SRI RAMAKRISHNA INSTITUTE OF TECHNOLOGY
(An Autonomous Institution)
(Approved by AICTE, New Delhi :: Affiliated to Anna University, Chennai)
Pachapalayam, Perur Chettipalayam, Coimbatore - 641010

B.E. – ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER I										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UICH001	Technical English	HS	2	0	1	3	40	60	100
2	UICH007	Electrical Engineers and Society	HS	2	0	0	2	40	60	100
3	UICM001	Engineering Mathematics – I	BS	3	1	0	4	40	60	100
4	UICP001	Engineering Physics	BS	3	0	1	4	40	60	100
5	UICC001	Engineering Chemistry	BS	3	0	1	4	40	60	100
6	UICE004	Computing Fundamentals and C Programming	ES	2	0	2	4	40	60	100
7	UICE010	Engineering Graphics	ES	2	0	2	4	40	60	100
			Total	**17**	**1**	**7**	**25**			

SEMESTER II										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UICH002	Business English	HS	2	0	1	3	40	60	100
2	UICM002	Engineering Mathematics – II	BS	3	1	0	4	40	60	100
3	UICC002	Ecology and Environmental Sciences	BS	3	0	0	3	40	60	100
4	UICE013	Engineering Materials	ES	3	0	0	3	40	60	100
5	UICE001	Basic Civil and Mechanical Engineering	ES	4	0	0	4	40	60	100
6	UICE015	Engineering workshop	ES	0	0	2	2	40	60	100
7	UEEC001	Circuit Theory	PCC	3	0	1	4	60	40	100
			Total	**18**	**1**	**4**	**23**			

SEMESTER III										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UICM003	Transforms and Partial Differential Equations	BS	3	1	0	4	40	60	100
2	UICE017	Object Oriented Programming with C++ and Java	ES	2	0	2	4	40	60	100
3	UCSC006	Data structures and Algorithm	ES	3	0	1	4	40	60	100
4	UICE022	Electronic Devices and Circuits	ES	3	0	1	4	40	60	100
5	UEEC002	Electro Magnetic Theory	PCC	3	0	0	3	40	60	100
6	UEEC003	Measurements and Instrumentation	PCC	3	0	1	4	40	60	100
			Total	**17**	**1**	**5**	**23**			

SEMESTER IV										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UICM004	Numerical Methods	BS	3	1	0	4	40	60	100
2	UICE021	Analog and Digital Systems	ES	3	0	1	4	40	60	100
3	UICE023	Microprocessors and Microcontrollers	ES	3	0	1	4	40	60	100
4	UEEC004	Control Systems	PCC	3	0	1	4	40	60	100
5	UEEC005	DC Machines and Transformers	PCC	3	0	1	4	40	60	100
6	UEEC006	Generation, Transmission and Distribution	PCC	3	0	0	3	40	60	100
7	UEEC101	Renewable Energy Sources	PCC	3	0	0	3	40	60	100
			Total	**21**	**1**	**4**	**26**			

SEMESTER V										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UEEC007	Induction and Synchronous Machines	PCC	3	0	1	4	40	60	100
2	UEEC008	Digital Signal Processing	PCC	3	0	0	3	40	60	100
3	UEEC009	Power System Analysis	PCC	3	0	0	3	40	60	100
4	UEEC010	Power Electronics	PCC	3	0	0	3	40	60	100
5	UEEC102	High Voltage Engineering	PCC	3	0	0	3	40	60	100
6	UEEC103	Power System Simulation Laboratory	PCC	0	0	2	2	40	60	100
7	xxxxxxx	Professional Elective-I	PE	3	0	0	3	40	60	100
8	xxxxxxx	Generic Elective-I	GE	3	0	0	3	40	60	100
			Total	**21**	**0**	**3**	**24**			

SEMESTER VI										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UEEC011	Design of Electrical Machines	PCC	3	0	0	3	40	60	100
2	UEEC104	Power System Operation and Control	PCC	3	0	0	3	40	60	100
3	UEEC105	Utilization and Conservation of Electrical Energy	PCC	3	0	0	3	40	60	100
4	xxxxxxx	Professional Elective-II	PE	3	0	0	3	40	60	100
5	xxxxxxx	Professional Elective – III	PE	3	0	0	3	40	60	100
6	xxxxxxx	Generic Elective-II	GE	3	0	0	3	40	60	100
7	UEEC013	Industrial Design Project (Course Work)	IDP	4	0	0	4	40	60	100
8	UEEC014	Industrial Design Project (Practical)	IDP	0	0	2	2	40	60	100
			Total	**22**	**0**	**2**	**24**			

SEMESTER VII										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UICH004	Industrial Management and Economics	HS	3	0	0	3	40	60	100
2	UEEC012	Protection and Switchgear	PCC	3	0	0	3	40	60	100
3	UEEC106	Energy Auditing and Management	PCC	3	0	0	3	40	60	100
4	xxxxxxx	Professional Elective – IV	PE	3	0	0	3	40	60	100
5	xxxxxxx	Professional Elective – V	PE	3	0	0	3	40	60	100
6	xxxxxxx	Generic Elective-III	GE	3	0	0	3	40	60	100
7	UEEC015	Industrial Design Project (Phase-II)	IDP	0	0	6	6	60	40	100
8	UEEC016	Final Year Project – Phase- I	FYP	0	0	2	2	60	40	100
			Total	**18**	**0**	**8**	**26**			

SEMESTER VIII										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	xxxxxxx	Professional Elective – VI	PE	3	0	0	3	40	60	100
2	xxxxxxx	Generic Elective-IV	GE	3	0	0	3	40	60	100
3	UEEC017	Final Year Project – Phase- II	FYP	0	0	6	6	60	40	100
			Total	**6**	**0**	**6**	**12**			

PROFESSIONAL ELECTIVE – I										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UEEE101	EHV Power Transmission	**PE**	3	0	0	3	40	60	100
2	UEEE102	Design of Photovoltaic Systems	**PE**	2	0	1	3	40	60	100
3	UEEE206	Virtual Instrumentation	**PE**	3	0	0	3	40	60	100
4	UEEE207	Power Plant Instrumentation	**PE**	3	0	0	3	40	60	100
5	UEEE210	Sensors for Robotics	**PE**	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – II & III										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UEEE103	Control of Electric Drives	**PE**	3	0	0	3	40	60	100
2	UEEE105	Advanced Energy Storage Systems	**PE**	3	0	0	3	40	60	100
3	UEEE110	Power Quality	**PE**	3	0	0	3	40	60	100
4	UEEE114	Hybrid Electric Vehicle	**PE**	3	0	0	3	40	60	100
5	UEEE304	Solid State Power Controllers	**PE**	3	0	0	3	40	60	100
6	UEEE309	PLC and SCADA	**PE**	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – VI & V										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UEEE104	Flexible AC Transmission Systems	**PE**	3	0	0	3	40	60	100
2	UEEE107	Static VAr Compensation and Harmonic Filtering	**PE**	3	0	0	3	40	60	100
3	UEEE111	Restructured Power Systems	**PE**	3	0	0	3	40	60	100
4	UEEE113	Industrial Power System Analysis and Design	**PE**	3	0	0	3	40	60	100
5	UEEE303	Digital System Design	**PE**	3	0	0	3	40	60	100
6	UEEE310	Switched Mode Power Converters	**PE**	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE – VI										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UEEE106	HVDC Transmission	**PE**	3	0	0	3	40	60	100
2	UEEE108	Nanotechnology for Energy Systems	**PE**	3	0	0	3	40	60	100
3	UEEE109	Power Electronics for Renewable Energy Systems	**PE**	3	0	0	3	40	60	100
4	UEEE112	SCADA and Distributed Control Systems	**PE**	3	0	0	3	40	60	100
5	UEEE201	Bio-Medical Instrumentation	**PE**	3	0	0	3	40	60	100

LIST OF GENERIC ELECTIVES

OFFERED BY DEPARTMENT OF CIVIL ENGINEERING										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UCEG001	Environmental Impact Assessment	**GE**	3	0	0	3	40	60	100
2	UCEG002	Disaster Mitigation and Management	**GE**	3	0	0	3	40	60	100
3	UCEG003	Global Warming and Climate Change	**GE**	3	0	0	3	40	60	100
4	UCEG004	GIS for Natural Resources Management	**GE**	3	0	0	3	40	60	100
5	UCEG005	Principles of Remote Sensing	**GE**	3	0	0	3	40	60	100

OFFERED BY DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UCSG001	Fundamentals of Information Security	**GE**	3	0	0	3	40	60	100
2	UCSG002	Introduction to Computer Networks	**GE**	3	0	0	3	40	60	100
3	UCSG003	Introduction to Software Engineering	**GE**	3	0	0	3	40	60	100
4	UCSG004	Python Programming for Engineers	**GE**	3	0	0	3	40	60	100
5	UCSG005	Soft Computing and its Applications	**GE**	3	0	0	3	40	60	100

OFFERED BY DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UECG001	Electronic Measurements	**GE**	3	0	0	3	40	60	100
2	UECG002	Introduction to Embedded Systems	**GE**	3	0	0	3	40	60	100
3	UECG003	Microcontrollers and its Applications	**GE**	3	0	0	3	40	60	100
4	UECG004	Nano Electronics and Sensors	**GE**	3	0	0	3	40	60	100
5	UECG005	Principles of VLSI Systems	**GE**	3	0	0	3	40	60	100

OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UMEG001	Automotive Fundamentals	**GE**	3	0	0	3	40	60	100
2	UMEG002	Computer Aided Design	**GE**	3	0	0	3	40	60	100
3	UMEG003	Introduction to Power Plant Engineering	**GE**	3	0	0	3	40	60	100
4	UMEG004	Introduction to Robotics	**GE**	3	0	0	3	40	60	100
5	UMEG005	3D Printing	**GE**	3	0	0	3	40	60	100

OFFERED BY DEPARTMENT OF INFORMATION TECHNOLOGY										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UITG001	Big Data Analytics and its Applications	**GE**	3	0	0	3	40	60	100
2	UITG002	Cloud Computing Fundamentals	**GE**	3	0	0	3	40	60	100
3	UITG003	Fundamentals of Internet of Things	**GE**	3	0	0	3	40	60	100
4	UITG004	Introduction to Data Base Management Systems	**GE**	3	0	0	3	40	60	100
5	UITG005	Web Interface Design and Development	**GE**	3	0	0	3	40	60	100

OFFERED BY DEPARTMENT OF SCIENCE AND HUMANITIES										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UHSG001	Indian Constitution, Democracy and World Affairs	**GE**	3	0	0	3	40	60	100
2	UPHG001	Fundamentals of Astrophysics	**GE**	3	0	0	3	40	60	100
3	UCHG001	Fundamentals of Biochemistry	**GE**	3	0	0	3	40	60	100
4	UMHG001	Statistical Inferences and Applications	**GE**	3	0	0	3	40	60	100

OFFERED BY DEPARTMENT OF MASTER OF BUSINESS ADMINISTRATION										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UMGG001	Entrepreneurship Development	**GE**	3	0	0	3	40	60	100
2	UMGG002	Intellectual Property Rights	**GE**	3	0	0	3	40	60	100
3	UMGG003	Total Quality Management	**GE**	3	0	0	3	40	60	100
4	UMGG004	Human Rights And Human Values	**GE**	3	0	0	3	40	60	100
5	UMGG005	Supply Chain Management And Logistics	**GE**	3	0	0	3	40	60	100

SEMESTER I

UICH001	TECHNICAL ENGLISH	L	T	P	C
		2	0	1	3

Course Objectives

- To equip the students with the LSRW skills.
- To perceive the art of effective speaking and writing through various grammar exercises.
- To enable the act of interpreting Comprehension passages and essays.
- To develop test-taking strategies and skills for BEC Prelims.

Course Content

Importance of Communication

Listening: Listening to audio files and answering the given questions, Speaking: Self-introduction and Peer introduction, Speak about one's native place/important festivals/ History of a company, Reading: Note-Making on the given text, Skimming and Scanning for specific information, Writing: Parts of Speech, Word formation with Prefix and Suffix, Regular and Irregular verbs, Articles, Tenses, Countable and Uncountable Nouns, Set phrases for e-mails and Letters, sending a group e-mail.

Formal Communication

Listening: Listening to motivational talks / TED talks, Telephone Conversation (information about orders and deliveries), Speaking: Role-Play (a telephone call to a supplier), Describing a product and how it is advertised, Reading: Reading Comprehension exercise, Writing: Subject-Verb Agreement, Comparative Adjectives, Expansion of Compound Nouns, Prepositions, Formal letter writing (A letter responding to an invitation and promotional letters), E-mail to Manager.

Writing Strategies

Listening: Listening to statistical information (short extracts), Speaking: Role-Play (Making an appointment), Planning a sales event, Reading: Finding key points from the given text, Writing: Cause and Effect, Compare and Contrast, Gerunds and Infinitives, Paragraph writing, Instructions, E-mail (confirming a booking/requesting information), Translating and interpreting written or spoken content from one language to another.

Presentation Skills

Listening: Listening to Mock Group Discussion and evaluating, Speaking: Making presentation on the given topic / Describing the given data and trends, Sales talk (Discussing on company information), Reading: Interpreting pictures of Flowchart/Pie chart/Bar chart, Writing: Letter to express an interest in a new product, Process Description, Recommendations.

Technical Communication

Listening: Listening to interviews (frequently asked questions and responses), Speaking: Giving impromptu talks, Giving a summary of an article, Reading: Business Report, E-mail to a Recruitment Agency, Writing: Resume Writing, Purpose and Function, Wh- questions.

List of Exercises

1. Self and Peer Introduction
2. Telephonic Conversation
3. Listening Comprehension
4. Oral Presentation on a given topic
5. Mock interview

References

1. Ian wood, Anne Williams with Anna Cowper, "Pass Cambridge BEC Preliminary", 2nd Edition, Cengage Learning, 2015.
2. Whitby, Norman, "Business Benchmark Pre-intermediate to Intermediate Business preliminary", 1st Edition Cambridge University Press, 2014.
3. Rizvi M.Ashraf, "Effective Technical Communication", Tata McGraw-Hill Publishing Company Limited, 4th Edition, 2010.
4. Gerson Sharon J, Steven M.Gerson, "Technical Writing-Process and Product", Pearson Education Pvt. Ltd. 3rd Edition, 2009.
5. Douglas Stone, Bruce Patton, Sheila Heen, "Difficult Conversations: How to Discuss" Kindle Publication, 1st Edition, 2010.

UICH007	ELECTRICAL ENGINEERS AND SOCIETY	L	T	P	C
		2	0	0	2

Course Objectives

- To impart an understanding of duties and responsibilities as professionals through gaining knowledge of the philosophies of ethics, professional practice, and case studies.
- To impart basic knowledge to make ethical decisions when confronted with problems related to Electrical Engineering.
- To impart better understanding of the impact of Electrical Engineering solutions in a global/societal context.

Course Content

Engineer Responsibilities

Engineering – Definition – Engineering education – Graduate attributes – Engineering functions – Role and Responsibilities of Engineers – Professional Societies and their codes of ethics – Constraints in Engineering

Role of Electrical Engineers in society

Introduction to Electrical Engineering – Branches of Electrical Engineering – Scope of Electrical Engineering – Role of Electrical engineer in solving societal issues such as Power Blackouts around the World and energy conservation. Role of electrical engineers on Innovations in world history, Information and communication technology and transportation sectors, Industrial and agricultural development.

Engineering Ethics

The concept of profession – Importance of ethics in Engineering – Role of codes of ethics – Professional responsibilities of Engineers – Overview of ethical theories and applications – Social and ethical responsibilities of Engineers – Whistle blowing and beyond, Case studies.

Engineers and Environment

Reliability, risk and safety – Risk management – Engineering and the environment – Ethics and the environment – Sustainable Engineering – Global and Cultural considerations – Specific case examples – Challengers Incidents

Electrical Standards and Safety

Indian electrical Standards and Rules-Fire and Electrical Safety Practices- Electronics Apparatus Safety Requirements- Earthing and grounding.

References

1. Kim Strom–Gottfried, "Straight Talk about Professional Ethics", Second Edition, Oxford University Press, 2014.
2. Kenneth K. Humphreys, "What Every Engineer Should Know about Ethics", CRC Press, 1999.
3. Thomas Petermann, HaraldBradke, Arne Lüllmann, MaikPoetzsch, Ulrich Riehm, "What Happens During a Blackout: Consequences of a Prolonged and Wide–ranging Power Outage", Books on Demand, 2014.
4. K.Nagabhushan Raju, "Industrial Energy Conservation Techniques: (concepts, Applications and Case Studies)", Atlantic Publishers &Dist, 2007.
5. Indian Standards (IS 302-1:2008, IS 1646: 1997, IS/IEC 61558-1: 1997).
6. V.S.Mahajan, "Growth of agriculture and industry in India", Deep & Deep, 1983.

UICM001	ENGINEERING MATHEMATICS - I	L	T	P	C
		3	1	0	4

Course Objectives

- Able to adopt the concepts of Eigenvalues and Eigenvectors of matrices and apply them in various Engineering fields.
- Able to make the student knowledgeable in the area of infinite series and their convergence.
- Able to develop the skills of solving problems under several variable calculus.

Course Content

Matrices

Eigen value and Eigenvectors – Properties – Cayley-Hamilton Theorem (without proof) - Diagonalization – Similarity and Orthogonal transformation – Quadratic forms – Orthogonal reduction– Applications.

Sequences and Infinite Series

Sequences – Convergence of series – General properties – Series of positive terms – Tests of convergence (Comparison test, Integral test, Comparison of ratios and D'Alembert's ratio test) – Alternating series – Series of positive and negative terms – Leibnitz rule (statement only) - Absolute and conditional convergence.

Differential Calculus

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals – Applications.

Functions of Several Variables

Partial derivatives – Total derivative – Differentiation of implicit functions – Change of variables – Jacobian – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

Multiple Integrals

Double Integrals (Cartesian and polar) – Change of order of integration – Change of variables – Triple integrals – Transformation – Spherical and Cylindrical coordinates – Applications to area and volume.

References

1. Grewal. B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2016.
2. Srimanta Paul and Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, 1st Edition, 2015.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2016.
4. James Stewart, "Calculus, Early Transcendental", 7th Edition, Cengage learning, New Delhi, 2015.
5. Ramana B.V, "Higher Engineering Mathematics", 6th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.
6. Ravish R Singh and Mukul Bhatt, "Engineering Mathematics", 1st Edition, Tata McGraw Hill Education, New Delhi, 2016.

UICP001	ENGINEERING PHYSICS	L	T	P	C
		3	0	1	4

Course Objectives

- To understand the properties of materials, concept of quantum mechanics, working of lasers and fiber optics.
- To perform experiments using semiconductor, laser and fiber optics.
- To apply the concept of physics in different engineering application and to solve scientific problems.

Course Content

Properties of Matter

Hooke's law - stress - strain diagram - modulus of elasticity - elastic constants - relation between elastic moduli - Poisson's ratio - expressions for Poisson's ratio in terms of elastic constants - work done in stretching a wire - work done in twisting a wire - Applications: twisting couple on a cylinder, rigidity modulus of a wire.

Thermal Physics

Fundamental modes of heat transfer - effect of temperature on thermal conductivity of solids, liquids and gases - Conduction in solids - Lee's disc method - flow of heat through a compound material - Application: Thermal insulation of buildings.

Principles of Quantum Mechanics

Blackbody Radiation - Quantum of energy and Planck's hypothesis - Rayleigh-Jeans Law - Photoelectric effect - Concept of photon mass - Compton effect - de-Broglie hypothesis - Davisson and Germer experiment - Schrödinger wave equations - Applications: Particle in one dimensional box - Quantum tunneling in p-n junction diode.

Laser and Fiber optics

Spontaneous emission - stimulated emission - Types of laser - pumping - ND-YAG laser - CO_2 laser- semiconductor laser (homojunction and heterojunction) - Engineering applications: holography (construction and reconstruction of hologram).Fiber optic materials - concept of light flow – modes of propagation of light through different media - types of optical fibers – acceptance angle - Applications: Temperature and displacement sensor, Fiber endoscope.

Fundamentals of Nanoscience

Introduction – classification – density of states of 1D, 2D, 3D – morphology (particles, nanowires and nanotubes) – Optical properties.

List of Experiments

1. Determination of moment of inertia of the metallic disc and rigidity modulus of the wire using Torsional Pendulum.
2. Determination of thermal conductivity of a bad conductor using Lee's Disc method.
3. Determination of energy band gap in a semiconductor by using p-n junction diode.
4. Determination of thickness of a thin sheet of paper using Air Wedge method.
5. (i) Determination of particle size using laser.
   (ii) Determination of acceptance angle and numerical aperture of an optical fiber.

