super heater, Reheater, Economizer,Air Preheater steam turbine,condenser, Ash handling plant, Cooling tower and ponds, Feed water heater, E.S.P, Power supply to auxiliaries. Governor, specific speed, Plant auxiliaries. Load frequency control,Turbine speed governing system,Modelling of speed governing system, Turbine model, generator model,load model, Integrated representation of various model,Excitation System: DC exciter, AC exciter, static exciter, AVR.

Hydro Power Plant

Classification according to (i) Water Flow (ii) Load (iii) Head, surge tank, Penstock, spillway, Tail Race, Types of turbine (i) Pelton turbine, (ii) Francis turbine, (iii) Kaplan turbine,Governor, specific speed, Plant auxiliaries.

Nuclear Power Plant

Location, Layout of nuclear power plant, Fission, Fusion, controlled chain reaction, Classification of Nuclear reactors –Advanced Gas cooled Reactor, Pressurized Water Reactor, Boiling Water Reactor, Fast Breeder Reactor, Reactor Control & Cooling.

Diesel Electric Power plant and Gas Turbine Power plant

Introduction, Selection of site, Layout and Main components, Application.

Electrical System

Testing and commissioning of generators and power transformers.HT, EHT, and LV Substation arrangements. Station batteries and battery chargers. Tariffs-Types, power factor improvement.

Text Books

1. Generation of Electrical Energy, B.R. Gupta, S.Chand Publication, 2009.
2. A course in power system, J.B.Gupta, S.K.Kataria and Sons Publication,2013.

Reference Books

1. B.G.A. Skrotzki and W.A. Vopat, Power Station Engineering and Economy, McGraw Hill, Digitized on Dec 2007.
2. Nag's Power Plant Engineering, 5th Edition, By Sudipta De, McGraWHill , 2021

ENERGY STORAGE TECHNOLOGY

Course Code : EE30042
Credit : 3
L-T-P :3-0-0
Prerequisite :Chemistry (CH 10001)

COURSE OUTCOMES

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

CO1:describe application of different energy storage systems.

CO2:understand the performance of different types of energy storage device.

CO3:analyze the principle of different types of fuel cell.

CO4:understand different types of battery technology.

CO5:solve the state of charge of batteries using different techniques.

CO6:know super capacitor, green house heating.

COURSE CONTENT

Introduction

Energy availability, Demand and storage, Need for energy storage, Different types of energy storage; Mechanical, Chemical, Electrical, Electrochemical, Biological, Magnetic, Electromagnetic, Thermal, Comparison of energy storage technologies.
Activity: Different types of storage technologies and its applications.

Mechanical, Thermal Energy Storage

Flywheel storage, Hydro storage, Capacitor, Principles and applications, Thermal energy storage, principles and applications, Phase change materials; Energy analysis of thermal energy storage, solar energy and thermal energy storage.
Activity: Design of super-capacitor.

Electrochemical Energy Storage

Electrochemical energy storage: Battery fundamentals and technologies, characteristics and performance comparison of Lead-acid, Nickel-Metal hydride, Lithium Ion; Battery system model, emerging trends in batteries, Voltages and Capacities of Electro-chemical Cells, Equivalent Circuit of an Electrochemical Cell, Charging and discharging operation of batteries, State-of-charge (SOC) of batteries, battery management systems.
Activity: Design of battery management systems for Solar PV systems and Electrical Vehicles.

Fuel Cells

Hydrogen as energy carrier and storage; Hydrogen resources and production; Basic principles; Fuel cell types: AFC, PEMFC, MCFC, SOFC, Microbial Fuel cell; Fuel cell performance; Fuel cell applications for power and transportation.
Application of Energy Storage: Food preservation, Waste heat recovery, Solar energy storage: Greenhouse heating; Drying and heating for process industries.
Activity: Analyze different manufacturers and applications of commercially available fuel cells.

Text Books :

1. Huggins R. A., Energy Storage: Fundamentals, Materials and Applications, second edition, Springer International Publishing, 2015.
2. Dincer I., and Rosen M. A., Thermal Energy Storage: Systems and Applications, second edition, Wiley, 2011.

Reference Books :

1. Fuel Cell Fundamentals, O'Hayre R., Cha S., Colella W., and Prinz F. B., Wiley, Second Edition, 2009.
2. Chemical and Electrochemical Energy System, Narayan R. and Viswanathan B., Universities Press, (1998).
3. Battery Systems Engineering, Rahn C. D. and Wang C., First Edition, Wiley, 2013.
4. Electrochemical Energy Storage for Renewable Sources and Grid Balancing, Moseley P. T., and Garche J., Elsevier Science, 2014.
5. Compressed Air Energy Storage, Miller F. P., Vandome A. F., and John M. B., VDM Publishing, 2010.

INDUSTRIAL AUTOMATION

Course Code : EE40009

Credit : 3

L-T-P : 3-0-0

Prerequisite :Linear Control System(EE20004)

COURSE OBJECTIVE

The course covers both theoretical and practical aspect of industrial automation through PLC and SCADA for solving real time problems. This course offers learning of hydraulics systems, electrical controls and Programmable logic controllers.

COURSE OUTCOMES

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

CO1: Describe Industrial Measurement Systems
CO2: Determine the effect of parameters of controller on system performance.
CO3: Demonstrate the controller using different tuning methods.
CO4: Design the ladder logic of PLC according to the problem statement.
CO5: Analyze DCS and SCADA and their merits/demerits in an industrial automation.
CO6: Know application of controller in hydraulic and pneumatic systems.

COURSE CONTENT

Introduction

Introduction, Architecture of Industrial Automation Systems, Measurement Systems Characteristics, Data Acquisition Systems.

Controller tuning

Introduction to Automatic Control, PI controller, PD controller, PID controller tuning methods: Ziegler-Nichols tuning method, Cohen coon tuning method.

Automation

PLC (Programmable logic controllers): Overview, operation and architecture, PLC programming, Application examples.

DCS (Distributed control systems)

Overview, Advantages, Functional requirements of Distributed control systems, Communication for distributed control, Application examples.

SCADA (supervisory control and data acquisition)

Introduction to SCADA, SCADA system components, architecture and communication, SCADA applications.

Controllers in Industrial Instruments

Flow Control Valves, Hydraulic Control Systems - I, Hydraulic Control Systems - II, Industrial Hydraulic Circuit, Pneumatic Control Systems - I, Energy Savings with Variable Speed Drives

Text Books

1. Modern Control Engineering, 4th edition, Ogata, Prentice Hall of India, 2002.
2. Fundamentals of Industrial Instrumentation and Process Control, William C. Dunn, Tata McGraw Hill, 2009.

Reference Books

1.Chemical Process Control – Theory and Practice, Stephanopoulous, Prentice Hall of India Ltd, 1984.

HYBRID ELECTRIC VEHICLES

Course Code : EE40053

Credit : 3

L-T-P : 3-0-0

Prerequisite :Power Electronins & Drives (EE31003)

COURSE OBJECTIVE

The course objective for hybrid electric vehicles is to provide students with a comprehensive understanding of their design, operation, and analysis, covering fundamental principles of electric and conventional power-trains, energy sources, and control systems.

COURSE OUTCOMES

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

CO1.understand the modeling of Electric Vehicles and Hybrid Electric Vehicles.
CO2.know the mechanism of propulsion drive system.
CO3.control the output voltage and current of Traction Inverter.
CO4.analyze the control of the speed and torque of various traction motors.
CO5.explain the different energy storage systems.
CO6.know the design of Hybrid Electric Vehicle.

COURSE CONTENT

Introduction
History of hybrid and Electric vehicles, social and environmental importance of hybrid and electric vehicles.**Electric Drive-trains:**
Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.
Hybrid Electric Drive-trains:
Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.
Activity: Demonstration of EV vs Conventional Vehicle with suitable schematic.

Electric Propulsion unit
Introduction to electric components used in hybrid and electric vehicles, configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, and Switch Reluctance Motor drives, drive system efficiency.
Activity: Types of hybrid electric vehicle drive train with the suitable schematic of power flow arrangement.

Energy Storage
Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems
Activity: Types of energy storage systems with their specific application, Discuss merits and demerits, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis.

Energy Management Strategies
Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, Comparison of different energy management strategies. concept of tariff management in charging stations.
Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).
Activity: Modelling and design of a HEV using multiple sources of energy.

Text Books :

1. Electric and Hybrid Vehicles: Design Fundamentals, by Iqbal Husain, CBC Press, Second Edition, 2010.
2. Vehicular Electric Power Systems by Ali Emadi, Willis Press, 2003

Reference Books :

1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
2. Electric Vehicle Technology by James and John, John Wiley & Sons, Ltd First Edition, 2004.

POWER SYSTEM OPERATION AND CONTROL

Course Code : EE30006

Credit : 3

L-T-P : 3-0-0

Prerequisite : Linear Control System (EE20004),Power System Engineering(EE31004)

COURSE OBJECTIVE

This subject provides the basic knowledge of analyzing a power system by different studies and suggests appropriate control action for smooth operation of a power system.

COURSE OUTCOMES

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

CO1: Compute the bus admittance matrices

CO2: Solve the load flow problems.

CO3: Find economic operation of power generation.

CO4: Classify different Power system faults.

CO5: Apply the stability concept to power system.

CO6: Analyze the concepts of generation control

COURSE CONTENT

Load Flow Studies:

Bus classification, Nodal Admittance matrix, Formulation of load flow problem, Approximate load flow solution by Gauss-Siedel Method with and without PV bus, acceleration of convergence, Newton-Raphson Method, Decoupled and Fast decoupled method.

Economic Operation of Power System:

Introduction, Optimal operation of generators, Distribution of load on various generating units, Penalty factor and Transmission loss as a function of plant generation.

Symmetrical and Unsymmetrical Fault Analysis:

Introduction, Transients in transmission line, Symmetrical components, Sequence analysis of power system, Symmetrical Fault analysis, Unsymmetrical Fault analysis.

Stability Analysis:

Introduction to stability, Dynamics of synchronous machines, Swing equation, Power angle curve and its equation, Steady state stability, Equal area criterion, Effect of clearing time on stability.

Automatic Generation and Voltage Control:

Introduction, Load frequency control, Turbine speed governing system, Modeling of speed governing system, Turbine model, Generator load model, Integrated representation of various models, Proportional plus integral control, Automatic voltage regulator .

Text Books:

1. Modern Power System Analysis, I. J. Nagrath, D. P. Kothari, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 3rd Edition, 2003.
2. Power System Analysis- By John. J. Grainger & W. D. Stevenson, Jr., TMH, 2003 Edition, (15th Reprint).

Reference Books:

1. Power System Analysis by T K Nagsarkar and M S Sukhija, 1st Edition, Eighth impression 2012, Oxford University Press.
2. Power System Analysis Operation and Control, Abhijit Chakrabarti, Sunita Halder, Third Edition, 2010, PHI Learning Private Limited.

ENERGY AUDIT AND ACCOUNTING

Course Code :EE30020
Credit : 3
L-T-P :3-0-0
Prerequisite :Network Theory (EE20001)

COURSE OBJECTIVE

The objective of Energy Audit is to determine ways to reduce energy consumption per unit of product output or to lower operating costs and accounting the cost of energy.

COURSE OUTCOMES

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

CO1: Analyze the importance of energy audit.

CO2: Understand the concept of energy conservation and audit.
CO3: Apply the concept of accounting in energy audit.
CO4: Design the capacitor rating for power factor improvement.
CO5: Evaluate the energy efficiency of furnace and CHP System.
CO6: Create a report for an Economic Evaluation.

COURSE CONTENT

General Aspects

Indian Energy scenario, definition of energy conservation, management and audit,, Energy audit-need, Types of energy audit, Energy Audit Reporting Format ,Energy audit instruments, Energy Conservation schemes, Energy index, Cost Index, Representation of energy consumption.Economic and ecological implications on management & auditing systems, auditing on emission, pollution, safety and reliability.

Energy Utilization and Conversion System

Furnace: Classification of furnace, controlled atmosphere in furnace, furnace fuels, efficiency of energy in furnace, thermal efficiency, heat losses, reducing heat losses.

Combined heat and power systems: Characteristic of prime movers, heat and power requirement, economics of C.H.P. system

Industrial Heating

Resistance heating, Induction heating, arc Heating, dielectric and microwave atmosphere generators, radiant heating

Lighting

Lamp lifetime, efficient lighting

Motive power and power factor improvement

Cost of electrical Energy, Power factor improvement, Capacitor rating, sitting the capacitor, effect of power factor improvement. Hydraulic power system, Electrical Measurement, Temperature measurement and optimal start control.

Economic Analysis

Introduction, Basic Concepts, Interest Rate, Inflation Rate, Tax Rate ,Cash Flows, break even charts, Compounding Factors, Single Payment, Uniform-Series Payment, Economic Evaluation Methods Net, Present Worth, Rate of Return Benefit–Cost Ratio, Payback Period, Summary of Economic Analysis Methods, Life-Cycle Cost Analysis Method, General Procedure for an Economic Evaluation.Financing Options, Direct Purchasing, Leasing, Performance Contracting

Text Books

1. W.R. Murphy and G. McKay, "Energy management", Butterworth & Co Publishers, Oxford, UK, 2001.
2. Energy Audit of Building systems: An Engineering approach, by: Moncefkrarti, CRC PRESS, Second Edition, 2009.

Reference Books

1. A Workbook for Energy Management in building by: Tarik Al-Shemmeri, Wiley-Blackwell.
2. Energy audit: Thermal power, combined cycle, and co-generation plants, by: Y. Pabbi, TERI, 2011.
3. Energy Management Handbook, Seventh Edition, (Fairmont Press Inc., 2007) by WC Turner.
4. Bureau of Energy Efficiency (BEE) (2016); Study material for Energy managers and Auditors Examination: Paper I.

SMART GRID

Course Code :EE40012

Credit : 3

L-T-P : 3-0-0

Prerequisite : Power System Engineering (EE31004)

COURSE OBJECTIVE

To provide students with a working knowledge of fundamentals and development of Smart Grid, from the basic concepts of power systems.

COURSE OUTCOMES

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

CO1: Know the different elements of smart grid.

CO2: Demonstrate on Smart Grid Architecture.

CO3: Describe Synchro Phasor Measurement Unit.

CO4: Understand the wide area monitoring system of smart grid.

CO5: Analyse the load frequency control in micro grid.

CO6: Design control techniques for power quality improvement in smart grid.

COURSE CONTENT

Introduction to Smart Grid

Definition of smart grid, Components and architecture of smart grid design, Review of the proposed architectures for smart grid, The fundamental components of smart grid designs, Transmission automation, Distribution automation, Renewable integration.

Tools and Techniques for Smart Grid

Synchro Phasor Measurement Units (PMUs), Computational intelligence techniques, Distribution Generation Technologies

Communication Technologies and Smart Grid

Computational techniques, Static and dynamic optimization techniques, Introduction to communication technology, Evolutionary algorithms, Artificial intelligence techniques.

Control of Smart Power Grid System

Load Frequency Control (LFC) in micro grid system, Voltage control in micro gridsystem, Reactive power control in smart grid, Case studies and test beds for the smart grids.

Text Books

1. James Momoh, "SMART GRID, Fundamentals of Design and Analysis" IEEE press, 2013.
2. A. G. Phadke and J. S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer Edition, 2010

Reference Books

1. Gil Masters, "Renewable and Efficient Electric Power System", Wiley–IEEE Press, 2004.
2. T. Ackermann, "Wind Power in Power Systems", Hoboken, NJ, USA, John Wiley, 2005.
3. Clark W Gellings P.E. "The Smart Grid enabling energy efficiency and demand response", CRC Press, 2013.
4. Stuart Borlase, "Smart Grids, Infrastructure, Technology and Solutions", CRC Press, 2013.

SEMICONDUCTOR FABRICATION DESIGN AND TECHNOLOGY

Course code: EE30021

Credit: 3

L-T-P: 3-0-0

Prerequisite: Nil

COURSE OBJECTIVE

The objective of this course is to equip participants with a comprehensive understanding of the semiconductor manufacturing ecosystem, spanning from design concepts to final product realization.

COURSE OUTCOMES

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

- Understand the ecosystem of semiconductor and its manufacturing from design to product.
- Know difference between design, fabrication, packaging, system manufacturing and product
- Learn microfabrication advantages, scaling effects, and their impact on device design.
- Develop familiarity with advanced FinFET process integration and module-level decisions.
- Gain working knowledge of process simulation using SEMulator3D.
- Apply statistical tools for process control and optimization in semiconductor fabrication.

COURSE CONTENT

Semiconductor Fundamental:

Energy bands in solids (insulators, semiconductors, metals), Intrinsic and extrinsic semiconductors, doping (n-type, p-type), Carrier concentration, drift and diffusion currents, mobility, resistivity, Generation and recombination of carriers, PN junction (equilibrium, forward/reverse bias characteristics), Introduction to semiconductor materials (Si, Ge, GaAs, SiC, GaN). Crystal structures, Miller indices.

Introduction to Semiconductor Manufacturing Ecosystem:

Semiconductor value chain: design, fabrication, packaging, system, product, Foundry vs IDM vs Fabless, Microfabrication and Moore's law, Circuit abstraction to layout and cross-section, Benefits and implications of scaling

Lithography and Unit Process Fundamentals:
Lithography: Resolution, i-line to EUV, SADP & SAQP; Unit processes: - Wafer properties and oxidation, Doping, diffusion, implantation, Deposition: APCVD, LPCVD, PECVD, MOCVD, ALD, PVD, Etching: wet/dry, isotropic/anisotropic, Cleaning and CMP.

Advanced CMOS FinFET Process Integration:
Isolation: STI vs LOCOS, Device Architecture: Planar to FinFET, strain, SiGe; Gate Stack: High-k dielectrics, metal gates, gate-first vs gate-last; Junction and Implantation: Well, source-drain, LDD; Contact: Metal-silicon contact, silicides (Ti/Co/Ni), salicidation; Interconnect: Cu vs Al, RC delay, electromigration, Damascene; ILD: Low-k dielectrics, integration challenges.

Tool Introduction: Process Simulation using SEMulator3D:
SEMulator3D overview, Layout import and creation, FinFET process flow simulation, Extraction of cross-sections, Geometric and overlay analysis.

Statistical Process Control and Emerging Topics:
Statistical Process Control (SPC): distributions, z-test, t-test; ANOVA, DOE: screening, RSM, full/fractional factorial; Test structures and design rules; Optional: 3D NAND process flow, semiconductor device physics basics.

Text Books:
1. S. M. Sze & Kwok K. Ng, Physics of Semiconductor Devices, 3rd Edition, Wiley.
2. Marc Madou, Fundamentals of Micro fabrication and Nanotechnology, 3rd Edition, CRC Press.

Reference Papers:
The following papers offer a very nice road map of evolution of semiconductor technology. Additional review papers and reading material will be shared during lectures.
1. S. Yang *et al*., "A high performance 180 nm generation logic technology," *International Electron Devices Meeting 1998. Technical Digest (Cat. No.98CH36217)*, San Francisco, CA, USA, 1998, pp. 197-200, doi: 10.1109/IEDM.1998.746320.
2. S. Tyagi *et al*., "A 130 nm generation logic technology featuring 70 nm transistors, dual Vt transistors and 6 layers of Cu interconnects," *International Electron Devices Meeting 2000. Technical Digest. IEDM (Cat. No.00CH37138)*, San Francisco, CA, USA, 2000, pp. 567-570, doi: 10.1109/IEDM.2000.904383.
3. S. E. Thompson *et al*., "A 90-nm logic technology featuring strained-silicon," in *IEEE Transactions on Electron Devices*, vol. 51, no. 11, pp. 1790-1797, Nov. 2004, doi: 10.1109/TED.2004.836648.

4. K. Mistry *et al*., "A 45nm Logic Technology with High-k+Metal Gate Transistors, Strained Silicon, 9 Cu Interconnect Layers, 193nm Dry Patterning, and 100% Pb-free Packaging," *2007 IEEE International Electron Devices Meeting*, Washington, DC, USA, 2007, pp. 247-250, doi: 10.1109/IEDM.2007.4418914.

NUMERICAL RELAY AND DIGITAL PROTECTION

Course Code : EE40054

Credit : 3

L-T-P : 3-0-0

Prerequisite : Power System Engineering (EE31004)

COURSE OBJECTIVE

It aims to give a comprehensive up-to-date presentation of the fundamentals of digital relays, concept of digital signal processing used in digital relays and various algorithms utilized in digital/numerical relays and protection.

COURSE OUTCOMES

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

CO1: Know the digital system for relaying and signal processing.

CO2: Demonstrate the principle and communication protocol of numerical relay.

CO3: Examine in different monitoring protocols and architecture of relay.

CO4: Understand integrated digital substation control system.

CO5: Describe digital protection scheme of transmission line.

CO6: Familiar with different digital protection of power apparatus.

COURSE CONTENT

Principles of Numerical Relays

Introduction, block diagram of numerical relay, sampling theorem, correlation with a reference wave, least error squared (LES) technique, digital filtering, and numerical over current protection. Definition of a Numerical Protection System, Advantages of Numerical Relays, Procession Unit, Man-Machine Interface (MMI), Communication in Protection Relays, Information Handling with Sub-station Monitoring System (SMS), Digital / Numerical Relays, Different Types of Numerical Relays, Principles of Fault Locators.

Protection and Coordinated Control

Protection and Coordinated Control, Place of Personal Computer, Self-Monitoring and Post Fault Analysis, Workstations and Remote Communication, Alstom EPA Computer (Publication N.1.6918 B), PSCN 3020 Bay Module: Integrated Digital Sub-station Control System, Architecture, Interface to SCADA, Local Control Point: Man-Machine Interface, SPACE 2000-System for Protection and Automatic Control.

Reliability, Testing, and Maintenance for Numerical Relays

Reliability, Software Considerations, Redundancy, Privatization and Deregulation of Electrical Industry, Protective Relaying Capabilities, Maintenance, Opto-electronic Sensors.

Digital protection

Digital protection of Transmission line, Synchronous Generator and power transformer.

Text Books

1. Fundamentals of Power System Protection", Y. G. Paithankar, S. R. Bhide, 2nd edition, Prentice Hall of India Private Limited, New Delhi, 2011.
2. Digital Protection, L.P Singh, New age International Publisher, 2nd Edition, 1997.

Reference Books

1. Protective Relaying: Principles and Applications, Fourth Edition, By J. Lewis Blackburn, Thomas J. Domin, CRC Press, Taylor and Francies.
2. Power System Protection Static Relays by T S M Rao, 2nd edition, Tata McGraw-Hill Education, 2005.

PROBABILITY AND STATISTICS

Course Code: MA21001

Credit :4

L-T-P :3-1- 0

Prerequisite :Differential Equations and Linear Algebra (MA11001)

COURSE OBJECTIVE

The objective of this course is to familiarize the students with the foundation of probability and statistics and to use it in solving the problems arises in engineering and real life applications.

COURSE OUTCOMES

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

CO1:understand basic probability and its applications
CO2: ~~s~~tudy probability distributions and can use it in real life data analysis
CO3:have a knowledge on univariate and bivariate distributions and their properties
CO4: measure the central tendency and dispersion of a data set to draw conclusion from the data and interpret the data with the appropriate pictorial representation.
CO5: have good understanding of the Central Limit Theorem and its applications
CO6: analyze the statistical inference

COURSE CONTENT

Probability and random variables

Basic concepts of sample space, events(with example), Axiom of Probability,Conditional Probability, Bayes' Theorem and its applications.Discrete random variable, probability mass function, cumulative distribution function and Moment Generating function for discrete random variable, some special distributions likeUniform distribution, Geometric distribution, Binomial distribution, Negative Binomial distribution, Poisson distribution, Hyper geometric distribution, mean and variance.Continuous random variable, density function, cumulative distribution function and Moment Generating function. Uniform distribution, normal distribution, mean, variance, percentile and critical value of normal distribution,normal approximation of the binomial distributionand exponential distribution.

Joint probability and distributions

Joint probability mass function and marginal probability mass function, joint probability density function and marginal probability density function, concept of independent random variable(joint probability), conditional probability mass function and conditional probability density function. Expected value, covariance and correlation for jointly distributed random variable(both continuous and discrete).

Descriptive Statistics

Frequency distribution,pictorial and tabular representation of data, stem and leaf display, dot plots, histogram, box plots and comparative box plots.Basic conceptson mean, median and mode, Skewness, Kurtosis, Correlation, Coefficient of Correlation, rank correlation, Regression Analysis: Least square method.

Inferential statistics

Population, sample, random sample, sampling distribution, distribution of sample mean, central limit theorem, point estimator, point estimation of parameter using method of maximum likelihood estimation, confidence interval, confidence interval for the mean of a normal population with known and unknown variance, confidence interval for the variance of a normal population, hypothesis testing, one sided and two sided alternatives, Tests for mean of the normal distribution with known variance, Tests for mean of the normal distribution with unknown variance, tests for variance of the normal distribution.

Text books:

1. Probability and Statistics for Engineers and Sciences by J. L. Devore, CENGAGE Learning, 9th Edition
2. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley, INC, 10th Edition.

Reference Books:

1. Introduction to Probability and Statistics for Engineers and Scientists by S.M. Ross, Elsevier/AP, 6th Edition.
2. Introduction to Probability and Statistics by J.S. Milton & J.C. Arnold, Mc Graw Hill, 4th Edition.
3. Introduction to Probability Theory and Statistical Inference by H.J. Larson, John Wiley & Sons Inc, 3rd Edition.
4. Fundamental of Mathematical Statistics by S.C. Gupta & V.K.Kapoor, S. Chand, 12th Edition.

VECTORS, DIFFERENTIAL EQUATIONS AND COMPLEX ANALYSIS

Course Code : MA21006

Credit :4

L-T-P :3-1-0

Prerequisite : Differential Equations and Linear Algebra (MA11001) and Transform Calculus and Numerical Analysis (MA11002)

COURSE OBJECTIVE

The objective of this course is to empower the students to design and solve branch prospective problems by the use of Vector calculus, partial differential equations, Complex variables.

COURSE OUTCOMES

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

CO1: understand the physical significance of the concepts like divergence, curl and gradient.
CO2: apply vector integration theorems like Gauss divergence, Stokes and Greens theorem in different engineering applications like work done by force, evaluation of flux etc.
CO3: know the basic analytical techniques for solving the classical wave, heat and Laplace equation
CO4: know the concepts of analytic functions, its differentiation and its series representation
CO5:understand the fundamental concepts of contour integration to evaluate complicated real integrals via residue calculus
CO6: apply multi steps numerical methods to solve initial and boundary value problems

COURSE CONTENT

Vector Calculus

Brief concepts of vectors, gradient of a scalar field, directional derivatives, divergence and curl of a vector field. Vector line integral, surface integral, Green's theorem, Gauss divergence theorem, Stoke's theorem, engineering applications of above integral theorems like work done by force, flux integration, independence of path etc.

Partial Differential Equations(PDE)

Basic concepts of PDE like order, degree, linear, nonlinear, homogeneous and non-homogeneous PDE. Solution of PDE by Variable Separable method. Classification of PDE and their reduction to normal form. One dimensional Wave equation, D'Alembert and Fourier series solution of 1-D wave equation. Solution of 1-D heat equation by Fourier series method. Solution of 2-D Laplace equation and 2-D heat equations. (steady state) with different types of boundary conditions using Fourier series.Laplace equation in polar co-ordinate and its application to find the electrostatic potential/steady state temperature in a disk with appropriate boundary conditions. Solution of PDE by Laplace Transform.

Complex Analysis

Basic concepts of complex number. Complex functions, derivatives, analytic function, Cauchy Riemann equations, harmonic functions, harmonic conjugate, elementary functions like exponential, trigonometric, hyperbolic, logarithmic functions and general powers. Curves in complex plane and their parametric representation. Line integrals, Cauchy integral theorem, Cauchy integral formula, Derivatives of analytic function. Power series, Taylor's series, Maclaurin's series, Laurent's series, singularities, Residues, Residue Integration, Real Integralsand Cauchy's Principal Value integrals.

Numerical Solution of ODEs

Solution of Linear Difference Equations; IVP (Multi Steps Method): (Predictor-Corrector method) Adams-Bashforth Method, Adam-Moulton Method; BVP: Shooting methods.

Text books

1. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley, INC, 10^{th} Edition.
2. Numerical Methods for Scientific and Engineering Computation by Jain , Iyenger and Jain, New age International (P) Ltd.,6th Edition.

Reference books:

1. Higher Engineering Mathematics by B.S.Grewal, Khanna Publishers,36^{th}Edition.
2. Higher Engineering Mathematics by B.V. Ramana, TMH, 2017 Edition.
3. Advanced Engineering Mathematics by H. K. Dass, S. Chand, 2007 Edition

INDUSTRY 4.0 TECHNOLOGIES

Course Code : EX20001

Credits : 2

L-T-P : 2-0-0

Pre-requisites :Nil

COURSE OBJECTIVES

The current manufacturing industries and businesses are moving from the third industrial revolution of the computers and automation the fourth where the automation becomes even smarter fueled by data analytic and artificial intelligence. This course is designed to offer learners an introduction to use of Internet and digital technology for better manufacturing and business. Learners will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges.

COURSE OUTCOMES

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

CO1: Understand the key components and enablers of Industry 4.0Technology

CO2: Appreciate the smartness in Smart Factories,smart products and smart Services.

CO3: Outline Smart Factory technologies and their role in an Industry 4.0 world

CO4: Outline IoT technology and scope of implementing IoT in Industries and businesses.

CO5: Comprehend distributed cyber-physical and digital manufacturing system

CO6: Demonstrate the opportunities, challenges brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits

COURSE CONTENT

Introduction

The Fourth Industrial Revolution, Difference between conventional automation and Industry 4.0, Case Studies: Health, Agriculture, Manufacturing

Industry 4.0 and its components

Internet of Things(IoT) and Industrial Internet of Things(IoT), Internet of Services, Value chains in manufacturing companies, Digital Twins

Digital Manufacturing and Design:

Cyber Physical Systemsand Next Generation sensors, Collaborative Platform and Product Life-cycle Management, Robotics and Automation

IndustrialIoT

Cloud Computing, Big-Data Analytic, AI&ML, Virtual and Augmented Reality, Block-chain

Challenges & Opportunities inIndustry4.0

A Digital Strategy alongside Resource Scarcity, Standards and Data security, Financing conditions, availability of skilled workers, Comprehensive broad-band infra-structure, Legal framework, protection of corporate data, liability, handling personal data.

Text books:

1. D. Pyo, J. Hwang, and Y.Yoon, Tech Trends of the 4th Industrial Revolution, Mercury Learning &Information publisher, 2021.
2. BrunoS. Sergi, Elena G. Popkova, Aleksei V.Bogoviz, and Tatiana N.Litvinova Understanding Industry4.0: AI, theInternet of Things, and the Future of Work, Pub: Emerald Publishing Limited, 2019

Reference Books:

1. S.Misra,A. Mukherjee,and A.RoyIntroduction toIoT. Cambridge University Press, 1st edn. 2021

2. Dac-Nhuong Le, Chung Van Le, Jolanda G. Tromp , Gia Nhu Nguyen, Emerging Technologies for Health and Medicine: Virtual Reality, Augmented Reality, Artificial Intelligence, Internet of Things, Robotics, Industry 4.0, John Wiley publisher, 2018
3. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, Apress Berkeley publisher, CA 1st

SCIENTIFIC AND TECHNICAL WRITING

Course Code: EX20003

Credit :2

L-T-P :2-0-0

Prerequisite : Nil

COURSE OBJECTIVE

Technical documents take many forms depending on their purpose and the audience. A technical document can be a project proposal, minutes of a meeting, an advertisement in a newspaper, or even a research paper. A scientific document is a form of technical document where both the author and the audience are experts. The writing styles and the document density of technical documents depend on the nature of the document. The objective of this subject is to train the students in the art and science of writing a range of scientific and technical documents.

COURSE OUTCOMES

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

CO1 :Realize the need to articulate the purpose of the document, identify its audience, and decide the density of information to be included in scientific and technical documents.
CO2 :Internalize the art and science of scientific and technical writing.
CO4 :Make appropriate use of crisp language, illustrations, and symbols.
CO4 :Distinguish between bad and good writing. (Analyze and Evaluate).
CO5 :Prepare a variety of scientific and technical documents, including laboratory and project reports;
CO6 :Write these documents in an accurate, clear, concise, coherent, appropriate, and readable manner.

COURSE CONTENT

Introduction

Forms and features of creative, technical, scientific, and science writing; Audience types (general and specific experts, technicians, managers, laypersons, and mixed audience); Examples of documents for technical, professional, and scientific communications; Characteristics of effective technical writing: Accuracy, clarity, conciseness, coherence, appropriateness, and readability.