References

1. Dattu R Joshi, "Engineering Physics", Tata McGraw Hill Publications, New Delhi, 1st Edition, 2010.
2. Vijayakumar S, "Engineering Physics – I", Wiley Publications, 2014.
3. Halliday, Resnick and Walker, "Fundamentals of Physics", Wiley International Publications, Extended 10th Edition, 2015.
4. Edelstein A S and Cammearata R C., "Nanomaterials: Synthesis, Properties and Applications",Institute of Physics Publishing, Bristol and Philadelphia, 1996.
5. Marikani A, "Engineering Physics", PHI Learning Pvt. Ltd., New Delhi, 2nd Edition, 2013.
6. Mani Naidu S, "Engineering Physics", Pearson Education, Delhi, 2010.

UICC001	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	1	4

Course Objectives

- To learn the electrochemical principles, various types of electrodes and understand the mechanism of corrosion and prevention methods.
- To conversant with Principles and generation of energy in batteries and fuel cells.
- To acquire knowledge on the quality of water and its treatment method for domestics and industrial applications.
- To be able to develop experimental skill in quantitative analysis of materials by volumetric and instrumental methods and apply in engineering industries.

Course Content

Electrochemistry

Electrolytic Conductance – Specific, Equivalent and Molar conductance (Definitions only) – Conductance measurement – Conductometric titrations – Electrochemical cells – Nernst Equation (Problems), Electrode potential – Electrodes – Standard Hydrogen Electrode (SHE), Saturated Calomel Electrode (SCE) and Glass Electrode – EMF Series and its applications.

Corrosion science and prevention

Definition – Impact in Industries – Mechanism (Dry and Electrochemical) – Types – Galvanic and Differential aeration corrosion – Corrosion prevention – Impressed current technique, sacrificial anodic protection – Inhibitors – Synthetic and Green.

Batteries

Batteries – Characteristics – Current, Power, Capacity, Classification of batteries – Primary (Alkaline battery) – Secondary batteries (Lead acid and Nickel – Cadmium) and Flow batteries (Hydrogen – Oxygen and Methanol – Oxygen fuel cells) – Modern batteries – Lithium Ion batteries – Applications.

Water treatment

Importance of water – Water sources – Impurities – Carbonate and Non Carbonate Hardness (simple problems) – Potable water and its specifications, Steps involved in treatment of potable water – Disinfection of potable water by Chlorination, UV treatment and Ozonization. Industrial water treatment methods – Demineralisation – Desalination (Reverse Osmosis).

Polymers

Polymers – Types (Natural and Synthetic) – Functionality – Degree of polymerization – Engineering polymers – Acrylonitrile Butadiene Styrene (ABS) , Polystyrene and Teflon – Structure and Industrial applications – Compounding of plastics – Fabrication – Extrusion moulding only – Management of waste plastics.

List of Experiments

1. Estimation of acidity of industrial effluent by conductometric titration.
2. Estimation of iron by Potentiometry.
3. Determination of corrosion rate by weight loss method.
4. Determination of percentage purity of bleaching powder.
5. Estimation of hardness of water by Complexometric method.

References

1. Vairam.S, Kalyani P, Suba Ramesh, "Engineering Chemistry", John Wiley & Sons, 1st Edition, 2016.
2. Palanna O G, "Engineering Chemistry", Tata McGraw – Hill Education, 1st Edition, 2009.
3. Renu Bapna and Renu Gupta, Engineering Chemistry, Macmillan Publishers India, 1st Edition, 2010.
4. Jeffery G. H, and Basset J., "Vogel's text book of quantitative chemical analysis", Prentice Hall, 5th Edition, 2012.
5. Qanungo, Kushal, "Engineering Chemistry", Prentice Hall India Limited, 1st Edition, 2009.

UICE004	COMPUTING FUNDAMENTALS AND C PROGRAMMING	L	T	P	C
		2	0	2	4

Course Objectives

- To learn the fundamental components and operating principles of digital computer
- To find solutions to complex engineering problems by developing computer programs using C language

Course Content

Introduction

Generation and Classification of Computers - Basic Organization of a Computer – Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

C Programming Basics

Problem formulation – Problem Solving – Introduction to C programming – fundamentals – structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements – Solution to complex Engineering, Scientific and statistical problems using appropriate control flow statements.

Arrays and Strings

Arrays – Initialization – Declaration – One dimensional and two dimensional arrays. String – String operations – String Arrays. Simple programs – sorting – searching – matrix operations.

Functions and Pointers

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers – Definition – Initialization – Pointers arithmetic – Pointers and arrays – Example Problems.

Structures and Unions

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives – File Handling.

List of Experiments

1. Experiments to solve domain specific complex Engineering problems using appropriate control structures and expressions. Proper formatting of Input / Output statements is mandatory.
2. Experiments to manipulate strings using appropriate data types and string handling functions.
3. Experiments to represent and perform operations on domain specific Engineering, Scientific data using arrays. Proper formatting of Input / Output statements is mandatory.
4. Experiments to represent and perform memory aware operations on domain specific Engineering, Scientific data using pointers. Proper formatting of Input / Output statements is mandatory.
5. Experiments to demonstrate the power of modular programming using functions.
6. Experiments to represent complex scientific data using user defined data types and perform operations to generate required output.
7. Experiments that demonstrate the use of operating system files to store output of computation through C language file handling features.

References

1. Paul Deitel, Harvey Deitel "C How to Program", 3rd Edition, Pearson Education Asia.
2. Behrouz A. Forouzan, Richard F. Gilberg, "Computer Science: A Structured Programming Approach Using C", 3rd Edition, Course Technology Inc, 2005.
3. E Balagurusamy, "Computing Fundamentals and C Programming", McGraw Hill Education; 1st Edition, 2008
4. Greg Perry, Dean Miller, "C Programming Absolute Beginner's Guide", 3rd Edition, Pearson Education, 2014.
5. Henry S. Warren Jr., "Hacker's Delight", 2nd Edition, Pearson Education, 2013.

UICE010	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	4

Course Objective

- To enable the students to communicate the concepts, ideas, and basic designs through graphical representations as per standards and
- Impart knowledge to interpret engineering drawings.

Course Content

Geometrical Constructions and Free Hand Sketching

Lettering – Types of lines – Dimensioning – Geometrical constructions – Principles of Orthographic projection – Orthographic projection of simple Engineering components using first angle Projection – Free Hand sketching only.

Projection of Points, Lines and Plane Surfaces

Projection of points – Projection of straight lines (only First angle projections) inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method – Projection of planes inclined to both the principal planes by rotating object method.

Projection of Solids

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

Projection of Sectioned Solids and Development of Surfaces

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

Isometric and Perspective Projections

Principles of isometric projection – isometric scale – isometric projections of simple solids and Truncated solids – Prisms, pyramids, cylinders, cones – combination of two solid objects in simple vertical positions – Perspective projection of simple solids by visual ray method. Introduction to CAD and their use

References

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.
2. Gary Bertoline., and Eric Wiebe.,"Technical Graphics Communication",McGraw–Hill, 4th Edition, 2009.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 2014.
4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2009.
5. David E. Goetsch, William S. Chalk, Raymond L. Rickman and John Nelson, "Technical Drawing and Engineering Communication", Delmar Cengage Learning, 6th Edition, 2005.

SEMESTER II

UICH002	BUSINESS ENGLISH	L	T	P	C
		2	0	1	3

Course Objectives

- To comprehend the techniques of correspondence that improves the listening and drafting skills.
- To facilitate the students to use the language efficiently at work place.
- To improve decision making and problem solving skills through reading practice.
- To develop test-taking strategies and skills for BEC Vantage.

Course Content

Fundamentals of Communication

Listening: Listening and noting specific information, Speaking: Extempore, Taking and Leaving Voice mail messages, Reading: scanning for gist and specific information, Writing: Discourse Markers, Writing a message, a memo (communicating policies, procedures within an organisation) or an email (business e-mail for appointment, enquiry, email with attachments).

Written Business Correspondence

Listening: Listening to identify topic, context, function, Speaking: Talking about present circumstances, past experiences and future plans, Reading: understanding text structure, Writing: Formal Letters (Calling for quotation, Placing Order, Complaint, Enquiry), Reports, Introduction to Blogs, Tweet, Social Networks, If Conditional, Adverbs / Adjectives.

Career Oriented Communication

Listening: Listening to different Accents/Intonation/Vowels/Consonants, Speaking: speculating about Brands and Marketing, Reading: Reading Comprehension (vocabulary and structure), Writing: Tag Questions, Modal Verbs, Writing Business Correspondence (explaining, apologising, reassuring, complaining), Reports (describing, summarizing), Preparation of Agenda, Notices and Minutes of the Meeting.

Oral Presentation and Professional Speaking

Listening: Listening for details and main ideas, Speaking: Giving personal information, Making a longer speech, Giving information and expressing and justifying opinions, Reading: Reading different kinds of texts, Interpretation of Graphics, Writing: Active / Passive Voice, Set phrases (requesting information, agreeing to requests).

Personality Development

Listening: Listening to longer conversations/Monologues, Speaking: Expressing and justifying opinions, speculating, comparing and contrasting, agreeing and disagreeing. A 'mini-presentation' on a business theme, Reading: understanding sentence structure and finding errors, Writing: Reported Speech, Proposals (describing, summarizing, recommending, persuading).

List of Exercises

1. Extempore
2. Social Networking
3. Technical Presentation
4. Marketing a product
5. Group Discussion

References

1. Ian wood, Anne Williams with Anna Cowper, "Pass Cambridge BEC Vantage", 2nd Edition, Cengage Learning, 2015.
2. Brook-Hart, Guy, "Business Benchmark", Cambridge University Press, 1st Edition, 2014.
3. Stephen E. Lucas, "The Art of Public Speaking", Mc Graw Hill Publications, 5th Edition, 2014.
4. Emilia Hardman, "Active Listening 101: How to turn down your volume to turn up your Communication Skills", Kindle Publication, 2nd Edition, 2012.
5. Patterson, Kerry, Joseph Grenny, Ron McMillan, Al Switzler, "Crucial Conversations Tools for Talking When Stakes Are High", Kindle Publication, 2nd Edition, 2011.

UICM002	ENGINEERING MATHEMATICS - II	L	T	P	C
		3	1	0	4

Course Objectives

- Able to build mathematical models in terms of differential equations.
- Able to acquaint the knowledge on vector calculus, complex variables, conformal mappings and complex integration to solve various Engineering problems.
- Able to understand Laplace transform to represent system dynamic models and evaluate their time responses.

Course Content

Ordinary Differential Equations

Homogeneous linear ODEs of second order – Non-homogeneous linear ODEs of second order with constant coefficients – Euler Cauchy's equation – Wronskian – Variation of Parameters – Modeling with Differential Equations.

Vector Calculus

Gradient of scalar field – Directional derivative – Divergence of vector field – Curl of vector field – Line integrals – Green's theorem in the plane – Gauss divergence theorem – Stokes theorem – (without proof) – Applications.

Analytic Functions

Analytic functions – Necessary and sufficient conditions – Cauchy-Riemann equations – Properties – Construction of analytic functions – Bilinear transformation – Conformal mapping: $w = z + c$, $w = c z$, $w = 1/z$ – Applications.

Complex Integration

Complex integration – Statement of Cauchy's integral theorem – Cauchy's integral formula – Laurent's series expansions – Singular points – Residues – Cauchy's residue theorem – Application of complex integration : Evaluation of real Integrals.

Laplace Transforms

Laplace transform – Properties – Initial and Final Value Theorems – Periodic functions: sine wave, square and triangular waves - Inverse Laplace Transform – Simple system dynamic models - Transfer Functions – Poles and Zeroes - Response of First-Order Systems - Solution of RC Free, Step and Sinusoidal Responses - Convolution theorem.

References

1. Grewal. B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2016.
2. Srimanta Paul and Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, 1st Edition, 2015.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2016.
4. Ravish R Singh and Mukul Bhatt, "Engineering Mathematics", 1st Edition, Tata McGraw Hill Education, New Delhi, 2016.
5. Ramana B.V, "Higher Engineering Mathematics", 6th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.

UICC002	ECOLOGY AND ENVIRONMENTAL SCIENCES	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the functions of natural system and various man induced activities that are affecting the nature in a destructive manner.
- To generate awareness about strategies to control, reduce and monitor all environmental threats.
- To manage various natural resources to attain environmental sustainability.

Course Content

Ecology and Biodiversity

Ecology – ecosystem – biomes – physical and chemical components of ecosystem – biological components of ecosystem – forest ecosystem – desert ecosystem and pond ecosystem – Energy flow in ecosystem – nitrogen cycle – carbon dioxide cycle – phosphorous cycle – food pyramid – Ecological succession – types. – Biodiversity – need for biodiversity – values of biodiversity – hot spots of biodiversity – endangered and endemic species – Conservation of biodiversity – in – situ and ex – situ conservation.

Natural Resources

Earth structure – internal and external earth processes – plate tectonics – erosion – weathering – deforestation – Anomalous properties of water – hydrological cycle – Effect of modern agriculture – fertilizers & pesticides – eutrophication – biomagnifications – Land degradation and mining – Desertification – soil erosion, methods of control of soil erosion – Renewable energy resources – wind, solar, geothermal, tidal and OTEC.

Case Studies: Loss of Forest Cover and Land Degradation in Jhum in India's North – East, Bijolia mining area in Rajasthan, Landslides in Nilgiris.

Environmental Pollution

Introduction – Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management: causes, effects and control measures of municipal solid wastes – Role of an individual in prevention of pollution – pollution case studies.

Case Studies: Polluted Rivers – Ganga, Yamuna and Noyyal River, Foundries in Haora, Zero waste management in Vellore.

Environmental Threats

Acid rain, greenhouse effect, global warming – Disaster management – flood, drought, earthquake, tsunami – Threats to biodiversity – destruction of habitat, habitat fragmentation, hunting, over exploitation, man – wildlife conflicts – The IUCN red list categories, status of threatened species.

Case Studies: Neutrino Project in Tamil Nadu.

Social Issues and Environmental Legislations

Environmental Protection – Role of Government, Legal aspects, Initiatives by Non–governmental Organizations – Sustainable development – sustainable technologies, need for energy and water conservation, rain water harvesting, water shed management, waste land reclamation, environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation – central and state pollution control boards – Public awareness, women and child welfare programs – Role of information technology in human and health.

Case Studies: Save the Children India, Rain water harvesting in urban areas – Women empowerment.

References

1. Tyler Miller G., "Environmental Science", Cengage Learning, 11th Edition, 2015.
2. Benny Joseph., "Environmental Studies", Tata McGraw Hill Education, 2nd Edition, 2008.
3. George Tchobanoglous, Howard S. Peavy, Donald R. Rowe., "Environmental Engineering", McGraw Hill Education, 1st Edition, 2013.
4. Henry J.G. and Heinke G.W., "Environmental Science and Engineering", Prentice Hall, 2nd Edition, 2007.
5. Masters G.B., "Introduction to Environmental Engineering and Science", Pearson Education, 3rd Edition, 2008.

UICE013	ENGINEERING MATERIALS	L	T	P	C
		3	0	0	3

Course Objectives

- To impart knowledge on structure of engineering materials and their influence on mechanical, chemical, electrical and magnetic properties.
- To acquire scientific understanding of engineering materials for relevant engineering applications.

Course Content

Semiconducting materials

Fermi-Dirac distribution function – effect of temperature – density of states – carrier concentration in metals – elemental – compound semiconductor – Concept of Fermi level and its variation with temperature and impurity – Position of Fermi level in intrinsic semiconductor and in extrinsic semiconductor – Conductivity of semiconductor – band gap energy and their determination – Hall effect in semiconductor.

Superconducting materials

Super Conductor: Properties, types and occurrence: BCS theory (qualitative) – applications (SQUID, cryotron, magnetic levitation).

Magnetic materials

Classification of magnetic materials based on spin – Hard and soft magnetic materials – Ferrites, garnets and magnetoplumbites – Magnetic bubbles and their applications – Magnetic thin films – Introduction to spintronics and devices (Giant magnetoresistance, Tunnel magnetoresistance and colossal magnetoresistance).

Dielectric materials

Polarization mechanisms in dielectrics - Frequency and temperature dependence of polarization mechanism – Dielectric loss – Dielectric waveguide and dielectric resonator antenna – Piezoelectric, pyroelectric and ferroelectric materials and their applications.

Nanomaterials

Introduction – surface area to volume ratio – quantum confinement – properties of nanomaterials – synthesis of nanomaterials by ball milling – plasma arcing-pulsed laser deposition and sol-gel methods – carbon nanotubes – properties and applications – applications of nanomaterials in environmental and health care.

References

1. Banerjee G K, “Electrical and Electronics Engineering Materials”, Prentice Hall of India Pvt. Ltd, New Delhi, 2015.
2. Marikani A, “Materials Science”, Prentice Hall of India Pvt. Ltd, Delhi, 2017.
3. Raghavan V, “Material Science and Engineering”, Prentice Hall of India Pvt. Ltd, 6th Edition, Delhi, 2015.
4. William D. Callister, “Material Science and Engineering”, Jr. Wiley India Ltd, 9th Edition, 2014.
5. Vijaya M S and Rangarajan G, “Materials Science”, Tata McGraw – Hill, New Delhi, 3rd Edition, 2006.

UICE001	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	C
		4	0	0	4

Course Objectives

- To enable the students to acquire fundamental knowledge in Civil and Mechanical Engineering disciplines.
- To understand and acquire knowledge about Construction materials, Roads, Surveying and Sources of water.
- To understand and acquire knowledge about various power plants, IC Engines and Refrigeration and Air Conditioning.

Course Content

Civil Engineering

Properties and uses of construction materials – stones, bricks, cement, concrete and steel. Site selection for buildings – Component of building – Foundation– Shallow and deep foundations – Brick and stone masonry – Plastering – Lintels, beams and columns – Roofs.

Roads–Classification of Rural and urban Roads– Pavement Materials–Traffic signs and road marking – Traffic Signals. Surveying –Classification–Chain Survey–Ranging–Compass Survey–exhibition of different survey equipment.

Sources of Water – Dams– Water Supply–Quality of Water–Wastewater Treatment – Sea Water Intrusion – Recharge of Ground Water.

Mechanical Engineering

Introduction, Classification of Power Plants – Working principle of Steam, Gas, Diesel, Hydro–electric and Nuclear Power plants – OTEC cycle, solar power generation and geo thermal energy.

Introduction, working principle of Petrol and Diesel Engines. Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.

Terminology of Refrigeration and Air Conditioning. Overview of Refrigerants. Principle of vapour compression and absorption system. Types of air conditioners (Window, Split, Centralized).

References

1. Palanichamy, M.S, “Basic Civil Engineering”, Tata Mc Graw Hill, New Delhi, 2010.
2. Suresh Gobi, “Basic Civil Engineering”, Pearson Publishers, 1st Edition, 2009.
3. EI– Wakil M.M, “Power Plant Technology”, McGraw–Hill, 2012.
4. Joseph Heitner, “Automotive Mechanics,” 2nd Edition, East–West Press, 1999.
5. Arora, C.P., "Refrigeration and Air Conditioning", 3rd edition, McGraw Hill, New Delhi, 2010.

UICE015	ENGINEERING WORKSHOP	L	T	P	C
		0	0	2	2

Course Objective

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.
- To impart the knowledge of Electronic Components, functionality of measuring equipment and building circuits on PCB Board.

List of exercises

I. CIVIL ENGINEERING PRACTICE LAB

Buildings: Study of plumbing and carpentry components of residential and industrial buildings.

Plumbing Works:

a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
b) Study of pipe connections requirements for pumps and turbines.
c) Preparation of plumbing line sketches for water supply and sewage works.

Hands–on–exercise:

a) Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
b) Demonstration of plumbing requirements of high–rise buildings.

Carpentry using Power Tools only:

a) Study of the joints in roofs, doors, windows and furniture.

Hands–on–exercise:

a) Wood work, joints by sawing, planning and cutting.

II. MECHANICAL ENGINEERING PRACTICE LAB

Welding & Sheet metal

a) Preparation of arc welding of butt joints, lap joints, tee joints and corner joints.
b) Forming of simple objects using sheet metal – Trays, funnels.

Machining practices

a) Simple turning, taper turning, drilling taping practice.

Study

a) Study of centrifugal pump
b) Study of air conditioner

Demonstration

a) Demonstration on foundry operations.

III. Electrical Engineering Practice Lab

Familiarization of wiring tools, lighting and wiring accessories, various types of wiring systems; Wiring of one lamp controlled by one switch; Study of Electric shock phenomenon, precautions, preventions and earthing; Wiring of one lamp controlled by two SPDT Switch and one 3 pin plug socket independently; Familiarization of types of Fuse, MCB; Wiring of fluorescent lamp controlled by one switch from panel with MCB; Familiarization with measuring instruments to measure current, voltage and power in AC/DC circuits.

IV. Electronics Engineering Practice Lab

a) Study of Electronic Components and instruments– Resistors, Capacitors, Inductors, Diodes and multimeter.
b) Measurement of AC signal parameters (voltage, period, frequency) using CRO
c) Measurement of ripple factor of half wave rectifier and full wave rectifier.
d) Study of logic gates –AND, OR, XOR and NOT.
e) Soldering practice using general purpose PCB – Components, Devices and Circuits.

References

1. Bawa H.S., "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, New Delhi, 2007.
2. W A J Chapman, "Workshop Technology", Oxford IBH, 2007.
3. Uppal S. L., Electrical Wiring & Estimating, Khanna Publishers—5^{th} edition, 2003.
4. John H. Watt, Terrell Croft: American Electricians' Handbook: A Reference Book for the Practical Electrical Man – McGraw–Hill, 2002.
5. Thomas L. Floyd and Steve Wetterling, "Laboratory Exercises for Electronic Devices", Pearson Education Limited, 10^{th} Edition, 2017.

UEEC001	CIRCUIT THEORY	L	T	P	C
		3	0	1	4

Course Objectives

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuits using network theorems
- To introduce the phenomenon of resonance in coupled circuits.
- To educate on obtaining the transient response of circuits.
- To draw the phasor diagrams and analysis of three phase circuits

Network Reduction and Network Theorems

Ohm's Law – Kirchoff's laws, series and parallel circuits, Independent and dependent sources, R, L and C elements – Phasor diagram – Complex impedance – real and reactive power, star–delta transformations, loop and nodal analysis for DC circuits and AC circuits. Theorems –Thevenin's, Norton's, Superposition, Reciprocity, Maximum power transfer theorems – Applications to DC circuits and AC circuits. Basic concepts of graph theory.

Resonance and Coupled Circuits

Resonant circuits–series, parallel, series – parallel circuits, Coupled circuits: mutual inductance – coefficient of coupling–dot convention– analysis of simple coupled circuits – Inductively coupled circuits – single tuned and double tuned circuits.

Transient Response and Three Phase Circuits

Transient response of RL, RC and RLC circuits to DC and AC excitation – Natural and forced oscillations. Three phase circuits: Three phase balanced/unbalanced voltage sources–analysis of three phase 3–wire and 4–wire circuits with star and delta connected balanced & unbalanced loads. Phasor diagram of voltages and currents – power and power factor measurements in three phase circuits

List of Experiments

1. Experimental verification of Ohm's law and Kirchhoff's laws.
2. Experimental verification of network theorems (Thevenin, Norton, Superposition and Maximum power transfer Theorem).
3. Design and Simulation of Series and Parallel resonance circuits.
4. Simulation of three phase balanced / unbalanced star, delta networks.
5. Measurement of power in three phase circuits by two–watt meter method.

References

1. Hayt W. H. and Kemmerly J. E., “Engineering Circuit Analysis”, McGraw Hill, New York, Eighth edition, 2012.
2. R. L. Boylestad, “Introductory Circuit Analysis”, Upper Saddle River, N.J.: Prentice Hall, Twelfth edition, 2010.
3. Mahmood Nahvi, Joseph A Edminister, “Electric Circuits”, Mcgraw Hill Education, Fifth Edition, 2010.
4. J. O. Bird, “Electrical Circuit Theory and Technology”, Oxford, New York: Newnes, Revised second edition, 2010.
5. Charles K. Alexander and Matthew N. O. Sadiku, “Fundamentals of Electric Circuits”, McGraw–Hill Companies, Fifth Edition, 2013.

SEMESTER III

UICM003	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

Course Objectives

- To impart knowledge in solving first and higher order partial differential equations.
- To construct full range and half range Fourier series expansion including Harmonic analysis.
- To develop methods to solve PDE using Fourier series solutions.
- To understand different types of Fourier transform and apply them to solve complex engineering problems.
- To familiarize Z transforms techniques to solve engineering problems.

Course Content

Partial Differential Equations

Formation of PDE by elimination of arbitrary constants and functions – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange's linear equation – Solution of second and higher order homogeneous and non-homogeneous linear equations with constant coefficients – Non-linear equations of first order – Charpit's method.

Fourier series

Dirichlet's conditions – Expansion of periodic functions into Fourier series – Change of interval – Fourier series for even and odd functions – Half-range expansions – Root mean square value of a function – Parseval's identity – Harmonic analysis.

Applications to Partial Differential Equations

Classification of second order linear partial differential equations – Solutions of one dimensional wave equation – one dimensional heat equation – Steady state solution of two-dimensional heat equation –Fourier series solutions.

Fourier Transform

Statement of Fourier integral theorem (without proof) – Fourier transform pairs – Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity – Finite Fourier Sine and Cosine transform.

Z - Transform

Z-transforms – Elementary properties – Inverse Z-transform (using partial fraction and residues) – Convolution theorem – Formation of difference equations – Solution of difference equations using Z - transform.

Reference Books

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2016.
2. Bali N., Goyal M, "Transforms and Partial differential equations" University Science Press, New Delhi, 2010.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 10th Edition, 2016.
4. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 3rd Edition, 2012.
5. Dennis G. Zill, "Advanced Engineering Mathematics", Jones and Bartlett Learning, LLC, an Ascend Learning Company, 6th Edition, 2016.
6. Peter V. O'Neil, "Advanced Engineering Mathematics", Cengage Learning, Boston, USA, 8th Edition, 2016.
7. Donald. A. McQuarrie, "Mathematical Methods for Scientists and Engineers", Viva Books Pvt. Ltd, New Delhi, 1st Edition, Reprint 2015.

UICE017	OBJECT ORIENTED PROGRAMMING WITH C++ AND JAVA	L	T	P	C
		2	0	2	4

Course Objectives

- To program using more advanced C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance, polymorphism, file I/O and exception handling.
- To solve moderate complex problems using Object oriented concepts in Java.

Course Content

Basic Concepts and benefits of OOP – Tokens – Keywords - Identifiers – Basic data types – Derived data types – Reference variables – Type modifiers – Type casting – Operators and control statements – Input and output statements. Classes and Objects – Class specification – Member function definition – Constructors – Parameterized constructors – Overloaded Constructors – Constructors with default arguments – Copy constructors – access qualifiers – Static data members and member functions – Instance creation – Array of objects – Introduction to friend function – Destructors.

Operator Overloading: Operator function – Overloading unary and binary operator – Overloading the operator using friend function – Stream operator overloading – Data Conversion. Inheritance: Basic Principle – use of Inheritance – Defining Derived classes – Single Inheritance – Protected Data with private inheritance – Multiple Inheritance – Multi-level Inheritance – Hierarchical Inheritance – Hybrid Inheritance. Virtual Functions: Need for virtual function – Pointer to derived class objects – Definition of virtual functions – Pure virtual functions – Abstract classes – Virtual destructors – Dynamic Binding.

Streams: Streams in C++ – Stream classes – Formatted and unformatted data – Manipulators – User defined manipulators – File streams – File pointer and manipulation – File open and close – Sequential and random access. Generic Programming With Templates: Introduction – Function templates – Class templates.

Data types, variables and arrays, operators, control statements, classes, objects, methods – Inheritance – Packages and Interfaces – Exception handling – Multi-threaded programming – Strings – Input/Output.

List of Experiments

Simple application problems that can be solved using the following concepts.

C++

1. Objects, Classes, Constructors and Destructors
2. Function and Operator Overloading, Inheritance
3. Virtual functions and Pointers
4. Files, Streams and Exception handling
5. Templates

JAVA

6. References to an instant of a class and handling strings
7. Package creation
8. Interfaces developing user defined interfaces
9. Creation of threads
10. Exception handling mechanism.

References

1. Herbert Schildt, "C++ The Complete Reference", 5th Edition, Tata McGraw Hill, New Delhi, 2014.
2. Bjarne Stroustrup, "The C++ Programming Language", 4th Edition, Addison-Wesley, May 2013.
3. Deitel and Deitel, "C++ How to Program", Ninth Edition, Prentice Hall India Learning Private Limited, 2014.
4. Herbert Schildt, "The Java Complete Reference", 10th Edition, McGraw-Hill Education, 2017.
5. Deitel and Deitel, "Java How to Program", 10th Edition, Pearson Education India, 2016.

UCSC006	DATA STRUCTURES AND ALGORITHM	L	T	P	C
		3	0	1	4

Course Objectives

- To focus on strategies and techniques to efficiently store data (Data Structures) and to perform processing on such data in efficient ways (Algorithms), as well as on the analysis and design of such techniques.
- To understand the various types of data structures and their applications.
- To familiarize with algorithm analysis and design techniques.

Course Content

Linear Data structures: Abstract data types-lists-arrays-linked list- stacks-queues. Complexity and asymptotic notations- Searching-Trivial sorting algorithms of quadratic complexity- Merge sort – quicksort- understanding their memory behavior on statically allocated arrays- Heapsort- Stability.

Non Linear Data structures: Binary search tree- AVL tree- Splay Tree- Red-black tree- B tree-Hash tables- heaps. Graph representations- BFS and DFS- Topological sort- Minimum spanning tree and algorithms- shortest path algorithms: Single source and All-pairs shortest path.

Computational Geometry-Convex Hull-Degeneracies and Robustness- Application Domains- Line Segment Intersection- The Doubly Connected Edge List- Computing the Overlay of Two Subdivisions

List of Experiments

1. Implementation of different operations on linked list – copy, concatenate, split, reverse, count no. of nodes etc
2. Implementation of (Infix, Prefix, Postfix) transformations and its evaluation program.
3. Implementation of Binary Tree algorithm.
4. Implementation of Shell sort, Radix sort and Insertion sort
5. Implementation of searching methods (Index Sequential, Interpolation Search.

References

1. Cormen, T.H., Leiserson, C.D., Rivest, R.L. & Stein, C, "Introduction to Algorithms", MIT Press, Third Edition, 2009.
2. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, "Computational Geometry" Springer-Verlag, Third Edition, 2008.
3. Knuth, D.A., "The Art of Computer Programming", Addison-Wesley, Third revised Edition, 2011.
4. Bjarne Stroustrup, "The C++ Programming Language", Addison-Wesley ISBN 978-0321563842., Fourth Edition, May 2013.
5. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", the Hardcover edition, Pearson Education, Fourth Edition, 2013.

UICE022	ELECTRONIC DEVICES AND CIRCUITS	L	T	P	C
		3	0	1	4

Course Objectives

- To impart basic knowledge about the structure of basic electronic devices.
- To inculcate the operation of different electronic devices
- To impart knowledge on the application of different electronic devices

Course Content

PN junction diode-VI characteristics, Rectifiers – Half Wave and Full Wave Rectifier and Bridge rectifier, Zener diode characteristics-Zener Reverse characteristics – Zener as regulator LED, LCD characteristics and applications, Varactor diode –Tunnel diode, UJT, SCR, Diac, Triac, BJT small signal model – Analysis of CE, CB, CC amplifiers- Input and Output characteristics.

JFET operation- V-I characteristics, transfer characteristics, MOSFET- Constructional details - Operation of enhancement and depletion type MOSFETs, V-I characteristics, transfer characteristics. Differential amplifiers

Oscillators– Classification, Barkhausen Criterion, LC- Hartley, Colpitts, RC- phase shift, Wien bridge, Quartz Crystal Construction, Electrical equivalent circuit of Crystal, Photo transistor, Opto Coupler, Solar cell, CCD.

List of Experiments

1. Characteristics of PN junction diode and Zener diode.
2. Half and full wave rectifiers.
3. Characteristics of Transistor under common emitter configurations.
4. Characteristic of FET and UJT
5. Photo diode, phototransistor Characteristics.

References

1. Salivhanan, “Electron Devices and Circuits”, McGraw Hill Education (India) Private Ltd., 4th edition, 2016.
2. Robert Boylestad and Louis Nashelsky, “Electron Devices and Circuit Theory” Pearson Prentice Hall, 10th edition, July 2008.
3. Millman, Hackias, Jit, “Electronic Devices and Circuits”, McGraw Hill education India Private Ltd., 4th edition, 2013.
4. Thomas L Floyd, "Electronic Devices", Prentice Hall of India, New Delhi, 2011.
5. David A. Bell., “Electronic Devices and Circuits” Oxford University Press., 5th edition 2008.

UEEC002	ELECTRO MAGNETIC THEORY	L	T	P	C
		3	0	0	3

Course Objectives

- To impart knowledge on the concepts of electrostatics, electrical potential, energy density and their applications.
- To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
- To inculcate the knowledge on the concepts of Faraday's law, induced emf, Maxwell's equations and electromagnetic waves and Poynting vector.

Course Content

Coordinate Systems, Basic Vector operations, Coulomb's law, Electric field intensity, electric fields due to point, line, surface and volume charge distributions, Electric flux density–Gauss law – Applications of Gauss Law–Divergence –Divergence theorem. Electric potential–Potential field-Potential gradient –Field due to dipoles– dipole moment– Energy density, Current and current density–Continuity of current–Conductor properties and Nature of Dielectrics–Boundary conditions–Capacitance– Polarization in dielectrics – Dielectric constant and Dielectric strength - Energy stored in capacitor–Poisson's and Laplace equations.

Biot- Savart Law–Ampere's Circuital Law–Applications–Curl and Stoke's theorem – Magnetic flux and Magnetic flux density – The Scalar and Vector magnetic potentials– Force on a moving charge and current elements– Force and Torque on closed circuit, magnetic materials- Magnetization and Permeability–Magnetic boundary conditions – Magnetic circuit – Potential energy and forces on Magnetic materials – Inductance and mutual inductance – Inductance of solenoids and toroids.

Faraday's Law– Time varying magnetic field, Conduction current and Displacement current – Maxwell's equation in point and integral forms– Wave propagation in free space– Wave propagation in Dielectrics – Power and the Poynting Vector – Propagation in good conductors.

References

1. William H. Hayt, John A.Buck, "Engineering Electromagnetics", McGraw Hill, New York, 8th edition , 2011.
2. Matthew N.O.Sadiku, Kulkarni S.V, "Principles of Electromagnetics", Oxford University Press, New Delhi, 6th edition, 2015.
3. Joseph A. Edminister, Mahmood Nahvi "Schaum's Outline of Electromagnetics", Tata McGraw Hill, 3rd edition (Schaum's Outline Series), 2011.
4. David J Griffiths, "Introduction to Electrodynamics, Prentice Hall of India, 3rd edition, 2008
5. Narayana Rao N, "Elements of Engineering Electromagnetics", Prentice Hall of India, 6th edition, 2004.

UEEC003	MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the basic functional elements and fundamentals of Electrical and Electronic Instrumentation.
- To impart knowledge on various storage and display devices.
- To expose the students to various transducers and the data acquisition systems.

Course Content

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Standards and calibration - Principle and types of analog and digital voltmeters, ammeters – Moving iron: attraction and repulsion type instruments, errors. Moving coil instruments – Permanent magnet moving coil instruments, Dynamometer type moving coil Instruments, Torque equations – Extension of ranges, use of shunts.

Single and three phase wattmeters and energy meters – Instrument transformers – A.C. and D.C potentiometers – Power factor meter – Frequency meter – Magnetic disk and tape recorders – Plotters and Printers – CRT display – digital CRO – LED & LCD – dot matrix display & Data Loggers.

D.C & A.C bridges – Earth Resistance measurement – Temperature transducers- RTD, thermister, Thermocouple - Displacement transducer -Inductive, capacitive, LVDT, Pressure transducer – Bourdon tube – Measurement of resistance Potentiometer, Strain gauges – Piezo electric and Hall effect transducer.

List of Experiments

1. AC & DC Bridges
2. Sensors & Transducers (Temperature, Pressure, Strain gauge)
3. Power Measurement
4. Energy Measurement
5. A/D and D/A Converters

References

1. Gupta J. B., "A Course in Electrical and Electronic Measurements & Instrumentation", S. K. Kataria & Sons, Delhi, 14th edition, 2014.
2. Murty D.V.S., "Transducers and Instrumentation", Prentice Hall of India Pvt Ltd, 2nd edition, 2008.
3. Kalsi v, "Electronic Instrumentation", Tata McGraw Hill Education Pvt. Ltd., 3rd edition 2010.
4. Sawhney A.K., "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co. Private Limited, 2015.
5. Doebelin.E.O and Manik.D.N, "Measurement Systems – Application and Design", Tata McGraw Hill Education Private Limited, 2012.

SEMESTER IV

UICM004	NUMERICAL METHODS	L	T	P	C
		3	1	0	4

Course Objectives

- To provide the mathematical foundations of numerical techniques for solving algebraic and transcendental equations.
- To apply appropriate numerical methods to estimate interpolation.
- To equip the students with numerical differentiation and numerical integration techniques.
- To acquire knowledge of numerical solution to ordinary differential equation using single and multi-step methods.
- To gain the knowledge of numerical solution for partial differential equation.

Course Content

Solution of Algebraic and Transcendental Equations

Solution of algebraic and transcendental equations – Fixed Point Iteration Method – Newton Raphson Method – Solutions of Linear system of equations – Gauss elimination Method – Gauss Jordan method – Gauss Seidel Method – Eigenvalue of a Matrix by Power Method – Jacobi Method. Curve fitting – Method of Least squares (Straight line and Parabola). Applications to Current and Voltages in Resistor Circuits and analysis of a statically determinate Truss.

Interpolation and Approximation

Interpolation – Lagrange's formula – Newton's divided difference formula – Newton Forward and Backward difference formula – Stirling's and Bessel's central difference formula.

Numerical Differentiation and Integration

Newton's forward and backward difference formula for derivatives – Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two point and Three point Gaussian quadrature formula – Double integrals using Trapezoidal and Simpson's rules – Applications to Root Mean Square current by Numerical Integration and Effective Force on the Mast of a Racing Sailboat.

Numerical Solution to Ordinary Differential Equation

Taylor's series Method – Euler Method – Modified Euler Method – Fourth order Runge-Kutta Method for solving first order equations – Milne's Method – Adam's Method – Applications to Simulating Transient Current for an Electric Circuit and applications using Predator-Prey models and Chaos.

Numerical Solution to Partial Differential Equations

Finite difference methods for solving second order ordinary differential equation – Classification of Partial differential equations – Finite difference solutions for one dimensional heat equation – Explicit and Implicit Methods – One dimensional Wave equation – Two dimensional Laplace's equation – Poisson's equation.

References

1. Grewal.B.S. "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi 2014.
2. Steven C Chapra; Raymond P Canale "Numerical Methods for Engineers" New York, NY Mcgraw-Hill Education Corp, 7th Edition, 2015(Applications: Unit 1, 3 and 4).
3. Joe D. Hoffman, "Numerical methods for Engineers and scientists", Wiley, 2nd Edition 2015.
4. Gerald C.F. and Wheatley, P.O. "Applied Numerical Analysis", Pearson Education Asia, New Delhi, 7th Edition, 2011.
5. Kandasamy P, Thilagavathy K and Gunavathy K, "Numerical Methods", 3rd Edition S.ChandCo.Ltd, New Delhi, 2013.
6. Balagurusamy E, "Numerical Methods", McGraw Hill Education Pvt Ltd, New Delhi, 1st Edition 2016.
7. Ken F.Riley, Mike P.Hobson and Stephen J. Bence, "Fundamentals of Engineering Numerical Analysis", Cambridge University Press, New Delhi, 2015.

UICE021	ANALOG AND DIGITAL SYSTEMS	L	T	P	C
		3	0	1	4

Course Objectives

- To inculcate the knowledge and implementation of combinational circuits and sequential circuits
- To inculcate the characteristics of linear circuits
- To understand the various applications of integrated circuits.

Course Content

Review of number systems and its conversion - Boolean Algebra- canonical forms - simplification of logic functions using karnaugh map, Digital Logic families - Logic gates –Design and implementation of combinational logic functions - encoders & decoders - multiplexers & demultiplexers- code converters -comparator – Adder, Subtractor - parity generator/checker. General model of sequential circuits – Latch, Flip-Flops, Shift register and counter.

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance and FETs, Ideal OP-AMP characteristics, DC characteristics, AC characteristics,

Basic applications of op-amp – Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, V-F & F-V Converters, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, Zero-crossing detector, clipper and clamper, S/H circuit.Schmitt Trigger using Op-Amp,D/A converter (R- 2R ladder and weighted resistor types), A/D converter - Dual slope, successive approximation and flash types. Signal generators –555 Timer circuit- Multivibrators- Astable and Monostable.