Language Issues

Revisiting English grammar; Punctuation (period, comma, colon, semicolon, question mark, exclamatory mark, apostrophe, quotation marks, hyphen, dash, parentheses, and brackets); Mechanics (capitalization, italics, abbreviations, acronyms); Latin terms used popularly in English texts; Informal and colloquial English; Dangling modifiers, Faulty parallelism, Judicious use of common words and phrases; Active and passive voice; Nominalization; Common English errors; Pitfalls in writing; Adapting texts to issues of gender, race, and ethnicity; and Guarding against Plagiarism.Paragraphing: Unity of idea, topic sentence, logical and verbal bridges through use of signposts, transitions, and link words; Patterns of development of an idea; and Lists.

Structure of Scientific Documents

Prefatory Materials:Title, Copyright Notice, Declaration and Certificates, Abstract, Keywords, Acknowledgements and Conflict of Interest Statement, Symbols and Abbreviations, and Table of Contents.

Body of Scientific Documents

Introductory Materials—Context, problem and current response, research questions, hypotheses, and objectives and scope; Literature Review—Presentation styles, citations and referencing systems, quoting, paraphrasing, and summarizing; Materials and Methods—Mathematical Materials: Methodology, methods, tools, and techniques; Quantitative, qualitative, experimental, and mixed methods; Numbers and numerals, engineering and scientific notations of numbers, mathematical operators, equations, flowcharts, algorithms, SI units, significant digits and order of magnitude, figures, tables, and photographs; Experimental apparatus, materials, specifications, measuring instruments, procedure, data analysis; Concluding Materials—Conclusions, implications, generalization, limitations, scope for further work, and contributions of the work.

End Matters

References, Appendixes, and Supplementary materials.

Structure of Selected Technical Documents

PowerPoint presentation, Abstract of a paper, Laboratory reports, Progress report, Project proposal, Minutes of a meeting, Brochure, and News items.

Test Books:

1. Lecture notes on Scientific and Technical Writing
2. Alred, G. J., C. T. Brusaw, and W. E. Oliu (2008), *Handbook of Technical Writing*, St. Martin's Press, New York, Ninth Edition.
3. Angelika H. Hofmann (2014), Scientific Writing and Communication, Papers, Proposals, and Presentations, Oxford: Oxford University Press.
4. Duke Graduate School Scientific Writing Resource(https://sites.duke.edu/scientificwriting/).

Reference Books:

1. Gerald. J. Alred, Charles. T. Brusaw, and Walter. E. Oliu (2008), *Handbook of Technical Writing*, St. Martin's Press, New York, Ninth Edition.
2. OWL, The Purdue Online Writing Laboratory, https://owl.english.purdue.edu/owl/.
3. Perelman, L. C., J. Paradis, and E. Barrett (1998), The Mayfield Handbook of Technical and Scientific Writing, Mayfield Publishing (ed.), Available free at http://www.mhhe.com/mayfieldpub/tsw/toc.htm, Mayfield Publishing Company, Inc.,1280 Villa Street, Mountain View, CA 94041, 415.960.3222, <http://www.mayfieldpub.com>, <mailto:hypertext@mayfieldpub.com>
4. Rubens, P. (2001), Science and Technical Writing: A Manual of Style, 2nd Edition, Routledge, New York.

RESEARCH METHODS AND ETHICS

Course code : EX40001
Credit : 3
L-T-P : 3-0-0
Prerequisite : NIL

COURSE OBJECTIVE

The objective of this course is to introduce to the undergraduate students the various elements and methods of ethically conducting a piece of scientific research.

COURSE OUTCOMES

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

CO1 : Select research topics and formulate research questions,

CO2 : Conduct a literature search and make a review of literature,

CO3 : Get acquainted with a range of qualitative, quantitative, experimental, and theoretical methods of Research,

CO4 : Become familiar with the techniques of data collection, analysis, and interpretation,

CO5 : Understand the importance of research ethics and the implications of the broader impact of research, and

CO6: Conduct research with honesty and integrity.

COURSE CONTENT

Introduction to research

Structure of research: Scientific method and Engineering design cycle, Defining and scoping Research problems, Formulating research objectives and research questions.

Literature Review

Searching for literature; Narrative and systematic literature review; Summarizing, paraphrasing, and quoting; and Referencing styles.

Design of Experiments

Basic Principles of randomization, replication, and Blocking; Factors and Responses; Analysis of variance, Experiments with blocking factors, and Factorial designs.

Data Analytics

Data pre-processing; Data visualization; Tests of hypothesis; Decision trees; and Artificial neural networks.

Theoretical Models

Typology of models; Optimization models, forecasting models, and control models; Monte Carlo simulation; Genetic Algorithm; Model verification and validation; and Measurement and

uncertainty analysis.

Drawing Inferences

Drawing inferences, Generalizing, Finding potential applications, Imagining future scope, and Highlighting novelty of research.

Research Ethics

Ethics and morality; Utilitarian and deontological theories of ethics; Fabrication, falsification, plagiarism, and questionable research practices; Issues related to privacy and confidentiality; and Ethical issues related to publications

Text Books:

1. Dunn, P. K. (2021), Scientific Research and Methodology: Tutorials, An Introduction to Quantitative Research and Statistics in Science, Engineering, and Health: Tutorials, Available free at https://bookdown.org/pkaldunn/SRM-tutorials/.

2. Dunn, P. K. (2021), Scientific Research and Methodology: Software, An Introduction to Quantitative Research and Statistics in Science, Engineering, and Health: Using Software, Available free at https://bookdown.org/pkaldunn/SRM-software/. (Uses Jamovi and SPSS Software, Jamovi is a freely downable software)
3. Lectures note on Research Methods and Ethics provide by Concerned faculty members

ENGINEERING PROFESSIONAL PRACTICE

Course Code :EX40003

Credit : 2

L-T-P : 2-0-0

Prerequisite :Nil

COURSE OBJECTIVE

Engineers are expected to perform their tasks responsibly and ethically, following professional standards and guidelines. This subject allows the students to understand the roles and responsibilities of engineers in society, learn professional standards, codes of ethics, issues concerning employment contracts and other legal matters, and skills of working in teams, and to effectively communicate. The subject will be offered jointly by the faculty members of various schools of technology and will be coordinated by the School of Mechanical Engineering.

COURSE OUTCOMES

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

CO1 : Know (a) the features of engineering as a profession, (b) the roles and responsibilities of engineers in society, and (c) the skills for working in teams,

CO2 : Realize the use of professional standards, codes of ethics, legal provisions surrounding engineering functions,

CO3 : Apply the above-stated standards, codes, legal provisions, and group communication skills in their decision-making situations,

CO4 : Break down a complex problem into smaller manageable tasks,

CO5 : Compare among alternatives in situations of uncertainty, risk, and ambiguity,and

CO6 : Design engineering solutions to industrial environmental and social problems.

COURSE CONTENT

Engineering and Engineer: Engineering as a discipline and a profession; Attributes and functions of a practicing engineer; and Engineer as a problem solver, designer, and change agent.

Selected Functions of Engineering: Designing for safety and reliability; Quality and productivity management; Dealing with problem complexity, uncertainty, risk, and ambiguity; Project management; and Managerial functions such as planning, organizing, motivating, and controlling; Costing and accounting.

Professional Aspects of Engineering: Accreditation, certification, and licensing; Ethical issues: Ethics and morality, ethical dilemmas, codes of ethics, professional conduct, nature and role of professional societies, engineering standards; Legal issues—Legal forms of business organizations, employment contracts, trademarks, patents, copyrights, trade secrets, professional liability, contractual agreements, environment and information technology laws, and international legal framework such as WTO.

Group Dynamics: Individual cognition; Dynamics of working in teams/groups; Interacting with stakeholders; Dealing with multicultural environments; Team and group communication; and Negotiation and conflict resolution.

Text Book

1. Shrestha, R. K. and Shrestha, S. K. (2020), Text Book of Engineering Professional Practice, 3rd Edition, Heritage Publishers and Distributors Pvt. Ltd.

Reference Books

1. Habash, R. (2019), Professional Practice in Engineering and Computing: Preparing for Future Careers, 1st Edition, Boca Raton: CRC Press.
2. Walesh, S. G. (2012), Engineering Your Future: The Professional Practice of Engineering, 3rd Edition, Wiley.
3. Subramaniam, R. (2017), Professional Ethics, 2nd Edition, Oxford University Press
4. Lectures note on Engineering Professional Practice provide by Concerned faculty members.

ECONOMICS OF DEVELOPMENT

Course Code : HS20120

Credit : 3

L-T-P : 3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

The objective of this course is to provide students with the essential tools and concepts of development economics, to prepare them to understand what makes underdevelopment persist and what helps development succeed.Students will explore diverse dimension and measures of development, as well as the application of micro-economic analysis to issues of development in poor countries, including the study of household decisions and the analysis of institutions and norms influencing development.And To enhance students understanding of the SDGs to create a better- informed citizenry, which will lead to a more sustainable action by all and for all.

COURSE CONTENT

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

CO1: Understand key factors and issues in the process of economic development,

CO2: Enhance their ability in applying economic models to study development Problems,

CO3: Learning the role of the three basic components of ecosystems and environment and underlying causes of their degradation,

CO4: Understand the policy scenario and the existing environmental conventions/ regulations/ laws,

CO5: Development of sustainable planning for sustainable development of environment, economy and firms

CO6: select and apply appropriate economic techniques to solve environmental problems and measure the value of environmental goods.

COURSE CONTENT

Economic Growth and Development

Meaning of development and Economic growth, Characteristics of less developed countries.

Factors in Economic development, Measuring development and development gap — per capital income, inequality of income and wealth, Gini coefficient, Human Development Index , Physical Quality of Life Index, and other indices of development.

Theories of Economic Growth and Development

Theories of Economic Development: Classical (Smith, Ricardo, Malthus), Marxian – Theory of Social change, immutable laws, Crisis in capitalism, Schumpeter and capitalist development,Rostow's stages of growth. Partial theories of growth and development: Vicious circle of Poverty, Big push, balanced growth, unbalanced growth,

International aspects of Economic Development

International trade as an engine of growth; Static and dynamic gains from trade; Prebisch,Singer and Myrdal theses vs. free trade; Export-led growth; Tariffs and effective protection;WTO and developing countries. External resources; FDI; Aid vs. trade;

Development and Environment

Economy linkage; Environment as a necessity and luxury; Population environment linkage.Allocation problem; Market failure for environmental goods; environment as a public good.

Sustainable Development

Concept and indicators of sustainable development.Common Property Resources, Property right approach to environmental problem-property rights approach, property rights and environmental problems,Externalities and Pigovian tax, Coase theorem, Coase theorem and transaction cost. Prevention,control and abatement of pollution.

Text Books

1. S.Ghatak, An Introduction to Development Economics, Allen and Unwin, London,2003
2. Kindleberger, C. P. Economic Development, McGraw Hill, New York, 1958
3. Todaro, M. P. Economic Development, Longman, London.

References Books

1. Thirwal, A. P. Growth and Development, Macmillan, U. K,2017
2. Adelman, I. Theories of Economic Growth and Development. Stanford University Press, Stanford, 1966.
3. Chenery, H. and T.N. Srinivasan (Eds) Handbook of Development Economics, Vols 1 & amp; 2 Elsevier, Amsterdam, 2002
4. Myint, H. Economic Theory and Underdeveloped Countries, Oxford University Press, NewYork,1971

INTERNATIONAL ECONOMIC COOPERATION

Course Code :HS20122

Credit : 3

L-T-P : 3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

This course's overarching objective is to equip students with knowledge of both the thoretical concepts and the actual procedures involved in international trade. The specific purpose is to increase the knowledge of importing and exporting essentials and to offer the with the skills for understanding the international trading process.

COURSE OUTCOMES

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

CO1 : Learn theories of international trade,

CO2 : Understand free trade, protection, and BOP,

CO3 : Analyse the role of international organisations,

CO4 : Understand the working of foreign exchange,

CO5 : Study the EXIM policies,and

CO6 : Analyse secondary data relating to international trade.

COURSE CONTENT

Theories of International Trade

Classical Theories of International Trade- Mercantilism, Absolute Advantage,Comparative advantage Theory, Gains from international trade; Terms of trade; Theory of Reciprocal Demand; Modern Theories of International Trade-Heckscher-Ohlin theory

Free Trade,Protection and Balance of Payment

Free trade and protection in developing countries; Forms, methods and effects of protection; Introduction of BoP; Structure of BoP; Disequilibrium in BoP; Measures to overcome disequilibrium in BoP., Tariff; Trade creation vs Trade diversion.

International Organizations

International Monetary Fund; World Trade Organasation; Regional Trade Agreements; Trade Blocs.

Foreign Exchange

Foreign Exchange Market; Theories of foreign exchange; Factors affecting exchange rate; Fixed and flexible exchange rate; FERA and FEMA.

EXIM Policies

Recent budgetary policies and programs relating to inequality; Analysis of Economic Survey data.

Text Books

1. R. R Paul, Money Banking and International Trade, Kalyani Publishers; 12th edition,2015,ISBN-10 : 932725774X ISBN-13 : 978-9327257748
2. Bo Södersten and Geoffrey Reed, Palgrave Macmillan, International Economics. 1994, ISBN-10 : 0333612167 ISBN-13 : 978-0333612163

Reference Books

1. Dominick Salvatore,International Economics: Trade and Finance, Wiley; Eleventh edition,2017, ISBN-10 : 8126552344ISBN-13 : 978-8126552344
2. Paul R. Krugman, Maurice Obstfeld, Marc Melitz,International Trade: Theory and Policy, 2017, ISBN-10 : 9789332585768 ISBN-13 : 978-9332585768

ORGANIZATIONAL BEHAVIOUR

Course code : HS20220

Credit :3

L T P :3 0 0

Prerequisite : NIL

COURSE OBJECTIVE

This course shall guide the students to learn the basic concepts of Organizational Behaviour and its applications in contemporary organizations. Further, it help them to describe how people behave under different conditions and understand why people behave as they do. The students would be in a position to synthesize related information and evaluate options for the most logical and optimal solution such that they would be able to predict and control human behaviour and improve results. Lastly, this course would help the students to understand how individual, groups and structure have impacts on the organizational effectiveness and efficiency.

COURSE OUTCOMES

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

CO1 : Know about organization, organizational behaviour, it's nature, scope and significance,

CO2 : Develop their personality as per industry requirement,

CO3 : Apply motivational techniques to make the employees work with confidence and satisfaction,

CO4 : Develop different leadership styles to adjust themselves in different organizational situations,

CO5 : Improve the knowledge of group behaviour and techniques of group decision making,and

CO6 : Apply the concepts for managing changes in organization as well as the development of an organization's human resources.

COURSE CONTENT

Introduction to Organizational Behaviour

Organizational Behaviour- nature and scope; Need for studying OB; contributing disciplines to OB; evolution of OB; OB approaches and models; OB opportunities and disruptions

Individual Perspective

Introduction to Individual behaviour; Personality- concept, determinants, types and theories/models; Personality and OB; Perception- meaning, perceptual process, factors affecting perception; perception and its application in OB; Attitude- nature, components, formation and types; Values- concepts, types and formation; attitude, values and behaviour

Individual Perspective

Learning- meaning, determinants, theories and principles; learning and behaviour; Motivation- nature, importance, process and theories; managerial implication of motivation- job design, quality of work life and employee engagement; organizational citizenship behaviour- meaning, theoretical perspective, determinants and predictors

Group Perspective

Foundation of group behaviour; meaning and characteristics of group; why do people form and join groups; types and groups; stages of group development; group decision making; Team building- meaning and types of team; team building process; Meaning, sources and types of conflict; conflict management and negotiation strategies; Leadership- meaning and importance; differentiating between leader and manager; leadership styles; leadership theories

Organizational Perspective

Organizational structure- meaning and elements; Organizational culture- meaning, types and functions of culture; creating, sustaining and changing a culture; Organizational change- meaning and need; ; managing resistance to change; Organizational development- meaning, objectives, models and interventions

Text Books

1. Dr. S..S. Khanka,Organizational behaviour texts and cases Sultan Chand, OB text and cases S.S. Khanka, S chand, 2022
2. Stephen P. Robbins, Timothy A. Judg, Neharika Vohra Organizational Behaviour, Pearson, 18th edition, 2018

Reference Books

1. Fiona M. Wilson,Organizational Behaviour and Work Oxford University Press,2014
2. K. Aswathappa ,Organizational Behaviour, , Himalaya Publishing House, 2013

HUMAN RESOURCE MANAGEMENT

Course code : HS20222

Credit : 3

L T P :3 0 0

Prerequisite : NIL

COURSE OBJECTIVE

This course aims at providing conceptual knowledge on human resource management that will be useful for a manager of an organization. It also understands employer and employee relationship in order to achieve organizational objectives effectively. It starts with hiring and continues till retention. It also focuses on enabling the students to integrate the understanding of various HR concepts along with the domain concept in order to take correct business decisions.

COURSE OUTCOMES

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

CO1: Learn the various functions of management, personal and professional qualities of a manager in order to manage human resource of an organization effectively,

CO2: Understand the process of acquiring human resource through effective planning, recruitment and selection process,

CO3: Apply different training and development methods for organizational effectiveness,

CO4: Analyse the importance of performance appraisal and equitable pay for the growth of both individual and organization,

CO5: Inculcate the sense of inter personal relation required in professional front in handling employer-employee relation effectively for achievement of organizational objectives,and

CO6: Know the technique of managing and being managed by the organization.

COURSE CONTENT

Introduction to HRM

Introduction, scope, objectives; Managerial and operational functions of Management; HRM as a source of competitive advantage; Qualities and role of HR managers

Planning and Acquiring Manpower

Human resource planning- Introduction, objectives, need, importance; Factors, Process and barriers of HRP; Job analysis- concept, objective and Process; Meaning, process and sources of recruitment; Factors of effective recruitment; Meaning and process of selection; Competency mapping for selection decision; Induction and socialization; recent trends in recruitment and selection

Developing Manpower

Training- nature, need, objectives, importance; areas of training; training process- identifying training need, designing a training program; methods and techniques of training; evaluating training effectiveness; Role specific and competency based training; career planning and development- meaning, objective and process

Managing Performance and Compensation

Performance appraisal- concept, objectives and importance of performance appraisal; Process of performance appraisal; Methods of performance appraisal; Problems in performance appraisal; Potential Appraisal; Components of compensation; objectives and factors affective Wage and salary administration; methods of wage payment; process of wage determination; Pay band compensation system

Maintaining and Retaining Human Resources

Industrial Relation- concept, objective and approaches: Reasons for poor industrial relation; Measures for improving industrial relation; Industrial Dispute- nature, causes, prevention and settlement; meaning, objectives, importance and conditions for successful collective bargaining; Workers Participation in management- concept, objectives, forms and measures; Discipline and Grievance- Statutory provisions concerning discipline; causes and machinery for redressal of grievances

Text Books

1. P. Jyoti & D. N. Venkatesh ,Human Resource Management, Oxford Publication.
2. Gary Dessler and Biju Varkkey ,Human Resource Management, , Pearson Education, 2020

Reference Books

1. S S Khanka Human Resource Management Text and Cases by, S.Chand and company Limited, 2022
2. K. Aswathappa,Human Resource Management. Mc Graw Hill Education, 2013
3. P. Subba Rao Personnel and Human Resource Management., Himalaya Publishing House, 2022

INDIAN LITERATURE IN TRANSLATION

Course Code : HS30050

Credit : 3

L-T-P : 3-0-0

Prerequisite : English (HS10001)

COURSE OBJECTIVE

The course aims to create awareness among the students, of the rich and diverse literary cultures of ancient, medieval and modern India. It would enable the students to appreciate the

Indian classical literature, discuss Indian society post partition and understand the importance of devotion and dedication in human life.

COURSE OUTCOMES

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

CO1 : Record the masterpieces in Indian classical literature.

CO2 : Explore images in literary productions that express the writers sense of their society.

CO3 :Imbibe the virtue of sacrifice , passions, integrity, tolerance and selflessness

CO4 :Compare English literature and Indian classical literature

CO5 :Appraise the richness of Indian culture and the quality of the translated works

CO6 :Familiarize with the mechanism of translation

COURSE CONTENT

Translation : A Brief Overview: What is translation? Types of translation

Epics

- A short section from *The Mahabharata* – Draupadi's humiliation
- A short selection from *Kamba Ramayana* – Sita's humiliation

Short Story

- A story from *Panchatantra*
- A story from Jataka
- Premchand – a story
- Sadat Manto- Toba Tek Singh

Poetry

- Sections from *Meghadutam*, Kalidasa
- Bhakti poems –,Mira Bai, Kabir, Bhima Bhoi
- Urdu tradition – Ghalib, Bahadur SahaZaffar
- Gitanjali – a few poems

Biography

- A selection from *Harshacharita*
- A short selection from *Akbarinama*

Play

- Bhasa – Urubhanga (short play – linked to section from Mahabharata)
- Mohan Rakesh – a section of his play(*AdheAdhure)*

Reading Materials:

1. Buck, W. (2019). Mahabharata. University of California Press.
2. Chakraborty, P. (2009). Stories from the Panchatantra.
3. Fazl, Abu'l (1877). Akbarnamah (Persian). Asiatic Society, Calcutta.
4. Francis, H. T., & Thomas, E. J. (Eds.). (2014). Jataka tales. Cambridge University Press.
5. Jeremy, Munday.. Introducing Translation Studies, London: Oxford University Press, 2001.
6. Kane, Pandurang Vaman, ed. The Harshacarita of Banabhatta:(text of Uchchhvasas I-VIII). Motilal Banarsidass Publ., 1986.
7. Rajan, Chandra. Kalidasa: The loom of Time, New York, Penguin Books, 1989
8. Rakesh, Mohan. Halfway House. Worldview Publications, 2006.
9. Ray P , Yajnaseni, the story of Draupadi. Translated by P Bhattacharya. New Delhi: Rupa & Co., 1995.
10. Saadat Hasan Manto (2006). Arif, Iftikhar; Khan, Mohammad Anwar; Siddiqui, Khurram Khiraam (eds.). Frances W. Pritchett (trans.). "Toba Tek Singh". Pakistani Literature. Islamabad: The Pakistan Academy of Letters. **11** (2): 83.
11. Saadat Hasan Manto (2008), ٹوبہ ٹیک سنگھ(Toba Tek Singh), Four Corners, 2008, ISBN 978-81-907633-5-6
12. Sreenivasan, R. (1993). Kamba Ramayanam.
13. Tagore, Rabindranath. Gitanjali. Courier Corporation, 2000.
14. Wilson, Horace Hayman (1813). The Mégha Dúta, Or, Cloud Messenger: A Poem, in the Sanscrit Language. Calcutta: College of Fort William.
15. School, B. (2016, August 24). Draupadi Humiliated, Mahabharata. World History Encyclopedia. Retrieved from https://www.worldhistory.org/image/5520/draupadi-humiliated-mahabharata/
16. https://allpoetry.com/Mirabai
17. https://allpoetry.com/Kabir
18. BHOI, B., & Rath, R. (1994). Three Songs. India International Centre Quarterly, 21(1), 23-25.
19. Beltz, J. (2008). Bhima Bhoi. Encyclopedia of hinduism, 775-775.
20. https://www.poemhunter.com/mirza-ghalib/poems/
21. https://allpoetry.com/Bahadur-Shah-Zafar
22. Gerow, E., & Bhāsa. (1985). Bhāsa's Ūrubhaṅga and Indian Poetics. Journal of the American Oriental Society, 405-412.
23. Paul, Samiran Kumar. The Complete Poems of Rabindranath Tagore's Gitanjali: Texts and Critical Evaluation. Sarup & Sons, 2006.
24. Sigi, R. (2006). Munshi Prem Chand. Diamond Pocket Books (P) Ltd..
25. https://archive.org/details/kamba-ramayana-english

CLIMATE CHANGE NARRATIVES

Course Code : HS30052

Credit : 3

L-T-P :3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

The objective of this course is to study climate fiction to demonstrate new ways of thinking about climate change and invoke opportunities for imagining more just and resilient futures. This course will enable skills for thinking, writing, and speaking critically about *both* literature *and* climate change. Moreover, it will enable the learners to analyze the specific formal and stylistic conventions of literary and cultural texts and situate those texts within broader debates and discourses—scientific, historical, and political—about climate change.

COURSE OUTCOMES

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

CO1: Draw on relevant political, historical, and scientific information to place literary and cultural texts within wider debates and discourses about climate change,

CO2: Identify how literary and cultural texts complement or challenge understandings of climate change,

CO3: Reflect on understandings of and feelings about climate change,

CO4: Employ logic, creativity, and interpretive skills to produce persuasive and imaginative arguments about literature, culture, and climate change,

CO5: Create a report on climate concerns

CO6: Evaluate the impact of climate change on the local communities.

COURSE CONTENT

Introduction to Climate Change

- The New Climate War: The Fight to Take Back Our Planet, Michael E Mann
- Time Capsule Found on the Dead Planet, Margaret Atwood

- The Drowned World, JG Ballard
- Environmental Crisis and Hindu Religion, O.P. Dwivedi and B.N. Tiwari.

Impacts of Climate Change

- "Evidence for Climate Change,": Explore the CEEW project (Blog)Research present or future climate change impacts in your own community.
- "Diary of an Interesting Year," Helen Simpson "The Tamarisk Hunter," Paolo Bacigalupi
- "The Weatherman," Holly Howitt
- Living Mountain: The Fable of our times "Amitav Ghosh

Language of Climate Communication in Literature

- I'm not a plastic bag, Rachel Hope Alison
- Leila, Prayag Akbar

TextBooks

1. Rachel Hope Alison. *I'm Not a Plastic Bag.* New York: Archaia, 2012. ISBN-10 : 1936393549
2. Prayag Akbar. *Leila*. Simon and Schuster, 2017. ISBN 978-0-571-34133-7
3. Ed. by Mark Martin (Editor), Bill McKibben (Introduction), Margaret Atwood (Contributor), Paolo Bacigalupi (Contributor), T.C. Boyle (Contributor). I'm With the Bears: Short Stories from a Damaged Planet. Verso, 2011. ISBN-10 : 9781844677443.
4. J.G. Ballard. The Drowned World. Reprint Fourth Estate: United Kingdom. ISBN-0007221835
5. Amitav Ghosh. *Living Mountain: The Fable of Our times.* India: Fourth State India. 9354898874
6. Michael E Mann. *The New Climate War: The Fight to Take Back Our Planet*. USA: Public Affairs. 1541758234
7. O.P. Dwivedi and B.N. Tiwari,Environmental Crisis and Hindu Religion , NewDelhi: Gitanjali Publishing House, 1987

Reference Books

1. Maslin, Mark. Climate Change: A Very Short Introduction, Third Edition. Oxford: Oxford UP,
   2014. ISBN: 9780198719045
2. Rich, Nathaniel. Odds Against Tomorrow. New York: Farrar, Straus and Giroux, 2013. ISBN:
   9781250

INTRODUCTION TO SCIENCE FICTION

Course Code : HS30054

Credit : 3

L-T-P :3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

Introducing students to science fiction literature, both classic and contemporary. The aim is to nurture an interest in literature for those who already have it, and to create interest for those who do not, through a genre of literature that may be more relevant and exciting to them than old classics. Texts will deal with fictional representations of dystopia, artificial intelligence, theories of technology, cyberpunk, and alternative reality.

COURSE OUTCOMES

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

CO1: Understand the concept of genre literature,

CO2: Acquire knowledge of the important concepts of science fiction ,

CO3: Learn methods of textual analysis and critique ,

CO4: Recognise the role of popular and commercial literature in everyday life,

CO5: Identify the role of technology and ethics in real-life future,

CO6: Develop the ability to analyse an issue from multiple perspectives.

COURSE CONTENT

Early Science Fiction, Emergence through 1917

Text: Jules Verne & Michel Verne, 'In the Year 2889' (1889)

Definition of science fiction, timeline of science fiction, categories of science fiction

Supplementary reading: H. G. Wells, 'The Chronic Argonauts' (1888)

Science Fiction between the Wars, 1918-1939

Text: E. M. Forster, 'The Machine Stops' (1928)

Science fiction as expression of potential; eutopia and dystopia

Supplementary reading: Murray Leinster, 'Proxima Centauri' (1935)

Supplementary viewing: Fritz Lang, *Metropolis* (1927)

The Golden Age and the Atomic Age 1940-1963

Text: C. L. Moore, 'No Woman Born' (1944)

Science fiction exploring alienness and mutation

Supplementary reading: Isaac Asimov, ‘Nightfall’ (1941), Judith Merrill, ‘That Only a Mother’ (1948)

Supplementary viewing: Ishiro Honda, *Godzilla* (1954)

New Wave and Reaction, 1963-1983

Text: Philip K. Dick, ‘We Can Remember It for You Wholesale’ (1966)

Humanity and human-machine division, beginnings of artificial intelligence, gender and its social implications in science fiction

Supplementary reading: James Tiptree Jr., ‘The Girl Who was Plugged In’ (1974)

Supplementary viewing: Ridley Scott, *Blade Runner* (1982)

Cyberpunk, 1984 and Onwards

Text: William Gibson, ‘Johnny Mnemonic’ (*Burning Chrome*, 1986)

Exploring artificial intelligence, alternate self, and alternate reality

Supplementary reading: Douglas Adams, ‘Young Zaphod Plays it Safe’ (1986)

Supplementary viewing: Barry Sonnenfeld, *Men in Black* (1997), Mamoru Oshii, *The Ghost in the Shell* (1995)

Contemporary Trends

Text: Manjula Padmanabhan, ‘Flexi-time’ (2019)

Science fiction in contemporary times, Indian science fiction, science fiction as series

Supplementary reading: Ruhan Zhao, ‘My Left Hand’ (2017)

Supplementary viewing: Charlie Brooker, *Black Mirror* (2016-present), Choi Hangyong, *The Silent Sea* (2021), Chris Renaud & Pierre Coffin, *Despicable Me* (2010)

Text Books

1. Jules Verne, Selected Short Stories, Maple Press, 2019
2. E. M. Forster, The Eternal Moment & Other Stories, Mariner Books, 1970
3. Philip K. Dick, The Short Story Collection, Createspace Independent Publishers, 2014
4. William Gibson, Burning Chrome, Gollancz Publishers, 2017
5. Tarun Saint & Manjula Padmanabhan eds. The Gollancz Book of South Asian Science Fiction vol. 1, Hachette India, 2019
6. Lucas K. Law & Derwin Mak eds. Where the Stars Rise: Asian Science Fiction & Fantasy, Laksa Media Groups Inc., 2017

Reference Books

1. Adam Roberts, The History of Science Fiction, Palgrave McMillan, 2nd edition, 2016
2. Brian Aldiss & David Wingrove, Trillion Year Spree, Gollancz, 1986
3. Carl Freedman, Critical Theory and Science Fiction, Wesleyan University Press, 1st edition, 2000
4. Darko Suvin, Metamorphoses of Science Fiction, Peter Lang AG, updated edition, 2016
5. Edward James & Sarah Mendlesohn, The Cambridge Companion to Science Fiction, Cambridge University Press, 1st edition, 2003

ENGINEERING ECONOMICS

Course Code : HS30101

Credit : 3

L-T-P : 3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

The objective of Engineering Economics is to aid in decision-making by focusing on the economic implications of technical analysis. It is committed to making operational level decisions and solving problems.

COURSE OUTCOMES

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

CO1 : Comprehend the significance of different components of Engineering Economics
CO2 : Analyze the basic economic concepts required for engineers and managers
CO3 : Develop the problem solving aptitude in the students through practical and case problems
CO4 : Decide the feasibility of a particular project by the application of different project evaluation techniques
CO5 : Use the economic tools in the decision making process
CO6 : Survey the current macroeconomic situations in the economy

COURSE CONTENT

Introduction to Economics and Engineering Economics

Basic concepts of Engineering Economics: Demand Analysis, Supply Analysis, Market Equilibrium. Revenue Analysis. Demand Forecasting- Quantitative Methods, Consumer's Equilibrium.

Production and Cost Analysis

Short Run and Long Run Production Functions, Producer's Equilibrium condition.Cobb-Douglas Production Function.

Cost Concepts: Short Run and Long Run Cost analyses. Break-Even Analysis.

Market: Concepts and Types;Perfect Competition, Monopoly

Time Value of Money

Interest Formulae and their applications with cash flow diagram. Evaluation of Investment Proposals - Present Worth, Future worth and Annual Equivalent Method of comparison

Economic Appraisal Techniques

Net Present Value (NPV), Internal Rate of Return(IRR) ,Cost Benefit analysis.Depreciation calculation; Meaning and Definition, Methods.

Macroeconomic policies

Functions of commercial banks and central bank, Fundamentals of Business cycle, Macroeconomic policies for stabilization.

Text Books

1. Dominick Salvatore,Siddartha K.Rastogi,Managerial Economics: Principles and Worldwide Applications, Oxford University Press, ISBN 9780199467068 , 9th Edition,2020
2. D N Dwivedi, H L Bhatia, & S N Maheswari,Engineering Economics:, Vikas Publishing House, Noida, ISBN:978-93-5674-625-1, 2nd Edition 2023.
3. James Riggs, David D.Bedworth and Sabah U.Randhawa ,Engineering Economics–, 4th Edition, McGraw Hill Education (India) Private Limited, New Delhi, 2016.