List of Experiments

1. Implementation Half adder and Full adder using basic gates
2. Design and implementation of Multiplexer and De-multiplexer using logic gates
3. Inverting, Non inverting amplifiers.
4. Integrator and Differentiator.
5. Astable and monostable multivibrators using 555 Timer.

References

1. M.Morris Mano, "Digital Design", 5th edition, Pearson Education, 2013.
2. Floyd and Jain, "Digital Fundamentals", 8th edition, Pearson Education, 2003.
3. Leach D, Malvino A and GoutamSaha, "Digital Principles and Applications", Tata McGraw-Hill, New Delhi, 2011.
4. Tocci R J, Widmer N and Moss G, "Digital Systems: Principles and Applications", Prentice Hall of India, New Delhi, 2010.
5. D.RoyChoudhary, SheilB.Jain, "Linear Integrated Circuits", 4th edition, New Age, 2010.

UICE023	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	1	4

Course Objectives

- To analyze the instruction set &Interrupt structure of 8085 & 8051.
- To develop skill in simple applications development with programming 8085 & 8051
- To introduce commonly used peripheral / interfacing

Course Content

8085 Architecture, Pin Assignments, Addressing Modes, Interrupts, Timing Diagrams, Instruction set and Assembly language programming, memory and I/O interfacing, data transfer schemes, programmable peripheral interface (8255), programmable interrupt controller (8259), programmable communication interface (8251), Programmable Keyboard/Display Interface (8279) .

8051 Architecture, Pin Assignments, Addressing Modes, Interrupts, Instruction set and Assembly language programming, Real time applications of Microcontrollers, Interfacing 8051 to LED's Push button, Relay's and Latch Connections, Traffic Light Controller.

Basics of Embedded C Programming, Introduction to PIC16F Microcontroller Family, Programming practices of Arduino controller for Electrical Engineering Applications, Overview of Advanced Processors and Controllers.

List of Experiments using 8085 and 8051

1. Programs for Arithmetic and Logical Operations.
2. Programs using control and looping Instructions.
3. Keyboard and Seven Segment Display Interfacing.
4. ADC and DAC Interfacing.
5. Stepper Motor Interfacing.

References

1. Krishna Kant, "Microprocessor and Microcontrollers", Prentice Hall of India, Eastern Company Edition, New Delhi, 2007.
2. Senthil Kumar. N, Saravanan. M, Jeevananthan. S, "Microprocessors and Microcontrollers", Oxford University Press, 2013.
3. Soumitra Kumar Mandal, "Microprocessor & Microcontroller Architecture, Programming &Interfacing using 8085, 8086, 8051," Tata McGraw-Hill Education, 2013.
4. Fernando E. Valdes-Perez, Ramon Pallas-Areny, "Microcontroller: Fundamentals and Applications with PIC", CRC press, Tayler & Francis group, 2013.
5. Gaonkar. R. S, "Microprocessor Architecture Programming and Application with 8085", Wiley Eastern Ltd., New Delhi, 2013.

UEEC004	CONTROL SYSTEMS	L	T	P	C
		3	0	1	4

Course Objectives

- To understand the use of transfer function models for analysing physical systems
- To provide adequate knowledge about time response of systems and steady state error analysis.
- To impart knowledge on open loop and closed–loop frequency responses of systems.
- To introduce stability analysis and design of compensators.

Course Content

Open loop and closed loop systems – Mathematical modeling of electrical, mechanical, electromechanical, pneumatic and hydraulic systems – Transfer function of DC generator and motor – Block diagram reduction and Signal flow graph techniques.

Time response of type 0 and type 1 first and second order systems – Steady state and dynamic error – Necessary and Sufficient conditions for stability – Absolute, Marginal and Relative stability – Routh stability criterion – Root locus construction – Effect of pole-zero addition – MATLAB Examples.

Frequency domain specifications – correlation between time and frequency domain specifications for type 1 second order system – Polar plot – Bode plot – Assessment of relative stability – Closed loop frequency response from open loop response. Performance criteria – Lag, Lead, Lag/Lead compensator design using bode plots – P-PD-PI-PID controllers MATLAB Examples.

List of Experiments

1. DC motor modeling, identification and speed control.
2. PID controller tuning of speed control of DC motor.
3. Transient and frequency response of the second order system.
4. Root locus analysis of the third order system: Simulation.
5. Design a lag, lead compensator for third order system.

References

1. Norman S. Nise, “Control System Engineering”, Wiley India, 6th edition, 2011.
2. Gopal M., “Control Systems:Principles and Design”, Tata McGraw Hill, New Delhi, 4th edition, 2012.
3. Katsuhiko Ogata, “Modern Control Engineering”, Prentice Hall of India Pvt Ltd, 5th edition, 2012
4. Richard C. Dorf, Robert H. Bishop, “Modern Control Systems”, Pearson Prentice Hall Publications, 12th edition, 2010.
5. Gene F. Franklin, J. David Powell, Abbas Emami-Naeini, “Feedback Control of Dynamic Systems”, Pearson Education US Publications, 6th edition, 2008.

UEEC005	DC MACHINES AND TRANSFORMERS	L	T	P	C
		3	0	1	4

Course Objectives

- To introduce the fundamentals of dc machines and transformer
- To enable the students to determine the parameters of DC machines and transformers by performing experiments on these machines.
- To facilitate the students to identify and solve DC machine and Transformer related problems.

Course Content

Magnetic circuits –Laws governing magnetic circuits – Flux linkage, Inductance and energy – Statically and dynamically induced EMF- Losses- Energy in magnetic system – Field energy and co-energy- singly and multiply excited magnetic field systems.

DC machine: Construction and principle of operation – Faradays Law – Back emf– Torque equation, characteristics of DC motors –Starters – Speed control & Braking – Losses and efficiency–Types of excitation of DC generators– EMF equation– open circuit and load characteristics – Armature reaction, Commutation, Testing of DC machines.

Transformer: Construction and principle of operation –EMF equation – Transformer on No load and Load –Phasor diagram –equivalent circuit – Regulation –three phase transformer connections –Auto transformers- Testing of transformer

List of experiments

1. Load test on DC motor (shunt, series, compound)
2. Open circuit & load characteristics of DC generator
3. Swinburne's test and Speed Control of DC Motor
4. Hopkinson's test
5. OC,SC and load test on transformer (Single and Three phase)

References

1. Kothari D P and Nagrath I J., "Electrical Machines", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 5th edition, 2010.
2. Bimbhra P S, Electrical Machinery, Khanna Publishers, Prentice Hall of India. 7th edition, 2011.
3. Gupta J B, "Theory and Performance of Electrical Machines ", S K Kataria & Sons, (English) 14th edition, 2010.
4. Deshpande M V, "Electrical Machines" PHI Learning Pvt. Ltd., New Delhi, 2011.
5. Fitzgerald A.E., Charles Kingsley Jr, Stephen.D.Umans, "Electric Machinery", Mcgraw Hill Education, 6th edition, 2002.

UEEC006	GENERATION ,TRANSMISSION AND DISTRIBUTION	L	T	P	C
		3	0	0	3

Course Objectives

- To enable the students to familiarize different generation systems.
- To understand and acquire knowledge about various transmission parameters and distribution systems.
- To impart knowledge on mechanical design of transmission line.

Course Content

Introduction to generation, transmission and distribution–Steam power plant, Hydro power plant, Nuclear power plant, Gas, Diesel power plant– Power generation from renewable energy–sun, wind, tidal, ocean, geothermal, fuel cell, MHD, Bio mass. General aspects – Kelvin's Law, A.C distribution –single phase and three phase – Techniques of voltage control and power factor improvement – Recent trends in transmission and distribution systems

Structure of Power systems Resistance, Inductance and Capacitance calculations – single phase and three phase lines –double circuit lines –effect of earth on transmission line capacitance, Regulation and efficiency – Tuned power lines, Power flow through a transmission line – Power circle diagrams, Formation of corona – critical voltages – effect on line performance

Line supports – Stress and sag calculation – effects of wind and ice loading. Substation Layout, Types of Towers, Tower footing, Comparison with overhead line – Types of cables –insulation resistance – potential gradient – capacitance of single core and three core cables, Insulators, Voltage distribution in suspension insulators – Testing of insulators - string efficiency.

References

1. Wadhwa C L, “Electrical Power Systems”, New Academic Science Ltd, 2009.
2. Singh S N, “Electric Power Generation, Transmission and Distribution”, Prentice Hall of India Pvt. Ltd, New Delhi, 2nd edition, 2011.
3. Gupta B R, Chand S, “Power System Analysis and Design”, New Delhi, 5th edition, 2013.
4. Ned Mohan, “Electrical Power Systems”, Wiley India Pvt Ltd, 2013.
5. Leonard L. Grigsby,” Electric Power Generation, Transmission, and Distribution”, CRC Press, 3rd edition, 2016.

UEEC101	RENEWABLE ENERGY SOURCES	L	T	P	C
		3	0	0	3

Course Objectives

- To create awareness about renewable Energy Sources and technologies.
- To analyze the various renewable energy resources and technologies and their applications.
- To understand the methods of harnessing renewable Energy.

Course Content

Primary energy sources, renewable vs. non-renewable primary energy sources, renewable energy resources in India, Advancements in renewable energy power production and development of renewable energy technologies.

Solar Power Generation- PV, solar thermal, Wind Power Generation- wind energy conversion systems, Energy from Biomass, Bio gas generation, types of biogas plants, Application of biomass and biogas plants and their economics. Hydrogen generation and Energy conversion from Fuel cell.

Geothermal energy Resources, types of wells, methods of harnessing the energy, potential in India. Ocean Thermal Energy Conversion, Principles utilization, setting of Ocean Thermal Energy Conversion plants. Tidal and wave energy: Potential and conversion techniques, mini hydel power plants and their economics, Introduction to Micro grid.

References

1. John Twidell and Tony Weir, “Renewable Energy Resources”, Routledge, 2005.
2. Clark W Gellings, “The Smart Grid, Enabling Energy Efficiency and Demand Side Response”, The Fairmont Press, 2009.
3. Krzysztof Iniewski, “Smart Grid & Infrastructure Networking”, TATA McGraw-Hill, 2012.
4. Bin Wu, Yongqiang Lang, Navid Zargari, Samir Kouro, “Power Conversion and Control of Wind Energy Systems”, John Wiley & Sons, 2011.
5. , “Sustainable Energy: Choosing Among Options”, MIT Press, 2012.

SEMESTER V

UEEC007	INDUCTION AND SYNCHRONOUS MACHINES	L	T	P	C
		3	0	1	4

Course Objectives

- To familiarize the students the concept of operating principles, methods of starting, testing and applications of synchronous and induction machines.

Course Content

Construction details of Induction machines - Principle of operation - Equivalent circuit - Torque slip Characteristics - Circle diagram and performance evaluation - Starters - speed control & braking methods.

Constructional details and starting methods of single phase Induction motor -Double revolving field theory - Equivalent circuit - Torque speed characteristics

Construction details of three phase synchronous machine - Emf Equation - Blondel's Two reaction theory - Voltage regulation - Synchronization and parallel operation of alternators - Torque equation - Starting methods.

List of Experiments

1. Load test on 1 phase and 3 phase induction motor.
2. No load and blocked rotor test on single-phase induction motor.
3. Regulation of three phase alternator.
4. Negative, Positive, Zero sequence of alternator
5. Synchronization of three phase alternator with infinite bus bar and V Inverted V curves.

References

1. S K Bhattacharya, "Electrical Machines", Mc Graw Hill Education, Fourth Edition, 2014.
2. S G Tarnekar, B L Theraja, & A K Theraja, "A Textbook of Electrical Technology: Volume 2 - AC and DC Machines", Published by S. Chand & Co., New Delhi, India, 2012
3. Stephen J. Chapman, "Electric Machinery Fundamentals", McGraw-Hill Education / Asia, Fifth Edition, 2011.
4. A E Fitzgeraid, Charles Kingsley, Stephen D. Umans, "Electric Machinery", McGraw-Hill Education, Sixth Edition, 2005.
5. M N Bandyopadhyay, "Electrical Machines Theory and Practice", PHI Learning pvt. ltd., New Delhi, First Edition, 2009.

UEEC008	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives

- To classify and analyse signals and systems & their mathematical representation.
- To study various transformation techniques & their computation.
- To study about filters and their design for digital implementation.
- To study about a programmable digital signal processor & quantization effects.

Course Content

Classification, types, properties, representation and reconstruction -Mathematical operations-convolution and correlation. Z-transform -properties-Region of Convergence-inverse z transforms-frequency response. Properties-magnitude and phase representation-computation of DFT using FFT algorithm-DIT and DIF-FFT using radix 2 -butterfly structure. Computation of IDFT using DFT.

FIR and IIR filter realization-FIR design-Hamming and Hamming Windowing Techniques -Linear phase characteristics-analog filter design-Butterworth and Chebyshev approximations.

Computer architectures for signal processing – pipelining - hardware multiplier – accumulator - special instructions -TMS320CX processor.

References

1. J.G. Proakis and D.G. Manolakis, “Digital Signal Processing Principles, Algorithms and Applications”, Pearson Education, New Delhi, PHI. 2014.
2. S.K. Mitra, “Digital Signal Processing – A Computer Based Approach”, McGraw Hill Edu, 2013.
3. Robert Schilling & Sandra L.Harris, “Introduction to Digital Signal Processing using Matlab”, Cengage Learning, 2014.
4. Dimitris G.Manolakis, Vinay K. Ingle, “Applied Digital Signal Processing”,Cambridge,2012
5. Lonnie C.Ludeman , “Fundamentals of Digital Signal Processing”,Wiley,2013

UEEC009	POWER SYSTEM ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce various power system studies which are very essential for the planning and operation of the power system.
- To expose the students about Gauss-Seidal and Newton Raphson methods that are used for obtaining the power flow solutions
- To present about short circuit response of the power system under symmetrical and unsymmetrical fault conditions in order to ensure the stability of the power system

Course Content

Basic structure of power system, restructuring of power system; Modeling of Generator, transformer, transmission line and load; per-unit system, per phase analysis; Power system representation - Network matrices: Admittance matrix, Impedance matrix; Sparse Matrix techniques for large scale power systems - Development of static load flow equations; Iterative power flow solution using Gauss-Seidal Method, Newton-Raphson Method and Fast decoupled load flow method; Case study – Power flow analysis of standard IEEE test system

Fundamental of short circuit analysis - Computations of short circuit capacity, post fault voltages and currents by Thevenin's theorem and Bus impedance Matrix method; Case study – Short circuit analysis of standard IEEE test system - Symmetrical components, Sequence impedance, Sequence networks of power system components - Solution of Single-line to ground fault, Line-line fault and Double line to ground fault using thevenin's method and Bus impedance matrix.

Classification of power system stability; Single Machine Infinite Bus (SMIB) system: Development of swing equation, Equal area criterion, determination of critical clearing angle and time; Multi Machine stability analysis; Solving swing Equation by Modified Euler method and Runge-Kutta fourth order method.

References

1. Hadi Saadat, “Power System Analysis”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Twenty first reprint, 2010.
2. Pai M A, “Computer Techniques in Power System Analysis”, Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, Third Edition, 2014.
3. Nagrath I J and Kothari D P, “Modern Power System Analysis”, Tata McGraw-Hill, Fourth Edition, 2011.
4. P. Venkatesh, B.V. Manikandan, S. Charles Raja, A. Srinivasan, “Electrical Power Systems-Analysis, Security and Deregulation”, PHI Learning Private Limited, New Delhi, 2012.
5. P Kundur, “Power System Stability and Control”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Tenth reprint, 2010.

UEEC010	POWER ELECTRONICS	L	T	P	C
		3	0	0	3

Course Objective

- To understand the working of power electronic converter and inverter circuits and their applications.

Course Content

Uncontrolled Bridge Rectifiers, controlled Rectifiers: 1 phase half wave, half and fully controlled bridge converters – continuous and discontinuous operation –effect of free-wheeling diode -3 phase half and fully controlled converters (no analysis) – Dual converters.

Principle of step-up and step-down operation in DC- DC converters - Four quadrant operation, principle of operation of buck, boost and buck boost, cuk regulators

Principles of high power VSI and CSI inverters,–analysis of three phase inverter circuits with star and delta loads; control and modulation techniques; Principle of single phase and three-phase AC voltage controller – ON/OFF and phase angle control; principle of single phase and three phase cycloconverters circuits, different control techniques and firing pulse generation. Higher applications – regulated power supply, UPS, solid-state motor starters, static circuit breakers.

References

1. L Umanand, “Power Electronics Essentials and Applications”, Wiley, 2010.
2. M D Singh, K B Khanchandani, “Power Electronics” , McGraw Hill India, 2013.
3. M H Rashid, “Power Electronics: Circuits, Devices and Applications", Pearson Education, PHI, Third Edition, New Delhi, 2004.
4. P.S.Bhimbra, “Power Electronics”, Khanna Publishers, 2012.
5. Mohan, Undeland, Robbins, “Power Electronics: Converters, Applications and Design”, Wiley, Third Edition, 2002.

UEEC102	HIGH VOLTAGE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- To understand various types of over voltage transients in power system.
- To understand the causes of insulation breakdown in power system.
- To study about the various techniques used to generate and measure high voltages and currents.

Course Content

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages – protection against over voltages – Bewley's lattice diagram. Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown –Conduction and breakdown in pure and commercial liquids – Breakdown mechanisms in solid and composite dielectrics.

Generation of High DC, AC, impulse voltages and currents. Tripping and control of impulse generators .Measurement of High voltages and High currents – Digital techniques in high voltage measurement.

High voltage testing of electrical power apparatus – Power frequency, impulse voltage and DC testing – International and Indian standards – Insulation Coordination.

References

1. S.Naidu and V. Kamaraju, "High Voltage Engineering", Tata McGraw Hill, Fifth Edition, 2013.
2. E. Kuffel and W.S. Zaengl, J.Kuffel, "High voltage Engineering fundamentals", Newnes Second Edition Elsevier , New Delhi, 2005.
3. C.L. Wadhwa, "High voltage Engineering", New Age International Publishers, Third Edition, 2010.
4. L.L. Alston, "High Voltage Technology", Oxford University Press, First Indian Edition, 2011.
5. Subir Ray, "An Introduction to High Voltage Engineering", PHI Learning Private Limited, New Delhi, Second Edition, 2013.

UEEC103	POWER SYSTEM SIMULATION LABORATORY	L	T	P	C
		0	0	2	2

Course Objective

- To provide better insight of power system analysis through digital simulation.

List of Experiments

1. Computation of Parameters and Modeling of Transmission Lines
2. Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
3. Load Flow Analysis: Solution of load flow and related problems using Gauss-Seidel, Newton Raphson and Fast Decoupled Method.
4. Fault Analysis-Symmetrical and Unsymmetrical faults.
5. Solution to Unit commitment problem.
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System
7. Transient Stability Analysis of Multi machine Power Systems
8. Electromagnetic Transients in Power Systems
9. Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
10. Economic Dispatch in Power Systems.

References

1. Olle. I. Elgerd, "Electric Energy Systems Theory – An Introduction, Tata McGraw Hill Publishing Company Ltd, New Delhi, Second Edition, 2003.
2. L.L. Grigsby, "The Electric Power Engineering, Hand Book, CRC Press & IEEE Press, 2001.
3. Allen.J.Wood and Bruce F.Wollenberg, "Power Generation, Operation and Control", John Wiley & Sons, Inc., 2003.
4. P. Kundur, "Power System Stability & Control", McGraw Hill Publications, USA, 2007.
5. Hadi Saadat, "Power System Analysis", PSA publishing LLC, 2011.

SEMESTER VI

UEEC011	DESIGN OF ELECTRICAL MACHINES	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce various magnetic materials and magnetic circuit calculations, thermal ratings of various types of electrical machines
- To expose the students about the design procedures of rotating DC electrical machines
- To present about design procedures for Induction and Synchronous machines and transformer.

Course Content

Major considerations in Electrical Machine Design - Electrical Engineering Materials –Choice of Specific Electrical and Magnetic loadings - Thermal considerations -– Standard specifications -Output Equation of DC machine – Calculation of Main Dimensions –- Magnetic Circuits Calculations - Selection of number of poles – Design of Armature, commutator and brushes.

Output Equation of Transformer – Main Dimensions - kVA output for single and three phase transformers – Window space factor – Design of core and winding - Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers.

Output equation of AC machine – Main dimensions – Choice of Specific Electrical and Magnetic loadings - Rules for selecting rotor slots of squirrel cage Induction machines – Design of rotor bars & slots –Design of end rings – Design of wound rotor Induction motor – Magnetic leakage calculations - – Design of salient pole synchronous machines – Short circuit ratio –– Armature design – Estimation of air gap length – Design of rotor –Design of damper winding – Design of field winding.

References

1. M V Deshpande, “Design and Testing of Electrical Machine Design”, Wheeler Publications, 2010.
2. S K Sen, “Principles of Electrical Machine Design with Computer Programmes”, Oxford and IBH Publishing Co. Pvt Ltd., New Delhi, 2006.
3. R K Agarwal, “Principles of Electrical Machine Design”, Esskay Publications, Delhi, 2012.
4. A K Sawhney, “A Course in Electrical Machine Design”, Dhanpat Rai and Sons, New Delhi, 2010.
5. Juha Pyrhonen, Tapani Jokinen,Valeria Hrabovcova, “Design of Rotating Electrical Machines”, John Wiley & Sons, 2009.

UEEC104	POWER SYSTEM OPERATION AND CONTROL	L	T	P	C
		3	0	0	3

Course Objectives

- To familiarize various aspects of power system operation and load forecasting techniques.
- To understand the control techniques as applied to power system for the normal operating condition.

Course Content

System load variation, Reserve requirements, Load forecasting techniques, Economics of power generation, Electrical tariff and its types, Fundamentals of speed governing mechanism and modeling, Speed-load characteristics, Load sharing between two synchronous machines in parallel, concept of control area, LFC control of a single area system and two area system, Static and dynamic analysis of uncontrolled and controlled cases, state variable model.

Statement of Unit Commitment (UC) problem, constraints in UC, solution methods: Priority-list methods, forward dynamic programming approach. Economic dispatch, solution by direct method and λ iteration method. Base point and participation factors, Economic dispatch controller added to LFC control.

Automatic Voltage Regulator (AVR) and Excitation control, Power system stabilizer. Energy control Centre, System hardware configuration, SCADA and EMS functions, state estimation, security analysis and control. Various operating states.

References

1. Olle. I. Elgerd, "Electric Energy Systems Theory – An Introduction", Tata McGraw Hill Publishing Company Ltd, New Delhi, Second Edition, 2003.
2. D.P. Kothari and I.J. Nagrath, "Modern Power System Analysis", Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
3. L.L. Grigsby, "The Electric Power Engineering", Hand Book, CRC Press & IEEE Press, 2001.
4. Allen.J.Wood and Bruce F.Wollenberg, "Power Generation, Operation and Control", John Wiley & Sons, Inc., 2003.
5. P. Kundur, "Power System Stability & Control", McGraw Hill Publications, USA, 2007.

UEEC105	UTILIZATION AND CONSERVATION OF ELECTRICAL ENERGY	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce the basic concepts of energy management and different methods of electric heating and welding.
- To expose various energy saving concepts and different types of illumination.
- To impart knowledge in efficient utilization and management of energy services in industrial applications.

Course Content

Definition of energy management - Energy conservation schemes- Energy conservation in space conditioning - Energy and cost indices - Energy diagrams – Industrial energy conservation: Waste heat recovery, Heat pump applications, Carbon savings and regulations (EU-ETS).

Electric Heating- Advantages and methods: resistance heating, induction heating and dielectric heating. Electric welding: Electric welding equipment, resistance welding and arc welding, comparison between AC and DC welding, Recent trends in electric traction.

Laws of illumination, coefficient of Utilization and depreciation, Polar curves, Different types of illumination- Systems of electric traction and track electrification-DC system, single phase and 3-phase low frequency and high frequency system, composite system, kando system, comparison between AC and DC systems.

References

1. H. Partab, “Modern Electric Traction”, Dhanpat Rai & Co, 2017.
2. E. Openshaw Taylor, “Utilisation of Electric Energy”, Orient Longman, 2015.
3. H. Partab, “Art & Science of Utilisation of Electric Energy”, Dhanpat Rai & Sons, 2014.
4. N.V. Suryanarayana, “Utilisation of Electrical power including Electric drives and Electric Traction”, New Age Publishers, 2017.
5. W.F. Kenney, “Energy Conservation in the Process Industries”, Academic Press, 2017.

UEEC013	INTEGRATED DESIGN PROJECT (COURSE WORK)	L	T	P	C
		4	0	0	4

Course Objectives

- To impart knowledge on project management and planning.
- To inculcate the knowledge on the concepts of Simulink to design systems for engineering applications.

Course Content

Introduction to Project Management - Brief history of project management - Different types of projects - Project life cycles and life histories - Customers, clients, contractors and end users - Associations representing the profession of project management.

First Steps in Planning the Timescale - General introduction to project planning - What makes an ideal project plan? - Museum project: a case example - Distinction between planning and scheduling.

Introduction to Matlab Simulink- Introduction of Simulink- Simulink Environment & Interface- Study of Library -Circuit Oriented Design- Equation Oriented Design -Model -Subsystem Design -Connect Call back to subsystem –Application. Case Study.

References

1. Dennis Lock, “Project Management”, Gower Publishing Company, USA, 9th edition, 2007.
2. Steven T. Karris, “Introduction to Simulink with Engineering Applications”, Orchard Publications, 2006.

UEEC014	INTEGRATED DESIGN PROJECT (PRACTICAL)	L	T	P	C
		0	0	2	2

Course Objectives

- To develop the ability of students to solve complex engineering problems through project based learning.

Course Content

1. Renewable Energy Systems
2. Robotics
3. Embedded Systems
4. Biomedical Instrumentation
5. Image and Signal Processing

Students have to do project in any one of the domains mentioned above.

SEMESTER VII

UICH004	INDUSTRIAL MANAGEMENT AND ECONOMICS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the basic concepts of management in order to aid in understanding how an Industry functions.
- To understand the various perspectives of economics in the industrial context
- To understand economic concepts that can be applied in the engineering field.

Course Content

Nature, Characteristics, Scope and objectives of management, management principles and functions, application and scope of industrial management. Objectives & functions.

Production Management, plant layout-types and factors affecting it, plant location- factors affecting it – Inventory management- supply chain management.

Policy and scope of economics - Micro and macroeconomics–Relationship between Science, Engineering, Technology and Economic Development. Factors of production - Production Possibility Curve – Demand Analysis - Supply Analysis -cost analysis - Break even analysis.

References

1. Robbins S.P. and Decenzo David A, "Fundamentals of Management: Essential Concepts and Applications", Pearson Education,2014
2. Andrew J. Dubrin, "Essentials of Management", Thomson South western, 9th edition,2012
3. Joel Dean, "Managerial Economics" , Prentice Hall India, 2014
4. Gupta, G.S., "Managerial Economics", 2nd Edition, Tata McGraw Hill , 2013
5. Steve Chapman ,Tony K. Arnold ,Ann K. Gatewood & Lloyd Clive, "Introduction to Materials Management", 8th Edition, Pearson 2012

UEEC012	PROTECTION AND SWITCHGEAR	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the principle of protective schemes and various faults in the Power System Scenario.
- To expose the students on protection of power system with various protection relays.
- To familiarize the various types of the circuit breakers, the arc quenching phenomena and the protection against over voltages.

Course Content

Principles and need for protective schemes – Nature and cause of faults – types of fault – abnormal operating conditions - essential qualities of protection- relay terminology- CT, PT and summation transformer. Electromagnetic relays – over current, directional and non-directional, distance, negative sequence differential and under frequency relays – Introduction to static relays – Microprocessor based protective relays

Main considerations in apparatus protection - transformer, generator and motor protection - protection of busbars. Transmission line protection - zones of protection. Numerical protection – block diagram

Physics of arcing phenomenon and arc interruption- Types of circuit breakers – Bulk oil, low oil, air blast, air break, oil, SF6 and vacuum circuit, HVDC breakers- testing of circuit breakers. Switching surges - Lightning phenomenon- Protections against lightning – Lightning arresters and its types. Earthing – Resistance and reactance -Earthing transformer. Insulation levels of sub-station equipment.

References

1. Badri Ram, Vishwakarma D N., “Power System Protection and Switchgear”, Tata McGraw Hill Publishing House Limited, New Delhi, 2011.
2. Soni, M.L., Gupta, P.V., Bhatnagar, U.S. and Chakrabarti, A., “A Text Book on Power Systems Engineering”, Dhanpat Rai & Sons Company Limited, New Delhi, 2008.
3. Wadhwa, C.L., “Electrical Power Systems”, New Age International Publishers Limited, 2006, New Delhi,6th Edition, 2010
4. Y G Paithankar and S R Bhide, “Fundamentals of Power System Protection”, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
5. Sunil S. Rao, “Switchgear and Protection”, Khanna publishers, New Delhi, 2012.

UEEC106	ENERGY AUDITING AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

- To prepare the students for energy auditing and managing the energy demand by analyzing the energy issues and concern.

Course Content

Energy Audit -various Energy Conservation Measures in Steam -Losses in Boiler. Energy Conservation in Steam Systems. Energy conservation in Centrifugal pumps, Fans & Blowers, Air compressor –energy consumption & energy saving potentials –Design consideration. Refrigeration & Air conditioning -Heat load estimation -Energy conservation in cooling towers & spray ponds.

Organizational background desired for energy management motivation, detailed process of M&T-Thermostats, Boiler controls-proportional, differential and integral control, optimizers; compensators. Role of energy managers in industries-Energy monitoring, auditing and targeting, Energy Management System-Computer Control techniques- Energy conservation opportunities in electrical power supply sector.

References

1. Leon K. Kirchmayer, “Economic Operation of power system”, Wiley India Pvt Ltd, July 2010.
2. Jean-Claude SabonnadiAre, “Low emission power generation technologies and energy management”, John Wiley & Sons, August 2010
3. Rik De Gunther, “Alternative energy for dummies”, John Wiley & Sons, May 2010.
4. Donald R Wulfinghoff, “Energy Efficiency Manual”, Energy Institute Press, USA, 1999.
5. Tripathy S C, “Electrical Energy Utilization and Conservation”, Tata McGraw-Hill, New Delhi, 1991.

UEEC015	INTEGRATED DESIGN PROJECT (PHASE – II)	L	T	P	C
		0	0	6	6

The objective of this course is to impart and improve the design capability of the student using advanced electrical and electronics engineering software and hardware. This course conceives purely a design problem in any one of the disciplines of Electrical and Electronics Engineering; e.g., Power and Energy, Embedded Systems, Robotics and Automation etc The design problem can be allotted to either an individual student or a group of students comprising of not more than three. The students will be guided by internal and external supervisors. The external supervisor will be appointed by head of the department after consultation with Industry-Institute interaction cell. At the end of the course the group should submit a complete report on the design problem consisting of the data given, the design calculations, specifications if any, complete set of circuit design along with hardware and software as a product developed to solve a societal issue/ design problem identified.

UEEC016	FINAL YEAR PROJECT (PHASE – I)	L	T	P	C
		0	0	2	2

Course Objectives

- To allow students to complete a research and / or development project via an individual work or team work.
- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To develop the methodology to solve the identified problem.
- To enhance students skills pertaining to scientific and technical report writing and presentation.

Course Content

The student individually or in a group of 2 to 3, works on a specific topic approved by the project review committee constituted by the head of the department under the guidance of a faculty member who is familiar in this area of interest. The students can select any topic which is relevant to the area of Electrical and Electronics Engineering. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The progress of the project is evaluated based on a minimum of three reviews by the project review committee. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

SEMESTER VIII

UEEC017	FINAL YEAR PROJECT (PHASE – II)	L	T	P	C
		0	0	6	6

Course Objectives

- To solve the identified problem based on the formulated methodology.
- To further develop students' skills to analyze and discuss the test results, and make conclusions.
- To enhance students skills pertaining to scientific and technical report writing and presentation.

Course Content

The student should continue the Final Year Project Phase I work on the selected topic as per the formulated methodology under the same supervisor. The progress of the project is evaluated based on a minimum of three reviews by the project review committee. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

Professional Elective I

UEEE101	EHV POWER TRANSMISSION	L	T	P	C
		3	0	0	3

Course Objective

- To expose the students on Recent Advancements in EHV transmission systems in current context of global power system.

Course Content

Standard transmission voltages – different configurations of EHV and UHV lines – average values of line parameters – power handling capacity and line loss – costs of transmission lines and equipment – mechanical considerations in line performance. Calculation of resistance, inductance and capacitance for multi-conductor lines – calculation of sequence inductances and capacitances – line parameters for different modes of propagation.

Charge - potential relations for multi-conductor lines – surface voltage gradient on conductor's gradient factors and their use – distribution of voltage gradient on sub conductors of bundle voltage gradients on conductors in the presence of ground wires on towers. Power losses and audible losses: I^2R loss and corona loss - audible noise generation and characteristics - limits for audible noise - Day-Night equivalent noise level.

Effect of EHV line on heavy vehicles - calculation of electrostatic field of AC lines effect of high field on humans, animals, and plants - measurement of electrostatic fields - electrostatic Induction in un energized circuit of a D/C line - induced voltages in insulated ground wires - electromagnetic interference.

References

1. Gilbert M. Masters, "Renewable and Efficient Electric Power Systems", A John Wiley & Sons, 2004.
2. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", New Age International (P) Ltd, 2006.
3. Kuffel E, Zaengl W S and Kuffel J, "High Voltage Engineering Fundamentals", Newnes publishers, Second edition, 2000.
4. Leonard L. Grigsby, "Electric Power Generation, Transmission and Distribution", CRC Press, 2016.
5. TNEB Engineers Association, "Power Engineers Handbook", Sixth edition, 2002.

UEEE102	DESIGN OF PHOTOVOLTAIC SYSTEMS	L	T	P	C
		2	0	1	3

Course Objectives

- To explore the design and installation of solar photovoltaic (PV) systems and their applications in off-grid and on-grid environment.
- To experimentally verify the parameters of solar PV modules.

Course Content

Solar Cell and its function, Solar Technologies, Solar Cell Parameters,Efficiency of Solar Cell, Solar PV Module, Rating of Solar PV Module, PV Module Parameters, Efficiency of PV Module, Measuring Module Parameters.

Battery function, Batteries for Photo voltaic System, Battery parameters and selection, Battery Maintenance and Measurements, Battery Fault Detection and Test, Battery Installation for PV systemBattery Charge controller, Maximum Power Point Tracking, Specification of Inverter and charger Maximum Power Point Tracking

Solar Radiation Energy Measurements, Estimating Energy requirement,Types of Solar PV System, Design methodology for SPV system, Design of Off Grid Solar Power Plant, Case studies of Off grid Solar PV Power Plant, Design and Development of Solar Street Light and Solar Lantern.

List of Experiments

1. Measurement of parameters of a solar PV module in the field.
2. Measurement of VI characteristics of Series and Parallel Connected PV modules.
3. Measurement of solar PV module parameters i) in dark and ii) under illumination.
4. Measurement of solar PV module parameters at different irradiance.
5. Spectral response measurement of a solar PV module.

References

1. Chetan Singh Solanki, “Solar Photovoltaic Fundamentals, Technologies and Applications”, PHI Learning Private Limited, Second edition, 2015.
2. Martin A. Green, “Solar Cells: Operating Principles, Technology and System Applications”, Prentice-Hall, 1982.
3. Stuart R. Wenham, “Applied Photovoltaic”, Earthscan, 2007.
4. Michael Boxwell, “Solar Electricity Handbook”, Code Green Publishing, 2009.
5. Rik DeGunther, “Solar Power Your Home for Dummies”, John Wiley &Sons, 2010.

UEEE206	VIRTUAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives

- To impart the knowledge about software and the programming structure of LabVIEW.
- To introduce various techniques of interfacing of external instruments of PC.

Course Content

Virtual Instrumentation: Historical perspective, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, and comparison with conventional programming; VI programming techniques: VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers.

Data acquisition basics: Introduction to data acquisition, Sampling fundamentals and Input/output techniques: ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements, VI Chassis requirements; Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB; Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, PXI system controllers, Ethernet control of PXI.

Analysis tools & Applications of VI: Fourier transforms, Power spectrum, Correlation methods, Windowing and flittering; Industrial applications: Instrument Control, Simulation of systems using VI, Development of Control system, Image acquisition and processing, Motion control.

References

1. Jane W. S. Liu," Real-time Systems", Pearson Education, 2001.
2. Jovitha Jerome, "Virtual Instrumentation using LabVIEW", Prentice Hall of India, New Delhi, 2011.
3. Gary Johnson, "LabVIEW Graphical Programming", McGraw Hill,1997.
4. Kevin James, "PC Interfacing and Data Acquisition: Techniques for Measurement", Instrumentation and Control, Newnes, 2000.
5. Gupta S and Gupta J P, "PC Interfacing for data acquisition and Process control", Instrument Society of America.

UEEE207	POWER PLANT INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives

- **To introduce various instruments available for monitoring/controlling power plant electrical and non-electrical parameters**

Course Content

Power generation : types, importance of instrumentation in power generation, thermal power plants, building blocks, details of boiler processes; P&I Diagram: Pipe & Instrumentation diagram of boiler ;cogeneration; Measurement of non-electrical parameters: flow of feed water, fuel, air and steam with correction factor for temperature, steam pressure and steam temperature, drum level measurement, radiation detector, smoke density measurement, dust monitor.

Flue gas oxygen analyser, analysis of impurities in feed water and steam, dissolved oxygen analyzer; chromatography; PH meter; fuel analyser; Combustion control; air/fuel ratio control; furnace draft control; drum level control; main steam and reheat steam temperature control; super heater control; attemperator; deaerator control; distributed control system in power plants; interlocks in boiler operation.

Speed, Vibration, shell temperature monitoring and control-steam pressure control; lubricant oil temperature control; cooling system; Piping and Instrumentation diagram of different types of nuclear power plant; Nuclear reactor control loops; reactor dynamics; excess reactivity; pulse channel and log arithmetic instrumentation; control and safety instrumentation; reliability aspects.

References

1. SwapanBasu, Ajay Debnath, “Power Plant Instrumentation and Control Handbook”, Academic Press, 2014.
2. Sherry A, Beck J S, Cruddace A E, “Modern Power Station Practice: Mechanical Boilers, Fuel and Ash-Handling Plant”, Vol 2, Oxford, 2014.
3. Krishnaswamy K, PonniBala M, “power plant instrumentation”, PHI Learning Pvt Ltd Delhi, 2013.
4. Philip Kiameh, “Power Plant Instrumentation and Controls”, McGraw-Hill Education, 2014.
5. Liptak B G, “Instrumentation in process industries”, Vol. I and II, Chilton books co, 2003.

UEET210	SENSORS FOR ROBOTICS	L	T	P	C
		3	0	0	3

Course Objectives

- To impart basic knowledge about various sensors and their applications in robots.

Course Content

Introduction- sensors and transducers- history and definitions, smart sensing, AI sensing, need of sensors in robotics; Position sensors, optical, non-optical, velocity sensors, accelerometers, proximity sensors, contact, non-contact, range sensing, touch and slip sensors, force and torque Sensors.

Different sensing variables- smell, heat or temperature, humidity, light, speech or voice recognition systems, telepresence and related technologies, robot control through vision sensors, robot vision locating position, robot guidance with vision system, end effector camera sensor.

Construction of tactile, and touch sensors- interpretation of sensory information-use of sensory data to determine kinematic information, peg into hole problem, RCC and IRCC systems-working with ultrasonic distance sensors, working with the IR proximity sensor, working with Inertial Measurement unit.

References

1. K.S.Fu, R.C.Gonzalez, CSG. Lee, “Robotics control, sensing, vision and Intelligence”, Tata McGraw Hill Education Pvt. Ltd., first edition, 2013.
2. Richard D Klafter, Thomas A Chmielewski, Michael Negin, “Robotics Engineering: An Integrated Approach”, PHI Learning, New Delhi, sixth edition, 2009.
3. Dahiya Ravinder, Valle.Maurizio, “Robotic Tactile Sensing”, Springer first edition, 2013.
4. Paul W Chapman, “Smart Sensors”, an Independent Learning Module Series, second edition, 1996.
5. Sabrie Soloman, “Sensors and Control Systems in Manufacturing”, McGraw-Hill Professional Publishing, 2nd Edition, 2009.

Professional Elective II & III

UEEE103	CONTROL OF ELECTRIC DRIVES	L	T	P	C
		3	0	0	3

Course Objective

- To enhance the knowledge in the field of electrical drive system including their characteristics, starting, braking and speed control techniques.

Course Content

Basic concept of electric drives, components of electric drives, types,Classes of duty selection of power rating for drive motors with regard to thermal overloading.

Characteristics, Starting, Braking of dc motors, Speed control of DC motors: ward leonard scheme, single phase and three phase fully controlled and half controlled rectifiers, chopper controlled drives.