Reference Book

1. William A. McEachern and Simrit Kaur Micro ECON-A South-Asian Perspective-, Cengage Learning, 2013.
2. Yogesh Maheshwari,Managerial Economics- 3rdEdition, PHI Learning Private Limited,2014.
3. A. Khan, Arshad Noor Siddiquee, Brajesh Kumar,Engineering Economy-Zahid Pearson Publication, 2012.
4. R.Panneerselvam Engineering Economics –, Pub: PHI Learning Private Limited, New Delhi, 9thEdition, 2008.
5. G.S Gupta Managerial Economics, , Tata McGraw Hill Education Private Limited, 2nd Edition, 2011.
6. D.M.Mithani, Managerial Economics – Theory and Applications –Himalaya Publication, New Delhi, 6th Edition, 2009.
7. S.B.Gupta, R7. Monetary Economics-Institutions, Theory and Policy- Publication: S.Chand, 1995.
8. R.D. Gupta R8. Macro – Economics –, Publication: Kalyani Publication, 1994.

MARKET STRUCTURE AND PRICING POLICIES

Course Code : HS30125

Credit : 3

L-T-P : 3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

Develop the ability for getting conceptual clarity about the various types of markets along with their functions and understand the pricing policy operations in the different markets.

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO1: Comprehend the significance of different components of market,
CO2: Analyze the basic economic concepts required for various types of market and theirpolicies
CO3: Develop the problem solving aptitude through practical and case study problems faced by the economy
CO4: Able to use the economic tools in the decision making process of fixing prices and quantities in different Market,
CO5: Differentiate between different markets and the policy measures to regulate it
CO6: Survey and map the impact of the current micro and macro-economic situations in the economy.

COURSE CONTENT

Cost and Revenue Analysis

Concepts of cost (economic cost, production cost, real cost, opportunity cost, private & social cost), cost function, Output maximisation and cost minimisation, Derivation of cost function, traditional and modern theories of costs.

Concepts of revenue (total, average, marginal revenue), relationship between TR, AR and MR.

Market Structures and Perfect Competition

Meaning of market, characteristics of market, and types of market.

Perfectly competitive market and features, equilibrium of the firm and industry under perfect competition (short run and long run).

Monopoly Market

Meaning, concepts and characteristics of monopoly market.

Equilibrium price and output determination under monopoly market in short and long run. Monopoly price discrimination. Degree of monopoly power and its measure.

Control and regulation of monopoly power.

Duopoly and Oligopoly Market

Non-collusive oligopoly: Cournot's duopoly and Kinked-Demand Model. Collusive oligopoly: Cartel; Cartels aiming at joint profit maximization and market sharing cartels.

Price leadership; low-cost price leadership, dominant firm price leadership and barometric price leadership.

Monopolistic Competition

Meaning, price determination of a firm under monopolistic competition; Chamberlin's group equilibrium; theory of excess capacity; selling costs; difference between perfect competition and monopolistic competition; difference between monopoly and monopolistic competition.

Text Books:

1. Koutsoyiannis, Modern Microeconomics, St. Martin's Press, New York,2nd Edition 1979, ISBN 978-0-333-25349-6
2. G. S. Maddala , Ellen M. Miller ,Microeconomics: Theory and Applications, , McGraw-Hill Inc.,US-Publisher, 1989, 0070394156-ISBN
3. H L Ahuja, Modern Microeconomics: Theory & Applications, S Chand Publishing,2022, ISBN : 9789355011015,

Reference Books:

1. Robert Pindyck, Daniel Rubinfeld, Microeconomics ,Eighth Edition, 2017, 9789332585096-ISBN,
2. Pearson Education Publication
3. G. Fransico Stigler, Theory of Price, Prentice Hall of India, New Delhi, 4th Edition 1996.
4. H. Gravelle and R. Rees, Microeconomics, Person Education U.K. 3rd Edition 2007, 2007ISBN: 9788131716557, 8131716554
5. H. R. Varian , Micro Economic Analysis, W W Norton & Company; New York, 3rd edition 2019, ISBN-13 : 978-8130908632

PRAGMATIC INQUIRY

Course Code : HS30127
Credit : 3
L-T-P : 3-0-0
Prerequisite : Nil

COURSE OBJECTIVE

As a foundation for lifelong inquiry, this course introduces students to research techniques and how they are used in both liberal arts, technical and professional courses.

COURSE OUTCOMES

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

CO1 :Understand the meaning and importance of research in behavioral science
CO2 :Describe in detail different types of research methodologies
CO3 :Identify the strengths and weaknesses of the different study designs
CO4 :Assess whether research studies are using the most appropriate study design
CO5 :Discuss why various approaches may be appropriate/ inappropriate for their work-based research Question
CO6 :Apply the concepts in research related activity.

COURSE CONTENT

Pragmatic Inquiry
Meaning, characteristics, need, type, and approaches.
Research Problem
Meaning, definition, selection, and framing of problem statement.
Research Design
Meaning, characteristics, need, type, approaches, and problems of research design.
Sampling Design
Meaning, characteristics, need, type, approaches, and problems.
Data Collection Method and Analysis
Types of data, Source of data, Methods of data collection, data analysis.
Text Book

1. Deepak Chawla & Neena Sodhi, Research Methodology: Concepts and Cases, Vikas Publishing House,2018, ISBN-10: 9325982390, ISBN-13: 978-9325982390.

Reference Books

1. C R Kothari and Gaurav Garg, Research Methodology, New Age International
2. Publishers,2019,ISBN-10 9386649225, ISBN-13- 978-9386649225
3. S.K. Mangal, Research Methodology in Behavioural Sciences, Prentice Hall India Learning Private Limited, 2013, ISBN-10 : 9788120348080, ISBN-13 : 978-8120348080
4. Sameer S. Phanse, Research Methodology-Logic, Methods, and Cases,OUP, Sameer S. Phanse,2016 ISBN: 9780199453788

ECONOMIC ANALYSIS OF DECISION RULES

Course Code : HS30129

Credit : 3

L-T-P : 3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

Analyze and understand investment decisions under the conditions of risk and uncertainty.Particular economic models are not the ends, but the means for illustrating the method of applying mathematical techniques to economic theory in general.

COURSE OUTCOMES

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

CO1: Analyze and understand investment decisions under the conditions of risk and uncertainty,

CO2: Explainhow game theory brings out the strategy used by the oligopoly firms to determine the best possible action to maximize profit-maximizing objective,

CO3: Understand functional formulation of the problem and application of linear programming,

CO4: Describes different concepts used in analysing the national income and the different methods applied to measure the national income,

CO5: Describe and explain the main channels of the monetary transmission mechanism through monetary and fiscal policy

CO6: Describe managerial decisions through the application of some economic concepts, theories and principles.

COURSE CONTENT

Investment Decisions under Risk and Uncertainty

Concepts of Risk and Uncertainty; Investment Decisions under Risk: The Pay-Off Matrix Method, Risk-Adjusted Discount Rate Method, Certainty-Equivalent Approach, Probability Theory Approach, Decision Tree Method, Simulation, Sensitivity Analysis.

Game Theory and Strategic behaviour of Firms

Basics of Game Theory, Prisoners' Dilemma: The Problem of Oligopoly Firms; Application of Game Theory to Oligopolistic Strategy; Nash Equilibrium: Pure and Mixed Strategy

Optimization: Constrained & Extrema

Free and constrained optimization, extrema of a function of two variables: graphical analysis, Lagrange method. Utility maximization & Cost minimization.

Linear and Non-Linear Programming for Business Decisions

Conditions for Application of Linear Programming; Concept of Feasible Solution; Assumptions of Linear Programming Application of Linear Programming Technique: Profit Maximization Problem, Formulation of Profit Maximization Problem in Linear Programming Mode; Graphical Method of Solving Linear Programming Problems; Simplex Method: Algebraic Solution, Simplex Tableau Method. Introduction to Non-Linear Programming

Input-Output Analysis

Input-output model, its structure and its derivation. The use of input output model in Economics.

Text Book

1. D. N. Dwivedi, H L Bhatia, S N Maheshwari, VIKAS® PUBLISHING HOUSE PRIVATE LIMITED, 2022.

Reference Books

1. C. Chiang and K. Wainwright, *Fundamental Methods of Mathematical Economics*, McGraw Hill International Edition, 2017
2. K. Sydsaeter and P. J. Hammond:, *Mathematics for Economic Analysis*, Pearson Educational Asia, 2002

ECONOMICS OF HEALTH AND EDUCATION

Course Code : HS 30131

Credit : 3

L-T-P : 3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

The United Nations member states' adoption of the Millennium Development Goals, which include among other objectives achieving universal primary education, reducing child mortality, enhancing maternal health, and combating diseases, reflects the significance of education and health in enhancing wellbeing. This course offers a microeconomic framework to examine, among other things, individual preference in the demand for health and education, governmental involvement, and elements of inequality and discrimination in both sectors. An outline of India's health and education system is also provided.

COURSE OUTCOMES

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

CO1: Understanding role of health and education in human development,

CO2: Analysing microeconomic foundations of health economics,

CO3: Assessing the growth of health sector in India,

CO4: Appraising the benefits of investment in human capital,

CO5: Assessing the growth of education health sector in India

CO6: Examining the underling discrepancies in both sectors.

COURSE CONTENT

Role of Health and Education in Human Development

Importance of health and education outcomes and their relationship with macroeconomic performance.

Health Economics Market

Demand for health; uncertainty and health insurance market; alternative insurance mechanisms; market failure and rationale for public intervention; equity and inequality.

Education: Investment in Human Capital

Rate of return to education: private and social; quality of education; signaling or human capital; theories of discrimination; gender and caste discrimination in India.

Health and Education Sectors in India: An Overview

Health outcomes; health systems; health financing. Cost effectiveness and cost-benefit analysis; burden of disease. Literacy rates, school participation, school quality measures.

Trend in Health and Education Sector in India

Secondary data analysis pertaining to health and education sector. Trend analysis and forecasting using time series data. Simple growth rate calculations.

Text Book

1. S. K. Mishra, and V. K. Puri, *Indian Economy*, Himalaya Publishing House,2022, ISBN: 978-93-5596-423-6

Reference Books

1. William, Jack, *Principles of Health Economics for Developing Countries*, World Bank Institute Development Studies, 1999.
2. World Development Report, *Investing in Health*, The World Bank, 1993.
3. G.Ronald, Ehrenberg and S.Robert, Smith, *Modern Labor Economics: Theory and Public Policy*, Addison Wesley, 2005.

FOUNDATIONS OF MODERN MACROECONOMICS

Course Code : HS30150

Credit : 3

L-T-P :3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

The objective of this course is to teach students the principles of economics of aggregates so they can apply these ideas to their own lives and the world in which they live.

COURSE OUTCOMES

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

CO1 : Introduce themselves to the basic principles of macro economics,

CO2 : Explain the circular flow model and use the concepts of aggregate demand and aggregate supply,

CO3 : Understand the basic economic problems of inflation,unemployment,poverty and their remedies through macro insights,

CO 4: Evaluate the relevance of macro variables in policy making,

CO5 : Relate the corporate functioning to macroeconomic indicators

CO6 : Define fiscal and monetary policies and how these affect the economy.

COURSE CONTENT

National Income and its measurement

Introduction to National Income, Concepts of GDP, GNP, GDP Gap, GDP Deflator and national income, Comparison of GDP deflator with CPI, Rules and Methods of Measurement of GDP (Income, expenditure and Out Put method), Circular Flow of Income and expenditure both in close and open economy..

General Equilibrium

Introduction of AD & AS. Derivation of product market equilibrium (IS curve) and money market equilibrium (LM curve) – equilibrium in IS-LM Model, Effectiveness of Monetary and Fiscal Policy, Crowding-Out Effect.

Inflation and Unemployment

Measuring Inflation rate and Unemployment rate; The Phillips relation – The expectation augmented Philips curve – The natural rate of unemployment hypothesis The Relation between GDP Gap, Inflation rate and unemployment Gap, Okun's Law.

Theories of consumption and Investment:

Keynesian and Post Keynesian**:** Consumption function, Marginal Efficiency of Capital, theories of consumption –Absolute, relative, permanent and life cycle income hypothesis.

Keynesian and Post Keynesian theories: The decisions to invest- Autonomous and Induced investment, MEI schedule. Multiplier and accelerator theories of Investment. Neo-classical theory of investment (Jorgensen)

Text Books

1. N.Gregory Mankiw. Principles of Macro economics with course mate, 7th edition,Cengage Publishers.
2. Andrew Abel and Ben Bernanke (2016), *Macroeconomics, Publisher: Pearson.*

Reference Books

1. Branson W.A , Macroeconomic Theory and Policy (latest Edition, Harper and Row New York.
2. Dornbusch, Fischer and Startz, *Macroeconomics,* McGraw Hill, 11th edition, 2010.
3. Shapiro, E. (1996), *Macroeconomic Analysis,* Galgotia Publications, New Delhi.
4. Ackley, G. (1976*), Macroeconomics: Theory and Policy*, Macmillan Publishing Company.
5. S.N.V.Siva Kumar, Macro Economics and Policy for Managers: An Indian Perspective ,Cengage publishers,2019.

MONEY AND FINANCIAL MARKETS

Course Code : HS30152

Credit : 3

L-T-P :3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

To give the students a basic understanding of the Indian financial market, to familiarize students with Money Market and its sub markets and the regulatory framework in the Indian Financial system.

COURSE OUTCOMES

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

CO1: Explain why people hold money and why it is used in the trading process

CO2: Explain the impact of money multiplier and accelerator

CO3: Describe and explain the role of interest rate in an economy.

CO4: Discuss the role of financial institutions in strengthening the economy.

CO5: Describe and explain the main channels of the monetary transmission mechanism, through which monetary policy can have real effects on the economy

CO6: Discuss the merits and disadvantages of different monetary policies used by Central Banks

COURSE CONTENT

Money: concept, functions, measurement; theories of money supply determination. High Powered Money. Money multiplier and accelerator theory. Cryptocurrency

Financial institutions, markets, instruments, and financial innovations. Role of financial markets and institutions; problems of adverse selection and moral hazard; financial crises Money and capital markets: organisation, structure, and reforms in India; role of financial derivatives and other innovations

Interest rates Determination; sources of interest rate differentials; theories of term structure of interest rates; interest rates in India.

Banking System Balance sheet and portfolio management Indian banking system: changing role and structure; banking sector reforms. Central banking and monetary policy.

Text Book

1. Monetary Economics: Institutions, Theory & Policy, Suraj B Gupta. S. Chand

Reference Books

1. Baye, M., Jansen, D. (2006). *Money, banking and financial markets.* AITBS.
2. Bhole, L., Mahukud, J. (2017). *Financial institutions and markets, 6th ed.* Tata McGraw-Hill.
3. Fabozzi, F., Modigliani, F., Jones, F., Ferri, M. (2010). *Foundations of financial markets and institutions, 4th ed*. Pearson Education.
4. Jadhav, N. (2009). *Monetary policy, financial stability and central banking in India.* Macmillan.
5. Khan, M. (2015). *Indian financial system, 9th ed*. Tata McGraw-Hill.
6. Mishkin, F., Eakins, S. (2017). *Financial markets and institutions, 8th ed.* Pearson.
7. Mohan, R. (2011). *Growth with financial stability: Central banking in an emerging market.* Oxford University Press.
8. Various latest issues of RBI Bulletins, Annual Reports, Reports on Currency and Finance, and Reports of the Working Group, IMF Staff Papers.

POVERTY TO PROSPERITY

Course Code : HS30154

Credit : 3

L-T-P :3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

This course studies poverty related issues from the economic perspective.

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO1 : Gain contextual knowledge on concept of poverty

CO2 : Understand Indicators and Issues related to poverty

CO3 : Examine links between poverty and well-being

CO4 : Understand the relation between Poverty and unemployment

CO5 :Create sound knowledge about Poverty Alleviation Programmes and Policies

CO6 :The ability to engage in critical thinking as a part of the analysis of economic problems and problem-solving potentiality as well

COURSE CONTENT

Introduction to the concept of poverty

Underdevelopment; Meaning and Indicators ,Common Characteristics of Developing Countries,The Concept of Poverty and poverty Line, Determinants and indicators of poverty, Incidence of Poverty, Tools to Measure Poverty;Headcount Ratio, Poverty Gap Ratio & Sen Index.

Multidimensional poverty

Dimensions of Poverty, Multidimensional poverty ,Measuring multidimensional poverty, Global Multidimensional Poverty Index, Multidimensional Poverty Index and SDGs.

Poverty and Unemployment

Problem of Unemployment, Nature and Estimates of Unemployment, Unemployment in Urban Areas, Agricultural Unemployment ,Causes of Unemployment, Government Policy for Removing Unemployment, Major Employment Programmes .

Poverty and planning process

Poverty Alleviation Programmes and Policies: Meaning, Measuring BPL in India, Poverty Alleviation in India- Five Year Plans, , Poverty Alleviation Programmes , Strategy of Poverty Alleviation.

Data analysis

Recent budgetary policies and programs relating to concepts of poverty; Analysis of Economic Survey data.

Text Book

1. S. K. Mishra, and V. K. Puri, *Indian Economy*, Himalaya Publishing House,2022, ISBN: 978-93-5596-423-6

Reference Book

1. Gaurav Datt and Ashwani Mahajan,*Indian Economy*, GENERIC. Classic Edition,2022 ISBN-10 : 9352531299 ISBN-13 : 978-9352531295
2. Todaro, M., Smith, S. (2011). *Economic development, 11th ed.* Pearson
3. Abhijit Banerjee, Roland Benabou and Dilip Mookerjee, *Understanding Poverty*. Oxford University Press, 2006
4. J. D. Sachs, *The End of Poverty: Economic Possibilities for Our Time*, Penguin, 2006g
5. Ministry of Finance. *Economic survey* (latest)
6. World Bank Group, *A Measured Approach to Ending Poverty and Boosting Shared Prosperity: Concepts, Data, and the Twin Goals*. World Bank, 2021, November 10 *https://www.worldbank.org/en/research/publication/a-measured-approach-to-ending-poverty-and-boosting-shared-prosperity*

BUSINESS ETHICS AND CORPORATE GOVERNANCE

Course Code : HS30223

Credit : 3

L-T-P : 3-0-0

Prerequisite : NIL

COURSE OBJECTIVE

This course focuses upon the fundamental principles and standards that should govern the business organizations. The objective of this paper is to make the students aware about the importance of ethics, corporate governance and role of CSR & sustainable development goals in the business to encourage moral practices and sensitivity towards the ethical dimension of managerial problems.

COURSE OUTCOMES

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

CO1: Familiarize the learners with the concept and relevance of Business Ethics in the modern era

CO2: Understand the value of business ethics which will guide them in maintaining firmmoral values while taking managerial decision

CO3: Apply the ability to make moral judgments in dilemmatic situations across the work domains

CO4: Analyse the application of management practices by adhering to corporate law and ethics

CO5: Evaluate the scope, opportunity and complexity of Corporate Social responsibility in the global and Indian context

CO6: Create an opportunity to understand the sustainable development goals in maintaining a balance between the economic, environmental and social needs.

COURSE CONTENT

Business Ethics: Concept, Principles and Theories

Meaning, objective and types of Ethics; Business ethics- concept, need, scope, objectives and importance; factors influencing business ethics; Principles of Business ethics; Relationship between ethics and business ethics; theories of business ethics; Ethical dilemma and ethical decision making

Ethics in Practice across the domain

Ethics in marketing- introduction, ethical dilemma in marketing, unethical marketing practices, measures to stop unethical practices in marketing; Ethics in Finance- introduction, code of ethics in finance, unethical practices in finance or frauds, measures to stop unethical practices in finance; Ethics in HRM- introduction, ethical issues in HRM (job discrimination, sexual harassment, employee privacy, whistle blowing, affirmative action); importance of workplace ethics and employee code of conduct

Corporate Governance

Corporate Governance- concept, objective and need. Role of law in corporate governance; important issues in corporate governance; Corporate governance in India-past, present and Future; Importance and principles of Corporate Governance

Introduction to Corporate Social Responsibility

CSR- Concept, evolution and development; Why CSR; Apprehensions against CSR; Forms and dimensions of CSR; making business corporations socially responsible; CSR in India

Sustainable Development

Introduction, meaning, history, features, objectives of sustainable development; The pillars and principles of sustainable development; SDG and its relevance in business

Text Books

1. Dr. K. Nirmala, Dr. B.A. Karunakara Reddy & N. Aruna Rani, Business Ethics and Corporate Governance, Himalaya Publication House
2. C.S.V. Murthy, Business Ethics and Corporate Governance, Himalaya Publishing, 2022

Reference Books

1. Prabhakaran Paleri,Corporate Social Responsibility (concept, cases and trends Cengage Learning India Pvt. Limited, 2020
2. Dr. S.S. Khanka,Business Ethics and Corporate Governance, Sultan Chand, 2019
3. C.U. Saraf, Corporate Social Responsibility (CSR), Corporate Governance, Sustainable Development and Corporate Ethics/Business Ethics Himalaya Publishing House 2017

LEADERSHIP AND TEAM EFFECTIVENESS

Course Code : HS30225

Credit : 3

L-T-P : 3-0-0

Prerequisite : NIL

COURSE OBJECTIVE

An effective leader understands the team dynamics, stimulates the morale of the followers and always aims at creating a participative workforce by enhancing team work. This course mainly focuses on individual, group and organization factors associated with leadership.There is a strong connection between emotional intelligence and leadership because the technical skills and knowledge will definitely help the students to fulfil the entry level requirements. Similarly, understanding employee empowerment would assist the students in acquiring the desirable professional skills.

COURSE OUTCOMES

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

CO1: Learn the characteristics and need of an effective leader

CO2: Understand the effectiveness of different leadership styles in different contextsfrom an instrumental, political and ethical perspective

CO3: Apply leadership theories to the real business scenario

CO4: Analyse group dynamics and importance of team work

CO5:Evaluate the ways to handle emotions and stress and manage work-life flexibility

CO6:Create organizational environment that is psychologically safe and make the employees feel empowered.

COURSE CONTENT

Leadership: concepts and practices

Meaning, Definition and understanding of leadership; the role and functions of a leader; Differentiation between leadership and management; ; what makes a leader effective; characteristics of an effective leader; leadership in Indian organization

Leadership Perspectives

Trait perspective of leadership (Great man theory and trait theory); Behavioural perspective of leadership (mangerial grid and likert system - four management); Studies on leadership (Hawthorne, IOWA, Michigan and Ohio); Contingency perspective of leadership (fiedler's contency theory, path goal, hersey blanchard situational theory); contemporary perspective to leadership (transformational, transactional, charasmatic,servant and Nurturant-task leadership style)

Team effectiveness and Leadership

Characteristics and types of teams; types and functions of group; Group vs team; understanding an effective team; who is a team leader; tuckman's team development stages; team development and team building; team meetings and leadership; team effectiveness leadership model; high-performance teams and leadership;team cohesiveness; common threats to groups

Emotional Intelligence and Leadership

What are emotions; Meaning, type and source of emotions; Concept and competencies of emotional intelligence; Elements of emotional intelligence; importance of EI; EI at workplace; Emotional intelligence and leadership; Significance of EI for leaders; strategies to enhance EQ in our jobs; EQ vs. IQ; developing EQ; obstacles to the development of EQ

Leadership and empowerment

Employee empowerment- concept, need and importance; approaches to empowerment; advantages and disadvantages of empowerment; empowerment skills of a leader; empowering vs. Dis-empowering; leader as a coach (coaching skill); delegation (advantages and levels of delegation, steps and principles of effective delegation); empowering interpersonal skills

Text Book

1. Ranjana Mittal,Leadership Personal effectiveness and Team Building, Vikas Publishing House Pvt Ltd, 2015

Reference Book

1. S. Bhargava and Gourav Bhargava,Team Building and Leadership Neelam Himalaya Publishing House, 2015

ORGANIZATIONAL CHANGE AND DEVELOPMENT

Course Code : HS30250
Credit : 3
L-T-P :3-0-0
Prerequisite : NIL

COURSE OBJECTIVE

The primary objective of the course is to understand the importance of organizational change and the need to respond to the changes in the industry. It also focuses on imparting the knowledge of organization development concepts, tools and techniques that are meant for improving the functioning of individuals, groups and organizations. The aim of the course is to develop the application of behavioral science concepts to the functioning of the organization development.

COURSE OUTCOMES

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

CO1: Respond and anticipate the needs of change in a proactive way,

CO2: Understand various levels and categories of change to develop appropriate intervention into the system,

CO3: Apply the OD concepts, tools and techniques for improving the performance of individual, groups and organization in change process,

CO4 :Analyse and overcome the challenges in the change process,

CO5: Explain the assumptions, beliefs and values of organizational development,

CO6: Implement behavioral science knowledge to bring changes in organizational .strategies, structures, and processes.

COURSE CONTENT

Organizational Change

Organizational Change: Concept and Significance; Managing Change; Concept of Analyzing the Environment; Perspectives on Change: Contingency; Resource Dependence; Population Ecology; Implications of Change.

Types of Change

Types of Change: Continuous or Incremental Change; Discontinuous or Radial Change; Participate Change and Directive Change; Change Levers; Levels of Change: Knowledge

Changes; Attitudinal Changes; Individual Behaviour Changes and Organizational Performance Changes.

Implementation of Change

Implementing Change : Steps-Assembling a Change; Management in establishing a

new direction for the organization; Setting up of change teams and promoting innovation; Aligning structure; Systems and resources; Removing road blocks; Absorbing changes into organization; keys to create a cultural change

Organizational Growth and Development:

Introduction to organizational growth and development; Historical Overview of OD (Laboratory Training, Survey Research, Action Research, Socio-technical systems); OD Values, Beliefs and Assumptions for individuals, Groups and Organizations; Role of OD Consultants – Styles, relation with client, entry strategies

Organizational Development Interventions

OD Interventions: Overview, characteristics of effective Interventions, Individual Level , Team & Group Interventions; Human Resource Interventions □(Performance Management, Reward Systems, Career Planning); Techno-Structural Interventions □ (Restructuring Organizations, Down sizing Employee Involvement , Work Redesign , Total Quality Management); Strategic Interventions □(Mergers and Acquisitions , Strategic Alliances and Joint Ventures, Organization Transformation); Indian Experiences of OD in Public and Private Enterprises.

Text Books

1. Organization Development and Change by Thomas Cummings and Christopher Worley - Cengage Publications, 2015.
2. Organizational Change and Development by Dipak Bhattacharya, Oxford Publishing House, 2011
3. Managing Organizational Change- a multiple perspective approach by Ian Palmer, Richard Dunford, David A, Buchanan, Mc Graw Hill, 2016

Reference Books

1. Organization Development: Behavioral Science Interventions for Organizational Improvement, by Wendell L French, Cecil H Bell - Pearson publications.
2. Organizational Change and Development, Kumkum Mukherjee, Pearson Publications, 2015

UNIVERSAL HUMAN VALUES

Course Code : HS30401

Credits : 3

L-T-P : 3-0-0

Pre-requisites: Nil

COURSE OBJECTIVE

The objective of the course is to develop a holistic perspective based on self-exploration, understand the harmony in the human being, strengthen self-reflection, and develop commitment and courage to act.

COURSE OUTCOMES

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

CO1: Understand the concept of value education and its need,

CO2: Apply their knowledge on value education for apt self-assessment,

CO3: Comprehend human-human relationship,

CO4: Build holistic perception of harmony at all levels of existence,

CO5: Develop the sense of natural acceptance of human values,

CO6: Create people friendly and eco-friendly environment.

COURSE CONTENT

Need, Basic Guidelines, Content and Process for Value Education

Purpose and motivation for the course, recapitulation from Universal Human Values-I. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.

Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer). Understanding the characteristics and activities of ‘I’ and harmony in ‘I’. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one’s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

Understanding Harmony in the Family and Society- Harmony in HumanHuman Relationship

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship . Understanding the meaning of Trust; Difference between intention and competence . Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students’ lives.

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of naturerecyclability and selfregulation in nature. Understanding Existence as Co-existence of mutually interacting units in all pervasive space. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c) Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations . Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. A.N. Tripathi, Human ValuesNew Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).

GENDER STUDIES

Course Code : HS30421

Credit : 3

L-T-P : 3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

The objective of this course is to make student understand the concepts of masculinity and femininity as analytical categories via analysing the role of communalism, patriarchy, violence as major hurdles to women's rights globally. Further, this course will enhance their understanding over the current health and education status of women to analyze impact of government health policy on women. Additionally, it will bring greater understanding over the integration of gender concerns and perspectives in policies and programmes for sustenance of environment at international, national, regional levels.

COURSE OUTCOME

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

CO 1: Familiarise the students with the concepts of sex, gender and sexuality commonly used in gender studies,
CO 2: Identifying major human rights violations faced by women worldwide,
CO 3: Learn about women's health movements and government health policies,
CO 4: Develop an insight into policy perspective issues, and concerns of girl's education in India,
CO 5: Delineate the characteristics and the issues of environment and the involvement of women in balancing ecosystem,
CO 6: Understand on sustainable development, millennium development goal, and other global level development initiatives taken for uplifting women status in society.

COURSE CONTENT

Understanding Basic Concepts in Gender Studies

Concepts: Sex, Gender, Sexuality, Femininities, Masculinities and other sexualities, Patriarchy; WID: Women in Development; WAD: Women and Development; GAD: Gender and Development

Gender and Human Rights Discourse

Women's Rights as Human Rights (FGM, FF, Rape, Honour Killing, IVP, Witch Hunting, Virginity Test, Communalism, Trafficking, Immigration); National Commission for Women and other State Commissions, Ministry and Department of Women and Child.

Gender and Health

Sexual and reproductive health (ICPD, B.P.A. Family planning and Abortion); Impact of violence on women's health; Women's health movement: National and International; National health and population policy; National Family Health Survey (NFHS)

Gender and Education

Women's Education in Free India: Gender Disparity in Enrolment; Constraints of Women's Education: Social, Economic, Cultural, Geographical, other Factors; Important Committees and Commissions on Women's Education: Radhakrishnan Commission (1948), Mudaliar commission (1952), Kothari Commission (1964-1966), Ramamurthy Commission (1991).

Gender and Environment

Role of women in environment conservation; Role of Women in Waste Management; Women's Resistance to Environmental Destruction: Joint Forest Management – CHIPKO Movement – Narmada Bachao Aandolan

Reading Materials

1. Gerda Lerner, Creation of Patriarchy, Oxford University Press,1985
2. Menon, Nivedita. ed. 2007. Sexualities. Women Unlimited. New Delhi.
3. Gnew, Sneja, A Reader in Feminist Knowledge, Routledge, New York,1991
4. Marjorie Agosin (ed.), Women, Gender and Human Rights: A Global Perspective, Rawat Publications, 2000
5. Monica Chawla, Gender Justice: women and law in India, Deep and Deep pub., New Delhi, 2006, 2013
6. P D Kaushik, Women's rights; access to justice, Bookwell Publications, New Delhi, 2007
7. Paola Monzini, Sex Traffic, Prostitution, Crime and Exploitation, Zed Pub., 2005
8. Chloe E. Bird, Patricia P. Rieker, Gender and Health, Cambridge University Press, 2008.
9. Jasmine Gideon, Ed., Handbook on Gender and Health (International Handbooks on Gender series), Development Studies, Birkbeck, University of London, UK, 2016.
10. Nelson E, Zimmerman C. Household survey on domestic violence in Cambodia. Ministry of Women's Affairs, Project Against Domestic Violence, Cambodia,1996.

11. Parker B, McFarlane J, Soeken K. Abuse during pregnancy: effects on maternal complications and birth weight in adult and teenage women. Obstetrics and gynaecology, 1994, 84(3):323-328.
12. Madeleine Arnot and Mairtin Mac, An Ghaill, (2006) "Gender and Education" Routledge, New York
13. Aruna Goel, (2004) "Education and Socio-Economic Perspective of Women Development and Empowerment" Deep and Deep Publications, New Delhi
14. Eileen M. Byrne, (1978) "Women and Education" Tevi Stock Publications, Michigan
15. Payal Mago and Isha Gunwal, (2019). Role of Women in Environment Conservation.
16. M.S Swaminathan. (1998). "Gender Dimensions in Biodiversity management". Konark Publisher's Pvt. Ltd, New Delhi.
17. P.K.Rao. (2000). "Sustainable Development – Economics and Policy". Blackwell, New Delhi.
18. Swarup, Hemlata and Rajput, Pam. (2000). "Gender Dimensions of Environmental and Development Debate: The Indian Experience" in Stuart S. Nagel, (ed.) "India's Development and Public Policy". Ashgate, Burlington.

TRIBAL RESOURCE MANAGEMENT

Course Code : HS30423

Credit : 3

L-T-P : 3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

The course intends to impart a comprehensive knowledge about the reality, pertaining to economic alleviation of the poor and downtrodden. It is inter-disciplinary and based on utilization of natural resources employing traditional means of approach, conducive for societal growth and development. This shall hone socioeconomic environmental development for uplifting the condition of tribal population for igniting new ideas in the new economy.

COURSE OUTCOME

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

CO 1: Identify the concept of sustainable natural resource management,
CO 2: Recognize agribusiness management, its opportunities and risks,
CO 3: Discuss adequate skills to prepare and implement integrated development plan & projects for the optimal use of tribal renewable resources for the sustainable development of the environment,
CO 4: Illustrate the nuances of environmental policies and Laws in India and understand the core competencies required for resource mobilization and policy formulation based on the research insight,

CO 5: Prioritize the role of health and education for the development of tribal community, considering tribal people as resources,

CO 6: Develop trainees or volunteers as competent change agent in the field of tribal resource management.

COURSE CONTENT

Natural Resource Management

Introduction to Natural Resources and their management: Natural Resource Management (NRM): Concept, Issue and Approaches; Need for developing extension strategies for NRM; Issues in management of NRM; Problems encountered while advocating strategies for NRM; Monitoring and auditing in Natural Resource Management (NRM); Triple Bottom Line (TBL) and concept of Sustainable Natural Resource Management; NRM of Water, land and forests: Water resources and their management, Overview of irrigation management, Integrated Watershed management and rainwater harvesting, River Basin management; Scope of market mechanism in NRM

Agribusiness Management

Agricultural value chains and their relevance; Managerial Insights: Identifying agribusiness opportunities; Assessing feasibility – technical, commercial and financial and thereby identify feasible opportunities for projects; Analyzing influences of external environment factors and associated risks; Discussions on illustrative agribusiness projects; select models and opportunities of agribusiness opportunities and ventures.

Environmental Resource Management of Tribals

Environment and Development-Theories of optimal use of exhaustible and renewable resources; Sustainable Development - The concept of sustainable development; strong and weak sustainability; Mechanism for environment regulation in India; environmental laws and their implementation; Environmental Policy in India-Policy instruments for controlling water and air pollution and forestry policy; Institution for forest Management- The institutions of joint forest management , social foresty-rationale and benefits

Tribal Health and Education Management

Role of Health and Education in Tribal Development: Importance in poverty alleviation; health and education outcomes and their relationship with macroeconomic performance; Tribal Health in India: An Overview Health outcomes; health systems; health; Evaluation of Health Programs for tribals: Costing, cost-effectiveness and cost benefit analysis; burden of disease; Tribal Education in India: An Overview Literacy rates, school participation, school quality measures

Agro forestry Management

Multiplicity of Agroforestry products and services- ecological and economic and cultural considerations- gender equality- preservation of indigenous knowledge. Socioeconomic benefits of agroforestry; Smallholder livelihood and the role of agroforestry- Food and nutritional security Fulfillment of food, fodder, fuelwood and shelter based needs- income generation vs. subsistence production; Adoption of AF- Determinants of adoption: feasibility, profitability, and acceptability; . Self-efficacy in farmer decision-making - policy aspects.

Text Books

1. Madhusudan Bandi ,Tribals and Community Forest Management , Rawat Publication, 2013
2. Jumyir Basar,Indigenous Knowledge and Resource Management Shipra Publications, 2014
3. Laishram Herojit, Rethinking Resource Management: Sustainability and Indigenous Peoples, A.K. Publications, 2012.

Reference Book

1. G.K. Bera, Tribal India's Traditional Wisdom and Indigenous Resource Management by, Abhjeet Publishers.

INDIAN KNOWLEDGE SYSTEM

Course Code : HS30425

Credit : 3

L-T-P : 3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

The objective of the course is to promote interdisciplinary study on all aspects of the Indian Knowledge System (IKS), preserve and disseminate IKS for further study and societal applications. It will actively help students to engage in spreading the rich heritage of our country and traditional knowledge in the field of Liberal Arts, Literature, Basic Sciences, Engineering and Technology, Economics, mental and physical well being etc.

COURSE OUTCOME

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

CO 1: Understand the concept of Indian traditional knowledge and its importance,

CO 2: Know the need and importance of protecting traditional knowledge,

CO 3: Develop an appreciation among the students for ancient scriptures,

CO 4: Contrast and compare characteristics and important kinds of traditional knowledge,

CO 5: Evaluate social change on traditional knowledge

CO 6: Create innovative ways of bringing forward ancient knowledge to the forefront.

COURSE CONTENT

Meaning of Traditional Knowledge System

Overview of the Vedas, the Upanishads, the Puranas, and the Itihasas. Main Schools of Darshana/ Philosophy: Astika (Vedanta, Nyaya, Vaisheshika, Sankhya, Mimamsa, Yoga) and Nastika (Buddhist, Jainist, Lokayata). Types of Shastra (Vyakarana, Kavya, Alamkara, Shilpa, Vastu, Natya and Sangita). Types of Kavya (Drishya, Shravya, Chitra). Theory of Rasa: Natyashastra by Bharata (Chapter 6). Applied Traditional Knowledge: Myths, Rituals, Taboos and Superstitions, Folktales, Proverbs. Fundamental Concept of Dharma and Its Role in Various Streams of Indian Knowledge System

Yoga and Spiritualism

Definition and Origin of Yoga. Significance of spirituality in Yoga, Historical development of Yoga; Yogic philosophy: The eight limbs of yoga according to Patanjali, Mind, body & spirit connection in yoga; Relevance of Asana, Pranayama & Dhyana in Yoga: Physical posture for physical, mental and spiritual development, Breathing techniques for energy restoration & consciousness, Meditation for inner stillness and mindfulness, Meditation for spiritual growth & self-discovery; Ethics & Moral Values in Yoga: Exploring the ethical principles Yama and Niyama, Application of yogic principles to daily life for spiritual growth; Yoga & Spirituality in modern life.

Fun with mathematics without calculator

Arithmetic- Quick calculation with 11 and 12, Multiplication with 99999 in seconds, multiplication with numbers near the bases, vertical and cross multiplication, Magic squares and square roots, cubes, fractions, divisions, HCF and LMC in ancient style. Algebra- Factorising quadratic expressions, One variable linear equation, Simultaneous linear equations. Implementation of Vedic mathematics tools during competitive examinations.

Ancient Indian Science and Technology

Technological development in India: Agriculture (Origin and development, ancient crops, Traditional practices), Water management (Overview, Harappan water management, other case studies, Medieval Water structures), Pottery (Overview, Technical aspects), Silpasastra (Architecture and Construction· An introduction to Silpasastra, Construction Technology), Metallurgy (Copper/Bronze/Zinc, Iron and Steel Technology in India).

Trade and Commerce in Ancient India

Internal, External, Trade routes Indo-Roman contacts and Maritime Trade of South India; Silk and Cotton Textiles, the Principal Maritime Trade Commodities of Ancient India; Trade routes in Ancient India: Silk Route and Spice Route.

Reading Materials

1. Dasgupta, Surendranath. A History of Sanskrit Literature, Motilal Banarsidass
2. Banerji, Suresh Chandra. A Companion to Sanskrit Literature, Motilal Banrasidass
3. Chatterjee, Satischandra. An Introduction to Indian Philosophy, Motilal Banarsidass
4. Sharma, Chandradhar. A Critical Survey of Indian Philosophy, Motilal Banarsidass
5. A Text Book on Yoga and Health by Dr. Sajib Kumar Bhowmik, Sports Publication, 2020.
6. Light on the Yoga Sutras of Patanjali, B.K.S Iyengar, Element, 2005.
7. The Complete Book of Yoga: Karma Yoga, Bhakti Yoga, Raja Yoga, Jnana Yoga by Swami Vivekananda, Fingerprint Publishing, 2019.
8. Singhal, Aditi. How to Become A Human Calculator. ISBN : 9789352836543. S Chand Publishing
9. M. Tyra and K Kundan. Magical Book on Quicker Maths . ASIN : B07X93W2FC. BSC Publishing Co Pvt Ltd.
10. Singh, Balram. Science and Technology in Ancient texts. DK Print World ltd, 2012. ISSN 9788124606322.
11. Chandra Moti, Trade and Trade Routes in Ancient India. New Delhi: Abhinav Publications, 1977
12. Textiles in Ancient India: From Indus Valley Civilization to Maurya Period. Vishwavidyalaya Prakashan, 1994.
13. Duraiswamy, D. Silk and Cotton Textiles, the Principal Maritime Trade Commodities of Ancient India. ACTA VIA SERICA, Vol. 6, No. 2, Dec. 2021: 91-116, 6(2), 91–116.

ECONOMETRICS FOR BUSINESS DATA ANALYTICS

Course Code : HS40151

Credit : 3

L-T-P :3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

Econometrics is a set of research tools used to estimate and test economic relationships. The methods taught in this course can also be employed in the business disciplines of accounting, finance, marketing and management and in many social science disciplines. SPSSprovidesdata analysis for descriptive and bivariate statistics, numeral outcome predictions and predictions for identifying groups. The software also provides data transformation, graphing and direct managing features.

COURSE OUTCOMES

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

CO1 : Understand the usage of econometric tools in business,
CO2 : Describe BLUE and various types of distribution,
CO3 : Forecast future values using correlation and regression using SPSS,
CO4 : Check the relation between variables using causality, factor analysis and SEM using SPSS,
CO5 : Estimate and predict using dummy variables using SPSS,
CO6 : Gain working knowledge on SPSS.

COURSE CONTENT

Nature and scope of Econometrics. Specification Analysis. Omission of a relevant variable. Inclusion of irrelevant variable, Tests of specification. Estimation of parameters, Testing of hypotheses , Defining statistical hypotheses, Distributions of test statistics, Testing hypotheses related to population parameters, Type-I and Type-II errors; Power of a test.

Properties of estimators, Best Linear Unbiased Estimator, Goodness of fit- R^2 and Adjusted $R^{2.}$ Scaling and units of measurement, Confidence intervals, Gauss Markov Theorem. Normal distribution; chi-sq, t-and F-distributions, , Tests for comparing parameters from two samples. Data analysis using SPSS.

Correlation- Partial and multiple. Estimation of model by method of ordinary least squares. Causality test, Granger test and Sim's test. Forecasting. Violations of Classical Assumptions: Consequences, Detection and Remedies – Multicollinearity; Heteroscedasticity; Serial correlation. Data analysis using SPSS.

Individual and Joint Functional Forms of Regression Models. Qualitative (dummy) independent variables. Factor Analysis. Cluster analysis. Structural Equation Modeling. Data analysis using SPSS and AMOS.

Text Books

1. Joseph F. Hair Jr., William C. Black, Barr y J. Babin, Rolph E. Anderson Multivariate Data Analysis, 8th Edition. . Cengage Publication.

Reference Books

1. Gujarati D. N., Basic Econometrics, Mc Graw Hill, New Delhi.
2. Wooldridge, Introduction to Econometrics,Cengage Publication.
3. Kmenta J., Elements of Econometrics, University of Michigan Press.
4. Johnston J., Econometric Methods (2nd edition), Mc Graw Hill, New Delhi
5. Gupta S.C, Fundamental of Statistics. Himalaya Publishing House.
6. Gupta S.C and Kapoor V.K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
7. G.S. Maddala- An Introduction to Econometrics
8. Landau, S., & Everitt, B. S. (2003). A handbook of statistical analyses using SPSS. Chapman and Hall/CR

FINANCIAL ECONOMICS

Course Code : HS40153

Credit : 3

L-T-P :3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

Financial economics analyzes the use and distribution of resources in markets. It employs economic theory to evaluate how time, risk, opportunity costs, and information can create incentives or disincentives for a particular decision.

COURSE OUTCOMES

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

CO1 : Understand theories of investment,

CO2 : Discuss portfolio analysis,

CO3 : Explain Efficient Market Hypothesis,

CO4 : Describe *Capital Asset Pricing Model,*

CO5 : Understand derivatives and options,

CO6 : Discuss various types of contracts.

COURSE CONTENT

Investment theory and portfolio analysis: deterministic cash flow streams; basic theory of interest; discounting and present value; internal rate of return; evaluation criteria; fixed-income securities; bond prices and yields; interest rate sensitivity and duration; immunisation; the term structure of interest rates; yield curves; spot rates and forward rates.

Single period random cash flows; mean-variance portfolio theory; random asset

returns; portfolios of assets; portfolio mean and variance; feasible combinations of mean and variance; mean-variance portfolio analysis: the Markowitz model and the two-fund theorem; risk-free assets and the one-fund theorem. Efficient Market Hypothesis.

CAPM: the capital market line; the capital asset pricing model; the beta of an asset and of a portfolio; security market line; use of the CAPM model in investment analysis and as a pricing formula; the CAPM as a factor model, arbitrage pricing theory.

Futures, options and other derivatives: introduction to derivatives and options;

forward and futures contracts; options; other derivatives.

Text Book

1. Zvi Bodie;Alex Kane;Alan J. Marcus; Pitabas Mohanty. Investments, 11th Edition. Mc Graw Hill.

Reference Books

1. Brealey, R., Myers, S., Allen, F., Mohanty, P. (2013). Principles of corporate finance, 10th ed. Tata McGraw-Hill.
2. Hull, J., Basu, B. (2017). Options, futures, and other derivatives, 9th ed.
3. Pearson Education.
4. Luenberger, D. (2013). Investment science. Oxford University Press.

CORPORATE FINANCE

Course Code : HS 40155

Credit : 3

L T P :3 0 0

Prerequisite : Nil

COURSE OBJECTIVE

Corporate financing manages financial activities by obtaining funds from the right sources. Corporate financing manages financial activities to maximize the return on investment. Corporate financing balances risk and profitability by properly structuring and budgeting the capital

COURSE OUTCOMES

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

CO1: Learn about expected utility maximization – Risk aversion,
CO2: Understand trade-off between risks and return,
CO3: Know the principle of arbitrage; discrete processes and the binomial tree mode,
CO4 Analyse the risk neutral valuation; stochastic process and the Markov property,
CO5 Learn the idea underlying the Black- Scholes-Merton (BSM) differential equation, BSM pricing formulas; the Greek letters
CO6 Understand the use of futures for hedging.

COURSE CONTENT

The Economic properties of utility functions – concept & measures to model attitudes towards risk – Expected utility maximization – Risk aversion – Motivation – First order stochastic dominance – Second order stochastic dominance – Stochastic dominance Vs dominance- risk: Risk versus return: Mean-variance analysis. Game Theory. The Prisoner's Dilemma. Nash Equilibrium.

Trade-off between risk and return (the Markowitz model) – Efficient frontier of risky assets – Value at risk of a portfolio – Computing VaR-Definition of VaR. Sharpe single index model.

The principle of arbitrage; discrete processes and the binomial tree model; risk neutral valuation; stochastic process (continuous variable, continuous time), the Markov property, Itô's lemma; the idea underlying the Black- Scholes-Merton (BSM) differential equation, BSM pricing formulas; the Greek letters.

The use of futures for hedging, stock index futures; forward and futures prices; interest rate futures and duration-based hedging strategies, option markets; call and put options; factors affecting option prices; put-call parity; option trading strategies: spreads; straddles; strips and straps; strangles.

Text Book

1. Westerfield, R. W., Jaffe, J., Ross, S. A., & Kakani, R. K. Corporate Finance (8th Edition ed.). The McGraw.Hill Companies.

Reference Books

1. D.G. Luenberger (1998), Investment Science, Oxford University Press, New York.
2. J. Cvitanic and Zapatero F (2004), Introduction to Economics and Mathematics of Financial Markets,
3. MIT Press, Cambridge, London.
4. E. J. Elton and M.J. Gruber, Modern Portfolio Theory and Investment Analysis, Wiley, London.
5. Z. Bodie, A. Kane and A.J. Marcus (2004), Investments, Irwin McGraw – Hill, London.
6. R.A. Haugen (2001), Modern Investment Theory, Fifth Edition, Prentice Hall, New Jersey.
7. J.C. Hull (2004), Futures and Option Markets, Prentice-Hall, New Jersey.

PUBLIC ECONOMICS

Course Code :HS40156

Credit : 3

L-T-P :3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

This course is overview of government finances with special reference to India. It aims to introduce students to the main concepts in public finance,they understand taxation policy, management of public expenditure, public debt and budgetary techniques and practices. It will be useful for students aiming towards careers in the government sector, policy analysis, business.

COURSE OUTCOMES

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

CO1 :Understand public finance and different roles played by the government in an economy,

CO2 :Learn about the interaction between the public and the private sector regarding several economic functions in an economy ,

CO3 :Analyze the rationale behind different public sector activities by the government as suggested from the study of public finance,

CO4 :Differentiate between public goods and private goods,

CO5 :Understand the market failure and the role of the government,

CO6 :Understand financial market in the light of the need to achieve efficiency and distribution goals.

COURSE CONTENT

Public Finance and private finance; public good vs. private good; Market failure and role of government; Criteria for public investment-Social Cost-Benefit Analysis; Maximum Social Advantage. Tax System: structure and reforms. Tax saving schemes.

Wagner's law of increasing state activities; Wiseman-Peacock hypothesis; Pure theory of public expenditure; Structure and growth of public expenditure; Criteria for public investment; Social cost-benefit analysis – Project evaluation.

Objectives of fiscal policy – full employment, anti-inflation, economic growth, redistribution of income and wealth; Interdependence of fiscal and monetary policies; Budgetary deficit and its implications; Fiscal policy for stabilization – Automatic vs discretionary stabilization; Alternative measures of resource mobilization and their impact on growth, distribution and prices; Balanced budget multiplier.

Challenges of financing small economic operators like moral hazard, adverse selection, high transaction cost and information asymmetry etc. Concept of microfinance: different models of microfinance operating in India; Self Help Group-Bank Linkage Programme (SBLP) in India. Subsidy-linked credit programmes and Non subsidy-link programmes of the Government of India for rural sector.

Text Book

1. Musgrave, R.A. and P.B.Musgrage (1976), Public Finance in Theory and Practice, McGraw Hill, Kogakusha, Tokyo.

Reference Books

1. Goode, R.(1986), Government Finance in Developing Countries, TMH, New Delhi.
2. Jha. R.(1998), Modern Public Economics, Routledge, London.
3. Atkinson, A.B. and J.E. Siglitz (1980), Lectures on Public Economics,TMH, New York.
4. Herber, B.P. (1967), Modern Public Finance, Richard D.Irwin, Homewood.
5. Stiglitz, J. E., & Rosengard, J. K. (2015). Economics of the public sector: Fourth international student edition. WW Norton & Company.
6. The Theory of Corporate Finance. Jean Tirole. ISBN 9780691125565. Princeton University Press.

EMPLOYMENT, EMPLOYABILITY AND GROWTH

Course Code : HS40157

Credit : 3

L- T-P :3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

The objective of the paper is to Introduce the development economics, and then proceeds to study developmental policies to promote economic opportunity, and the future of work in the rapidly changing world, and to explain the link between environment and economic development, and globalization and economic development.

COURSE OUTCOMES

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

CO1 : Learn about basics of development economics, with in depth discussions of the concepts of development and growth,

CO2 :Understand importance of human development and human capital for the economic development,

CO3 : Understand the impact of globalisaion on economic growth, CO4 :Learn about long run dynamic technology and future of work,

CO5 : Gain knowledge on policies and programmes to develop more sustainable economy

CO6 : Analyze the data related to growth and development.

COURSE CONTENT

Introduction to economic growth and development

Conceptualizing Development: Meaning of Economic development, Growth and Development; Growth accounting, Solow residual, A Contrast in Concepts, Measuring Economic Growth, Measuring Economic Development, The Development Gap; Human Development:What and Why Human Development, Essential Components of Human Development , Human Development Index

Labour force growth and occupational pattern;Labour relation and social Security

Labour Force Growth in India,Occupational Structure and Economic Development Occupational Distribution of Labour Force in India; Magnitude of Industrial Disputes ,Causes of Industrial Disputes ,Industrial Relations: Policy of the Government ,Social Security in India.

Globalisation, Foreign aid and trade: Enable growth and development.

Globalisation and its impact:Meaning, steps, effects. Foreign Capital/Foreign Direct Investment(FDI), government policy, foreign aid, Foreign trade,Foreign trade of India, Foreign direct investment and trade: interlinkages and policy implications, Special Economic Zone(SEZ), International migration(FLO),Global value chaim(GVC); concept as a model of growth.

Technology and future of work:

Global value chaim(GVC); Tradition and Technology, Transfer of technology, ICT and employment opportunities- agriculture, industry, service sector; social and economic development; ICT infrastructure and E-resilience, Skill development programmes of India.

Data analysis (Using software)

Recent budgetary policies and programs, Analysis of Economic Survey data pertaining to above concepts.

Text Book

1. Gaurav Datt and Ashwani Mahajan,*Indian Economy*, GENERIC. Classic Edition,2022, ISBN-10 : 9352531299 ISBN-13 : 978-9352531295

Reference Books

1. S. K. Mishra, and V. K. Puri, Indian Economy, Himalaya Publishing House,2022, ISBN: 978-93-5596-423-6
2. Uma Kapila, *Indian Economy:Economic Development and Policy,* Academic Foundation, 2022, ISBN-10 : 9332705550 and ISBN-13 : 978-9332705555.
3. Michael P. Todaro and Stephen C. Smith, *Economic Development*. Pearson Publications,2015
4. Ministry of Finance. *Economic survey* (latest)
5. J.Drèze, & R. Khera, Recent Social Security Initiatives in India. *World Development*,*98*,555–572, 2017. https://www.sciencedirect.com/science/article/pii/S0305750X17302097

ADVANCED ECONOMETRICS

Course Code : HS40158

Credit : 3

L-T-P :3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

The primary objective of this course is to provide an advanced treatment of econometric methods for cross section and panel data including linear and non-linear models. EViews can be used for general statistical analysis and econometric analyses, such as cross-section and panel data analysis and time series estimation and forecasting.

COURSE OUTCOMES

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

CO1 :Learn the regressions with Qualitative Independent Variables,
CO2 :Understand the theory and application of dynamic econometrics models,
CO3 :Know to estimate and interpret the Granger causality test results,
CO4 :Understand about Eviews software and import of data to Eviews,
CO5 :Learn the data analysis using Eviews,
CO6 :Know the theory and application of cointegration, VAR and VECM with time series data.

COURSE CONTENT

Regressions with Qualitative Independent Variables : Dummy variable technique – Testing structural stability of regression models comparing to regressions, interaction effects, seasonal analysis, piece wise linear regression; The LPM, Logit, Probit and Tobit models – applications. Data analysis using Eviews.

Dynamic Econometric Model: Auto-regressive and distributed lag models – Koyak model, partial adjustment model, adaptive expectations; Instrumental variables, Problem of auto-correlation – application; Almon approach to distributed lag models. Data analysis using Eviews.

Ordinary Least Square Methods: OLS, FMOLS, DOLS. Estimating generalized least squares (GLS) equations using the Cochrane-Orcutt method. Data analysis using Eviews.

Volatility model(s): ARCH, GARCH, GARCH-M, TGARCH, EGARCH. Cointegration, VAR and VECM. Data analysis using Eviews.

Text Book

1. Bhaumik, Sankar – Principles of Econometrics: A Modern Approach using EViews, OUP, 2015

Reference Books

1. Koutsoyiannis, A. (1977) Theory of Econometrics, Macmillan Press, London.
2. Amemiya,T. (1985), Advanced Econometrics, Harvard University Press, London
3. Mas-Colell,A., M.D. Whinston and J.R. Green Microeconomic Theory, Oxford University Press, 1995.

ECONOMIC INEQUALITY

Course Code : HS40162

Credit : 3

L-T-P :3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

This course studies inequality from the economic perspective.

COURSE OUTCOMES

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

CO1: Learn about various aspects of inequality,
CO2: Analyse and Measuring Inequality,
CO3: Understand food security and inequality ,
CO4: Understand about health and educational disparity,
CO5: Learn about effectiveness of current government programs,
CO6: Analyze the data on economic inequality.

COURSE CONTENT

Introduction to inequality: Meaning of inequality; Global versus within-country inequality, growth and inequality; indicators of regional imbalance; cause of regional inequality; policy measures to remove regional inequality.

Measuriing Inequality :Income Inequality,causes of income inequality; Axioms of inequality, Lorenz curve and Kuznets' inverted U hypothesis, Gini Coefficient, Decile dispersion ratio,Palma ratio, Gary S. Fields's Prediction.

Inequality and Food Security: Food and nutritional value; Global Hunger Index; Concept of food security, Global food security index; food self sufficiency; Public Distribution System (PDS); Steps to reform PDS.

Inequality and Human Resource Development.: Essential components of Human development, Human development Index(HDI),HDI ranking vs Income ranking, Inequality adjusted human development index, Gender inequality, Gender inequality index.; Population stabilization; Health care infrastructure; Development of education sector in India, Equity and inclusion in education, policy measures to remove inequality.

Current Status of Inequality: Recent budgetary policies and programs relating to inequality; Analysis of Economic Survey data.

Text Book

1. Gaurav Datt and Ashwani Mahajan,*Indian Economy*, GENERIC. Classic Edition,2022 ISBN-10 : 9352531299 ISBN-13 : 978-9352531295

Reference Book

1. S. K. Mishra, and V. K. Puri, *Indian Economy*, Himalaya Publishing House,2022, ISBN: 978-93-5596-423-6
2. Inequality Re-Examined. Amartya Sen. Oxford University Press. ISBN-10 : 0198289286 ISBN-13 : 978-0198289289
3. Uma Kapila, *Indian Economy:Economic Development and Policy*, Academic Foundation ISBN-10 : 9332705550 and ISBN-13 : 978-9332705555.

OPEN ELECTIVE COURSE OFFERD BY SCHOOL OF APPLIED SCIENCE

ADVANCED NUMERICAL TECHNIQUES

Course Code :MA30002

Credit : 3

L-T-P : 3-0-0

Prerequisite : Transform Calculus and Numerical Analysis (MA11002)

COURSE OBJECTIVE

The objective of this course is to equip the students with the advanced level of numerical computations to tackle the different mathematical models.

COURSE OUTCOMES

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

CO1 : Understand the error propagation in numerical computations,
CO2 : Know the concept of numerical techniques to find the root of non-linear equations and simultaneous equations,
CO3 : Find the interpolating polynomials and inverse interpolation,
CO4 : Apply the numerical techniques to approximate the definite single and double integrals,
CO5 : Know the concept of numerical solution of boundary value problems,
CO6 : Use the finite difference method to solve partial differential equations.

COURSE CONTENT

Errors

Definition and sources of errors, Propagation of errors, Errors in summation

Rootfindingfornonlinearequationsandsystemsofequations

Muller's Method, Chebyshev Method, Solution of the system of non-linear equations using the Newton Raphson method.

Interpolation

Gauss forward and backward interpolation, Hermit's interpolation, Bivariate Interpolation and Inverse interpolation.

NumericalIntegration

Rombergh Integration,Gauss-Legendre, Gauss-Chebyshev, Gauss-Laguerre, andGauss-Hermite Integration Methods. Double Integration by Trapezoidal and Simpsons methods.

NumericalSolutionofODEsandPDEs

Milne' method, Shooting Method and Finite difference methods to solve parabolic and elliptic equtions.

Text book

1. M.K.Jain, S.R.K.Iyenger and R.K.Jain Numerical, Methods for Scientific and engineering computation by,NewAge International Publisher, 6th Edition.

Reference books

1. S.Rajasekharan, Numerical Methods in Science and Engineering (A Practical Approach), S.Chand Publishing, 1stEdition.
2. K.EAitkinson ,An Introduction to Numerical Analysis by, 2ndEdition,Wiley,1989.
3. David R, KincaidandE. Ward. Cheney, Numerical Analysis: Mathematics of scientific computing .

COMPOSITE MATERIALS AND STRUCTURES

Course Code : CH40002

Credit : 3

L-T-P :3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

The main objective of this course is to increase student knowledge in design, manufacture and analysis of composite materials that can have better structural, thermal, electrical, mechanical, dielectric, magnetic, optical, electrochemical and biomedical properties.

COURSE OUTCOMES

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

CO1 : Define and classify composites,

CO2 : Evaluate the relative merits of using composites with respect to conventional materials for important engineering and other applications,

CO3 : Quantify physical and mechanical properties of composite materials as afunction of parameters such as volume fraction, orientation and arrangement,

CO4 : Design and prepare composite structures,

CO5 : Apply XRD, SEM and TEM in micro- structural analysis of composites,

CO6 : Understand the concept of green composite and their processing techniques.

COURSE CONTENT

Classifications and Industrial Applications of Composite

General introduction, classification of composites, matrix materials (polymer, metal and ceramics) and reinforcement materials (fibres-glass, Aramid, Carbon, Boron), microstructure of composite, applications: in civil constructions, aerospace industries, automobile, packing industry, advantages and limitations of composite materials.

Performance of structural composites

Matrix/reinforcement interface, reinforcement mechanism, combination effects (law of mixtures, weight fraction, volume fraction), effect of voids in composites, fracture mechanics of composites, strengthening mechanisms, stress-strain relations (generalized hooke’s law), stress distribution in fibre and the matrix (shear stress and axial tensile stress in the fibre along its length), critical length of fibre for full strengthening, estimation of the critical amount of fibre to gain a composite strength.

Fabrication of composites

Fabrication of metal matrix composites, fabrication of polymer matrix composites, fabrication of ceramic matrix composites, selection of constituents, solidification processing of composites, synthesis of in situ composites, various techniques of vapor deposition, liquid phase method and hot pressing etc.

Characterization

Characterization methods of composites (x-ray diffraction (XRD), Electron microscopy (SEM, TEM) analysis of composites, Thermal Analysis, Fire retardancy test for polymer composites.

Green Composite

Introduction, Composition of green composite, bio-degradable reinforcement fibre (cellulose, starch,
wool/silk, carbon nanotube, nano-clay, biodegradable matrix (cellulose, starch, chitin, protein),
applications of green composite.

Textbook

1. Krishan K. Chawla, Composite Materials. 2nd Edition, Springer Press, 2001
2. Deborah D. L. Chung, Composite Materials: Science and applications, Springer, 2004.

References Book

1. T. W. Clyne, and D. Hull, “An Introduction to Composite Materials”, Cambridge University Press, Cambridge, 1996
2. Bhagwan D. Agarwal, Lawrence J. Broutman and K. Chandrashekhar, “*Analysis and* Performance of Fibre Composites,” John Wiley And Sons. Inc., New York, 1995.
3. Susheel Kalia, Biodegradable Green Composites, John Wiley & Sons Inc., [2016], eBook.
4. Composite Materials Properties, Characterisation, and Applications, Edt by Amit Sachdeva, Pramod Kumar Singh, Hee Woo Rhee, CRC press, broken sound parkway NW, 2021.

FINITE ELEMENT ANALYSIS

Course Code :MA40001

Credit : 3

L-T-P :3-0-0

Prerequisite : Transform Calculus and Numerical Analysis (MA11002)

COURSE OBJECTIVE

This course aims to develop a practical understanding to Finite Element Analysis (FEA) as a tool to solve variety of problems governed by differential (ode and pde) equations in all areas of engineering and the sciences. This is an introductory course. This course will expose the key concepts to help in understanding the nuances of the FEA techniques.

COURSE OUTCOMES

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

CO1 :Definemathematicalmodelsusingfiniteelementmethods,

CO2 :Understand the concepts of nodes, elements and shape and can use it in the discretization,

CO3 :Develop stiffness matrices for 1-D and 2-Dproblems using the concept of direct, Galerkin and variational methods,

CO4 :Apply isoparametric concept to convert the non-orthogonal domain to orthogonal domain,

CO5 :Solve1-Dand2-DboundaryvalueproblemsinODE/PDE

CO6 :Implement the methods by developing computer code/using software.

COURSE CONTENT

IntroductiontoFEA

Introduction to finite element methods, finite element formulation starting from governing differential equation, weighted residual method, weak(variational) form of the weighted residual, comparison of differential equation with weak form and weighted residual form. Rayleigh-Ritz method, piece wise continuous trial function, functionals and differential equation forms.

Discritization and Interpolation

Element Shapes, Nodes, Nodal Unknowns and Coordinate Systems, Shape Functions, Polynomial Shape Functions, Convergence Requirements of Shape Functions, Derivation of Shape Functions Using Polynomials, Finding Shape Functions Using Lagrange Polynomials, Shape Functions for Serendipity Family Elements, Hermite Polynomials as Shape Functions.

Stifness Matrix and Variational Forms

Strain-Displacement Matrix for Bar Element, Strain Displacement Matrix for CST Element, Strain Displacement Relation for Beam Element, Assembling Stiffness Equation, Direct Approach(Element Stiffness Matrix for CST Element, Nodal Loads),Galerkin's Method,Virtual Work Method, Variational Method. Solution of 1-D and 2-D boundary value problems using direct, Galerk in and Variational method.