Characteristics, starting and braking of three phase induction motor, Speed control using AC voltage controllers, variable frequency and variable voltage control from inverters, slip power recovery– Scherbius and Kramer drive.

References

1. Dubey G.K., “Fundamentals of Electrical Drives”, CRC Press, 2002.
2. Vedam Subramanyam, “Electric Drives Concepts & Applications”, Tata McGraw Hill Education, Second edition, 2011.
3. Nisit K.De and Prasanta K.Sen, “Electric Drives”, Prentice Hall of India Private Limited, 2006.
4. Krishnan R, “Electric motor Drives: Modelling, Analysis and control”, Prentice Hall, 2001.
5. Pillai S.K., “A First Course on Electrical Drives”, New Age International Publishers, 1990.

UEEE105	ADVANCED ENERGY STORAGE TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objective

- To impart knowledge on various types of energy storage systems and their applications

Course Content

Introduction, types and necessity of energy storage and Application comparison, Thermal storage system – Types of thermal storage units ,Simple water and rock bed storage system, pressurized water storage system ,Simple units, packed bed storage units.

Fundamental concept of batteries –measuring of battery performance, Types of batteries – Fuel Cell – History of Fuel cell, Principles of Electrochemical storage –Types – advantage and drawback of each type. Hydrogen as fuel: Sources of hydrogen - Hydrogen production gas clean - up various methods of hydrogen storage. Integrated Gasification combined cycle (IGCC

Alternative energy storage technologies - Flywheel, Super capacitors, Principles & Methods – Applications, Compressed air Energy storage, Concept of Hybrid energy Storage, Battery vehicles, Electric vehicles.

References

1. Ibrahim Dincer and Null, “Thermal Energy Storage: Systems and Applications”, John Wiley & Sons 2011.
2. Ru-Shi Liu, Lei zhang, Xueliang sun, Hansan Liu and Jiujun Zhang, “Electrochemical Technologies for Energy Storage and Conversion”, John Wiley & Sons, 2012.
3. James Larminie and Andrew Dicks,“Fuel Cell Systems Explained”, Wiley, 2003.
4. Dell Ronald M and David A.J Rand, “Understanding Batteries”, Royal Society of Chemistry, 2007.
5. David Linden and Thomas B. Reddy, “Hand Book of Batteries”, Tata McGraw-Hill, Third edition, 2002.

UEEE110	POWER QUALITY	L	T	P	C
		3	0	0	3

Course Objective

- To familiarize with various power quality phenomenon, origin, monitoring and mitigation methods.

Course Content

Introduction of Voltage & Current Quality, Importance of Power Quality, Power quality Evaluation. General Classes of Power quality Problems, Transients, Long-Duration Voltage Variations, Short-Duration Voltage Variations, Voltage Imbalance, Waveform Distortion, Voltage fluctuation, Power Quality Terms, CBEMA and ITI Curves.

Sources of Sags and Interruptions, Estimating voltage Sag Performance, Fundamental Principles of Protection, Solution at the End-User Level, Motor –Starting Sags, Sources of Transient over voltages, Principles of over voltage Protection, Devices for over voltage Protection, Utility Capacitor-Switching transients, Utility System Lightning Protection, Managing Ferro-resonance, Switching Transient Problems with Loads, Computer Tools for Transients Analysis, Fundamentals of Harmonics-Causes, Effects and Elimination/Suppression of Harmonics, passive and active filters, IEEE and IEC standards.

Monitoring considerations, monitoring and diagnostic techniques for various power quality problems-modeling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance analyzer, quality measurement equipment - harmonic/spectrum analyser, flicker meters, Applications of expert systems for power quality monitoring.

References

1. Roger. C. Dugan, Mark. F. Mc Granaghan, Surya Santoso, Wayne Beaty H, “Electrical Power Systems Quality”, Tata McGraw-Hill Education, 2012.
2. Arrillaga J, Watson N. R. and Wood A. R., “Power System Harmonic Analysis”, John Wiley & Sons, Second edition, 2008.
3. Heydt G.T, “Electric Power Quality”, Stars in a Circle Publications, 1994.
4. Bollen M H J, “Understanding Power Quality Problems (Voltage Sags and Interruptions)”, Standard Publishers Distributors, 2001.
5. Arrillaga J, Watson N R, Chen S, “Power System Quality Assessment”, John Wiley & Sons, 2000.

UEEE114	HYBRID ELECTRIC VEHICLE	L	T	P	C
		3	0	0	3

Course Objectives

- To explore about different configurations of Hybrid electric vehicles and its applications.

Course Content

Introduction to electric vehicle, components, vehicle mechanics, Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion, Propulsion System Design. Battery Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

Motor and Engine rating, Requirements, DC machines, Three phase AC machines, Induction machines, permanent magnet machines, switched reluctance machines. Electric vehicle drive train - Transmission configuration, Components – gears, differential, clutch, brakes regenerative braking, motor sizing.

Hybrid electric vehicles- Types – series, parallel and series-parallel configuration – Design – Drive train, sizing of components, concepts of wireless technologies, Latest trends in battery charging.

References

1. Iqbal Husain, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, Second edition, 2011.
2. James Larminie, John Lowry, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2012.
3. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals”, CRC Press, 2017.
4. Sandeep Dhameja, “Electric Vehicle Battery Systems”, Newnes, 2001.
5. Chris Mi, Abul Masrur M, “Hybrid Electric Vehicles Principles and Applications with Practical Perspectives”, Wiley Publication, Second edition, 2011.

UEEE304	SOLID STATE POWER CONTROLLERS	L	T	P	C
		3	0	0	3

Course Objectives

- To provide knowledge about various types of power electronic controllers and their applications in power systems.

Course Content

Electrical Transmission Network – Power Flow in AC System– opportunities for FACTS – possible benefits – FACTS Controllers – Types, brief description and definitions. Need for Static Var Compensation – introduction to shunt and series compensation – objectives, configuration and operating characteristics – Thyristor Controlled Reactor (TCR) – Thyristor Switched Capacitor (TSC) – Fixed Capacitor - Thyristor Controlled Reactor (FC – TCR) – Comparison

Commutation in DC motors, difference between mechanical and electronic commutators, Hall sensors, Optical sensors, Multiphase Brushless motor, Square – Wave permanent magnet brushless motor drives, equations and characteristics of Permanent Magnet Brush less DC Motors – controllers PM DC Motor

Voltage and phase angle regulators – approaches to Thyristor Controlled Voltage and Phase Angle Regulator. Construction and principle of operation of Linear Induction Motor - Universal Motor - Hybrid Motor – Linear Synchronous motor – Applications

References

1. Narain G. Hingorani, Laszlo Gyugyi, “Understanding FACTS – Concepts and Technology of Flexible AC Transmission Systems”, Wiley India Pvt Ltd, 2013.
2. R. Mohan Mathur , Rajiv K. Varma, “Thyristor Based FACTS Controller for Electrical Transmission Systems”, Wiley, 2011.
3. Padiyar K. R., “FACTS Controllers in Power Transmission and Distribution”, Anshan, First Edition, 2009.
4. Miller T.J.E, “Reactive Power Control in Electrical Systems”, Wiley, 1982.
5. Dubey, G.K, “Thyristorised Power Controllers”, Halsted Press, 1986.

UEEC309	PLC AND SCADA	L	T	P	C
		3	0	0	3

Course Objectives

- To impart knowledge about PLC and its applications.
- To familiarize with SCADA and its tools.

Course Content

Basics of PLC, Advantages, Capabilities of PLC, Architecture of PLC, Scan cycle, Types of PLC, Types of I/O modules, configuring a PLC, PLC wiring, Installation and maintenance procedures for PLC, Troubleshooting of PLC; Overview of PLC programming methods, ladder diagram, various examples of PLC application, a basic relay type instruction, timer and counter instructions, logical and arithmetic instructions, data handling instructions.

PLC Networking, Networking standards and IEEE Standard, Protocols, Field bus, Process bus and Ethernet; Applications of PLC - Machine automation, Process automation, Selection parameters for PLC; Introduction to Programmable Automation Controller.

Supervisory Control and Data Acquisition (SCADA) –overview, Developer and runtime packages, architecture, Tools, Tag, Internal & External graphics, Alarm logging, Tag logging, structured tags, Trends, History, Report generation, SCADA applications.

References

1. John W Webb, Ronald A Reis, “Programmable logic controllers: Principles and Applications”, Prentice Hall, Fourth edition, 2007.
2. Frank D Petruzella “Programmable Logic Controllers ", McGraw Hill Education, Fourth edition, 2010.
3. Kelvin T. Erickson, “Programmable Logic Controllers: An Emphasis on Design and Application ", Dogwood Valley Press, Third edition, 2016.
4. David Bailey, Edwin Wright, “Practical SCADA for Industry”, Elsevier publication, First edition, 2003.
5. Bela G. Liptak, “Process Control- Instrument Engineer’s Hand Book”, Butterworth Heinemann, Third edition, 2013.

Professional Elective IV & V

UEEE104	FLEXIBLE AC TRANSMISSION SYSTEMS	L	T	P	C
		3	0	0	3

Course Objective

- To understand the various FACTS controllers and operation of FACTS systems to improve the power quality.

Course Content

Introduction to FACTS controllers – Power flow equations – Principles of conventional reactive power compensators: Synchronous condensers, saturated reactor, phase angle regulator and other controllers.

Objective of shunt compensation – Principle and operating characteristics of Thyristor Controlled Reactor(TCR) – Thyristor Switched Capacitor(TSC) -Static VAR Compensators (SVC) – SVC control system – SVC voltage regulator model –Series compensation – Principles of operation of TCSC –Modelling of TCSC – TCSC control system –mitigation of sub-synchronous resonance-Static Synchronous Compensator (STATCOM): Principle of operation, VI Characteristics.

Static Synchronous Series Compensator (SSSC): Principle of operation and characteristics of SSSC – control range and VA rating – capability to provide real power compensation – Immunity to sub-synchronous resonance – control scheme for SSSC.UPFC-Basic operating principles – conventional transmission control capability – Independent real and reactive power flow control – control scheme for UPFC.

References

1. Narain G. Hingorani, Laszlo Gyugyi, “Understanding FACTS: Concepts & Technology of Flexible AC Transmission System”, Wiley, 2000.
2. Mohan Mathur R, Rajiv K. Varma, “Thyristor – Based Facts Controllers for Electrical Transmission Systems”, John Wiley and Sons, 2002.
3. Padiyar K.R, “FACTS Controllers for Transmission and Distribution”, Anshan, 2009.
4. Vijay K. Sood, “HVDC and FACTS Controller: Application of Static Converters in Power Systems”, Springer Science & Business Media, 2006
5. John A, Yong-Hua Song, “Flexible AC Transmission Systems”, IET, 1999.

UEEE107	STATIC VAr COMPENSATION AND HARMONIC FILTERING	L	T	P	C
		3	0	0	3

Course Objective

- To understand the different control schemes for static VAR compensators to mitigate power quality problems in power system

Course Content

Fundamentals of load compensation, Steady-State Reactive Power Control in Electric Transmission Systems, Reactive Power Compensation and Dynamic Performance of Transmission Systems

Static reactive power compensators and their control, shunt compensators, SVCs of thyristor switched and thyristor controlled types and their control, STATCOMs and their control, series compensators of thyristor, SSSC and its control ,Sub-synchronous resonance transient and dynamic stability improvement in power systems, converters for static compensation, standard modulation strategies, GTO inverters, multi-level inverters

Passive harmonic filtering, single phase shunt filter and its control, three phase active filtering and their control, hybrid filtering using shunt active filters, series active filtering in harmonic cancellation mode, series active filtering in harmonic isolation mode, dynamic voltage restorer and its control, power quality conditioner

References

1. Miller T.J.E, “Reactive Power Control in Electric Systems”, John Wiley & Sons, 1982.
2. Hingorani N.G & Gyugyi L, “Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems”, Wiley Publications, 2000.
3. Ned Mohan, Tore M.Underland, William P. Robins, “Power Electronics: Converters, Applications, and Designs”, John Wiley & Sons, 2003.
4. Arrillaga J, Smith B. C, Watson N. R. and Wood A. R, “Power System Harmonic Analysis”, John Wiley & Sons, 1997.
5. Mohan Mathur R, Rajiv K.Varma, “Thyristor –Based Facts Controllers for Electrical Transmission Systems”, John Wiley and Sons, 2002.

UEEE111	RESTRUCTURED POWER SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce the restructuring of power industry with various market models.
- To impart learning about optimal power system expansion and it's planning.

Course Content

Introduction, Market Models, Entities, Key issues in regulated and deregulated power markets; Market equilibrium- Market clearing price, Electricity markets around the world. Operational and planning activities of a GENCO, Electricity Pricing and Forecasting –Price Based Unit Commitment Design - Security Constrained Unit Commitment design. Ancillary Services for Restructuring- Automatic Generation Control (AGC), Fundamentals of restructured system, Load Elasticity, Social welfare maximization, OPF: Role in vertically integrated systems and in restructured markets.

Transmission Pricing and Tracing of power, Ancillary Services, Standard Market Design, Distributed Generation in restructured markets, Congestion Management in open access transmission, Optimal Bidding, Risk assessment and Hedging, Open-access Coordination Strategies; Power Wheeling- Transmission Cost Allocation Methods Open Access Distribution - Changes in Distribution Operations- Maintaining Distribution Planning.

Power Market Development – Electricity Act, 2003 - Key issues and solution; Reform initiatives: Developing power exchanges suited to the Indian market- Competition- Indian power market- IT applications in restructured markets, working of restructured power systems: PJM. Infrastructure model for power exchanges- Congestion Management-Day Ahead Market- Online power trading.

References

1. Mohammad Shahidehpour, Alomoush M, "Restructured Electrical Power Systems: Operation, Trading and Volatility", CRC Press, 2001.
2. Loi Lei Lai, "Power System Restructuring and Deregulation: Trading, Performance and Information Technology", John Wiley & Sons Ltd., 2001
3. Kankar Bhattacharya, Math H.J. Bollen, Jaap E. Daadler "Operation of Restructured Power Systems", Springer Science and Business Media,2012.
4. Sally Hunt," Making Competition Work in Electricity", John Willey and Sons, 2002.
5. Steven Stoft," Power System Economics: Designing Markets for Electricity", Wiley, 2002.

UEEE113	INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

Course Objectives

- To gain knowledge on various aspects of Industrial power system analysis and design.

Course Content

Introduction to Industrial Power system, Evaluation Criteria, Starting Methods, System Data, Voltage Drop Calculations, Calculation of Acceleration time, Motor Starting with Limited-Capacity Generators, Computer-Aided Analysis.

Power factor correction studies, System Description and Modeling, Acceptance Criteria, Frequency Scan Analysis, Voltage Magnification Analysis, Sustained Over voltages Switching Surge Analysis-Back-to-Back Switching, Summary and Conclusions.

Harmonic Sources, System Response to Harmonics-System Model for Computer-Aided Analysis, Acceptance Criteria, Harmonic Filters, Harmonic Evaluation, Case Study-Summary and Conclusions. Flicker analysis, Sources of Flicker, Flicker Analysis, Flicker Criteria, Data for Flicker analysis, Case Study-Arc Furnace Load-Minimizing the Flicker Effects, Ground grid analysis. Introduction-Acceptance Criteria, Ground Grid Calculations, Computer-Aided Analysis, Improving the Performance of the Grounding Grids.

References

1. Duncan Glover J, Mulukutla S.Sarma, Thomas J. Overbye, “Power System Analysis and Design”, Cengage Larning, Sixth edition, 2016.
2. Turan Gonen, “Electrical Power Transmission System Engineering: Analysis and Design”, CRC Press, Third Edition, 2015.
3. Ramasamy Natarajan, “Computer-Aided Power System Analysis”, CRC press, 2002.
4. Ramnujam R, “Power System Dynamics Analysis and Simulation”, PHI Learning Private Limited, 2009.
5. Cutsemand T.V, Vournas C, “Voltage Stability of Electric Power Systems”, Springer Science and Business Media, 2007.

UEEE303	DIGITAL SYSTEM DESIGN	L	T	P	C
		3	0	0	3

Course Objective

- To provide knowledge about the need for hardware descriptive language in the digital IC design flow and explain its various abstraction levels.
- To provide strong foundation on designing the combinational and Sequential circuits using VHDL.
- To disseminate about testing of digital circuits on hardware devices (FPGA) at various levels of abstraction using VHDL (Gate/Switch/Behavioral).

Course Content

Introduction to VHDL, Digital system Design process, the art of modeling, Hardware simulation and synthesis, Requirements of HDL, Elements of HDL, Top - Down design with HDL, operators, conventions and syntax; Characterizing Hardware Languages, objects and classes, Signal assignments, concurrent and sequential Assignments, functions, procedures, Packages and libraries.

Behavioral and RTL style of Description and synthesis- Advanced process concepts, case statement, loop statement, null statement, assert and report statement, subprograms, procedures and functions, subprogram overloading, operator overloading, RTL Description; Dataflow style of Description and synthesis - Concurrent conditional assignments, Concurrent Selected Signal Assignment, Block statement, modeling of sequential circuits, Structural system of Description and synthesis - Component declaration, Generics and Instantiation, Configuration statement, configuration declaration unit, generate statement, mixed modeling style, Writing test benches and synthesis, File I/O operations, Test Bench Architecture.

Design of combinational and sequential circuits, designing with Programmable Logic Devices – Read only memories, Programmable logic arrays, Programmable array logic, Design of networks for Arithmetic operations - Design of a adder with accumulator, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider; Digital Design with State Machine charts, Derivation of SM charts, Realization of State Machine charts.

References

1. Peter Ashenden, Jim Lewis, “VHDL-2008: Just the New Stuff”, Morgan Kaufmann Press, 2007.
2. Pong P. Chu, “RTL Hardware Design Using VHDL”, Wiley-IEEE Press, 2006.
3. Stephen Brown, Zvonko Vranesic, “Fundamentals of Digital Logic with VHDL”, McGraw Hill Education, Third edition, 2017.
4. Volnei A. Pedroni, “Circuit Design with VHDL”, MIT Press, Second edition, 2010.
5. Charles H Roth, Lizy Kurian John, “Digital Systems Design using VHDL”, Thomson Learning, Second edition, 2007.

UEEE310	SWITCHED MODE POWER CONVERTERS	L	T	P	C
		3	0	0	3

Course Objective

- To provide knowledge about various types of switched mode dc - dc converters, inverters and resonant converters and their control techniques.

Course Content

Reactive elements in Power Electronic Systems, Design of inductor, Design of transformer, Capacitors for power electronic applications; Basic concepts of Switched Mode power converters, Primitive DC to DC Power Converter, Operating Principle, Exact and Approximate Analysis.

Non - isolated DC to DC Power Converter - Buck, Boost, Buck-Boost, Cuk, Sepic and Quadratic Converters; Isolated DC to DC Power Converter - Forward, Flyback, Half/Full Bridge Converters; Steady state model, dynamic model, analysis, modeling and performance functions of switching power converters.

Classification of resonant converters - resonant load converters, principal of operation, SMPS using resonant circuit, steady state modeling; Resonant switch converters - Buck converter with ZCS and ZVS, operation and analysis.

References

1. Ned Mohan, Tore M. Undeland, William P. Robbins, “Power Electronics: Converters, Applications and Design”, John Wiley & Sons, Third edition, 2011.
2. Abraham I. Pressman, Keith Billings and Taylor Morey, “Switching Power Supply Design”, McGraw Hill Education, Third edition, 2009.
3. Simon Ang, Alejandro Oliva, “Power Switching Converters”, Marcel Dekker Inc, Third edition, 2009.
4. Muhammad H. Rashid, “Power Electronics Handbook”, Butterworth Heinemann, Fourth edition, 2017.
5. Ramanarayanan V., “Course Material on Switched Mode Power Conversion”, Department of Electrical Engineering, Indian Institute of Science, Bangalore, 2007.

Professional Elective VI

UEEE106	HVDC TRANSMISSION	L	T	P	C
		3	0	0	3

Course Objectives

- To impart knowledge on operation, modelling and control of HVDC links.
- To provide insight upon harmonics and its mitigation techniques.

Course Content

Early discoveries and application, DC Power transmission technology ,Comparison of HVAC and HVDC transmission, Classification of HVDC links, HVDC transmission schemes, Component description, Planning for HVDC transmission ,Modern trends in HVDC technology, Operating problems, HVDC transmission based on VSC, Types and applications of MTDC systems.

Converter: principles, characteristics, control circuits, Pulse number, choice of converter configurations, Analysis of Graetz circuit with and without overlap, voltage waveforms, Analysis of two and three valve conduction mode, Converter Bridge characteristics, Inverter mode of operation, voltage waveforms, Converter and HVDC Control: Principles of DC link control, Converter fault and Control, Power control.