Isoparametric Formulation and its Implementation

Isoperimetric Formulation, Coordinate Transformation, Basic Theorems of Isoparametric Concept,Uniqueness of Mapping, Isoparametric, Superparametric and Subparametric Elements, Assembling Stiffness Matrix,Solution of1-D and 2-D boundary value problems (steady and unsteady heat transfer) using the above discussed method and its implementation using any programming language (C/C++/MATLAB/Python)or software likeCOMSOL.

Textbook:

1. Singresu S Rao,"The Finite Element method in Engineering",Elsevier Butterworth Heinemann, 5^{th}edition. .

ReferenceBooks

1. S.Rajasekharan, "Finite Element Analysis in Engineering Design", S.Chand, 2^{nd}Edition.
2. S.SBhabikatti, "Finite Element Analysis",New Age InternationalEdn., 8^{th}Edition.
3. P.Seshu,"Textbook of Finite Element Analysis" PHI

INDUSTRIAL ECOLOGY AND DESIGN FOR SUSTAINABILITY

Course Code : LS30002

Credit : 3

L-T-P : 3-0-0

Prerequisite :Nil

COURSE OBJECTIVE

The course will aim to cover the core concepts of sustainability, sustainable engineering, and how natural ecosystems function. The next objective would be to identify replicable natural systems from an engineering perspective, and how technological systems may be able to mimic nature. Modelling human made and natural systems and their dynamics, along with identifying key structural and functional nodes that can turn an industry to become fully automated while considering key environmental and social angles.

COURSE OUTCOMES

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

CO1 : Identify the basic nature of the course on offer,

CO2 : Comprehend and scrutinize the underlying network of every ecosystem,

CO3 : Apply ecological concepts to industries,

CO4 : Understand the sequence of events which lead to an environmental impact,

CO5 : Apply and visualize engineering knowledge to solve practical problems,

CO6 : Learn an organized approach to manage environmental quality.

COURSE CONTENT

Introduction to Industrial Ecology

Fundamentals of sustainability, Sustainable Development Goals, Climate crisis, the promise of an ever-expanding global economy, industrial engineering, role of engineers, origin of IE, its definition, the environment and the anthrosphere, industrial systems, material resources, societal factors and environmental equity. Link to sustainable development.

Ecosystem Functioning

Components, interactions, structuring, energy flow in different ecosystems, ecological pyramids, nutrient cycling, concept of niche.

Industries as Ecosystems

Components of an industrial ecosystem (Kalundborg example), zero waste industries, Material cycling, Resilience to stochastic events industrial symbiosis, role of government, community, developers, management, biomimetics, turning linear process cyclical, waste utilization (refusing, reducing, repurposing, recycling, and reuse)evaluating the success of eco-industrial development,

Life Cycle Assessments

Cradle to coffin following up on the origin and degradation of materials used in industries, how can one assess the fate of materials, waste products, and reduce industrial waste. Life cycles of products, processes and facilities; life cycle assessment (components, methodology, applications, difficulties), design for environment, efficient use of material (remanufacturing, recycling, reuse, etc.

Design for Sustainability

Product design, automating industries (drones, neural networks, IOT), conception of environmentally friendly products, carbon neutral industries, use of bamboo, mushrooms and alternative materials.

Environmental Management Systems

ISO, auditing, maintenance of EMS, ISO14001

Textbook

1. Erkman S. and Ramaswamy R. (2003) Applied Industrial Ecology – A New Platform for Planning, Sustainable Societies, AICRA Publishers, Bangalore, India.

Reference Book

1. Edward Cohen-Rosenthal E. and Musnikow J. (edited) (2003) Eco-industrial Strategies, Sheffield, UK: Greenleaf Publishing.

QUANTUM COMPUTING

Course Code : PH40001

Credit : 3

L-T-P :3-0-0

Prerequisite :Nil

COURSE OBJECTIVE

The objective of this course is to open up and introduce quantum computation as well as its supremacy over classical computation to the students and technically trained professionals from the field of engineering and general science.

COURSE OUTCOMES

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

CO1 : Understand and apply the mathematical background and principles of basic quantum mechanics needed for quantum computation,

CO2 : Understand and apply the principle of measurement in quantum theory on pure and composite systems,

CO3 : Know the architecture of quantum computers and apply them in handling quantum circuits,

CO4 : Understand some fast quantum search algorithms and evaluate certain simple problems,

CO5 : Understand quantum cryptography and know simple cryptography protocols,

CO6 : Understand principles and working of practical quantum systems for physical realization of quantum computers.

COURSE CONTENT

Background mathematics and Framework of Quantum mechanics

Operators, Projectionra and Ket Vectors, Orthonormal Bases, Two Dimensional Hilbert Space, Qubit and Quantum States, Linear Operators, Matrix Representations of Vectors and Linear Operators, Inner and Outer Products, Eigen Values and Eigen Vectors, Gram–Schmidt Procedure of Constructing an Orthonormal Basis Set, Completeness Relation, Hermitian Operators, Projection Operator, Unitary Operator, Normal operator, The Commutator and Anti-commutator, Change of Basis, Spectral Decomposition, Pauli Matrices, Tensor Products, The Postulates of Quantum Mechanics, Collapsing of Wave Function, Uncertainty Principle, State Space, Time Evolution of Quantum State, Stern-Gerlach Experiment, Spin as a Degree of Freedom, Representing Spin States using Spin Vectors. Bloch Sphere, Representation of Qubit on Bloch Sphere.

Density operator and Quantum Measurement theory

Density Operator for Pure and Composite Systems and its Key Properties, Partial Trace and Reduce Density Operator, Density Operator and Bloch Vector. Projective Measurements, Measurements on Composite Sytems, Positive Operator Valued Measures (POVM).

Basic Quantum **Logic Operations and Gates**

Classical Irreversible and Reversible Gates, Reversible Computation.

Single Qubit Gates and Their Matrix Representations, Identity Gate, Pauli Gates, Square Root of NOT Gate, Phase Shift Gates, Hadamard Gate, Rotation Operator Gates. Limitations with These Gates.

Multiple Qubit Gates and their Matrix Representations: Controlled NOT (CNOT) Gate and its Matrix Representations, CNOT Basis Transformations, Entangled States and Their Visualization.

Universal quantum gates**:** Two-level Unitary Gates as Universal Gates, Single Qubit and CNOT Gates as Universal Gates, A Discrete Set of Gates for Universal Quantum Computation.

Quantum Algorithms

Matrix representation of serial and parallel Operations, Quantum Interference, Quantum Parallelism, Deutsch's-Jozsa Algorithm, Quantum Fourier Transform, Phase Estimation, Shor Factorization, Grover Search.

Quantum Cryptography

Classical Cryptography, Quantum Key Exchange: BB84 Protocol, B92 Protocol, EPR Protocol, Teleportation

Quantum hardware

Goals and Challenges, Implementing Quantum Computers, Guiding Principles, Ion Traps, Linear Optics, Nuclear Magnetic Resonance (NMR) and Superconductors.

Textbook

1. Nielsen and Chuang, Quantum Information and Quantum Computation (Cambridge University Press-2002)

Reference Books

1. David McMahon- Quantum Computing Explained, John Wiley & Sons, Inc. (2008)
2. G Benenti, G Casati, G Strini - Principles of quantum computation and information. Volume 1-World Scientific (2004)

SUSTAINABLE ENERGY AND ENVIRONMENT

Course Code : CH30002

Credit : 3

L- T- P : 3- 0- 0

Prerequisite : Nil

COURSE OBJECTIVE

This course has been designed to make the learners understand principles of sustainable energy sources, their working principles, and their conversion systems. It also explores society's present needs; future energy demands and different energy conservation methods.

COURSE OUTCOMES

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

CO1 : Explore different renewable energy sources available in present scenario, CO2 : Understand the mechanism of harvesting solar energy, its use and future prospective,

CO3 : Understand biomass energy generation and its technologies,

CO4 : Realize energy generation principles and techniques of hydrogen and hydro power ,

CO5 : Explore energy generation from wind, wave and geothermal sources

CO6 : Apply the renewable energy technologies to solve various environmental problems.

COURSE CONTENT

Introduction of renewable energy

Introduction, Principles of renewable energy, Role of energy in economic development and social transformation, Energy Scenario (Classification of Energy Sources, advantages and disadvantages of conventional sources), Salient features of nonconventional energy sources, Energy efficiency and security, Energy and its environmental impacts, Importance of renewable energy sources, Standards and regulations, social implications.

Solar energy

Solar radiation and its nature, fundamentals of solar transmission, absorption and reflection, basics of solar thermal conversion, fundamentals of solar heating, principle and working of solar collectors, basics of solar photovoltaics, Solar photovoltaic energy conversion and utilization, materials and device design, P-N junction, Solar thermal applications to water desalination, refrigeration, and cooling, future prospects of solar energy.

Biomass energy

Basic principles of photosynthesis, photosynthesis and its mechanism at cellular level, Usable forms of biomass, Classification, Chemical composition, fuel properties of biomass, Concept of bio-refinery: Bio-fuels, Bio based chemicals and materials, Biomass conversion routes; biological (Aerobic and Anaerobic conversion, Fermentation), chemical (hydrolysis and hydrogenation) and chemical (Pyrolysis, Combustion, Gasification, and Liquefaction), production of biogas, alcohols, hydrogen, biodiesel and green diesels.

Hydrogen and hydro energy

Hydrogen as a renewable energy source, Sources of Hydrogen, Hydrogen Production: Direct electrolysis of water, thermal decomposition of water, biological and biochemical methods, Storage of Hydrogen: Gaseous, Cryogenic and Metal hydride, Principles of hydropower and types of turbines. Social and environmental aspects of hydrogen fuel and hydropower.

Alternate sources of renewable energy

Wind: Wind resources, characteristics of wind, classification of wind energy conversion systems. Ocean and tidal: Principle of tides and tidal power, ocean thermal energy conversion (OTEC), Energy and Power forms of waves, Wave energy conversion devices. Geothermal Energy: Geothermal Sources, Geothermal energy conversion and aquifer analysis, harnessing of geothermal resources, Social and environmental aspects of wind energy, wave energy and geothermal energy.

Textbook

1. John Twidell and Tony Weir,Renewable Energy Resources-3e, , Routledge-Taylor and Francis.

Reference Books

1. D.P. Kothari, K.C. Singal, Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies-3e, PHI Learning.
2. N.S Rathore and N.L. Panwar, Renewable Energy Sources For Sustainable Development-3e, New India Publishing Agency.

SOLID WASTE MANAGEMENT

Course Code : CH40001

Credit : 3

L T P :3 0 0

Prerequisite : Nil

COURSE OBJECTIVE

The uncontrolled consumption lifestyle is the root cause of the huge waste generation problem of our modern world. According to WHO report, world cities are producing 1.3 billion tonnes of solid waste per year and will be nearly double by the end of 2025. This course aims to cover different solid waste management techniques for sustainability and at the same time it also deals with the legal institutional framework for the same.

COURSE OUTCOMES

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

CO1 : Understand integrated solid waste management concepts and its requirement,
CO2 : Able to understand waste prevention at different levels such as production, supply, consumption and disposal,
CO3 : Understand the importance of public engagement in sustainable waste management,
CO4 : Implement waste reduction and recycling policies,
CO5 : Explore modern treatment techniques for solid wastes
CO6 : Understand the legal and institutional framework for sustainable solid waste management.

COURSE CONTENT

Waste management and sustainability

Solid waste and types, source and characteristics of waste, toxic and hazardous waste, generations of wastes, waste testing and analysis. Environmental health, driving force for sustainability, integrated waste management and sustainability.

Waste storage, segregation, collection and prevention

Introduction, source segregation, waste storage, waste collection, waste separation, Health and Safety issue, waste prevention, The growing burden of waste, waste prevention in the context of sustainability, The policy context, waste prevention at the level of production and supply, Waste prevention at the level of consumption and household, Barriers to waste prevention, best practice in developed countries.

Public Engagement for Implementation of Waste Reduction and Recycling Policies

Introduction, Defining Public Participation, Public participation in waste management systems, Public participation policy in Global context, typical areas of Public participation in waste management systems, Key Ingredients in Public Participation, selected Examples of Public participation in Waste Reduction and Recycling in Asia.

Treatment Techniques

Incineration, Gasification, Pyrolysis, Aerobic and Anaerobic Digestion as well as co-digestion, Plasma Arch Gasification, Bio-hydrometallurgical Processing of Metallic Components of E-Wastes, s/s immobilization of toxic/hazardous wastes.

Legal and Institutional Framework

Introduction, Why Legal Framework Matters, Nature and Characteristics of Legal Framework, Scientific and policy judgments in risk assessment, Trajectory of US Experience, European Union's Legislative Effort, South Asia

Textbooks

1. Jonathan W. C. Wong, Rao Y. Surampalli, Ammaiyappan Selvam, Rajeshwar D.

Tyagi, Tian C. Zhang; Sustainable solid waste management, American Society of Civil Engineers, 2016 (Text book)
2. Freeman H.M. (1988) Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw Hill. New York.

Reference Books

1. G., Theissen H., Eliassen R. (1991), Solid waste Engineering-Principles and Management McBean, Edward A., Frank A. Rovers, and Grahame J. Farquahar. Solid waste landfill; engineering and design. Prentice Hall, 1995. (Supporting materials)
2. Sharma, Hari D. Waste containment systems, waste stabilization, and landfills: design and evaluation. John Wiley & Sons, 1994. (Supporting Materials)
3. Tchobanoglous Issues, McGraw Hill, New York.
4. Bruner, C. R., Hazardous Waste Incineration, 2nd Edition, McGraw-Hill, Inc., New York, 1993.

OPEN ELECTIVE COURSE OFFERD BY SCHOOL OF LAW

LAW OF PATENT

Course code : LW30910

Credit : 3

L T P :3 0 0

Prerequisite : Nil

COURSE OBJECTIVE

Patents contribute, preserve and channelize value for enterprises ranging from the world's largest technological corporations to start-up entities. Apart from economic gain by rendering competitive and transactional advantage, Patents have a remarkable effect in spurring innovation, research and dissemination of knowledge. The student of this Course will develop a clear understanding of the law relating to Patent practice and procedure, and will imbibe skills for applying the law for patent prosecution and transactions.

COURSE OUTCOMES

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

CO1 :Explain the origin, development and significance of patent law and its significance in commercial transactions and value addition to enterprises, CO2 :Apply preliminary advisory and negotiation skills useful for commercial transactions involving patents,

CO3 :Analyze better employability in this field of intellectual property law through skill oriented training,

CO4 :Evaluate the problem-solving skills for the topics learnt,

CO5 :Develop critical thinking to impart basic skills required in litigation involving patents

CO6 : Understand and analyze the remedies and defenses in case of patent litigation.

COURSE CONTENT

Patentability And Patent Eligibility

Novelty Requirement; Inventive Step Requirement; Industrial Applicability Requirement; Patentable and Non patentable subject matter andProduct & Process patent.

Patent Prosecution

Application for patent, Publication and Examination, Specification - Provisional and Complete; Contents of
specification; Objection and Pre-Grant and Post-Grant Opposition.

Patent Grant

Sealing and granting of patents; Withdrawal and abandonment of application; Duration of patent: Law and
policy consideration and Rights and obligations of a patentee.

compulsory licenses, revocation and surrender of patent

Abuse of Patent Rights; Compulsory Licenses; Grounds for granting compulsory licenses; Matters to be
considered in granting compulsory licenses; Revocation of Patent- who may apply? And Different grounds
for and modes of revocation.

Patent Enforcement And Defences

Infringement- Meaning and the scope; Burden of proof; Modes of infringement; Doctrine of colourable
variation; Doctrine of Pith and marrow; Doctrine of equivalents and Defenses in suits of infringement of
patent;

Introduction To Patent Law And International Agreements

Definition, nature and object of granting patent; Development of Patent jurisprudence; Paris Convention and Patents; An overview of TRIPS(only relevant provisions for Patent); Patent Co-operation Treaty(PCT) and Budapest Treaty

Text Books:

1. Feroz Ali Khader, The Law of Patents, Lexis Nexis, 1st Edition. (2009)

Reference Books:

1. Elizabeth Verkey, Law of Patents, Eastern Book Company, 2nd ed. (2012)

2. Merges & Duffy, Patent Law &Policy: Cases and Materials, Lexis Nexis 5th ed. (2011)

LAW OF CONTRACT

CourseCode :LW30904

Credit :3

L T P :3 0 0

Prerequisite :Nil

COURSE OBJECTIVE

This subject is designed to enrich the basic knowledge of engineering students in the field of law and to support the engineering and research programs. To introduce the basic understanding of the General Principles of Law of Contract-I so that students develop an understanding various features of contract. The subject will also help the students to develop knowledge about Indian Contract Act to understand the nature of agreements and remedies for breach of contract.

COURSE OUTCOMES

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

CO1 : Learn the basic concepts of Law of Contracts and principles of common law and how common law provisions have been adopted in the Indian Contract Act, 1872,

CO2 : Understand the vitiating factors for contract which render them void or voidable,
CO3 : Understand the nature of agreements,
CO4 : Analyze different modes of discharge of contract,
CO5 :Understand the remedies for breach of contract
CO6 :Learn the different types of E-contract

COURSE CONTENT

Fundamental Concepts & Formation of A Contract

Basic concepts of contract, offer and acceptance,certainty; intention to create legal relations, consideration, promissory estoppel, third parties

Vitiating Factors

Duress and coercion, Undue influence, Misrepresentation, Non-disclosure and fraud, Mistake

Nature Of Agreement

Quasi-contracts and contingent contracts

Discharge Of Contracts

By performance, by agreement, by breach, by frustration

Remedies For Breach Of Contract

General concept of damages, Money damages, Restitution, Specific performance and Equitable relief

Electronic Contract

How e-contracts are formulated, Basic genres of e-contract; the click wrap, the shrink wrap

Text Book

1. Anirudh Wadhwa(Ed.), Mulla The Indian Contract Act, Lexis Nexis, 2015

Reference Books

1. Anson, Law of Contract, 29th Ed., Oxford University Press, 2010
2. Pollock & Mulla, Indian Contract Act and Specific Relief Act (Vol. 1 & 2), Lexis Nexis 14th Ed., 2012.
3. The Law of Contract, Butterworths Common Law Series, 3rd Edition, 2007

INTELLECTUAL PROPERTY RIGHTS (IPR) LAW

Course Code : LW30908

Credit :3

L- T- P : 3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

Keeping the fact in mind that the present subject would be taught to the students as a general paper, the main object behind teaching this subject is to make the students understand IPR as a concept and the different forms of IPR. The course would be more of informative in nature to help the students appreciate the whole idea of protecting human labour through exclusive rights in the form of intellectual property rights and to help them to generate interest in the subject for further research.

COURSE OUTCOMES

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

CO1 :Explain the origin, development and significance of intellectual property law and its significance in commercial transactions and value addition to enterprises,

CO2 :Equip with specific technical, legal and management skills related to protection,enforcement and commercialization of the various forms of intellectual properties,

CO3 :Analyze better employability in this field of intellectual property law through skill oriented training,

CO4 :Evaluate the problem-solving skills for the topics learnt,

CO5 : Develop critical thinking to impart basic skills required in issues pertaining to intellectual property rights,

CO6 : Understand and analyze the remedies and defenses in case of Intellectual Property litigation.

COURSE CONTENT

Law Of Copyright

Introduction; Nature of Copyright; Basic features of copyright; Originality, Idea-expression dichotomy and Authorship ownership and Works in which copyright subsists

Law Of Patents

Introduction to Patent, Nature of Rights, Patentability standards - Patentable subject matter; Patent Registration; Patent term and enforcement.

Trademarks

Basic concept of trademarks; Conceptual Analysis ; Need for trademark protection; Registration of Trademarks, Registration of Trademark- who may apply? And Enforcement of Registered Trademarks.

Geographical Indications

Introduction, Geographical Indications and Trademarks, Procedure for registration of Geographical Indications; Effect of Registration; Enforcement of registration of Geographical Indications.

Designs

Definition, nature and object of granting designs ; Procedure for registration of designs; Effect of Registration; Enforcement of registration of Designs.

Text Books:

1.VK Ahuja, Law relating to Intellectual Property, Lexis Nexis, 3st ed. (2017)

Reference Books:

1. Hustin Pila, The subject matter of Intellectual Property, Oxford University Press, 1st ed. (2017)
2. Merges & Duffy, Patent Law &Policy: Cases and Materials, Lexis Nexis 5th ed. (2011)

ENVIRONMENTAL LAW

Course Code : LW30914

Credit :3

L-T-P : 3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

The basic objective is to familiarize the concept and scope of environmental law and also of its particular dominant issues so as to become a value addition in learning and to ignite academic/research interest, eventually.

COURSE OUTCOMES

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

CO1 :Understand the Jurisprudence behind the development of Environmental law and the underlying principles behind the development of such law,

CO2 : Understand the Constitutional obligations over the Government as well as the citizen in regardto improvement and protection of environment,

CO3: Understand the origin, evolution and expansion of international environmental law and will beable to identify and critically analyse international environmental law instruments,

CO4: Analyze the various environmental pollution and pollutants as provided under the National legislationvis-a-vis the international approach in defining the above,

CO5: Provide an insight on the objectives of the Environment Protection Act, the role of governmental authorities,

CO6 :Understand and analyze the legal precaution and remedies in case of Environmental hazards.

COURSE CONTENT

Introduction and Fundamental Principles of Environmental Protection

Concept of Environment – Meaning and Scope;Development v. Environment; Sustainable Development – Meaning, Definition, Object and Scope;Environmental Ethics; Inter-generational and Intra-generational Equity;Precautionary Principle, Polluter Pays Principle, Public Trust Doctrine.

Constitutional Perspective of Environmental Laws

Right to Healthy Environment & Public Interest Litigation;Fundamental Rights & Duties - Right to Wholesome Environment; Directive Principles of State Policy.

International Environmental Law

International environmental law - Nature and scope, Stockholm declaration & Rio declaration, UNFCCC & recent developments

Water Pollution and Air Pollution

The Water (Prevention and Control of Pollution) Act, 1974&The Air (Prevention and Control of Pollution) Act,1981; Water Pollution & Air Pollution –Meaning, Causes and Effects;Central and State Pollution Control Boards –Constitution, Powers and Functions;Offenses & liabilities of Companies; Future usage of alternative energy

Environmental Protection

The Environment (Protection) Act, 1986;Meaning of “Environment” and Environmental Pollutant”;Powers and Functions of the Central Government; Environmental Impact Assessment,(EIA);National Green Tribunal Act.

Text Books:

1.P. Leela Krishnan, Environmental Law in India (5th ed., 2019)

Reference Books:

1. Divan Shyam & Rosencranz Armin – Environmental Law and Policy in India, Oxford UniversityPress (2019)
2. P Leelakrishnan -- Environmental Law Case Book, Lexis Nexis ButterworthsWadhwa (2019)

COPYRIGHT LAW

Course Code : LW30918

Credit : 3

L-T-P : 3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

Copyright is a right given by the law to the creators of literary, dramatic, musical and artistic works and producers of cinematograph films and sound recordings. In the wake of technological developments and growth of digital communication, the concept of Copyright which was mainly restricted to Literary works has expanded to cover 'Neighbouring Rights' consisting of rights of performers, producers of phonograms and broadcasting organizations. The main motivation of law relating to copyright is to encourage and reward authors, composers, artists, designers, film producers and other creative people by providing protection through economic rights over their works.

COURSE OUTCOMES

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

CO1 : Explain the origin, development and significance of copyright law and its significance in commercial transactions,

CO2 : Apply preliminary policies derived from critical-analytic reasoning over selected portions of the Copyright Act, International Treaties and relevant case laws decided by National and Foreign Courts,

CO3 : Analyze better employability in this field of copyright law through skill oriented training,

CO4 :Evaluate the problem-solving skills for the topics learnt,

CO5 :Develop critical thinking to impart basic skills required in litigation involving copyright law

CO6 :Understand and analyze the remedies and defenses in case of Copyright litigation

COURSE CONTENT

Copyright and International Legal Instruments Relating to Copyright Protection

Concept of Copyright as a protection under the Intellectual Property law regime, Berne Convention for the Protection of Literary and Artistic Works, 1886, Universal Copyright Convention, 1952, Rome Convention for the Protection of Performers, Producer of Phonograms and Broadcasting Organizations, 1961: Neighbouring Rights, Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS), 1994: Background, Enforcement and Impact, WIPO Copyright Treaty, 1996, WIPO Performances and Phonograms Treaty, 1996;

Historical Development of Copyright as IPR

Development of Copyright Law in India, Development of Copyright Law in U.K., Development of Copyright Law in U.S.A, Concept of Copyright and Copyleft with respect to Copyright protection;

Subject-Matter of Copyright and Rights Conferred

Concept of Originality in U.S.A, U.K. and India, The Idea and Expression Dichotomy, Copyright in Original
and Derivative Works, Moral Rights of the Authors, Assignment, License and Registration;

Protection of Copyright in Cyberspace

Concept, Acts and Uses in the Internet and their Copyright Implications, Right of Reproduction of work on the
Internet, Liability of Internet Service Providers, Copyright in the Music Industry, Concept of Copyright Protection in U.S.A.-Digital Millennium Copyright Act: Fair Use and Safe Harbor;

Infringement And Defences of Copyright Liability

Infringement under Indian Law and tests for determining Copyright Infringement, Fair Dealing, Copyright law and Education: Concept of Copyright in Academics and Research in India;

Enforcement of Copyright

TRIPS Agreement and the Mandate on Enforcement, Judicial Remedies in India: Civil and Criminal.

Text Books:

1. P. Narayanan, Law of Copyright and Industrial Designs (4th ed. Eastern Law House, 2010)

Reference Books:

1. Melville B. Nimmer and David Nimmer, Nimmer on Copyright Law (LexisNexis, Indian reprint 2010)
2. Lal’s Commentary on The Copyright Act, 1957(4thed. Delhi Law House, 2010)

INFORMATION TECHNOLOGY LAW

Course Code : LW30920

Credit : 3

L-T-P : 3-0-0

Prerequisite : Nil

COURSE OBJECTIVE

The first and foremost object of the course is to introduce the student to the general principles of Information & Communication Technology Law and then help them in understanding the nuances and its application. In other words the chief object of the course is learning & understanding the fundamental principles of Internet Law.

COURSE OUTCOMES

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

CO1: Learn different national and international principles that are involved in regulating the jurisdiction of Cyberspace,

CO 2: Develop knowledge and understanding of the different cyber contraventions and adjudication Process,

CO 3: Understand the interface between ICT law and commercial law and practice in that it examines in detail the closed sub-set of online transactions which are clearly commercial in nature,

CO4: Develop a critical approach and will introduce students to techniques and technologies for monitoring cyber crime and the legal regulatory framework.

CO 5 : Understand the various aspects of electronic signature and digital signature,

CO6: Understand and analyze the remedies and defenses in case of cyber crimes.

COURSE CONTENT

Introduction to Cyber Law

Need and scope of cyber law, Growing concerns relating to cyberspace and cyber technology, Important definitions under Information Technology Act (IT Act), Theories of jurisdiction in cyberspace

Civil liabilities and adjudication under Information Technology Act 2000

Cyber torts and contraventions, Adjudication under the Information Technology Act 2000, Judicial and Quasi-Judicial bodies under IT Act, Dispute Resolution under IT Act

Cyber Crimes

Introduction to Cyber Crimes, Cyber Crimes vs. Conventional Crime. Classification of Cyber Crimes, Cyber Crimes under IT Act- Sec 65- Tampering with the Source Code, Sec

66- Computer related crimes , Sec 67,67A & 67 B- Pornography , Sec 69- Decryption of Information, Sec 70- Protected System, Cyber Crimes not listed under IT Act- Hacking, Email Spoofing and Email bombing, Online Defamation, Cyber Stalking, Phishing, Viruses , Denial of service attacks

Regulation of E-Commerce

Legal recognition of electronic records under IT Act, , Validity of digital contracts

Electronic Signature and Digital Signature

Electronic Signatures, Cryptography, Public and Private Key, Verification of Digital Signature, Public Key Infrastructure, Electronic Signature and Information Technology Act, 2000.

E-Governance

Components of E Governance, Types of interactions in E Governance (Interactive Models like G2G, G2B, G2C), Benefits of E Governance, E Governance challenges specific to India, Legal Frame work for E Governance under IT Act,2000, Various E-Governance Projects in India

Text Book:

1. Sharma, Universal Law Publishing , An imprint of Lexis Nexis; Fifth edition (1 November 2016)

Reference Books:

1. Information Technology Law and Practice- Cyber Laws and Laws Relating to E-Commerce by Vakul

OPEN ELECTIVE COURSE OFFERD BY SCHOOL OF PUBLIC HEALTH

HEALTH AND WELLBEING

Course code : PE10002

Credit : 3

L T P :3 0 0

Prerequisite : NIL

COURSE OBJECTIVE

The course is designed for non-health science students to sensitize them about health and well-being which is very important to lead a socially and economically productive life. The course will help the student to assess their own health and well-being status as well as those of others.

COURSE OUTCOMES

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

CO1 : Recognize concepts of health, disease and wellbeing,

CO2 : Differentiate between health and wellbeing,

CO3 : Analyze the factors affecting health and wellbeing,

CO4 : Identify tools for measurement of wellbeing,

CO5 : Apply the tools to measure their wellbeing,

CO6 : Design an intervention to ensure their health and Wellbeing.

COURSE CONTENT

Concept of Health, Disease & Wellbeing

Definition of health, disease & wellbeing; evolving concepts and dimensions of health, Individual health vs community health, Community Diagnosis, Health and well-being of the vulnerable

Factors Affecting Health & Well-being

Social & behavioral determinants of health & wellbeing; vicious cycle of disease & poverty, enabling environment for health, Role of the health system and health services in ensuring health & wellbeing

Approaches to Positive Health and Wellbeing

Theoretical models of health promotion and their relationship with the concept of wellbeing, Health Behavior Change models to understand and improve the health and well-being of people, Importance of mental health & wellbeing

Measurements of Health, Disease, and Wellbeing

Morbidity, mortality, health-status assessment (incidence, prevalence, cumulative incidence, incidence rate), Newer measures of health and disease: QALY, DALY, HYL etc., Vital health indicators at the population level (Life expectancy, CBR, CDR, IMR, MMR, CPR, etc), Measures of functioning (physical, cognitive, emotional, and social), Concept of social capital, measures of satisfaction with Life: Satisfaction With Life Scale (SWLS)

Text Book:

1. K Park, Text of Preventive and Social Medicine, M/s. Banarsidas Bhanot, 27th Edition, 2023.

OPEN ELECTIVE COURSE OFFERD BY SCHOOL OF RURAL MANAGEMENT

SUSTAINABLE RURAL DEVELOPMENT

Course Code : RM30152

Credits : 3

L T P : 3 0 0

Prerequisite : NIL

COURSE OBJECTIVE

Sustainability has become an important aspect of our lives in the wider context of the United Nations' Sustainable Development Goals (SDGs). This course aims to provide the participants knowledge on how the rural communities can achieve sustainable form of development. Apart from discussing about the various concepts related to sustainable development of rural areas and three pillars of sustainability such as society, environment and economy, the course will also focus on building multi-stakeholder partnerships to achieve sustainable rural development. The Sustainable Development Goals 3, 4, 5, 6, 7, 8, 9, 12, 15, 16 and 17 are integrated in the course.

COURSE OUTCOMES

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

CO1 : Understand on the need for sustainability in the rural areas,

CO2 : Understand the relevance of social aspects of sustainable rural development,

CO3 : Appreciate the importance of economic dimensions of sustainable rural development,

CO4 : Comprehend the relationship between environment and other dimensions,

CO5 : Attain skills to build multi-stakeholders partnerships for sustainable rural development,

CO6 **:** Draw up a plan for achieving sustainable development in rural areas.

COURSE CONTENT

Understanding sustainable development: Concepts of rural, development, rural development, integrated rural development, sustainable development, equitable and inclusive development, sustainable rural development and three pillars of sustainability-social, environmental and economic dimensions, possibilities and hindrances towards sustainable rural development and Sustainable Development Goals (SDGs)

Equitable and sustainable rural social development: Crosscutting issues such as rural poverty, its causes, dimensions and reduction, ethnicity, gender, quality education, health care and social services, people's participation for sustainable rural development, building the ability of households and communities to consistently meet the basic needs, social inclusion and inclusive development, people centered development, women and youth empowerment, Human Development Index (HDI), Human Poverty Index (HPI) and Gender Development Index (GDI)

Economy and sustainable rural development: Full and sustainable employment of rural population, improved quality of life, definition and meaning of rural livelihoods, sustainable rural livelihoods framework, financial security of individuals, building financial assets and sustaining adequate income throughout the life-span, concepts of rural nonfarm-off farm, role of off farm and non-farm in rural development, development of local Small and Medium Enterprises (SMEs) as a means to industrialize the rural areas and building a local economic system of agro-industrial integration

Environment and sustainable rural development: Sustainable agricultural systems, optimizing agricultural and non-farm sector production, environmentally harmonious/judicious use and sustainable management of land, water, forest, air and other natural resources, fair and transparent natural resources governance, restoration and conservation of natural ecosystems, environmentally sustainable technologies covering renewable energy, energy efficient technologies, sustainable waste management and biomass conversion

Partnerships for sustainable rural development

Community participation, community action, community mobilization, collaboration and partnership between various community networks such as Self Help Groups (SHGs), Community Based Organizations (CBOs), voluntary organizations, Panchayati Raj Institutions (PRIs), rural cooperatives, farmer producer organizations, youth clubs and women organizations to plan and participate in implementing sustainable rural development programmes, implement and contribute for policy making for sustainable rural development

Reading Materials

1. A set of reading materials from various text books/research articles to be compiled

FOOD SECURITY

Course code : RM20152

Credits : 3

L T P : 3 0 0

Prerequisite : **NIL**

COURSE OBJECTIVE

The major objective of the course is to understand the causes, consequences of food insecurity and learn how local communities, governments and international institutions have been combating food insecurity and hunger. The other objectives of the course are to enlighten the participants on what they can undertake as individuals, decision and policy makers to ensure food security.

COURSE OUTCOMES

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

CO1: Have a systematic understanding on various concepts and discussions related to food security from multiple perspectives,

CO2 : Demonstrate a critical awareness of the local, regional, national and global challenges encompassing social, political, global and economical contexts related to achieving food security,

CO3: Exhibit a wide-ranging understanding on the global strategies to overcome food insecurity,

CO4: Comprehend the food (in)security in the Indian context ,

CO5 : Critically analyze the India's policies and programmes to address food security,

CO6 : Capable of assessing the food security status of individuals, households, local areas, and regions, countries and world and develop solutions to address food insecurity.

COURSE CONTENT

Concepts of Food Security

Food security and hunger in a global perspective, concepts of food and nutritional security, human right to food and adequate nutrition, food security and diet as a means of achieving global health targets, definition of food insecurity and its types-chronic and transitory food insecurity, four dimensions of food security - food availability and accessibility.

Challenges in Achieving Global Food Security

Uneven distribution of food and other basic resources in the world, sustainability of food production and consumption, competing uses – bio-fuels' competition for land, water and energy resources and implication for food security, co-existence of genetically modified food, organic and conventional food crops and food security; complex emergencies, disasters, Covid-19, conflicts, protracted crises, gender and racial/ethnical inequality,poverty and food security; food insecure sections in vulnerable situations, limited food resources, increasing world population, growing world food demands, liberalization of food markets, international trading, climate change and the food security systems.

Global Strategies to Overcome Food Insecurity and Hunger

Alternative methods to achieve food security, elimination of food waste at all levels, globalization of food supply, global movements for food justice, delivering food subsidy, public and private sector's roles in food production, regulation and supply, multidimensional nutrition programs, FAO food security policies, community, household and family food insecurity coping strategies, adaptive responses of food security systems for climate change, global early warning and emergency food monitoring and management systems

Food Security in the Indian Context

Availability and accessibility of food in India, post-Green revolution status of food security, lack of access to food in India, hunger and starvation deaths, data on per capita daily supply of calories, child malnutrition, undernourished, anemic, India's status on Global Hunger Index and Global Food Security Index, NFHS data and heat maps, provisions related to right to food in Indian Constitution, impact of Covid-19 on food supply chains and food security

India's Policies and Programmes to Eliminate Hunger and Food Insecurity

Food security systems in India, Food for Work, Integrated Child Development Services (ICDS) Schemes, Mid-Day Meal Scheme (MDMS), Public Distribution System (PDS), Targeted Public Distribution System (TPDS), Pradhan Mantri Garib Kalyan Anna Yojana (PMGKAY) and the Pradhan Mantri Poshan Shakti Nirman Yojana (PM POSHAN Scheme), diversifying PDS food basket, *Aadhaar* biometric identification system for food security, *AntyodayaAnna Yojana* (AAY) to reduce hunger among the poorest, National Food Security

Mission, Right to Food Legislation in India, National Food Security Act, (NFSA) 2013, its norms and salient features, priority households (PHHs), promotion of fortified food products, millets for food security and nutrition, State Food Commissions, obligations of Central, State and Local governments for food security and role of cooperatives in India's food security.

Text Book

1. A set of reading materials from various text books/research articles to be compiled

Reference Books

1. CFS, Coming to Terms with Terminology. Food Security. Nutrition Security. Food Security and Nutrition. Food and Nutrition Security, CFS document 2012/39/4, http://www.fao.org/docrep/meeting/026/MD776E.pdf
2. Drèze, J. et al. 2016, "Food Security Act: How are India's poorest states faring?", Ideas for India, https://www.ideasforindia.in/topics/governance/food-security-act-how-are-indias-poorest-states-faring.html
3. FAO, IFAD, UNICEF, WFP and WHO, In Brief to The State of Food Security and Nutrition in the World 2022. Transforming food systems for food security, improved nutrition and affordable healthy diets for all, Rome, FAO, https://www.fao.org/3/cc0639en/cc0639en.pdf
4. Global Network for the Right to Food and Nutrition, State of the Right to Food and Nutrition Report 2021, July 2021, https://www.fian.org/files/files/20210719_State-RtFN-Report_2021_ENG_v15.pdf
5. Ipe, BT, Shubham S and Satyasai KJS (2022), Food and Nutritional Security in India, Charting the way to a robust agri-food system, Department of Economic Analysis and Research, NABARD Research Study–35, November 2022
6. Second International Conference on Nutrition (2014), Outcome Document, Rome Declaration on Nutrition. Rome, 19-21 http://www.fao.org/3/a-ml542e.pdf

OPEN ELECTIVE COURSE OFFERD BY SCHOOL OF MANAGEMENT

TRAINING AND DEVELOPMENT

Subject Code :BM30102

Credit : 3

L-T-P : 3-0-0

Prerequisite :Nil

COURSE OBJECTIVE

Students must understand the inevitability of training. The elective shall focus on the importance of an effective training needs assessment to plan training more effectively. At the end of the session, the student shall be able to link Strategy and T&D. The different kinds of training methods are covered in this course. In the present competitive and dynamic environment, it has become essential for organizations to build and sustain competencies that would provide them sustainable competitive advantage. Dynamic and growth-oriented organizations recognize training as an important aspect of managerial function in a rapidly changing economic and social environment. Training is a process which enhances and develops his/her capabilities and effectiveness at work. After studying this, one will be able to understand new training techniques and how training is evaluated**.**

COURSE OUTCOMES

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

CO1: Remember the importance of training,

CO2: Understand the nature, concept, difference between training and other related concepts,

CO3: Apply knowledge to understand the importance of training and its link with strategy,

CO4: Analyze the various industry training and development practices,

CO5: Evaluate the various industry training and development practices and identify the most effective methods aligned with the situation,

CO6: Develop the ability to evaluate the effectiveness of training.

COURSE CONTENT

Introduction to Training & Development
Relevance of Training To Organizations
Training & Competitive Advantage
Linking Training to Business Goals
Learning and theories of learning
Training Need Identification:- Assessing Current & Future Training Needs
Methods & techniques of delivering training inputs
Roles & competencies of trainer
Training design
Transfer of Training
Training Evaluation

Text Book

1. Raymond A Noe and Amitabh Doe Kodwani,Employee Training & Development Need,McGraw Hill Publication, Latest Edition.

Reference Books

1. Blanchard &James,Effective Training,Pearson Publication,3rd Edition.
2. Devendra Agochiya,Every Trainers Hand Book,Sage Publication,2nd Edition, 2009, ISBN:978-8132100812.
3. Dr. B Janakiram, Training & Development, Biztantra, Latest Edition.

FINANCIAL MANAGEMENT

Subject code : BM30202
Credit : 3

L-T-P : 3-0-0

Prerequisite :NIL

COURSE OBJECTIVE

Financial management I is an introductory course in finance area. This course includes the basic concepts of finance like the first principles, financial environment, time value of money, risk and return, investment evaluation estimated, etc. The other topics are covered in Financial Management II in the next semester.

COURSE OUTCOMES

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

CO1: Remember and comprehend importance of leverage in finance,

CO2: Understand long term investment evaluation techniques,

CO3: Apply principles of finance and how they work,

CO4: Analyze the worth of time value of money in financial decision making,

CO5: Evaluate the risk and return perspective in finance,

CO6: Delve deep into financial decisions after an overview of the financial environment.

COURSE CONTENT

Introduction to Finance and Financial Management: Financial management functions; role of a CFO, Wealth Vs Profit maximization principles; agency theory.

Financial System: Overview of Indian Financial System – Financial Intermediaries, Financial Markets, Financial Instruments and Regulators of the Financial System.

Time value of money: Importance of Time value of money in financial decision making; Present value, Future value, Annuity estimations using excel; Loan amortization using excel.

Risk and Return: Concept of Risk and Return; Measurement of historical and expected return; Measurement of risk; Portfolio risk and return.

Long-term Investment Decision: Capital budgeting concepts; Methods of investment evaluation – NPV, IRR, BCR and other methods.

Cost of Capital Estimation: Cost of capital concepts; measurement of component costs, cost of capital – WACC estimation

Leverage: Operating and Financial leverage; Combined leverage; EBIT – EPS relationship

Textbook

1. M Pandey, Financial Management,Vikas Publication, 11th Edition, 2016, ISBN: 978-9325982291.

Reference Books

1. Damodaran, Corporate Finance: Theory and Practice, Wiley Publication, Latest edition.
2. Brealey, Myers and Allan, Principles of Corporate Finance, McGraw Hill Publication, 11th Edition, 2017, ISBN: 978-9332902701.
3. Dr. R P Rustagi,Fundamentals of Financial Management,Taxmann Publication, 18th Edition, 2023, ISBN: 978-9357780810.

MARKETING MANAGEMENT

Subject code : BM30302
Credit : 3

L-T-P : 3-0-0

Prerequisite :NIL

COURSE OBJECTIVE

The course would provide an understanding of the basic concepts, philosophies, processes and techniques of managing marketing operations of the organization with a greater emphasis on the process of value creation for customers.

COURSE OUTCOMES

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

CO1: Define Marketing and remember the core concepts of marketing,

CO2: Understand markets,

CO3: Apply the strategic frameworks in developing a marketing plan,

CO4: Analyze consumer buying behavior,

CO5: Evaluate the theories of consumer behavior in real life marketing, using analytics to uncover such behaviors,

CO6: Craft the marketing positioning based on Segmentation and Targeting.

COURSE CONTENT

Introduction to Marketing: Why Marketing? Objectives and Definitions of marketing, Orientations to the market – Concepts, , Fundamental Marketing concepts: Needs, Wants, Demand, and other essential fundamental concepts, The Marketing Mix elements, Decision making – SWOT and BCG matrix

Marketing Environment: Macro Environment - components, Micro Environment – components, Differences between the two. Importance of environment scanning.

Consumer Buying Behavior: Consumer decision Processes - What influences Consumer Behavior? Key Psychological Processes, Buying roles, Consumer decision making Process, Business Market vs. Consumer Market, Stages in Buying Process

Introduction to Marketing Research: Why Marketing Research? Types of MR, Quantitative and qualitative, The Marketing Research process

Segmentation, Targeting, Positioning: Levels of Segmentation, Basis for Segmentation and methods, Segmentation Criteria and evaluation of Segments, Selection of Target Segment, Product differentiation, Differentiation strategies, Positioning stances, positioning strategies

Contemporary Issues in Marketing: New trends in marketing, Consumerism, Rural Marketing, Social Marketing, Digital Marketing, Green Marketing

Text Book

1. Kotler, Armstrong, Agnihotri, and Haque, Principles of Marketing, Pearson Publication, Latest Edition.

Reference Books

1. Kotler, Philip, Keller, Kevin Lane, Koshy, Abraham, Mithileshwar, Jha, M M – A South Asian Perspective, Pearson Publication, Latest edition.
2. Paul Bains, ChirsFill, Kelly Page & Piyush K. Sinha, Marketing, Oxford University Press, 1st Edition, 2013, ISBN:978-0198079446.

BASICS OF MANAGEMENT INFORMATION SYSTEM

Subject code : BM30602
Credit : 3

L-T-P : 3-0-0

Prerequisite : NIL

COURSE OBJECTIVE

Students should have hands-on experience to students in using computers for data organization and addressing business needs.

COURSE OUTCOMES

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

CO1: Remember the types of IS and basic concepts,

CO2: Understand the application of various IS in business domains,
CO3: Apply the principles of financing,

CO4: Analyze how firm decides between debt and equity, dividend payments,

CO5: Evaluate the tactical usage of IS in particular,
CO6: Develop an ability to understand application of Integrated enterprise systems.

COURSE CONTENT

The Information Age:
Purpose of IS, Types of IS, IS in Business function, Career in IS

Strategic Uses of Information Systems:
Jet Blue Success Story and Ford on the Web Failure Story Summary:

Business Function& Supply Chains:
Effectiveness and efficiency, Accounting, Finance, Engineering, SCM, CRM, ERP

IT in Business:
Business Hardware, Business software, Business Networks and Telecommunications, Business Data Bases

Types of IS:
TPS, MIS, EIS and ERP, Web Enabled Commerce, Challenges of Global, SDLC, Case Study and Test on Indian IS Cases, Open Sources, Outsourcing Basics. Expert System and DSS

Risk Management, Security and Disaster Recovery

Textbook

1. Effy Oz, Management Information Systems, Cengage Publication, Latest Edition.

Reference Books

1. Murthy.C,S,V, Management Information Systems, Himalaya Publication, Latest edition, ISBN:978-8184882759.
2. Laudon and Laudon, Management Information Systems, Pearson Publication, Latest Edition, ISBN:978-9352865475.

ENTREPRENEURSHIP

Subject code : BM30702
Credit : 3

L-T-P : 3-0-0

Prerequisite : NIL

COURSE OBJECTIVE

Entrepreneurship has been the engine of economic growth and prosperity in any society. The entrepreneur transforms resources to useful and valuable products, services and solutions. S/he does so by sensing opportunities and seizing opportunities while transforming assets. Considering significance of entrepreneurship for the economy and society, large companies besides governments and Universities are promoting entrepreneurship. This is often known as Intrapreneurship. In fact, all early management education was centered around creating and supporting entrepreneurs. It is therefore essential for all management graduates to learn entrepreneurship.

COURSE OUTCOMES

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

CO1: Remember the basic tenets of entrepreneurship,

CO2: Understand key concepts such as opportunities, challenges, resources & capabilities, new product development, intellectual property rights, efficiency, quality, innovation and customer responsiveness,

CO3: Apply the learned concepts to sense and seize opportunities,

CO4: Analyze opportunities for key success factors and required capabilities to win in the market place,

CO5: Evaluate resource constraints &opportunities and select appropriate opportunities,

CO6: Create a business plan.

COURSE CONTENT

Self-diagnosis and Understanding Entrepreneurship: What is Entrepreneurship, Test for an affinity for entrepreneurial work, Characteristics and skills of entrepreneurs, Age of an Entrepreneurial Firm, Types of Entrepreneurs

Finding &Evaluating the opportunity: New Business Opportunity, Characteristics of genuine business opportunities, Where to look for profitable opportunities, The process of opportunity evaluation.

Intellectual Property: Trademarks, Copyright, Patents, Geographical Indication of Goods, Designs, Other IPR Laws, Trade Secrets and Confidential Information

Family Business: Family Business in India, The Founder, The Next Generation, Entry of family Members, N0n-family Members, Succession, Best Practices

Organizing the enterprise: Issues involved in Doing Business in India, The various forms of organization, Advantage & Disadvantage of each form, Determining the best form of an Organization, Legal Issues

Entrepreneurial Support: Policies, Business Incubation, Business Clusters

Buying a Business: Challenges in Buying a Business, The Search, Process of Buying, Scrutiny, valuation, negotiation, Franchising

Financing the business: Angels & Venture Capitalists, Debt Finance

Making a Business Plan and Strategy: Uses of Business Plan, Writing a Business Plan, Data Collection, Kinds of Business Plans, Importance of the Executive Summery, Description of the Business, The Management Team, The Industry and the Market, Marketing Plan, Finance, Risk and Contingencies

New Product Development: Types of New Products, New Product Development Process, The Adoption Process, Barriers to New product Development

E-Business: E-Commerce and Marketing Strategies

Text Book

1. Rajeeb Roy,Entrepreneurship,Oxford University Press Publication,2nd Edition, 2011, ISBN:978-0198072638.

Reference Books

1. Richard Luecke,Entrepreneur’s Tool Kit: Tools & Techniques to launch and grow your business,Harvard Business Review Press Publication,2004 Edition, ISBN:978-1591394365.
2. Robert D Hisrichis,Entrepreneurship,McGraw Hill Publication, 11th Edition,2020, ISBN:978-9390113309.

PRODUCTION AND OPERATIONS MANAGEMENT

Subject Code :BM30802

Credit : 3

L-T-P : 3-0-0

Prerequisite :Nil

COURSE OBJECTIVE

Students have to understand the production and operation functions and familiarize themselves with the techniques for planning and control.

COURSE OUTCOMES

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

CO1: Remember the basic concepts of production and operation functions,

CO2: Understand the principles of work method and motion study,

CO3: Apply the decision framework for deciding facility and location,

CO4: Analyze the quality dimensions and process for product and measurement processes,

CO5: Evaluate and differentiate different production systems,

CO6: Develop their ability to appreciate the materials and production planning steps.

COURSE CONTENT

Introduction to Operations Management: Concept, Input-Output Model, System view, Interface with other functional areas.

Facility & Location Layout: Facility location, Facility layout, Selection, Feasibility, Economy, Types, Design of layout.

Materials Management: Introduction – Scope, Function, Planning (MRP), Purchasing, Inventory Management, Standardization, Simplification, Material Handling – principles, Equipments, Systems.

Production Planning & Control: Aggregate Planning, Capacity planning, MPS, MRP, ERP, JIT, Scheduling, Routing

Quality Management: Concept, Strategy, Factors, Dimensions, Cost of Quality, Quality Inspection & Assurance, Quality Performance & Conformance, Quality Control – SPC, SQC, Quality Circle, TQM, ISO 9000

Motion & Time Study: Productivity, Method Study, Motion Study, Time Study, Ergonomics

Maintenance Management: Breakdown and Preventive maintenance, Total Productive maintenance (TPM)

Waste Management: Managing Disposal, Salvage & Recovery of Waste

Automation: Concept, Advantages, Disadvantages, AGVS, AS/RS

Text Book

1. S. Anil Kumar and N. Suresh, Production & Operations Management, New Age International Publication, 2nd Edition,2011,ISBN:978-8122421774.

Reference Books

1. Kaniska Bedi,Production & Operations Management,Oxford Publication,3rd Edition, 2013, ISBN:978-0198072096.
2. Everett E Adam Jr., and Ronald J Ebert,Production & Operations Management,Prentice Hall Publication,Latest Edition.
3. S. N. Chary,Production & Operations Management,McGraw-Hill Publication,6th Edition, 2019, ISBN:978-9353164812.
4. K. Ashwathappa,Production & Operations Management,Himalaya Publication,Latest Edition.

K-Xplore

(Practice Oriented Open Elective – I)

The B. Tech. curriculum provides for a 1-Credit practice-oriented Open Elective K-Xplore in Semester V to make our undergraduate engineering programme holistic, multidisciplinary, skill-based, and balanced. This course allows the students to explore the opportunity that the KIIT University offers to them to sharpen their skills in areas which excite them the most.

Offered in a self-learning mode, this subject allows the students to hone their skills in areas they are passionate about which they select from a wide spectrum of subjects in art, literature, technology, community engagement and service, health, and environment and sustainability. In addition, the students develop soft skills that are important for them in their professional life. This course, thus, allows students to explore and grow in areas outside of core academics and provides a channel for complementing the lessons learned in the classroom, offering them the opportunity to apply academic skills in a real-world context and providing a truly well-rounded education.

This course is designed on the basis of the guiding philosophy of student-centered learning where the students define problems, evaluate alternatives, design solutions, and self-learn by performing certain assigned activities with limited guidance from faculty facilitators.

Each student selects an area of his (or her) choice from a specified list of areas. All the students with choice in a particular area are assigned to one or more faculty facilitators. Faculty facilitators assign the activities and tasks necessary for the course to the students and decide the desired mode of skills training. They may decide to make small groups of students of varying group sizes to carry out the assigned activities and tasks. They also make the required facilities available to the students to enable them to carry out the assigned activities and tasks.

The timetable will earmark specific hours for the subject. But the students are expected to use their spare time (including holidays and after-lecture hours on working days) to learn the required skills and use these skills to accomplish the assigned activities and tasks. The students, however, have to meet the faculty supervisors on the specified hours every week to appraise them of their progress, clear their doubts, if any, and chart their future plan.

The Head of KIIT Student Activity Centre (KSAC) will coordinate offering of the course.

COURSE OUTCOMES

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

CO1 : Develop the needed technical skills in their chosen fields of interest,

CO2 : Develop higher levels of self-confidence and soft skills such as communication, writing, discussion and debate, time-management, and leadership skills,

CO3 : Apply the learned skills to give shape to their passionate ideas,

CO4 : Develop Innovation and entrepreneurial mindset,

CO5 : Analyze and judge a problem situation for deploying the learnt knowledge and skills and develop problem solving strategies,

CO6 : Build new products and services using the learned knowledge and skills.

ROBOTICS

Course Code : SA38001
Credit : 1
L-T-P : 0-0 -2
Prerequisite :Nil

COURSE OBJECTIVE

To assist students develop the knowledge of robotics and circuitry, build circuits, bots and robots, and participate in different Robotics events such as Robo Wars.

WEB DESIGNING

Subject Code : SA38003
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To help a student learn and develop front-end and back-end web development skills and create websites.

CIVIL-TECH

Subject Code : SA38005
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To make a student ready to plan and design selected aspects of real life construction projects with relation to environment, transport & connectivity, water resource engineering & soil exploration and gain pre-, present-, and post- construction experience.

CIRCUIT DESIGN & CONTROL

Course Code : SA38007
Credit: :1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To let the students learn the required skills to design and develop electrical circuits and implement controllers for use in robotics, automation, voice recognition, gesture recognition, etc.

INDIAN CLASSICAL, FOLK & BOLLYWOOD DANCE

Course Code : SA38009
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To encourage and boost the confidence of the students to choreograph and perform in classical, semi classical / folk and bollywood dance forms.

INDIAN CLASSICAL & WESTERN MUSIC

Course Code : SA38011
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To give confidence to the students to participate and perform as a vocalist and/or instrumentalist in different forms of Indian classical and western music.

GRAPHIC DESIGNING & EDITING

Course Code : SA38013
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To nurture the students' skills in creative designing, photo and video editing activities, and digital sketching and painting, using Designing & Editing software such as Photoshop, Illustrator and video editing software.

ART & CRAFT

Course Code : SA38015
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To endow the students with the skills to do various types of painting such as portrait painting, landscape painting, abstract painting, pencil sketching, and doodling and craft, using various Painting and Sketching tools.

THEATRE & STREET PLAY

Course Code : SA38017
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To give students the confidence to perform in Theatres, Nukkad, Mono Acts and skits based on written scripts.

FILM MAKING

Course Code : SA38019
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To impart skills for film making in areas such as cinematography, script writing, audio recording, and editing.

DEBATING, PUBLIC SPEAKING & ANCHORING

Course Code : SA38021
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To develop the students' skills for performing oratory activities such as extempore speech, debate, poetry reading, open topic speech, public speaking, interviewing, open dialogue, anchoring, and presentation.

CREATIVE WRITING

Course Code : SA38023
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil
COURSE OBJECTIVE

To develop the students' skills in creative writing, content writing, article writing, and poem composition.

PHOTOGRAPHY & VIDEOGRAPHY

Course Code : SA38025
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To provide the technical knowledge required to create photos and videos that tell a story or capture a real-world occurrence.

FASHION STYLING

Course Code : SA38027
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To impart the basic skills of costume design, styling, grooming, and presentation relevant to a specified theme.

CULINARY ARTS

Course Code : SA38029
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To help the students learn the skills of cooking, knowing ingredients, and preparing cuisines of Pan India and 65 countries

QUIZ ACTIVITY

Course Code : SA38031
Credit : 1
L-T –P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To give the students the confidence to participate in, and conduct, various forms of quiz, such as Technical Quiz and Business Quiz.

SOCIAL OUTREACH

Course Code : SA38033
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To sensitize the students on the social issues and giving them an opportunity to connect with the community and the environment through outreach activities, community projects, and volunteering.

HEALTH & EMERGENCY CARE

Course Code : SA38035
Credit : 1
L-T-P : 0-0-2
Prerequisite :Nil

COURSE OBJECTIVE

To let the students learn about health issues, basic Life-saving skills and participate in health awareness and sensitization programs.

VOCATIONAL ELECTIVES

Vocational Courses Offered by School of Civil Engineering

BUILDING DRAWING, ESTIMATION & COSTING

Course Code :CE28001

Credi : 1

L-T-P : 0-0-2

Prerequisite :Nil

COURSE OBJECTIVE

This subject is designed to enrich the basic knowledge of engineering students to develop building drawings. The subject will also give students exposure about quantity estimation and costing of the building.

COURSE OUTCOMES

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

CO1: Prepare the layout plan, elevation of building

CO2: Understand the building drawings and details

CO3: Learn the basic concept of estimation and its application in real construction projects.

CO4: Analyze the rates of individual items for the preparation of the estimates.

CO5: Prepare schedule of quantities required to be attached with the tender documents.

CO6: Develop critical thinking ability to optimize the building construction cost.

COURSE CONTENT

Building Drawing:

Construction Standards and drawing techniques in projects. Introduction to basic principles of Computer-Aided Design (CAD), Orthographic projection including sectional views of buildings and parts of buildings and building details, e.g. foundations, walls (including openings), jambs, sills, lintels and arches, floors and roofs, doors and windows, simple stairs. Preparation of simple working drawings and details from free-hand sketches.

Estimation:

Estimation, units, item work, different kinds of estimates, different methods of estimation, estimation of materials in building, with different sections of walls, foundation. Bar Bending Schedule, Estimation of finishing works.

Specification of Works:

Necessity of specification types of specification, general specification, specification of bricks, cement, sand, reinforcement, detailed specification for earthwork, cement, concrete, brickwork, flooring, D.P.C, R.C.C, cement plastering, white and colour washing, distempering, painting.

Rate analysis:

Procedure of rate analysis for items - Earth work, concrete works, R.C.C works, reinforced brick work, plastering.

Text Book(s):

1. B. N. Dutta, Estimating and Costing in Civil Engineering – Theory & Practice, CBS Publishers & Distributors Pvt Ltd, 28th Edition, 2020.
2. M. Chakraborty, Estimating & Costing, Specification and Valuation in Civil Engineering, Chakraborty, 29th Edition, 2006, ISBN-10: 818530436X.

Reference Book(s):

1. B. S. Patil, Civil Engineering Contracts and Estimates, Universities Press, 3rd Edition 2006, ISBN-10: 8173715599.

GIS & GPS APPLICATIONS

Course Code :CE28003

Credit :1

L T P : 0 0 2

Prerequisite :Nil

COURSE OBJECTIVE

The objective of the course is to understand the GIS principles, applications, preparation of study maps, creation of interpolation maps, delineation of watershed, explain the functions of GPS and operation of GPS.

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO1: explain the fundamentals of GIS
CO2: understand the operations of ArcGIS tools and prepare the layout of study area
CO3: create interpolation maps
CO4: delineate watershed using ArcGIS
CO5: describe the principles and functions of GPS
CO6: operate GPS in the field for navigation

COURSE CONTENT

- Overview of Geographic Information System (GIS)
- Familiarization to ArcGIS Interface
- Layout of study area
- Preparation of interpolation map
- Watershed delineation
- Remote sensing satellites
- Basics of Global position system
- Basic operations of GPS Handset
- GPS field surveying and data processing

Reference Books

1. Principles of geographical information systems by P.A. Burrough and R. A. McDonnell, Oxford University Press, UK.
2. Geographic information systems and science by M.F. Goodchild, P.A. Longley, D.J. Maguire and D.W. Rhind, John Wiley & Sons Ltd., England.

3. Global Positioning system: Principles and Applications by SatheeshGopi, McGraw Hill Education.

Vocational Courses Offered by School of Computer Science Engineering

WEB DESIGN

Course code :CS28001

Credit : 1

L-T-P :0-0-2

Prerequisite : Nil

COURSE OBJECTIVE

Web design and programming is a large field, with different types of technologies implemented by different tools. HTML, CSS, and JavaScript are known to be the three pillars of client-side web programming. After finishing this course, a student should be prepared to write nicely formatted, interactive web pages, with no dependencies on server-side technologies.

COURSE OUTCOMES

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

CO1: Understand the basics of web page design.

CO2: Use formatting instructions of HTML.

CO3: Apply the style formats using CSS.

CO4: Write basic scripts using JavaScript.

CO5: Apply DOM in web pages.

CO6: Create dynamic web pages using HTML and JavaScript.

COURSE CONTENT

HTML Fundamentals

HTML: Structure of a program, various tags and their roles in HTML programs, Lists: ordered, unordered, definition, Table

More with HTML

Form design,Frames, link and it’s types, Images

CSS Essentials

Style sheets: Inline, Internal, External

JavaScript Basics

Introduction, characteristics, Variables, Data types, Type casting and conversion Functions. Primitives, operators, Control statements, Array, Function, Function – Parameter Passing and dynamic argument and return statement

More with JavaScript

DOM - browser, window, document, image and form object, Properties and Methods of different objects, Predefined Java Script Object - Array, String and Date Object and their methods, Event handling – Link, Body, Image and events associated with different HTML tags

Text Book:

1. MASTERING HTML, CSS & Java Script Web Publishing, Laura Lemay, Rafe Colburn and Jennifer Kyrnin, BPB Publications.

Reference Books:

1. HTML, CSS and JavaScript All in One, Sams Teach Yourself, Julie C. Meloni and Jennifer Kyrnin, Pearson Education.
2. HTML 5 Black Book, DT Editorial Services, Dreamtech Press.

Vocational Courses Offered by School of Electrical Engineering

INDUSTRIAL WIRING AND CONTROL PANEL DESIGN

Course Code	:	**EE28011**
Credit	:	**1**
L-T-P		**:0-0-2**
Pre-requisites	:	**NIL**

COURSE OBJECTIVE

This vocational course will provide an overview of electrical occupations, including the training and the employment options available in electrical industry. It is also designed to provide related training in the electrical trade that will give students the proper coursework in installation and designing of control panel.

COURSE OUTCOMES

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

CO1 : Realize the purpose and general principles of control components and circuits

CO2: Install Industrial wiring circuits according to given specification and plan.

CO3: Analyze circuit operations on basic motors.(3ø induction Motor)

CO4: Interpret and install circuits according to rules and regulations of the National Electrical Code book.

CO5: Connect motor controllers for specific applications with emphasis on safety practices and in accordance with National Electrical Code (NEC) requirements.

CO6: Select and size contactors, relays and timing relays and overload relays both physically and schematically and describe their operating principles.

COURSE CONTENT

Hands on Practice:

1. Design multiwire circuit for a direct motor starter (DoL) with one operating (forward) direction using QElectrotech software.
2. Design multiwire circuit for a direct motor starter (DoL) with two operating (forward &reverse) direction using QElectrotech software.
3. Design multiwire circuit for a Star – Delta motor stator with one operating (forward) direction using QElectrotech software.
4. Design multiwire circuit for a Star – Delta motor stator with two operating (forward

&reverse) direction using QElectrotech software.

5. Design &connect for a direct motor starter (DoL) with one operating (forward) direction in modular set up .
6. Design &connect for a direct motor starter (DoL) with two operating (forward & reverse) direction in modular set up .
7. Design &connect for a Star – Delta motor stator with one operating (forward) direction in modular set up.
8. Design &connect for a Star – Delta motor stator with two operating (forward& reverse) direction in modular set up.
9. Install & wire for a direct motor starter (DoL) with one operating (forward) direction in Industrial Control Panel.
10. Install & wire for a direct motor starter (DoL) with two operating (forward & reverse) direction in Industrial Control Panel.
11. Install & wire for a Star – Delta motor stator with one operating (forward) direction in Industrial Control Panel.
12. Install & wire for a Star – Delta motor stator with two operating (forward &reverse) direction in Industrial Control Panel.

Reference Book:

1. Installation, commissioning and maintenance of electrical equipment by Tarlok Singh.
2. Industrial Electrical Systems by B. P. PATIL and M. A. CHAUDHARI

INSTALLATION, OPERATION AND MAINTENANCE OF SOLAR POWER SYSTEM

Course Code	**:**	**EE28013**
Credits	**:**	**1**
L-T-P	**:**	**0- 0- 2**
Pre-requisites	**:**	**NIL**

COURSE OBJECTIVE

To impart job-oriented training to students and make them well convergent on Installation, operation & maintenance of solar PV system. This vocational course is based on study of solar photovoltaic (PV) cells, modules, and system components; electrical circuits; PV system design and sizing for use on homes, commercial building etc., understanding energy conversion from sunlight to electricity, and working with solar conversion equipment. This Course will give students the book knowledge and hands on experience needed to become entrepreneur / self-employed.