Reactive power requirements in steady state, Sources of reactive power, SVC and STATCOM, Harmonics and filters, effects of Harmonics, sources of harmonic generation, Types and design of filters, AC-DC system interaction, AC- DC load flow.

References

1. Edward Wilson Kimbark, “Direct Current Transmission”, Wiley- Interscience Publication, 1971.
2. Arrillaga.J, “High Voltage Direct Current Transmission”, IET, Second edition, 1998.
3. Padiyar K.R, “HVDC Power Transmission Systems: Technology and System Interactions”, New Age International Publications, 1990.
4. Rao S, “EHV-AC, HVDC Transmission and Distribution”, Khanna Publications, 1999.
5. Uhlmann E, “Power Transmission by Direct Current”, Springer Science and Business Media Publications, 2012.

UEEE108	NANOTECHNOLOGY FOR ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

Course Objective

- To present the importance of the non-conventional energy and the key role played by nanotechnology in Energy systems.

Course Content

Energy challenges, Development and implementation of renewable energy technologies Nanotechnology enabled renewable energy technologies, Energy transport, conversion and storage, Nano, micro and meso scale phenomena and devices.

Energy Sector Products Using Nano materials**,** Light emitting diodes, Batteries, Catalytic reactors, Capacitors – Super capacitors, Micro fluidic systems, Nano engines, Biogas, Biodiesel. Fuel cell technologies: Integration and performance for micro, Fuel cell systems – Thin film and micro fabrication methods, Design methodologies, Micro-fuel cell power sources, carbon nano tubes.

Hydrogen storage methods, Metal hydrides, Hydrogen storage capacity, Hydrogen reaction kinetics, Carbon-free cycle, Gravimetric and volumetric storage capacities, Hydrating/dehydrating kinetics, High enthalpy of formation, Thermal management during the hydrating reaction, Distinctive chemical and physical properties, Multiple catalytic effects, Degradation of the sorption properties, Hydride storage materials for automotive applications**.**

References

1. Javier Garcia-Martinez, “Nanotechnology for the Energy Challenge”, John Wiley & Sons, 2013.
2. Hoogers Gregor, “Fuel Cell Technology Handbook”, CRC Press, 2002.
3. Wolf Vielstich, Arnold Lamm, Hubert A.Gastiger, “Handbook of Fuel Cells: Fundamentals Technology, Applications”, John Wiley & Sons, 2009.
4. Leon F, David Infield, “Renewable Energy in Power Systems”, John Wiley & Sons, 2008.
5. Ram B. Gupta, “Hydrogen Fuel: Production, Transport and Storage”, CRC Press, 2008.

UEEE109	POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

- To assess the need of integrating various alternative sources of energy.
- To realize the present and future energy demand and techniques to exploit the available energy resources.

Course Content

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) – Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

Reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG. Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) – Boost and buck-boost converters- selection of inverter, battery sizing, array sizing. Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters. Standalone operation of fixed and variable speed wind energy conversion systems and solar system.

Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system. Need for Hybrid Systems- Range and type of Hybrid systems - PV Maximum Power Point Tracking (MPPT).

References

1. Daniel W. Hart, “Power Electronics”, Tata McGraw -Hill, 2011.
2. Andrzej M. Trzynadlowski, “Introduction to Modern Power Electronics”, John Wiley &Sons Third edition, 2015.
3. Khan B H,“Non-conventional Energy Sources”, Tata McGraw-Hill Publishing Company, 2009.
4. Sudipta Chakraborty, Marcelo G. Simoes, William E. Kramer, “Power Electronics for Renewable and Distributed Energy Systems”, Springer Science & Business Media, 2013.
5. Muhammad H. Rashid, “Alternative Energy in Power Electronics”, Butterworth-Heinemann, 2014.

UEEE112	SCADA AND DISTRIBUTED CONTROL SYSTEM	L	T	P	C
		3	0	0	3

Course Objectives

- To provide the knowledge of SCADA and its applications and study about the Distributed Control System development and configuration.

Course Content

Introduction to SCADA, types of control systems, components of SCADA Systems, communication media, Architecture- interfaces and security; SCADA in power systems, Regional Grid and DCS based SCADA systems. Monitoring and supervisory functions, SCADA key features, remote Terminal Units (RTU), DCS versus SCADA terminology, SCADA applications.

Introduction, Various function Blocks, DCS components/block diagram, DCS Architecture of different makes, comparison of these architectures with automation pyramid, DCS specification, latest trend and developments, DCS support to Enterprise Resources Planning (ERP), performance criteria for DCS and other automation tools.

DCS detail Engineering, configuration and programming, functions including database management, reporting, alarm management, diagnosis, Historical database management, security and user access management, communication, third party interfaces ,control, display etc. Enhanced functions like Advance process control, fuzzy logic, ANN

References

1. Petruzella F.D, “Programmable Logic Controllers”, Tata McGraw-Hill, Third edition, 2005.
2. Michael P. Lukas, “Distributed Control Systems: Their Evaluation and Design”, Van Nostrand Reinhold Co., 1986.
3. Popovic D and Bhatkar V.P,’ Distributed Computer Control for Industrial Automation”, Routledge, 2017.
4. Stuart A. Boyer, “SCADA: Supervisory Control and Data Acquisition”, Instrument Society of America Publications, 1993.
5. Gordon R Clarke, Deon Reynders, Edwin Wright, “Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems”, Newnes Publications, 2004.

UEEE201	BIOMEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives

- To impart knowledge on human physiology and to introduce about various instrumentation systems for measurement and analysis of physiological parameters.

Course Content

Development of Biomedical Instrumentation: Man-instrument systems, block diagram; Physiological Systems of the Body: Brief description of nervous, circulatory, Excretory and respiratory systems; Sources of bioelectric potentials; resting and action potentials; propagation of action potentials& bioelectric potentials; Bio potential electrodes: microelectrodes, skin surface electrodes, needle electrodes; biomedical transducers, transducers for biomedical applications.

The Heart System and its Measurements: Cardiovascular system; Electrocardiography, Electrodes and leads; Measurement of Blood Pressure; Measurement of blood flow and cardiac output; Measurement of heart sounds; Cardiac pacemakers; defibrillator; Measurement of Nervous system & Respiratory System: Electroencephalogram, anatomy of nervous system, neuronal communication, EEG measurement; Electromyogram (EMG), Nerve Conduction velocity measurements, Electromyogram measurements; Physiology of respiratory system, Respiratory parameters: spirometer, body plethysmography; Respiratory therapy equipment; heart lung machine.

Imaging Techniques: X-rays- principle of generation, fluoroscopy, angiography, tomograms, Endoscopy, Diathermy; Basic principle of computed tomography; magnetic resonance imaging system; Ultrasonic imaging system; Instruments for clinical laboratory: tests on blood cells, Chemical tests; Introduction to Biotelemetry: Physiological parameters adaptable to Biotelemetry, The Components of a Biotelemetry System, Implantable Units; Electrical Hazards & Patient safety in Bio-medical equipments: Electrical safety, Physiological effects of electric current, shock hazards from electrical equipment, methods of accident prevention.

References

1. Joseph J.carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, John Wileyand sons, New York, 4th Edition, 2012.
2. Khandpur.R.S., “Hand book of Bio-Medical Instrumentation”, Tate McGraw –Hill 2015.
3. Duane Knudson, “Fundamentals of Biomechanics”, Springer, 2013.
4. Robert B. Northrop, “Introduction to Instrumentation and Measurements”, Taylor and Francis group, New York, 3rd Edition, 2014.
5. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 2010.

GENERIC ELECTIVES OFFERED BY THE DEPARTMENT OF CIVIL ENGINEERING

UCEG001	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

Course Objectives

- To provide an overview of the concepts, methods, issues and various forms and stages of the EIA process.
- To learn and understand principles, process and necessary techniques for EIA, mitigation and monitoring.
- To expose the students to the methods of qualitative and quantitative assessment of environmental impacts due to developmental activities.

Course Content

Impact of Development projects on Environment and Environmental Impact Assessment (EIA) and Environmental Impact Statement (EIS) – Objectives – EIA Types – EIA in project cycle – capacity and limitations – Legal provisions on EIA – Environmental Impact Assessment Notifications – Environmental Impact Assessment Consultants – Legal provisions on EIA. Methods of Categorization of industries for EIA - Elements of EIA – Process screening, baseline studies, mitigation, matrices, checklist - Methods of EIA – Strengths, weaknesses and applicability – appropriate methodology solution. Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna, Socio Economic Impact, Mathematical models for Impact prediction, Rapid EIA, Public participation – Post Environmental Audit.

Plan for mitigation of adverse impact on environment – options for mitigation of impact on water, air and land, water, energy, flora and fauna; Addressing the issues related to the Project Affected People – Environment management Plan – ISO 14000. EIA case studies for new and expansion projects - wastewater treatment plants, water supply and drainage, Highways and bridges, Railways, Dams, Irrigation projects, Power plants.

References

1. Bram F. Noble, “Introduction to Environmental Impact Assessment: A Guide to Principles and Practice”, Oxford University Press; 3 edition, 2014.
2. Canter, R.L. “Environmental impact Assessment”, 2nd Edition, McGraw Hill Inc., New Delhi.
3. Anjaneyulu, Y, “Environmental Impact Assessment methodologies”, B.S. Publications, Hyderabad, 2012.
4. S.K. Shukla and P.R. Srivastava, “Concepts in Environmental Impact Analysis”, Common Wealth Publishers, New Delhi, 1992.
5. John G. Rao and David C. Hooten (Ed.), “Environmental Impact Analysis Handbook”, McGraw Hill Book Company, 2010.

UCEG002	DISASTER MITIGATION AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

- To provide students an exposure to disasters, their significance and types.
- To distinguish between disaster management and risk management.
- To develop skills in various stages of disaster preparedness, mitigation and management.
- To explain selected models of disaster management and strategies for risk mitigation.
- To learn about organizational and administrative strategies for managing disasters.

Course Content

Natural Disasters around the world; Principles, Elements, and Systems; Natural disasters- Cyclones, Floods, Drought and Desertification - Earthquake, Tsunami, Landslides and Avalanche. Man -made Disasters- Chemical industrial hazards, major power breakdowns, traffic accidents, Fire, War, Atom bombs, nuclear disaster, and Forest Fire-Oil fire –accident in Mines, Disaster risk analysis - prevention and mitigation.

Applications of Space Technology (Satellite Communications, GPS, GIS and Remote Sensing and Information / Communication Technologies (ICT) in Early warning Systems, Disaster Monitoring and Support Centre– Information Dissemination, mobile communication etc., post disaster recovery & rehabilitation, Relief & Logistics Management, Disaster related infrastructure development- Post Disaster, Emergency Support Functions and their coordination mechanism, Education and Training, Establishment of capacity building among various stake holders, Government - Educational institutions, Use of Multi-media knowledge products for self-education.

References

1. Mukesh Kapoor, “Disaster Management”, Dhanpat Rai, 2012.
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012
3. Gupta Anil K, Sreeja S. Nair. “Environmental Knowledge for Disaster Risk Management”, NIDM, New Delhi, 2011
4. Claudia G. Flores Gonzáles , “Risk Management of Natural Disasters”, KIT Scientific Publishing, 2010.
5. Rajdeep Dasgupta, “Disaster Management and Rehabilitation”, Mittal Publishers, New Delhi, 2010.

UCEG003	GLOBAL WARMING AND CLIMATE CHANGE	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the complex interrelationship of the physical, chemical and biological systems found in nature and the impact upon them of human activity.
- To provide an overview of contemporary changes to our global environment, current responses to environmental and social problems.
- To develop knowledge on the possibilities and challenges associated with transformative change processes.
- To understand the role of citizens, public land management agencies, and non-governmental organizations in protecting and conserving natural resources.

Course Content

Introduction –Sources and impact of resource degradation, social insecurity, industrialization and Globalization on environment, Global Environmental Problems. Changes in Lithosphere – Soil and agriculture, erosion, mining and pollution, urban pollution. Atmosphere - Global warming, Ozone layer depletion, Acid rains, desertification. Hydrosphere – Water use and pollution. Water abuse and control. Biosphere -Loss of Biodiversity, urbanization. Introduction to historical global climate change, Attribution of change, Perceptions of climate change. Projections of future climate - Introduction to climate models, Scenarios, Climate projections, Uncertainty. Impact of climate change - Observed impacts, Future climate impacts.

Adaptation to climate change - Terminology and history, Types of adaptation, Adaptation approaches, Adaptive capacity, Selecting and evaluating adaptation options, Opportunities limits, and constraints to adaptation, Indigenous knowledge and gender issues in adaptation, International and national adaptation strategies. Sustainable progress, Concept of sustainable development, Components of sustainability, carrying capacity, public participation, Energy generation and efficiency, conserving ecosystems and their services. Sector specific mitigation opportunities, Types of policy instruments, International climate change agreements.

References

1. Edmond Mathez. "Climate Change: The Science of Global Warming and Our Energy Future", Columbia University Press, 1st edition, 2009.
2. K. Jain, "A Practical Guide to Disaster Management", 2013.
3. Ann Henderson-Sellers & Kendal McGuffie, "The future of the world's climate, Elsevier", 2012.
4. "Intergovernmental Panel on Climate Change: The Third Assessment Report)", Cambridge University Press, 2007.
5. Russell D. Thomson, "Atmospheric processes and systems", Taylor and Francis, 2002.

UCEG004	GIS FOR NATURAL RESOURCES MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

- To comprehend the raster and vector data processing and eliminate errors of sources in GIS.
- To apply the GIS techniques for natural resources management, planning and mitigation.

Course Content

GIS - History of Development - Components of GIS – Hardware, Software and Organizational Context – Data – Spatial and Non-Spatial – Data Input Sources— DBMS – Data Output - Data models - Raster and Vector data structures – Data compression – Raster vs. vector comparison. Analysis using Raster and Vector data – Operations – Overlaying - Buffering – Modeling in GIS - Digital Terrain Modeling, Analysis and application – Products of DEMs and their uses – Sources of errors in GIS and their elimination.

Advanced applications of GIS in natural resource management; ecosystem inventory and monitoring - forests, wetlands, Water resource, Land use – Land cover – land use planning, urban planning, snow and glaciers, potential ground water mapping, coastal zone management, protected area management- Disaster management.

References

1. Jenson, John R, "Remote Sensing of the environment: An earth resource perspective", 2 nd edition, Pearson Education, 2013.
2. Jones, Hamlyn G., and Robin A. Vaughan, "Remote Sensing of Vegetation: Principles, Techniques, and Applications", Oxford University Press, 2010.
3. Lo, Chor Pang, and Albert K. W. Yeung, "Concepts and Techniques of Geographic Information Systems", 2 nd Edition, Pearson Education, 2016.
4. Awange, Joseph L., and John B. Kyalo Kiema, "Environmental Geoinformatics: Monitoring and Management", Springer, 2013.
5. Gomarasca, Mario A, "Basics of Geomatics", Springer, 2009.

UCEG005	PRINCIPLES OF REMOTE SENSING	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce to the students about the basic principles of remote sensing as a tool for mapping.
- To learn about the electromagnetic interactions with earth surface materials and their spectral signatures.
- To comprehend the satellite and sensor parameters.
- To employ digital image interpretation and analysis.

Course Content

Remote Sensing – History - Principle - Electro-magnetic energy, spectrum - EMR interaction with atmosphere – Atmospheric Windows and its Significance – EMR interaction with Earth Surface Materials – Spectral Signature. Aerial photography / aerial cameras / photographic process – Satellites - Classification – Satellite Sensors – satellite and sensor parameters - Resolution – Types of Remote Sensing - Elements of visual interpretation – Image data interpretation and Analysis – Photogrammetric process / softcopy photogrammetry – Digital Image processing. Characteristics of different platforms: Landsat, SPOT, IRS series, IKONOS, QUICKBIRD – Radar, LIDAR, SAR, MODIS, AMSRE, Sonar remote sensing systems. Applications - Remote sensing of vegetation – Remote sensing of Water resources – Remote sensing of urban landscapes – Remote sensing of soils and geomorphology.

References

1. Lillesand, Kiefer, and Chipman, "Remote Sensing and Image Interpretation", 7th (Student) edition, Wiley, 2014.
2. Jenson, John R, "Remote Sensing of the environment: An earth resource perspective", Second. Pearson Education, 2013.
3. Jones, Hamlyn G., and Robin A., Vaughan, "Remote Sensing of Vegetation: Principles, Techniques, and Applications", Oxford University Press, 2010.
4. Richards, John A, "Remote Sensing Digital Image Analysis: An Introduction", 5th edition, Springer, 2012.
5. Anji Reddy M, "Remote Sensing and Geographical Information System", 4th edition, B S Publications, 2012.

GENERIC ELECTIVES OFFERED BY THE DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

UCSG001	FUNDAMENTALS OF INFORMATION SECURITY	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the basics of Information Security.
- To know the legal, ethical and professional issues in Information Security.
- To analyse the aspects of risk management.
- To become aware of various standards in this area.
- To know the technological aspects of Information Security.

Course Content

Introduction

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

Security Investigation

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues

Security Analysis

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk

Logical Design

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture

Physical Design

Security Technology, IDS, Scanning and Analysis Tools, Cryptography – Protocols for secure communications, Physical Security, Security and Personnel.

References

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003.
2. Micki Krause, Harold F. Tipton, " Handbook of Information Security Management", Vol 1-3 CRC Press LLC, 2004.
3. Stuart Mc Clure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw-Hill, 2003.
4. Matt Bishop, "Computer Security Art and Science", Pearson/PHI, 2002.
5. Mark Stamp, "Information Security: Principles and Practice", Wiley-Blackwell, 2nd edition, 2011.

UCSG002	INTRODUCTION TO COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives

- Understand the division of network functionalities into layers
- Be familiar with the components required to build different types of networks
- Be exposed to the required functionality at each layer
- Learn the flow control and congestion control algorithms

Course Content

Fundamentals & Link Layer

Building a network – Requirements - Layering and protocols - Internet Architecture – Network software – Performance ; Link layer Services - Framing - Error Detection - Flow control

Media Access & Internetworking

Media access control - Ethernet (802.3) - Wireless LANs – 802.11 – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP)

Routing

Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM)

Transport Layer

Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management - Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED)

Application Layer

Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – Web Services – DNS – SNMP.

References

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers, 2011.
2. James F. Kurose, Keith W. Ross, “Computer Networking - A Top-Down Approach Featuring the Internet”, Fifth Edition, Pearson Education, 2009.
3. Nader. F. Mir, “Computer and Communication Networks”, Pearson Prentice Hall Publishers, 2010.
4. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open Source Approach”, Mc Graw Hill Publisher, 2011.
5. Behrouz A. Forouzan, “Data communication and Networking”, Fourth Edition, Tata McGraw – Hill, 2011.

UCSG003	INTRODUCTION TO SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- To be successful professionals in the field with solid fundamental knowledge of software engineering
- To utilize and exhibit strong communication and interpersonal skills, as well as professional and ethical principles when functioning as members and leaders of multi-disciplinary teams
- To apply the foundations in software engineering to adapt to readily changing environments using the appropriate theory, principles and processes

Course Content

Requirements Analysis and Specification

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets.

Software Design

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components

Testing and Maintenance

Software testing fundamentals-Internal and external views of Testing–Types of testing - System testing and debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Re-engineering-BPR model

References

1. Roger S Pressman, "Software Engineering – A Practitioner's approach", Seventh edition, McGraw-Hill International edition, 2010.
2. Ian Somerville, "Software Engineering", 9th edition, Pearson Education Asia, 2011.
3. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009.
4. Pankaj Jalote, "Software Engineering", A Precise Approach, Wiley India, 2010.
5. James F Peters, Witold Pedrycz, "Software Engineering an Engineering Approach", John Wiley, Dec 1999

UCSG004	PYTHON PROGRAMMING FOR ENGINEERS	L	T	P	C
		3	0	0	3

Course Objectives

- To know the basics of algorithmic problem solving, read and write simple Python programs.
- To develop Python programs with Python data structures –- lists, tuples, dictionaries.

Course Content

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments.

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension.

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

References

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2", Network Theory Ltd., 2011.
3. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition, 2013.
4. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013
5. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.

UCSG005	SOFT COMPUTING AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

Course Objectives

- Introduce a relatively new computing paradigm for creating intelligent machines useful for solving complex real world problems.
- Insight into the tools that make up the soft computing technique: fuzzy logic, artificial neural networks and hybrid systems Techniques.