COURSE OUTCOMES

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

CO1: Demonstrate and apply the knowledge of solar electric systems terms and concepts

CO2: Size and design a photo voltaic system.

CO3: Mount, ground, position, install, wire and connect a photo voltaic system.

CO4: Test voltage generated by photo voltaic system.
CO5: To learn different types of solar PV modules and batteries used in solar PV plant
CO6: Design of solar PV plant based on estimated loads.

COURSE CONTENT

Designing of solar panel and installation

1. Homer
2. PVSYST
3. Helioscope

Hands on Practice:

1. Demonstrate the I-V and P-V Characteristics of PV module with varying radiation and temperature level.
2. Demonstrate the I-V and P-V characteristics of series and parallel combination of PV modules.
3. Show the effect of variation in tilt angle on PV module power.
4. Demonstrate the effect of shading on module output power.
5. Demonstrate the working of diode as bypass diode and blocking diode.
6. Draw the charging and discharging characteristics of battery.
7. Observe the output waveform of the inverter in auto mode.
8. Workout power flow calculations of standalone PV system of AC load with battery.
9. Workout power flow calculations of standalone PV system of DC load with battery.
10. Find the MPP manually by varying the resistive load across the PV panel.

Reference Book:

1. Solar Photo Voltaic Technology and Systems by Chetan Singh Solanki
2. Non-Conventional Energy Resources by B.H.Khan.
3. Solar Energy - Principles of Thermal Collection and Storage by P.Sukhatme.
4. Solar Energy: Fundamentals, Design, Modelling and Applications by G.N.Tiwari.

DOMESTIC WIRING AND HOME AUTOMATION

Course Code	**:**	**EE28015**
Credit	**:**	**1**
L-T-P	**:**	**0- 0-2**
Pre-requisites	**:**	**NIL**

COURSE OBJECTIVE

This vocational course will provide an overview of electrical occupations, including the training and the employment options available in electrical consultancy. It is also designed to provide related training in the electrical wing that will give students the proper coursework in installation and designing of domestic wiring and home automation.

To develop electrical wiring skills in students through systematic training that would enable the students to construct and test various electrical circuits using appropriate electrician tools, wires, protective devices and wiring accessories as per IS standards.

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO1:Use appropriate electrician tools, wires, protective devices and wiring accessories
CO2:Rig up wiring diagrams using conduit system of wiring.
CO3:Apply IS standards for electrical wiring
CO4:Prepare different types of wiring joints.
CO5:Well convergent in drawing electrical wiring circuit.
CO6. Enhancement of knowledge regarding specification and application of different electrical devices.
Domestic wiring and Home Automation, QElectrotech software.

COURSE CONTENT

Hands on Practice:

1. Perform the assembly, wiring and implementation of a single switch (SPST Switch) in circuit.
2. Perform the assembly, wiring and implementation of a Double switch (SPST Switch) in circuit.
3. Perform the assembly, wiring and implementation of a power socket in circuit.
4. Perform the assembly, wiring and implementation of a controlled power socket circuit in housing.
5. Perform the assembly, wiringand implementation of a two ways switches (SPDT Switch) in circuit.
6. Perform the assembly, wiring and implementation of a impulse relay in circuit.
7. Perform the assembly, wiring and implementation of a time switch in circuit
8. Perform the assembly, the wiring and the implementation of a timer lighting in circuit.
9. Perform the assembly, the wiring and the implementation of a twilight switch in circuit in house or in a shop.
10. .Perform the assembly, wiring and implementation of a controlled lighting in circuit (time switch, timer, twilight switch).
11. Perform the assembly, the wiring and the implementation of a water heater in circuit.
12. Perform the assembly, wiring and implementation of a central impulse relay in circuit.
13. Study and implementation of Light sensitive switch.
14. Perform the assembly, wiring and implementation of a fan in circuit.
15. Perform the assembly, wiring and implementation of a distribution panel.
16. Home automation using KNX technology.
17. Application of Load shedding contactor and programmable time switch.

Reference Book:

1. Home Automation - A Smart Home Guide: The Beginner's Manual Including Google Home, Echo Dot and Amazon Alexa. Easy Instructions, Directions and Commands ... and Home Automation Guide Series Book 1) Kindle Edition
2. Home Automation and Wiring by James Gerhart

CYBER PHYSICS APPLICATION IN INDUSTRIAL IOT

Course Code	:	**EE28017**
Credits	:	**1**
L-T-P	:	**0-0-2**
Pre-requisites	:	**NIL**

COURSE OBJECTIVE

The students will utilize the principles of Cyber-Physical Systems (CPS) and Internet of Things (IoT) to develop applications, implement IoT applications by selecting appropriate hardware and software platform and also Develop IoT applications using open-source platforms.

COURSE OUTCOMES

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

CO1 : Basics of cyber physics components
CO2: Understanding of sensors and actuators
CO3: Layout diagram of open source microcontroller board
CO4: Understanding of analog and digital I/O for cyber-physics
CO5: Understanding of different protocols for IoT connectivity
CO6: Basic architecture for IoT enabled Cyber Physics

COURSE CONTENT

Cyber Physical System

CPS Real-world,Design and Validation of CPS,Smart city application CPS,CPS Hardware Platforms (Process, Sensors and Actuators)

Industry 4.0.

IOT Fundamentals and protocols including layers, Sensor and Interfacing.

Hands on Practice:

1. Architecture and pin diagram of Arduino UNO/MEGA and ESP8266

2. IDE installation for open source C++ or Python

3. Analog and Digital voltage sensing and processing through Firmware

4. Analog and Digital voltage based actuator through Firmware

5. Display OLED/Seven segment integration through IDE PCB Design Concept and implementation with Uc

6. Implementation of UI/UX through Rest API based Thing speak

7. DATA logging and Generating CSV through RestAPI

8. Writing a Firmware for ESP-8266 or NODEMCU(programming based knowledge)

9.IoT based transformer / condition monitoring system

Reference Book:

1.Designing the Internet of Things , Adrian McEwen (Author), Hakim Cassimally
2.Asoke K Talukder and Roopa R Yavagal,"Mobile Computing," Tata McGraw Hill, 2010.
3.Computer Networks; By:Tanenbaum, Andrew S; Pearson Education Pte. Ltd., Delhi, 4th Edition
4.Data and Computer Communications; By:Stallings, William; Pearson Education Pte. Ltd., Delhi, 6th Edition
5.F. Adelstein and S.K.S. Gupta, "Fundamentals of Mobile and Pervasive Computing," McGraw Hill, 2009.

INDUSTRIAL CONTROL AND REMOTE MONITORING

Course Code	:	**EE28019**
Credits	:	**1**
L-T-P	:	**0-0-2**
Pre-requisites	:	**NIL**

COURSE OBJECTIVE

To provide hands on experience in developing Industrial Control and remote monitoring by using PLC (Programmable logic Controller), thus by utilizing it in Process control applications

COURSE OUTCOMES

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

CO1: Know about typical components of a Programmable Logic Controller

CO2: Know the concept of Electrical ladder logic and its relationship to PLC instructions

CO3: Understand the concept of digital electronics and data acquisition

CO4: Program PLC logical switching circuits for industrial applications

CO5: Choose and utilize Timer, Counter, and other intermediate programming functions

CO6: Design and program automated industrial production line

COURSE CONTENT

Programmable Logic Controller System:

Introduction to Industrial Automation, Introduction to PLC programmable logic controller

PLCs & related software and its major Components:

Relay logic Hardware Platforms (Switches, Sensors and Actuators), Study of Contactors, Timers, Counter and Comparator

Human Machine interface:

Introduction to HMI Communication with PLC, HMI tags and Assignments, Project on Industrial load sequential feedback control Using PLC HMI

Hands on Practice:

1. Introduction of PLC SOFTWARE as TIA Portal
2. Ladder Programming for Basic gates logics by using SPST Contacts
3. Ladder Programming on SPDT
4. Latching Concept and related Latching program
5. Study of program memory and Programming on Memory Bits
6. Study of TIMER BLOCKs and its Programming
7. Introduction to COMPARATOR BLOCK and its Programming
8. Introduction to COUNTER BLOCK and its Types with Programming
9. Project on Industrial Load OFF/ON control Using PLC and HMI
10. Introduction to analog Logic in PLC and its Programming

Reference Book:

1. Programmable logic Controller by Vijay R. Jadhav KHANNA PUBLISHERS Second Edition 2012
2. Industrial Automation Using PLC,SCADA and DCS by R.G Jamkar Laxmi Publications Private Limited;
3. PLC and SCADA by Prof Rajesh Mehra and Er. Vikrant Vij Published by University Science Press, 1st
4. Programmable logic Controller: Programming methods and Applications By John R Hackworth and Frederick D. Hackworth Jr. PEARSON Edition: 1st Edition, 2006.

MATLAB Applications

Course code : EE28021

Credit : 1

L-T-P :0-0-1

Prerequisite: Nil

COURSE OBJECTIVE

The prime focus of this course is to provide the students a basic understanding of the MATLAB coding and to solve mathematical and engineering problems numerically relevant to the academic and industrial applications.

COURSE OUTCOMES

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

CO1: Use the MATLAB environment as a programming tool.

CO2: Execute the MATLAB commands and features to defined problem.

CO3: Apply the concepts of the MATLAB to write codes for a verity of mathematical problems such as finding the roots of an equation.

CO4: Analyse the errors in the post-processing and display the results graphically.

CO5: Write the algorithm for solving partial and ordinary differential equations.

CO6: Write the algorithms to solve the complex engineering and industry standard problems.

COURSE CONTENT

Introduction to MATLAB:

Introduction to the course, description, installation and basics of MATLAB as a programming tool. Performing matrix inversion and solving eigen-value problems using Gauss-Jordan Method.

LOOP Commands and applications

Demonstration and practice of the basic commands and features of the MATLAB (Do loop, If-else loop, While loop etc... plotting graphs).

Math Applications:

Formulate a Matlab algorithm for the solution of algebraic and transcendental equations using bi-section method. Regula-Falsi method and Newton Raphson method. Performing matrix inversion and solving eigen-value problems using Gauss-Jordan Method, Formulate a Matlab algorithm for interpolation using Newton's forward / backward interpolation formula, Numerical solution of ordinary differential equations through Euler's Method and 4th order Runge-Kutta method, Numerical solution of partial differential equations: Solution to Laplace equation.

Concept of Simulink:

Introduction to simulink in MATLAB,Open-ended programming/numerical experiment.

Text Books:

1. S. C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, Indian Edition , McGraw Hill, 2012.
2. V. Rajaraman, Computer Oriented Numerical Methods , PHI, 2002.
3. David Houcque, Introduction to Matlab for engineering students, Northwestern University.

Vocational Courses Offered by School of Electronics Engineering

COMPUTATIONAL PHOTOGRAPHY

Course code :EC28001

Credit : 1

L-T-P :0-0-2

Prerequisite : MA11001

COURSE OBJECTIVE

Computational photography (CP) is the fusion of computer graphics, computer vision, optics and imaging. The role of CP is to overcome the limitations of traditional cameras by combining imaging and computing to enable new and improved ways to capture, represent and interact with the physical world. The course provides and overview of elements photography, which includes digital image capturing mechanisms, lighting controls, effect of focal length and aperture and various lossy and lossless image storage mechanisms. Objective is to briefly explain computational methods used to enhance photographs.

COURSE OUTCOMES

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

CO 1: Appreciate concept of photography, and digital camera technology

CO 2: Understand types of cameras and their mechanisms

CO 3: Demonstrate computational image processing

CO 4: Apply computational photography methods for photo composition and panoramic

CO 5: Apply computational image processing for photography quality enhancement

CO 6: Explain various image filtering techniques

COURSE CONTENT

Introduction to Computational Photography:

History of Photography and Computational Photography, Digital Representation of Images, Cameras, Difference between Full frame, APSC and Medium format sensors, scaling, crop sensor advantages/disadvantages

Digital photography:

Principle of Operation of DSLR camera, Aperture, ISO, Shutterspeed and Angle Control, Camera Calibration and Tethering, Computational Cameras, Image Storage formats: Compressed vs uncompressed formats, Basics of Lenses: Wide angle, Telephoto, Prime lenses, Macro lenses. Difference in angle, Depth of field control

Computational Techniques:

Concept of Color, color models, noise, its types, image histogram, Image Processing software: Licensed and Open Source

Training on Computational Photography:

Shooting with wide angle lenses, Shooting with Telephoto lens, zooming, changes in angle, Shooting with Prime lenses and constant aperture lenses, Shooting with Macro lenses, microscopic photography

Training on Digital Imaging-I:

Photography Genres, Scene Composition, Dynamic Range improvement, Portraits, Photographing scenes, crowd and people, Shooting Portraits, group photos and events

Training on Digital Imaging-II:

Long exposure, Brenizer's Method, Sports High Shutter speed, Burst, fisheye, architecture photography, Macro, Basics of Long exposures, using polarizing filters Shooting panorama, Brenizer's method and other photographing techniques Shooting sports, high shutter speed

Training on Digital Imaging-III:

Use of lights, soft box and flashes, guide number etc. , product photography, computational photography,E-commerce photography, Use of Lights, Flash, wireless flash, Basics of product photography, photography for e-commerce and computational photography

Training on Post Processing-I:

RAW image processing, Basic adjustments and correction, Lens Distortion and color correction using Adobe Photoshop, Monochrome image processing, color image processing batch processing using Light-room

Training on Post Processing-II:

Image enhancement operations, noise removal, Artistic filtering, cosmetic filtering, and other post processing methods. Post Processing III: Background removal, artificial coloring.

Training on Post Processing-III:

Open Source and free software for image post processing and computational photography, their usage and capabilities.

Photography Ethics:

Photography ethics: empathy, consent, integrity, ethical decision making, privacy

Text Book:

1. Computer Vision: Algorithms and Applications, 2nd ed by by Richard Szeliski

Reference Books:

1. Computational Imaging Book, by AyushBansai, AchutaKadambi, and Ramesh Raskar.
2. Multiple View Geometry in Computer Vision, by Richard Hartley and Andrew Zisserman.
3. Computer Vision: A Modern Approach, by David Forsyth and Jean Ponce.
4. Foundations of 3D Computer Graphics, by Steven Gortler.
5. Digital Image Processing, by Rafael Gonzalez and Richard Woods.
6. Photography, by Barbara London and John Upton

SOUND ENGINEERING

Course code :EC28003

Credit :1

L-T-P :0-0-2

Prerequisite :Nil

COURSE OBJECTIVE

It elaborately covers in various aspects of sound (physical and mechanical behavior), equipment used for recording/ reproducing and basic idea for the preparation of final sound track in film or television production.

COURSE OUTCOMES

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

CO1: Recognize, define, and explain the principles of sound engineering related to signal flow, microphones, recording, mixing, production, and mastering.
CO2: Demonstrate practical, imaginative understanding and fluency on sound engineering technologies and procedures.
CO3: Solve problems independently, imaginatively, and creatively in the field of sound engineering will be demonstrated by students.
CO4: Learn how to conduct research and have a critical comprehension of sound engineering and its related fields.
CO5: Understand the basic techniques of sound recording.
CO6: Understand the working of different types microphone and loudspeakers and their applications in industry.

COURSE CONTENT

- Introduction to technology of sound
- Analysis of prerecorded speech, music and effects
- Observation of the installation of PA System in a large auditorium
- Study and analysis of different microphones
- Study the feature of 2 channel digital sound recorder
- Study about the effect of loudness in relation with the distance from source to the listener
- Sound recording and reproduction practice by using recorder in PA system chain

- Study of sound in different environmental situation
- Study and analysis on Modulated Radio wave AM and FM in Live streaming radio stations
- Study the effect of Bass and Treble (Concept of Equalization)

Text Book:

1. Sound Recording and Reproduction – Glyn Alkin

Reference Book:

1. Sound Assistance – Michael Talbot Smith

SENSORS FOR AUTOMATION

Course code :EC28005

Credit : 1

L-T-P :0-0 -2

Prerequisite : Nil

COURSE OBJECTIVE

Sensors and automation are revolutionizing the technology in the areas like consumer electronics, automotive industry, healthcare, and in other settings. The course will provide an opportunity for students to learn different sensors and its application in real world problems. It will empower the students to develop their knowledge regarding operation, application and integration of sensors to enable the design and realization a complete systems.

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO1: Learn about the microcontroller, its hardware interfacing and programming

CO2: Understand the working principle and characteristics of different types of sensor

CO3: Interface various sensor interfacing with microcontroller and display devices

CO4: Understand the basic principles of analog to digital conversion and its application with different sensors

CO5: Gain knowledge about various types of automation system

CO6: Develop and implement sensor for final products in real time applications

COURSE CONTENT

1. Introduction to microcontroller, platform of operations with basic programming techniques
2. Interfacing of serial and parallel device with microcontroller
3. Interfacing of microcontroller with display devices
4. Use of ADC to interface various analog sensors with microcontroller
5. Introduction to sensor, measurement of physical parameters like temperature and humidity
6. Application of ultrasonic and proximity sensor
7. Application of gas and pressure sensor
8. Application of IR sensor and RFID
9. Interfacing actuators to drive DC motor (application of touch switch as actuators)
10. Implement sensor in final products for real time solution

Text Book:

1. T. Karvinen, and K. Karvinen, Getting started with sensors, Shroff Publishers, Kindle, Edition, 2014.

Reference Books:

1. J. S. Katre, Sensors in Automation, TechKnowledge Publications, 1st Edition, 2023
2. D. Patranabis, Sensors and Transducers, PHI Learning, 2nd Edition, 2003.

PCB DESIGN

Course code :EC28007

Credit : 1

L-T-P :0-0-2

Prerequisite : Basic Electronics EC10001

COURSE OBJECTIVE

Over the years, printed circuit board manufacturing has continued to grow in order to keep up with the increasing demands of newer, faster, and more complex electronic circuitry. This course will familiarize students to design, simulate electronics circuit and fabricate PCB for prototyping using CAD tool. This program is designed to provide a balanced foundation of theoretical knowledge and practical skills in printed circuit board design.

COURSE OUTCOMES

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

CO1: Understand and evaluate different electronics components.

CO2: Create schematic and simulate the circuit using OrCAD or any other CAD tools.

CO3: Understand single- and double-layer PCB.

CO3: Create and fabricate PCB and analyze the PCB using screen printing method.

CO4: Understand assembly of electronics component by soldering.

CO5: Analyze and test the circuit for any error.

COURSE CONTENT

Description of different Electronics Component and their Identification:

Passive and active components, component identification, Color code for resistor and disc capacitors, Inductor and their types, simple air core and iron core inductor design.

Circuit Design and Simulation using CAD tool (OrCAD): Design of a simple electronics circuit using data sheet and circuit schematic and simulation.

Schematic to PCB transfer and routing:

Schematic to PCB transfer (assigning foot prints to various components, transfer to PCB), routing, DRC, ERC, EMC

Screen Printing Procedure:

Preparation of screen, mask transfer

PCB preparation and Checking of Routing:

transfer of layout to PCB using screen printing methods, etching, cleaning, error checking of routing, component mounting, soldering

Testing and Verification:

Testing the circuit with the help of multi-meter and CRO

Text Books:

1. Chris Robertson, Printed Circuit Board, PHI, 2003
2. Elaine Rhodes, Developing Printed Circuit Assemblies: From Specifications to Mass Production, 2008, ISBN: 978-1435718760.

Reference Books:

1. Douglas Brooks, Signal Integrity Issues and Printed Circuit Board Design, PHI, 2003.
2. Kraig Mitzner, Complete PCB Design Using OrCAD Capture and PCB Editor, Newnes, 2009 Open source EDA Tool KiCad Tutorial : http://kicad-pcb.org/help/tutorials/

Vocational Courses Offered by School of Mechanical Engineering

ADDITIVE MANUFACTURING (3D PRINTING)

Course Code : ME28011

Credit : 2

L-T-P : 0-0-2

Prerequisite :Nil

COURSE OBJECTIVE

Additive Manufacturing (AM) is a modern manufacturing technology also known as 3D printing process, will provide a clear understanding about the process, acceptability and usability in various field. AM technologies classified on the basis material types will be focused with its real life applications with advantages and disadvantages. Different types of errors associated with AM and CAD technology will be discussed with suitable error minimization processes. Various reverse engineering process will be discussed and practically implemented with its real life applications.

COURSE OUTCOMES

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

CO1: Understand the concept of additive manufacturing, its benefits and applications in various field.
CO2: Know the various liquid, powder and solid material based technologies in Rapid Prototyping and Rapid Tooling process.
CO3: Know the application of AM process in the field of Biomedical.
CO4: Design solid models and converting it to 3D printing readable file format required for part fabrication.
CO5: Focus on the various types errors in the RP parts and errors during CAD file conversion.
CO6: Apply reverse engineering process to generate data for fabrication RP part.

COURSE CONTENT

Introduction to Additive Manufacturing Technologies:

Need and Development of AM systems, AM process chain, Impact of AM and Tooling on Product Development, Benefits, Applications, Digital prototyping, Virtual prototyping.

Model Preparation using Solid Modelling Software.

Classification of Additive Manufacturing Technologies:

Classification of AM technologies on the basis of Materials types. Discussion on various AM processes based solid, liquid and semi solid type of materials along with its application, advantages and disadvantages.

Hands on practice for model creation and saving on particular file format.

Data Processing for AM Technologies:

Process planning for AM, CAD model preparation, data requirements & geometric modelling techniques: Wire frame, surface and solid modelling data formats.

Hands on practice for the fabrication of Single components and Assembly components.

Rapid Tooling:

Classification: Soft tooling, Production tooling, Bridge tooling; direct and indirect, Fabrication

processes, Applications, Rapid tooling techniques such as laminated metallic tooling, direct metal

laser sintering, vacuum casting.

Hands on practice for the fabrication of pattern and mould preparation.

Reverse Engineering Processes:

Introduction to reverse engineering, Integration of reverse engineering with AM technology.

Hands on practice to generate model data in revere engineering process integrated with AM process

Reference Books:

1. Rapid Prototyping: Principle and Applications, Rafiq I Noorani, Wiley & Sons, 2006.
2. Rapid prototyping: Principles and applications, Chua C.K., Leong K.F., and Lim C.S., Yes Dee Publishing Pvt. Ltd, Third edition, 2010.
3. Rapid Prototyping and Engineering Applications, Frank W. Liou, CRC Press, Special Indian Edition, 2007.
4. Additive manufacturing, R.B. Choudhary, Khanna Publication, 2022

DIE DEVELOPMENT BY CNC MILLING

Course code : ME28013

Credit :1

L-P-T : 0-0-2

Prerequisite : Workshop (ME18001)

COURSE OBJECTIVE

The objective of the course is to provide basic knowledge on various tools and precision instruments used during CNC milling operation. It helps in understanding the usage of various machining cycles to reduce the manufacturing lead time. Moreover, it explains the usage of various standards and programming methods to be followed during CNC machining operation. Finally, the students can develop/generate the programs used to produce the geometries with complex contours using CNC milling machine.

COURSE OUTCOMES

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

- CO1: Understand the usage of different tools and precautions to be followed during machining.
- CO2: Know the principle and operation of precision instruments.
- CO3: Understand the technological advancements in NC and aimed to achieve JH pillar.
- CO4: Understanding the programming methods and programming in simulators
- CO5: Planning for optimized CNC programming by estimating suitable process parameters
- CO6: Programming of die contours and executing on CNC milling machine.

COURSE CONTENT

Tools and Safety: List of tools used on Milling Machine to perform various operations.

Safety: Introduction to safety equipment and their uses.

Measuring instruments

Vernier caliper, Micrometer, Bevel protractor, Coordinate measuring machine (CMM): Construction, principle graduation and reading, least count.

Introduction to CNC

Introduction to CNC technology, Conventional Vs. CNC machine tool, CNC clamping system. Implementation of JH for CNC.

CNC programming

Introduction to CNC programming, Introduction and demonstration of line programs milling machine using ISO codes into the CNC simulator. Part programming methods, Cutting process parameter selection, Process planning issues and path planning, G & M Codes, Interpolations, Tool compensations.

CNC Programming-Milling

Calculations of parameters like speed feed, depth of cut etc. and set a references for the various operations. Prepare & set CNC Milling operations and dry run on the machine. Execute program and inspect simple geometrical forms / standard parts.

Reference Books:

1. Computer Control of Manufacturing Systems, Mc Graw Hill Publication, By Yoram Koren.
2. CAD/CAM ByMikell P. Groover
3. A text book of Manufacturing Technology-II By P C Sharma
4. Engineering Metrology, Khanna Publishers, By R K Jain

CONCEPT CAR MANUFACTURING

Course code : ME28015

Credit :1

L-P-T : 0- 0-2

Prerequisite : Workshop (ME18001)

COURSE OBJECTIVE

Objective of the course is to give the students hands on experience on building a racing car. Students find it very interesting to develop important parts of a racing car and then assemble and take part in various national and international events. In this process they meet the requirement set by the authorities. Therefore the students learn here how to propose a new car body and prove the feasibility by computational analyisis of the body and other important parts.

COURSE OUTCOMES

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

CO1: Remember the fundamentals of concept car characteristics.
CO2: Understand the aerodynamic requirements in racing vehicles.
CO3: Use the concepts of chassis behaviour of concept car
CO4: Illustrate the suspension characteristics of the concept car.
CO5: Understand the problems faced in drives and braking systems in motorsports.
CO6: Build a concept car body

COURSE CONTENT

Car Development

Constraints And Specifications – Performance, Handling, Structure; Driver Accommodation and Safety

Tyres: Adjustable Features, Preliminary Design And Analysis; Driver-Vehicle Relationship. Desirable Vehicle Characteristics, Fundamentals of Track and Lap

Racing Car Aerodynamics

Aerodynamic Force and Moment, Race Car Drag; Spoilers, Dams, Wings - Effectiveness Of Wings In SteadyState Cornering

Chassis Design

Conditions For Traversing a 90° Corner, Effects Of High Speed Braking, Cornering, Combined Braking Cornering; Steady State Cornering, Throttle Behaviour, Steering Wheel Force And Kick Back; Moving CG Position, Roll Centre Position Changing

Suspension System

Front Suspension- General Design Issues, Camber Effects; SLA Suspension, McPherson Struts; Independent Rear Suspension- Trailing Arm Types, Instant Axis Concept; Suspension Springs- Torsion Springs, Coil Springs.

Text Book

1. Advanced Race Car Chassis Technology HP1562: Winning Chassis Design and Setup for Circle Track and Road Race Cars Bob Bolles, HP Books; Revised, Updated ed. edition 2010

Reference Books

1. Race car vehicle dynamics, William F. Milliken and Douglas L. Milliken, 11th edition, SAE, 1995.
2. Formula 1Technology, Peter Wright, Sae Intl; 1st edition 2001.

DEVELOPMENT OF AUTONOMOUS WHEELED ROBOTS

Course code : ME28017

Credit : 2

L-T-P : 0-0-2

Prerequisite : Basic Electronics EC10001

COURSE OBJECTIVE

Nowadays, robotics is playing a vital role in industry 4.0, and autonomous wheeled robots are being applied to minimize human efforts and to improve the production rate. This course gives fundamental knowledge about wheeled robotics and its different hardware and software components. Moreover, the subject discusses kinematics equations, which will be implemented to control the motion of wheeled robots through the actuators. Further, the present course also describes the integration of various sensors and their programming, which will be used to make an autonomous control system for a robot.

COURSE OUTCOMES

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

CO1: Understand the fundamentals of wheeled robotics and its different components.

CO2: Apply locomotion constraint features to travel the wheeled robots in different surface conditions.

CO3: Apply various sensors integration on wheeled robots for autonomous navigation.

CO4: Analyze the kinematics of wheeled robots.

CO5: Create a robot programming to make an autonomous sensor-actuator control system.

CO6: Design of automation solutions using wheeled robots.

COURSE CONTENT

About Locomotion for Wheeled Robot:

Key issues for locomotion, wheeled mobile robot's locomotion, Legged wheeled robots.

Wheeled Robots Kinematics:

Kinematic models and constraints, Representing robot position, Forward kinematic models, Wheel kinematic constraints, Degree of freedom.

Sensors for Autonomous Wheeled Robots:

Various sensors for wheeled robots, Sensor classification, Ultrasonic sensor, Infrared sensor, Vision sensor, Inertial measurement unit (IMU).

Actuators for Autonomous Wheeled Robots:

Various actuators for wheeled robots, DC motor, Servo motor, Stepper motor, Motor controller.

Wheeled Robots Programming:

Robot programming language features, Computer control and robot software (monitor mode, run mode and editor mode), Arduino microcontroller programming, Raspberry Pi programming, Complete design of an autonomous wheeled robot.

Reference Books:

1. R. Siegwart, I.R. Nourbakhsh, D. Scaramuzza, Introduction to Autonomous Mobile Robots, MIT Press, 2011.
2. S.G. Tzafestas, Introduction to Mobile Robot Control, Elsevier Science, 2013.
3. G. Dudek, M. Jenkin, Computational Principles of Mobile Robotics, Cambridge University Press, 2010.
4. T. Bräunl, Embedded Robotics Mobile Robot Design and Applications with Embedded Systems, Springer Berlin Heidelberg, 2013.
5. U. Nehmzow, Mobile Robotics A Practical Introduction, Springer London, 2012.

MODELLING OF MICRO-WIND TURBINE BY 3D CAD DESIGN

Course code : ME28019

Credit : 2

L-T-P : 0-0-2

Prerequisite: Mathematics (MA11001), Fluid Mechanics (ME2021)

COURSE OBJECTIVE

Introduce computer-based solid, parametric, and assembly modeling as a tool for engineering design; enhance critical thinking and design skills. This course introduces the technology and economics of converting wind energy to electricity and other kinds of energy. Both utility scale horizontal axis wind turbines and small-scale horizontal are addressed, as well as the economical and environmental issues associated with wind energy.

COURSE OUTCOMES

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

CO1: Learn about the basic concepts of wind energy conversion system.

CO2: Understand the engineering design process and the implementation of different design phases.

CO3: Create a 3D solid model with high degree of confidence.

CO4: Develop the ability to extract 2D orthographic views from the 3D model for fabrication.

CO5: Learn the basics of assembly and associative constraints.

CO6: Understand the importance of standalone, grid-connected, and hybrid operation in renewable energy systems.

COURSE CONTENT

Introduction to Wind Energy, Wind Power, State of the art technology:

Introduction to renewable sources, Wind energy, Types of wind turbines, State of the art technology in wind energy.

Design and development of small wind turbines:

Small wind technology, blade element momentum theory, design of tail fin, Wind turbine tower structure design stiffness and strength consideration, Aerodynamics of wind turbine rotor blade design, angle of attack, profile.

3D modelling of wind turbine using CAD tools (SOLIDOWRKS):

Introduction to 3D modeling, Parametric modeling, feature-based modeling, Design Intent; Solid modeling commands: Sketching, Extrusion, Revolve, fillet, pattern.; Solid Modeling: reference geometry, Sweeps and Lofts;

Assembling of the 3D model of the Wind turbine:

Assembly modeling; Top-down and bottom-up, Mates in assembly, exploded view,

Creation of 2D drawings for production/manufacturing processes.

Extract 2D orthographic views from the 3D model for fabrication by specifying the proper dimensions, according to industry standards, for parts to be fabricated and to extract section and auxiliary views, Dimensioning standards and conventions. 3D assembly drawing of the wind turbine, exploded view of the tower, 3D drawings of all 3D printed parts.

Simulation of wind turbine using SOLIDWORKS using CAD tools (SOLIDOWRKS and ANSYS):

Engineering analysis with SolidWorks, Stress and deflection of the wind turbine tower, Simulation of wind turbine using SolidWorks

Reference Books:

1. Wind Energy Explained: Theory, Design, and Application, By James F. Manwell, Jon G. McGowan, and Anthony L. Rogers, Wiley (2010).
2. Wind Power Plants: Fundamentals, Design, Construction and Operation, Gasch, Robert, Twele, Jochen (Eds.) Springer-Verlag Berlin Heidelberg; 2nd edition (2012).
3. Open source SOLIDWORKS Tutorial : https://my.solidworks.com/training/video/40d7a678-3293-4d7b-ba18-2113ff114b2a

LABORATORY AND SESSIONAL SUBJECTS

ELECTRICAL MACHINES LABORATORY

Course Code :EE 29002
Credit :1
L-T-P :0-0-2
Prerequisite(s) : Engineering Laboratory (EX19001)

COURSE OBJECTIVE

The main objective of the Electrical machines laboratory is to provide the practical exposure to the student regarding operation of various electrical machines like DC generators, DC Motors, Alternators, Synchronous motors, Induction Motors, Special Motors and Transformers. Students are allowed to conduct various experiments for the validation of performance characteristics of all the machines. From this laboratory courses student will gain the skill to select correct machine for a specific application.

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO 1: Memorize the working principle and applications of different electrical machines.
CO 2: Understand the challenges in industrial applications of electric motors.
CO 3: Utilize different electrical machines.
CO 4:Analyse different electrical machine according to the requirement in the industrial applications.
CO 5: Assess the safety precautions to be taken while using electrical equipment.
CO 6: Design the equivalent circuit of the transformer and construct the circle diagram of an induction motor.

COURSE CONTENT

Topics:

- No Load and Load Characteristics of a (i) D.C Shunt Generator and (ii) Separately Excited Generator.
- Design of the equivalent circuit by using the open circuit and short circuit test on a single phase Transformer.
- Determination of the voltage regulation of a three phase alternator using the Open circuit and short circuit test.
- Design of the circle diagram using the No load and Block rotor test on three phase induction motor.
- Speed control of D C Motor by using the different Methods.
- Connection of three single Phase transformers in star-star, star-delta, delta-star, delta-delta and open delta.
- Testing of a D C motor to find the different parameters and to draw the performance characteristics.
- Draw the V curve and inverted V curve of a three phase synchronous motor.
- Draw the performance characteristics of a single phase induction motor by using the different tests.

Textbook(s)

1. Electrical Machinery, P. S Bimbhra, 7th Edition, Khanna Publishers, 2008.
2. Electrical Machines, by P. K. Mukherjee and S. Chakravorti, Dhanpat rai Publication, 18th reprint 2013

Reference Book(s)

1. Electrical Machines, Ashfaq Hussain, Dhanpat Rai, Delhi, 2nd Edition, 2008.
2. Electrical Technology, Volume -II. B. L. Theraja, S .Chand Publications. 2010.
3. Electric Machines, C. I. Hubert, Pearson Education, 2003.
4. Electric Machines ,by Kothari. D P and I J Nagrath, 3rd Edn, Tata McGraw-Hill, New Delhi. 2004.

DATA STRUCTURE AND ALGORITHMS LABORATORY

Course Code :ES29001

Credit :1

L-T-P :0-0-2

Prerequisite(s) : Programming Laboratory (CS13001)

COURSE OBJECTIVE

This course demonstrates familiarity with major algorithms and data structures and analyzes performance of algorithms. It is used to choose the appropriate data structure and algorithm design method for a specified application and determine which algorithm or data structure to use in different scenarios.

COURSE OUTCOMES

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

CO 1: Apply the algorithm for problem solving.

CO2: Identify Data Structure to develop program for real time application.

CO 3: Implement linear data structures such as stacks using array and linked list.

CO 4: Implement linear data structures such as queues using array and linked list.

CO 5: Implement non-linear data structures such as trees, graphs.

CO 6: Develop various kinds of searching, sorting and traversal techniques and know when to choose which technique.

COURSE CONTENT

Topics:

- Introduction (Structure,pointer,Dynamic memory allocation)
- Arrays
- Linked list
- Stacks
- Queues
- Trees
- Graph
- Sorting

Textbook(s):

1. Data Structures, Schaum's OutLines, Seymour Lipschutz, TATA McGraw Hill
2. Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahani Anderson-Freed, Universities Press. Pearson, 2nd Edition

Reference Book(s):

1. Data Structures using C by Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein. Pearson, 1st Edition
2. Data Structures A Pseudocode Approach with C, 2nd Edition, Richard F. Gilberg, Behrouz Forouzan, CENGAGE Learning, India Edition
3. Data Structures Using C, Second Edition, Reema Thereja, Oxford University Press
5. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson Education, 2nd Edition.

ANALOG AND DIGITAL CIRCUIT DESIGN LABORATORY

Course Code :EE29005

Credit :1

L-T-P :0-0-2

Prerequisite(s): Engineering Laboratory (EX19001)

COURSE OBJECTIVE

The main objective of the Analog and Digital electronics Laboratory is to learn and understand the basic concepts to design Schmitt trigger circuit, Active high pass & low pass filter with the help of variac, oscilloscope, function generator, DSO, multimeter etc. understand the concepts of digital electronics. Students will be able to design basic logic circuits using different gates (AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR); combinational circuits like adder, subtractor, decoder, multiplexer, demultiplexer; sequential circuits like synchronous counters, asynchronous counters, shift registers. From this laboratory course students will be able to analyze & design digital circuits for a specific application.

COURSE OUTCOMES

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

CO 1: Explain the digital circuits using Boolean algebra and K-maps.

CO 2: Execute different combinational circuits and Differentiating multiplexer and demultiplexer using logic gates.

CO3: Analyse line regulation and load regulation in a voltage regulator circuit using zener.

CO 4: Assess the conditions of oscillations in a RC phase shift oscillator and to design Schmitt trigger circuit.

CO 5: Checking the operation of synchronous & asynchronous counters using different flip-flops.

CO 6: Design different types of shift registers.

COURSE CONTENT

Topics:

- Determination of line & load regulation using Zener diode.
- Study of an RC phase shift oscillator and find its frequency of oscillation.
- Design of Schmitt trigger circuit, Active Low Pass & High Pass Filter using op-amp.
- Verification & implementation of different gates using universal gates.
- Realization of adder & substractor circuits.
- Implementation of MUX & DEMUX using logic gates.
- Design of synchronous & asynchronous counters using flip-flops.
- Design of shift registers.

Textbook(s)

1. Fundamentals of Digital Circuits by A.Anand Kumar - PHI, 4th Edition, 2017.
2. Fundamentals of Electric Circuits 4th Edition, by Charles K. Alexander, Matthew N.O. Sadiku, Mcgraw-Hill, 2009.
3. Digital Logic and Computer Design by M. Morris Mano - PHI, 2011.

Reference Book(s)

1. Digital Fundamentals by T.L. Floyd & Jain -Pearson Education, 10th Edition, 2011.
2. Digital Principles and Applications by Malvino & Leach -TMH, 7th Edition, 2011.

DATABASE MANAGEMENT SYSTEM LABORATORY

Course Code :ES29002

Credit :1

L-T-P :0-0-2

Prerequisite(s) : Data Structure and Algorithms (ES20001)

COURSE OBJECTIVE

The main objective of Database Management System Lab is to make student aware of the knowledge of creation, updating, and maintenance of the database. This lab allows the students to understand the basic concepts of the database management system and apply those concepts in creating and maintaining the database for real-life problems. This lab intends to provide in- depth knowledge in DBMS using SQL commands with different types of integrity constraints. It also focuses on the security aspects of a database system along with a brief discussion on accessing and manipulating data using PL/SQL blocks.

COURSE OUTCOMES

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

CO 1: Understand Oracle client/server Database Management System and its utilities.
CO 2: Understand in-depth knowledge in database management using SQLcommands with different types of integrity constraints.
CO 3: Apply the knowledge of database security & authorization inorder to access database for the different kinds of the user.
CO 4: Evaluate the database applications related to set theory operations, join and subqueries.
CO 5: Analyse the various methods to access and manipulate data using PL/SQL blocks.
CO 6: Create new table, extract and maintain data base file of a system

COURSE CONTENT

Topics:

- SQL Fundamentals - Basic (DDL - DML - DCL) Statements and (DDL - DML - DQL - TCL) Statements.
- Built in functions in SQL
- Aggregate Functions
- Group by and Having Clause
- Set Theory Operations
- Join
- Subqueries
- Views and Sequences
- PL/SQL Basics, Introduction to Cursors in PL/SQL

Software Requirements

a. Windows OS
b. Oracle/My SQL/DB2/SQL Server

Textbooks:

1. Fundamentals of Database Systems, Elmsri & Navathe, 7^{th} Edition

Reference Book(s):

1. Database System Concepts Seventh Edition. Avi Silberschatz · Henry F. Korth · S. Sudarshan. McGraw-Hill ISBN 9780078022159

CONTROL SYSTEM LABORATORY

Course Code :EE29004

Credit :1

L-T-P :0-0-2

Prerequisite(s) : Engineering Laboratory (EX19001)

COURSE OBJECTIVE

The main objective of the Control Systems laboratory is primarily used for teaching Control system basics and Design of controllers for different systems. The Control Systems Laboratory is equipped with different modules for DC position control, AC position Control, DC Motor Speed Control, Frequency Response Analysis, Time Response Analysis, Tunning of PID controller, Temperature Controller, Pressure Controller, Flow Rate Controller etc. From this laboratory courses student will gain the skill to evaluate the performance of PID controller with respect to changes in control parameters, study the effect of controllers on different electrical and mechnical systems, analyse the stability of designed controller & develop computer software programs for analysis of controllers.

COURSE OUTCOMES

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

CO 1:Remembers the modern software tools for feedback controllers.

CO 2:Understand the iterative nature of a successful controller design.

CO 3: Apply the theoretical concepts and computational tools while designing controllers.

CO 4:Analyse the characteristics obtained by by varying the input parameters in a SIMULINK environment

CO 5:Evaluate the electrical and mechanical parameters of a given system and to find the transfer function.

CO 6:Create new programs in MATLAB environment.

COURSE CONTENT

Topics:

- Time response analysis of linear system
- Tuning of PID controller or a First Order Process with Time Delay (FOPTD) Simulated System by Process Reaction Curve Method.
- Lead Compensator design
- Stability analysis using bode plot
- Stability analysis using root locus plot
- Design of Speed Controller for Armature controlled DC motor

Textbook(s):

3. Modern Control Engineering- By D. Roy Choudhury, PHI Publication, 5th Edition, 2009.
4. Control Systems- By Smarajit Ghosh, Pearson, Second Impression, 2013.

Reference Book(s):

2. Automatic Control System- By Hasan Saeed, Sixth Revised Edition, 2008
3. Modern Control Engineering- By K. Ogata, PHI publication, 5th edition 2010
4. Automatic Control Engineering- By B. C. Kuo , Prentice Hall, 7th edition 2009
5. Control System Engineering- By I. J. Nagrath and M. Gopal, New Age International Publication
6. Automatic control systems- By Prof. B.S. Manke &S.N.Verma ,Khanna publication, 2012.

ELECTRICAL SYSTEM MODELING USING MATLAB

Course Code : EE28002

Credit :1

L-T-P :0-0-2

Prerequisite(s):Nil

COURSE OBJECTIVE

This course is proposed as a Sessional to UG students with the aim of imparting basic understanding of Modeling and Simulation so that the students will find it easy to use this knowledge in profession for applying to various engineering systems and design.

COURSE OUTCOMES

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

CO1: Know the characteristic of half wave and full wave uncontrolled rectifier .

CO2: Understand the characteristic of half wave and full wave controlled rectifier .

CO3: Apply modeling techniques to Simulate the R-L and R-C circuit.

CO4: Analyse the methods of plotting of single phase and 3 phase sine wave.

CO5: Evaluate the simulated design of the PID controller.

CO6: Design a circuit to Plot I-V & P-V Characteristic of a PV cell.

COURSE CONTENT

Topics:

- Simulation of single phase half wave uncontrolled rectifier with R & R-L load.
- Simulation of single phase full wave uncontrolled rectifier with R & R-L load.
- Simulation of Single Phase Half Wave Controlled Rectifier with R &R-L Load
- Simulation of Single Phase Full Wave Controlled Rectifier with R &R-L Load
- DC transient analysis of R-L and R-C series circuit in Matlab-Simulink.
- Simulation of PID Controller
- Matlab Programming plot a 1-ph and 3-ph sine wave in MATLAB.
- Modelling and simulation of DC shunt motor.
- I-V Characteristic of PV system
- P-V Characteristic of PV system.

Textbook(s):

1. Getting started with MATLAB by Rudra Pratap.

Reference Book(s):

1. Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers by Rudra Pratap.
2. MATLAB: An Introduction with Applications by Amos Gilat.

POWER ELECTRONICS AND DRIVES LAB

Course Code: ES39001

Credit: 1

L-T-P: 0-0-2

Prerequisite: Nil

COURSE OBJECTIVE

This course utilizes the knowledge of Power Electronic to verify AC-DC converters, which are examined in details with R and RL loads. Analysis of DC-DC converters are done so that experimental verification can be facilitated. The waveforms and the output voltage equation of SMPS are experimentally verified. It also imparts knowledge on performance of the fundamental control practices associated with AC and DC machines (starting, reversing, braking, plugging, etc.) using power electronics. Students will perform experiments related to topics studied in electric drives like various DC and AC motor drives and their control.

COURSE OUTCOMES

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

CO1: Choose an appropriate converter for variety of needs.

CO2: Comprehend the principles of operation of various converters.

CO3: Apply AC-DC converters for rectification.

CO4: Analyze the parameters and the waveforms of the output of the converters.

CO5: Evaluate the electrical and mechanical parameters of a given motor.

CO6: Design different DC and AC motor drives electric drive industrial and domestic applications.

TOPICS:

- Study of output voltage waveforms and parameters of three phase uncontrolled rectifier.
- Study of single phase fully controlled AC-DC converter with R and RL load.
- Verify the performance of DC-DC converters.
- Speed control of separately excited DC motor by armature voltage control method using single phase fully controlled AC to DC converter with and without load.
- Speed control of 3 phase squirrel cage induction motor using V/F control method.

Textbooks

1. Dubey, G.K. (2007). Fundamentals of Electric Drives, Second Edition, Narosa Publishers.
2. Pillai, S.K. (2007). A First Course on Electrical Drives, New Age International Publishers, 2nd Ed.

Reference books

1. Bose, Bimal. K. (2006). Power Electronics and Motor Drives: Advances and Trends, Academic Press.
2. De, N.K., Sen, P.K. (2004). Electric Drives, PHI Learning Pvt. Ltd., 7th Edition.
3. Bose, Bimal. K. (2013). Modern Power Electronics and AC Drives, PHI Publisher, 1 st Ed.
4. Nasar, S.A., Boldea. (2006). Electrical Drives, CRC Press, Second Edition.
5. El-Sharkawi, M.A. (2000). Fundamentals of Electrical Drives, Thomson Learning, 1st Ed.
6. Krishnan, R. (2003). Electrical Motor Drives, PHI.

PYTHON PROGRAMMING LAB

Course Code: ES38001

Credit: 1

L-T-P: 0-0-2

Prerequisite: Nil

COURSE OBJECTIVE

The objective of the Python Programming Lab is to provide students with practical knowledge of Python programming concepts and to develop problem-solving skills through hands-on coding. The lab enables students to understand core programming constructs, data structures, functions, file handling, and the use of Python libraries for real-world engineering applications.

COURSE OUTCOMES

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

CO1: Apply basic Python syntax, data types, operators, and control structures to write simple programs.

CO2: Develop programs using functions, modules, and packages to solve computational problems.

CO3: Implement Python data structures such as lists, tuples, sets, and dictionaries in practical applications.

CO4: Perform file handling operations and exception handling for robust program development.

CO5: Utilize Python libraries (such as NumPy, Matplotlib, Pandas) for data processing, visualization, and engineering computations.

CO6: Design and implement Python programs to solve real-world engineering problems using logical and analytical thinking.

TOPICS:

- **Python Basics & Numerical Computing**
- **Data Handling & Visualization**
- **Electrical & Signal Processing Applications**
- **Control Systems & Optimization**
- **Numerical Methods**

Textbook

1. Kenneth A. Lambert (2023). Fundamentals of Python: First Programs, 3rd Edition, Cengage Learning (India) Pvt. Ltd.

Reference books

1. Manaranjan Pradhan & U Dinesh Kumar (2022). Machine Learning using Python, Wiley.

2. Dr. Jisu Elsa Jacob & Bharath Viswam S. (2022). Python Programming, 2nd Edition, S.K. Kataria & Sons

SENSOR MODELING & SIMULATION LABORATORY

Course Code : ES38003

Credit :1

L-T-P :0-0-2

Prerequisite(s) : Engineering Laboratory (EX19001)

COURSE OBJECTIVE

The main objective of the Sensor Modeling & Simulation Laboratory is to enable students to understand, model, and simulate the static and dynamic characteristics of various sensors using hardware module as well as simulation software.

COURSE OUTCOMES

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

CO 1: Recognize the applications of different sensors.

CO 2: Understand the working principles and measuring errors of sensors.

CO 3: Utilize simulation software for predicting real-world sensor behavior.

CO 4: Analyze different static and dynamic characteristics of all major sensors.

CO 5: Evaluate the on impact of various parameters on governing performance of sensors.

CO 6: Design the circuit for measuring and storing of sensor data

COURSE CONTENT

Topics:

- Measurement of the temperature using RTD
- Characterize the LVDT
- Object Detection by IR SENSOR
- Distance Measurement by ULTRASONIC SENSOR
- Humidity &Temperature Measurement using DHT11 Sensor
- Measurement of level in a tank using capacitive type level probe
- Simulate the performance of a bio-sensor
- Characterize the strain gauge sensor
- Optimize the solar panel position using Light-dependent resistor (LDR) Sensor
- Design an orifice plate for a typical application

Text Books:

1. ACourseinElectricalandElectronicsMeasurementandInstrumentationbyA.K.Sawhney,16th edition,DhanpatRai, 2019.

2. IanRSinclair,“Sensorsandtransducers”,ThirdEdition,NewnessPublishers,2001.

Reference Books:

1. ElectronicsInstrumentsandMeasurements–DavidA.Bell–PHI,2012.

2. Electronic Instrumentation and Measurement Techniques, By William DavidCooper,PHI,2017.

3. JackPHolman,“ExperimentalMethodsforEngineers”,SeventhEdition,McGrawHill,USA,2001.

4. RobertGSeippel,“Transducers,Sensorsanddetectors”,RestonPublishingCompany,USA,2017.

POWER SYSTEM ENGINEERING LABORATORY

Course Code :ES39002

Credit :1

L-T-P : 0-0-2

Prerequisite(s) : Electrical Machines Laboratory (EE29002), Control SystemLaboratory(EE29004)

COURSE OBJECTIVE

The main objective of the Power Systems laboratory is primarily used for teaching power system basic and advance modelling of transformers, transmission lines, fault analysis, protective relays characteristics and its schematics. The Power Systems Laboratory is equipped with different Protection Scheme of Alternator, over Current Relay, over voltage relay, Percentage biased Differential Relay, Microcontroller based negative sequence relay, Transmission line simulator kit. From this laboratory courses student will gain the skill to analyse the performance of power system networks, study different power system protective relays and develop computer software programs for analysis of power systems.

COURSE OUTCOMES

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

CO 1: Spell the characteristics of a transmission line.

CO 2: Comprehend the uses of different relays in power systems.

CO 3: Apply suitable techniques to locate the fault of an underground cable.

CO 4: Analyze the results of short circuit analysis for symmetrical and unsymmetrical faults.

CO 5: Assess the characteristics of a solar PV module.

CO 6: Discuss the procedural steps needed to implement for interpreting the results of the power system software.

COURSE CONTENT

- Determine the ABCD parameters of a transmission lines.
- Study of electromechanical type over current relay & over voltage relay
- Fault location of Under Ground Cable by Varley Loop Test
- Develop software programs for analysis of power systems

Textbook(s):

1. Modern Power System Analysis, I. J. Nagrath, D. P. Kothari, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 4th Edition 2013.
2. Electrical Power System, C.L. Wadhwa, New Age International (P) Limited, Publishers, 2010.

Reference Book(s):

1. Power system analysis by Hadi Sadat Tata McGraw Hill.
2. Power System Protection and Switchgear by B Rabindranath and M Chander, Wiley Eastern (1977)
3. Fundamentals of Power System Protection", Y. G. Paithankar, S. R. Bhide, 2nd edition, Prentice Hall of India Private Limited, New Delhi, 2011
4. A Text Book on Power System Engineering, A. Chakrabarti, M.L. Soni, P.V. Gupta and U.S. Bhatnagar, Dhanpat Rai and Co., Reprint 2012

EMBEDDED SYSTEM DESIGN AND INTERFACING LABORATORY

Course Code :ES38005

Credit :1

L-T-P : 0-0-2

Prerequisite(s) :Nil

COURSE OBJECTIVE

This laboratory course provides hands-on experience in embedded system design using 8051 and ARM microcontrollers. Students will learn to write and debug assembly and embedded C programs, interface microcontrollers with sensors and actuators, and perform memory operations. The course also introduces hardware description through Verilog for basic digital circuit design. Emphasis is placed on practical implementation using simulation tools and industry-relevant development environments such as KEIL and ModelSim

COURSE OUTCOMES

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

CO1: Understand 8051 and ARM microcontroller architectures and instruction sets.

CO2: Develop programs using assembly and embedded C for basic operations.

CO3: Interface sensors and actuators with microcontrollers.

CO4: Perform memory access and manipulation in embedded systems.

CO5: Design and simulate digital modules using Verilog.

CO6: Use KEIL and other tools for embedded system development.

COURSE CONTENT

- **Introduction to Embedded Systems and 8051 Programming:** Overview of embedded systems lab, programming 8051 using arithmetic, logical, timer, counter, and serial port instructions.
- **Interfacing and Control using 8051:** Stepper motor, temperature sensor interfacing, and relay control using 8051.
- **Complex Instruction Set Programming on ARM**: Use of LDMFD/STMFD, B, BL, and memory/branching instructions on ARM platform.
- **Arithmetic and Logical Operations on ARM:** Register/memory-based arithmetic and logic operations using ARM assembly.
- **ARM State Mode and Memory Segmentation:** Use of MRS/MMSR to switch ARM state modes and define segments via command line.
- **Embedded C Programming in KEIL for ARM**: Develop and simulate ARM-based programs using embedded C in KEIL IDE.
- **Random Number Generation in Embedded Systems**: Develop random number generation using C and assembly; store and access using RAM.
- **Memory Mapping and Access in Embedded Systems**: Read/write to memory using C and assembly (words, half-words, bytes, etc.
- **LED Interfacing with ARM**: Program ARM I/O ports to blink and light up LEDs.
- **Verilog-Based Digital Design:** Implement basic hardware modules like adders, counters, mux, ALU using Verilog HDL.

Textbooks :

1. Raj Kamal, Embedded Systems: Architecture, Programming and Design, Tata McGraw-Hill Education, 3rd Edition.

2. Muhammad Ali Mazidi, Rolin D. McKinlay, Janice Gillispie Mazidi, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Pearson Education, 2nd Edition.

Reference Books:

1. Jonathan W. Valvano, Embedded Systems: Introduction to ARM Cortex-M Microcontrollers, CreateSpace Independent Publishing, 5th Edition.

2. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufmann, 3rd Edition.

3. Shibu K.V., Introduction to Embedded Systems, McGraw-Hill Education India.

4. Lyla B. Das, Embedded Systems: An Integrated Approach, Pearson Education India.

DATA COMMUNICATION & COMPUTER NETWORKS LAB

Course Code : ES39004

Credit :1

L-T-P :0-0-2

Prerequisite(s) : Nil

COURSE OBJECTIVE

The main objective of this laboratory is to provide practical exposure to data communication standards and computer networking protocols. Students will learn to implement various link-layer and transport-layer protocols, design network topologies using simulation tools, and analyze network traffic.
Students are allowed to conduct experiments to validate the theoretical concepts of the OSI and TCP/IP models.
From this laboratory course, students will gain the skill to develop socket programs and troubleshoot network configurations.

COURSE OUTCOMES
After successfully completing the course, the students will be able to

CO 1: Understand different components of computer networks, transmission media, and utilize basic networking commands (Ping, Traceroute, Netstat, etc.).
CO 2: Implement error detection and correction techniques (like CRC, Hamming code) and flow control algorithms (Stop-and-Wait, Sliding Window).
CO 3: Develop client-server applications using TCP and UDP socket programming mechanisms.
CO 4: Analyze and simulate various network topologies (Star, Bus, Ring) and routing protocols (Distance Vector, Link State) using tools like NS2 or Cisco Packet Tracer.

CO 5: Assess network performance parameters such as throughput, delay, and packet delivery ratio under different congestion scenarios.
CO 6: Design and inspect network packets and headers to understand protocol behaviors using packet analyzer tools like Wireshark.

COURSE CONTENT

Topics:

- **Study of Network Components and Crimping:** Study of different types of network cables (Twisted pair, Coaxial, Fiber Optic) and practical implementation of Cross-wired and Straight-through cable using a crimping tool (RJ-45).
- **Basic Network Commands:** Hands-on practice with basic networking commands to troubleshoot and analyze networks: ping, traceroute/tracert, ifconfig/ipconfig, netstat, nslookup, and arp.
- **Error Detection and Correction:** Implementation of error detection techniques such as Cyclic Redundancy Check (CRC) and Hamming Code using C/C++.
- **Flow Control Protocols:** Simulation and implementation of Data Link Layer flow control mechanisms: Stop-and-Wait, Go-Back-N, and Selective Repeat sliding window protocols.
- **Socket Programming (TCP):** Design of a Client-Server application using TCP sockets (e.g., Echo Server, Chat Application, or File Transfer).
- **Socket Programming (UDP):** Design of a Client-Server application using UDP sockets (e.g., DNS simulation or simple datagram transfer).
- **Routing Algorithms:** Implementation of routing algorithms to compute shortest paths:
- Dijkstra’s Algorithm (Link State Routing)
- Distance Vector Routing (Bellman-Ford).
- **Network Simulation (Topologies):** Simulation of various network topologies (Star, Bus, Ring, Mesh) using **NS2** or **Cisco Packet Tracer** to study node-to-node communication.
- **Performance Analysis:** Simulation of a Local Area Network (LAN) to analyze the performance (Throughput, Delay, Jitter) by varying parameters like bandwidth and queue size.
- **Packet Analysis:** Capture and analysis of network traffic (TCP/IP, HTTP, DNS packets) using **Wireshark** to inspect protocol headers and handshake processes.

Textbook(s)

- Computer Networking: A Top-Down Approach, James F. Kurose and Keith W. Ross, Pearson, 2022.
- Data Communications and Networking, Behrouz A. Forouzan, McGraw-Hill, 5th Edition.

Reference Book(s)

- Computer Networks, Andrew S. Tanenbaum, Pearson Education.
- Unix Network Programming, W. Richard Stevens, Prentice Hall.

IOT in ENGINEERING LABORATORY

Course Code :EE38002

Credit :1

L-T-P : 0-0-2

Prerequisite(s) :Nil

COURSE OBJECTIVE

This Internet of Things (IoT) lab focuses on the interconnected network of physical objects—known as "things"—embedded with electronics, software, sensors, and connectivity that enable data exchange. IoT facilitates seamless integration between the physical world and computer-based systems, thereby connecting people, processes, and devices.The course emphasizes a structured and logical understanding of various IoT communication protocols, which are essential for designing and managing networks. It also aims to familiarize students with different types of sensors, cloud storage solutions, and the analysis of stored data using IoT analytics tools.

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO 1: Understand the significance of sensors and their key parameters.
CO 2: Develop effective teamwork skills while collaborating towards a common goal.
CO 3: Identify various communication protocols and their applications in IoT systems.
CO 4: Recognize different types of cloud storage solutions for IoT data.
CO 5: Analyze and interpret experimental results using IoT analytics tools.
CO 6: Design and develop basic Internet of Things (IoT) architectures.

COURSE CONTENT

- **Installation of Arduino IDE and Pin Configuration**: Installing the Arduino IDE and understanding the pin configuration of various microcontrollers.
- **Interfacing LM35 Temperature Sensor with NodeMCU**: Acquiring temperature data using the LM35 sensor and transmitting it through the NodeMCU.
- **Displaying DHT11 Temperature and Humidity Data on an OLED Display:** Reading environmental data from the DHT11 sensor and visualizing it on an OLED screen.
- **Controlling Electrical Appliances Using a Relay Module with ESP8266**: Interfacing a relay module with ESP8266 to control external electrical devices.
- **Creating a ThingSpeak Account for IoT Data Monitoring**: Setting up a ThingSpeak account for cloud-based IoT data storage and visualization.

- **Temperature and Humidity Monitoring with DHT11 and Data Transmission to ThingSpeak**: Collecting real-time data using DHT11 and uploading it to ThingSpeak for remote monitoring.
- **Developing a Web Server Using ESP8266 for Relay Control**: Creating a web-based interface to control appliances via a relay connected to ESP8266.
- **LED Control via Blynk App Using Analog Input and ESP8266**: Implementing LED control through the Blynk mobile app and understanding ESP8266 pin functions.

Text Books:

1. Designing the Internet of Things, Adrian McEwen, Hakim Cassimally, Wiley publication, 1st Edition, November 2013.
2. The Internet of Things in the Power Sector Opportunities in Asia and the Pacific, Ramamurthy, A. and Jain, P, 2017.

Reference Books:

1. The Internet of Things: A Survey, Journal on Networks, Luigi Atzori, Antonio Lera, Giacomo Morabito, Elsevier Publications, October, 2010.
2. The Internet of Things in the Cloud:A Middleware Perspective, Honbo Zhou, CRC Press-2012.
3. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Springer, 2011.

MINOR PROJECT

Course Code: ES 37002

Credit:2

L-T-P :0-0-4

Prerequisite(s):[Electrical Circuits Analysis, Linear control system, Electrical Machine, Power Electronics , Power system operation control and protection]

COURSE OBJECTIVE

The minor project for Electrical engineering students is projected to acquire practical knowledge in Electrical engineering . The students are directed to do a project related to Electrical engineering . The objective of the minor project is to provide an opportunity for students to undertake short research training outside the classroom to solve real-world issues. That mainly involves the application of Electrical engineering as a part of its solution, through a short project.

COURSE OUTCOMES

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

CO 1: Recall various technologies for project management.
CO 2: comprehend the practice of literature review for defining novel objectives.

CO 3: Apply the literature search techniques to identify and formulate the engineering problem.
CO 4: Analyse the environmental friendly solutions to engineering problems.
CO 5: Evaluate the prescribed standards/ safety norms through implementation.
CO 6: Create an independent study to identify the mathematical, engineering and managerial concepts to solve engineering problem

PROJECT-I

Course Code :ES 47001

Credit :5

L-T-P :0-0-10

Prerequisite(s) :[Electrical Circuits Analysis, Linear control system, Electrical Machine, Power Electronics, Power system operation control and protection]

COURSE OBJECTIVE

A fully engaged student shall be able to get exposure to undertake a short research project. Also, able to communicate and demonstrate the learning through structured thesis and oral presentation. Student's conduct research under the mentorship of the research supervisor/s in an organization on a topic mutually agreeable to them. The minor project coordinator oversees the process and mentor students whenever required.

COURSE OUTCOMES

After successfully completing the course, the students will be able to
CO 1: Remembers the objectives of short research project.
CO 2: Understand the tenets of literature review
CO 3: Apply the engineering concepts and tools to arrive at design solution(s) for various problems
CO 4: Analyze the results of experiments conducted to arrive at valid conclusions.
CO 5: Evaluate an exhaustive list of available engineering tools used for solving problems.
CO 6: Create a structured thesis report and presentation to disseminate the learning.

PROJECT-II

Course Code :ES 47002

Credit :9

L-T-P :0-0-18

Prerequisite(s):[Electrical Circuits Analysis, Linear control system, Electrical Machine, Power Electronics , Power system operation control and protection]

COURSE OBJECTIVE

A fully engaged student shall be able to get exposure to undertake a short research project. Also, able to communicate and demonstrate the learning through structured thesis and oral presentation. Student's conduct research under the mentorship of the research supervisor/s in an organization on a topic mutually agreeable to them. The minor project coordinator oversees the process and mentor students whenever required.

COURSE OUTCOMES

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

CO 1: Know the practices of budget analysis by the utilization of resources (finance, power, area, bandwidth, weight, size, any other).

CO 2: Understand the IEEE paper format for project report writing.

CO 3: Utilise the communication skill in reporting in IEEE paper format.

CO 4: Analyse the project reports from the point of view of adherence to professional ethics.

CO 5: Evaluate the individual contributions in a team work.

CO 6: Create an effective audio visual presentation to disseminate the inferences of a project work

INTERNSHIP

Course Code :ES 48001

Credit :2

Prerequisite(s):[Electrical Circuits Analysis, Linear control system, Electrical Machine, Power Electronics , Power system operation control and protection]

COURSE OBJECTIVE

A student will undergo the internship training to know the engineering application in real life. They come across the day to day application of his/her leering and how theory is different from the practical applications. Apart from this how the theoretical knowledge is important to understand each and every concepts or engineering in real application. If the industry permits then they will do some hands on in their interest to learn and feel the importance of engineering.

COURSE OUTCOMES

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

CO1: Know the importance of safety practices to be adopted in the industry.

CO2: Comprehend the industrial operations during the training.

CO3: Utilize the industrial safety parameter to ensure the smooth operation.

CO4: Analyse the various operational procedures of an industry to identify imminent problems.

CO5: Evaluate the policies of human resource managements adopted for optimizing benefits.

CO6: Create a report reflecting all the findings during the tenures of the training.

Kalinga Institute of Industrial Technology (KIIT)
Deemed to be University U/S 3 of UGC Act, 1956
Bhubaneswar, Odisha, India