Course Content

Introduction to Soft Computing, Introduction to Fuzzy logic, Fuzzy membership functions, Operations on Fuzzy sets Fuzzy relations, Fuzzy propositions, Fuzzy implications Fuzzy inferences Defuzzyfication Techniques-I, Defuzzyfication Techniques-II, Fuzzy logic controller-I, Fuzzy logic controller-II Solving optimization problems, Concept of GA, GA Operators: Encoding, GA Operators: Selection-I

GA Operators: Selection-II, GA Operators: Crossover-I, GA Operators: Crossover-II, GA Operators: Mutation Introduction to EC-I, Introduction to EC-II. MOEA Approaches: Non - Pareto, MOEA Approaches: Pareto – I MOEA Approaches: Pareto - II, Introduction to ANN, ANN Architecture and ANN Training-I, ANN Training-II, ANN Training-III, Applications of ANN.

References

1. S.Rajasekaran and G.A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications”, Prentice-Hall of India Pvt. Ltd., 2006.
2. George J. Klir, Ute St. Clair, Bo Yuan, “Fuzzy Set Theory: Foundations and Applications” Prentice Hall, 1997.
3. David E. Goldberg, “Genetic Algorithm in Search Optimization and Machine Learning” Pearson Education India, 2013.
4. James A. Freeman, David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India, 1991.
5. Simon Haykin, “Neural Networks Comprehensive Foundation” Second Edition, Pearson Education, 20

GENERIC ELECTIVES OFFERED BY THE DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

UECG001	ELECTRONIC MEASUREMENTS	L	T	P	C
		3	0	0	3

Course Objectives

- To impart knowledge on the functional elements of instrumentation.
- To learn the fundamentals of electrical and electronic instruments.
- To understand the operation of transducers, data acquisition systems, storage and display devices.

Course Content

Electronics Instruments

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement — Standards and calibration – Principle and types of analog and digital voltmeters, ammeters, multimeters – Single and three phase wattmeters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss.

Measuring Instruments

D.C & A.C potentiometers, D.C & A.C bridges, transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic interference – Grounding techniques.

Storage and display Devices

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & dot matrix display – Data Loggers.

Transducers and Data Acquisition Systems

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – A/D, D/A converters – Smart sensors.

References

1. A.K. Sawhney, “A Course in Electrical & Electronic Measurements & Instrumentation”, Dhanpat Rai and Co, 2004.
2. J. B. Gupta, “A Course in Electronic and Electrical Measurements”, S. K. Kataria & Sons, Delhi, 2003.
3. J Doebelin E.O. and Manik D.N., “Measurement Systems – Applications and Design”, Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd., 2007.
4. H.S. Kalsi, “Electronic Instrumentation”, Tata McGraw Hill, II Edition 2004.
5. D.V.S. Moorthy, “Transducers and Instrumentation”, Prentice Hall of India Pvt Ltd, 2007.

UECG002	INTRODUCTION TO EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the architecture and programming concepts of embedded systems.
- To impart the knowledge on embedded computing platform design and analysis.
- To learn the basic concepts of real time operating systems and embedded system applications.

Course Content

Architecture of Embedded Systems

Categories of Embedded Systems – Specifications of Embedded systems – Recent trends in Embedded Systems – Detailed Hardware and Software Design – ARM Processor – CPU: programming input and output - supervisor mode, exceptions and traps – Co-processors – Memory system mechanisms – CPU performance – CPU power consumption.

Embedded Computing Platform Design

The CPU Bus-Memory devices and systems – Designing with computing platforms – Host and target machines – consumer electronics architecture – platform-level performance analysis - Components for embedded programs – Models of programs – Assembly, linking and loading – compilation techniques – Program level performance analysis

Processes and Operating Systems

Introduction – Multiple tasks and multiple processes – Multi rate systems – Preemptive real-time operating systems – Priority based scheduling – Inter process communication mechanisms – Semaphores and Shared Data – Message Queues – Mailboxes and Pipes – Interrupt Routines in RTOS Environment – Evaluating operating system performance – power optimization strategies for processes.

Hardware/Software Integration & Programming

Cross-Compilers – Cross-Assemblers – Linker/Locator – Debugger – Emulator – Simulators – Introduction to Integrated Development Environment (IDE) – Getting Embedded Software into Target System: In-Circuit Emulators –Serial Port Programming and Interrupts Programming.

Embedded System Applications

Applications of Embedded systems – Case study of Embedded systems like automatic chocolate vending machine, Adaptive Cruise Control Systems in a Car, Digital camera, Smart card and ATM.

References

1. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, Third Edition, Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
2. Jonathan W. Valvano, “Embedded Microcomputer Systems Real Time Interfacing”, Third Edition Cengage Learning, 2012.
3. Raj Kamal, “Embedded Systems Architecture Programming and Design”, Pearson, 2011.
4. K.V.K.K.Prasad “Embedded /Real-Time Systems: Concepts, Design and Programming” Dream tech, Wiley 2012.
5. Daniel 5.W Lewis, “Fundamentals of Embedded Software” Pearson Education, 2013.

UECG003	MICROCONTROLLERS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the architecture and programming of 8051 and PIC microcontrollers.
- To familiarize with the concept of interfacing the microcontrollers for various applications.

Course Content

8051 Microcontroller

Architecture of 8051 – Register set - I/O Pins, Ports and Circuits - Instruction set - Addressing modes - Assembly language programs for arithmetic and Logical operations.

Interfacing 8051 Microcontroller

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - Stepper Motor Interfacing – Application of 8051 in power optimization- Power and real-world constraints.

PIC Microcontroller

CPU Architecture – Register – I/O pins, Ports -Instruction set – addressing modes - Interrupts

Interfacing PIC Microcontroller

PIC: Timers- I2C Interfacing –UART- A/D Converter –Pulse Width Modulation

References

1. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson Education, 2011
2. Subrata Ghoshal, “8051 Microcontrollers: Internals, Instructions, Programming &Interfacing”, Second Edition, Pearson education, 2014.
3. John. B. Peatman, “Design with PIC Microcontroller”, Prentice Hall, 2011.
4. Gene .H.Miller, “Micro Computer Engineering”, Pearson Education, 2013.
5. Subrata Ghoshal, “8051 Microcontrollers: Internals, Instructions, Programming &Interfacing”, Second Edition, Pearson education, 2014.

UECG004	NANO ELECTRONICS AND SENSORS	L	T	P	C
		3	0	0	3

Course Objectives

- To learn the basics of Nano electronics.
- To learn characteristics and operation of the basic components of Nano electronic systems.
- To familiarize with characteristics of Sensors, Actuators and Memory Devices.

Course Content

Overview of Nano-Electronics

Nano-scale electronics; Foundation of nano-electronics – low dimension transport, quantum confinement, Coulomb blockade and quantum dot; Ballistic transport and Quantum interferences; Landauer formula, quantization of conductance, example of Quantum point contact.

Two-Terminal Junction Transistors

Basic CMOS process flow; MOS scaling theory; Issues in scaling MOS transistors; Requirements for non-classical MOS transistor; PMOS versus NMOS; Design and construction of MOS capacitor; Integration issues of high-k MOS – interface states, bulk charge, band offset, stability, reliability; MOS transistor and capacitor characteristics.

Gate Transistors

Metal gate transistors – motivation, basics and requirements; quantum transport in nano MOSFET; Ultrathin body silicon on insulator (SOI) – double gate transistors; Vertical transistors – FinFET and surround gate FET; compound semiconductor MOSFET – Hetero-structures MOSFET.

Sensors and Actuator Characteristics

Basics: types and working principles of sensors and actuators; Characteristic features: Range, Resolution, Sensitivity, Error, Repeatability, Linearity and Accuracy, Impedance, Nonlinearities, Static and Coulomb Friction, Eccentricity, Backlash, Saturation, Dead-band, System Response, First Order System Response, Under-damped Second Order System Response, Frequency Response.

Memory Devices and Sensors

Nano ferroelectrics – Ferroelectric random access memory –Fe-RAM circuit design – ferroelectric thin film properties and integration – calorimetric -sensors – electrochemical cells – surface and bulk acoustic devices – gas sensitive FETs – resistive semiconductor gas sensors –electronic noses – identification of hazardous solvents and gases – semiconductor sensor array.

References

1. W. Ranier, “Nano Electronics and Information Technology”, Wiley, 2003.
2. K.E. Drexler, “Nano systems”, Wiley, 1992.
3. M.C. Petty, “Introduction to Molecular Electronics”, Oxford University Press, New York, 1995.
4. Handbook of Nanoscience, Engineering and Technology”, Kluwer publishers, 2002.
5. G. Cao, “Nanostructures & Nanomaterials: Synthesis, Properties &Applications” Imperial College Press, 2014.

UECG005	PRINCIPLES OF VLSI SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

- To learn the principles of operation of MOS transistors
- To impart knowledge on the design of digital VLSI circuits using MOS transistors.
- To learn the basics of FPGA implementation.

Course Content

MOS Transistor Principle

NMOS and PMOS transistor operations, MOS DC Equations, Electrical properties of CMOS circuits and device modeling, Scaling principles CMOS inverter, Second Order Effects, Stick diagram.

Combinational Logic Circuits

MOSFETs as switches, Basic Logic Gates in CMOS, Examples of Combinational Logic Design, RC Delay Model, Linear Delay Model, Elmore's constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design.

Sequential Logic Circuits

Static and Dynamic Latches and Registers, Timing issues, Memory architecture and memory control circuits.

Arithmetic Building Blocks

Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, Multipliers, speed and area tradeoff

Implementation Strategies

Full custom and Semi-custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures, Xilinx FPGA.

References

1. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Second Edition, Prentice Hall of India, 2013.
2. M.J. Smith, "Application Specific Integrated Circuits", Addisson Wesley, 2001.
3. A.Pucknell, Kamran Eshraghian, "BASIC VLSI Design", Third Edition, Prentice Hall of India, 2009.
4. Weste and Harris, "CMOS VLSI DESIGN: A Circuits and Systems Perspective", Fourth edition, Pearson Education, 2010.
5. N.Weste, K.Eshraghian, "Principles of CMOS VLSI Design", Second Edition, Addison Wesley, 2009.

GENERIC ELECTIVES OFFERED BY THE DEPARTMENT OF MECHANICAL ENGINEERING

UMEG001	AUTOMOTIVE FUNDAMENTALS	L	T	P	C
		3	0	0	3

Course Objectives

- To provide knowledge on IC Engines, braking, transmission, suspension, starting systems.
- To import knowledge in new combustion techniques used for various fuels and alternative sources.

Course Content

Vehicle structure, Engine

Types of automobiles, vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics, IC engines –components function and materials

Engine auxiliary systems

Electronically controlled gasoline injection system for SI engines and diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Variable valve timing (VVT), Firing order.

Transmission Systems

Types of transmission, Clutch: Types diaphragm clutch, single and multi-plate clutch, centrifugal clutch and construction, Gear box: Types - gear selector and shifting mechanism, over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle.

Brakes and Suspension Systems

Suspension system: Types of Suspension Systems-front and rear suspension, Braking system: Types of brakes, Mechanical, Hydraulic, and Air brakes, Disc & Drum brakes, Engine brakes, anti-lock braking system (ABS).

Alternative Energy Sources and Emission Control

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles. Electric and Hybrid Vehicles, Fuel Cell. Engine emission: Automotive air pollution, emission control, Engine emission control by three-way catalytic converter system, Emission norms (Euro and BS).

References

1. Kirpal Singh, “Automobile Engineering”, Standard Publishers, Vol-I & II. 13th edition. New Delhi, 2014.
2. R. K. Rajput, “A Text book of Automobile Engineering”, Lakshmi publication, 2nd edition. 2014
3. Heniz Heisler, “Vehicle and Engine Technology”, SAE, 2nd edition. 2009.
4. Julian Happian Smith, “An Introduction to Modern Vehicle Design”, Butterworth-Heinemann, New Delhi, 2002.
5. Gupta R B, “Automobile Engineering", Satya Prakashan, 2015.

UMEG002	COMPUTER AIDED DESIGN	L	T	P	C
		3	0	0	3

Course Objective

- To provide an overview of how computers are being used in engineering component design
- To provide knowledge on different CAD standards

Course Content

Fundamentals of Computer Graphics

Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations homogeneous coordinates - Line drawing -Clipping- viewing transformation

Geometric Modeling

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches. Solid modeling techniques- CSG

Visual Realism

Hidden – Line-Surface-Solid removal algorithms – shading – colouring – computer animation.

Assembly of Parts

Assembly modelling – interferences of positions and orientation – tolerance analysis-mass property calculations – mechanism simulation and interference checking.

CAD Standards

Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images- Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CAL Setc. Communication standards.

Reference

1. Ibrahim Zeid, “Mastering CAD CAM”, Tata McGraw-Hill Publishing Co.2007
2. Chris McMahon and Jimmie Browne, “CAD/CAM Principles", "Practice and Manufacturing management”, 2nd edition, Pearson Education, 1999.
3. William M Neumann and Robert F.Sproul, “Principles of Computer Graphics”, McGraw Hill Book Co. Singapore, 1989.
4. Donald Hearn and M. Pauline Baker, “Computer Graphics”, Prentice Hall, Inc, 1992.
5. Foley, Wan Dam, Feiner and Hughes,"Computer graphics principles & practice", Pearson Education - 2003.

UMEG003	INTRODUCTION TO POWER PLANT ENGINEERING	L	T	P	C
		3	0	0	3

Course Objective

- To providing an overview of power plants and detailing the role of Engineers in their operation and maintenance.
- To impart knowledge on renewable power sources and operating cost.

Course Content

Layout of power plants

Layout of Steam, Hydel, Diesel, Nuclear and Gas Turbine Power Plants - Combined Power Cycles – Comparison and Selection

Nuclear and Hydro power plants

Nuclear Energy – Fission, Fusion Reaction, Types of Reactors, Waste Disposal and safety. Hydroelectric power plants – runoff storage and pumped storage type, Selection of Turbines

Diesel and Gas Power plants

Types of Diesel Plants, Components, Selection of Engine Type, Applications, environmental hazards – Gas Turbine Power Plant – Fuels – Gas Turbine Material – Regeneration and Intercooling.

Solar, tidal, wind power plants and economic issues of power plants

Geo thermal –Fuel cells – Tidal - Solar thermal central receiver system – wind power plants -Cost of Electric Energy – Fixed and operating Costs – Energy Rates – Types of Tariffs.

Reference

1. EI- Wakil M. M, “Power Plant Technology”, McGraw-Hill, 2nd edition, 2014.
2. Arora S. C and Domkundwar S, “A course in Power Plant Engineering”, Dhanpatrai, Third Edition, 2012.
3. Nag P.K, “Power Plant Engineering”, Tata McGraw-Hill, 2014.
4. G. D. Rai, “Introduction to Power Plant Technology”, Khanna Publishers, Third Edition, 2014.
5. T. Morse Frederick, “Power Plant Engineering”, Prentice Hall of India, Third Edition, 2014.
6. Culp A. W., “Principles of Energy Conversion”, McGraw Hill, Second Edition, 2014.

UMEG004	INTRODUCTION TO ROBOTICS	L	T	P	C
		3	0	0	3

Course Objectives

- To impart knowledge about automation, various sensors and their applications in robots.
- To learn about Robot Programming methods & Languages of robot.

Course Content

Introduction

Automation and robotics –History of robotics - Definition of a Robot - Basic concepts - Robot configurations - Types of Robot drives - Basic robot motions - Point to point control - Continuous path control.

Components and Operations

Basic control system concepts - control system analysis - robot actuation and fed back, Manipulators - direct and inverse kinematics, Coordinate transformation - Brief Robot dynamics. Types of Robot and effectors - Grippers - Tools as end effectors - Robot/End - effort interface.

Sensing and Machine Vision

Range sensing - Proximity sensing - Touch sensing - Force and Torque sensing. Introduction to Machine vision - Sensing and digitizing - Image processing and analysis.

Robot Programming

Methods - languages - Capabilities and limitation - Artificial intelligence - Knowledge representation - Search techniques - A1 and Robotics.

Industrial Applications

Application of robots in machining - Welding - Assembly - Material handling - Loading and unloading - CIM - Hostile and remote environments.

References

1. S.R. Deb, “Robotics Technology and flexible automation”, Tata McGraw-Hill Education., 2010
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, “Industrial Robotics, Technology programming and Applications”, McGraw Hill, 2012.
3. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, “Robotics Engineering an Integrated Approach”, PHI Learning, 2011.
4. K.S. Fu., R.C.Gonalez, C.S.G.Lee, “Robotics Control Sensing ", Vision and Intelligence, McGraw Hill International Edition, 2000.
5. Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, 2008.

UMEG005	3D PRINTING	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the various RPT processes adopted to produce parts.
- To impart knowledge on three dimensional printing, reverse engineering, new technologies and their influence in manufacturing.

Course Content

Fundamentals of RPT

RPT History, Development of RP systems, Applications in Product Development, Rapid Tooling, Rapid Manufacturing- Principle –Fundamental – File format – Other translators – medical applications of RP- Materials for Rapid Prototyping Systems

Liquid Based and Solid based Rapid Prototyping Systems

Liquid based system - Stereolithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system - Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing

Powder Based Rapid Prototyping Systems

Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses.

Three Dimensional Printing

Process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development

Reverse Engineering and New Technologies

Reverse Engineering - Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-preprocessing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, and other applications.

References

1. Douglas Bryden, "CAD and Rapid Prototyping for Product Design", Laurence King, 2014.
2. Kalani Kirk Hausman, Richard Horne, "3D Printing For Dummies", Wiley Publications, 2014.
3. Chee Kai Chua, Kah Fai Leong, Chu Sing Lim "Rapid Prototyping: Principles and Applications" World Scientific Publication Pvt Ltd, 2011.
4. Chua C. K, Leong K. F and Lim C. S, "Rapid Prototyping: Principles and Applications", World Scientific, Second edition, 2010.
5. Ian Gibson, "Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototyping", Wiley, 2006.

GENERIC ELECTIVES OFFERED BY THE DEPARTMENT OF INFORMATION TECHNOLOGY

UITG001	BIG DATA ANALYTICS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

Course Objectives

The students should be made to:

- Understand various basic concepts related to big-data analytics.
- Understand the basics of Hadoop
- Gain knowledge on the real-time applications of big data.

Course Content

Introduction to Big Data

Introduction – distributed computing – Need of distributed computing for Big Data– Evolution of data management–Understanding the data – Defining big data – characteristics of Big Data – Big Data and its importance– Big Data analytics–Traditional and advanced analytics. Big Data Types - Structured data - Unstructured data - Semi structured data.

Introduction to Hadoop

Big Data – Apache Hadoop & Hadoop Ecosystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of Map Reduce - Data Serialization.

Big Data Applications

Big Data in Health care – Big Data contributions to Education - Big Data contributions to Insurance Services - Big Data Contributions to Industrial and Natural Resources - Big Data Contributions to Transportation - Big Data Contributions to Banking Zones and Fraud Detection.

References

1. Chris Eaton, Dirk deroos, “Understanding Big data”, McGraw Hill, 2012.
2. Judith Hurwitz, Alan Nugent et al., “Big Data for Dummies”, John Wiley & Sons, Inc, 2013.
3. Vignesh Prajapati, “Big Data Analytics with R and Haoop”, Packet Publishing 2013.
4. Tom Plunkett, Brian Macdonald et al, “Oracle Big Data Handbook”, Oracle Press, 2014.
5. Jy Liebowitz, “Big Data and Business Analytics”, CRC press, 2013.

UITG002	CLOUD COMPUTING FUNDAMENTALS	L	T	P	C
		3	0	0	3

Course Objectives

The students should be made to:

- Understand various basic concepts related to cloud computing technologies.
- Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
- Gain knowledge on the concept of cloud virtualization, cloud storage, data management and data visualization.
- Understand different cloud programming platforms and tools.

Course Content

Cloud computing and cloud services

Introduction to Cloud Computing - History of Cloud computing - Types of Clouds Characteristics of Cloud Computing - Cloud Architecture - Cloud Storage - Cloud Services Benefits from Cloud Computing - Pros and Cons of Cloud Computing - Applications of Cloud Computing. Web based applications - Advantages of cloud development - Disadvantages of cloud development - Types of Cloud Service Development: Software as a Service - Platform as a Service Web Services - On demand Computing - Discovering Cloud services development services and tools.

Virtualization technology and services

Introduction - Virtualization Defined - Virtualization benefits - Server Virtualization - Virtualization for x86Architecture - Hypervisor Management Software - Virtual Infrastructure Requirements. Exploring Online Calendar Applications: Google Calendar - Yahoo Calendar - Windows Live Calendar - Apple MobileMe calendar - Exploring Online Scheduling Applications - Exploring Online Planning.

Collaborating with cloud

Evaluating Web mail services - Evaluating Instant Messaging Services - Evaluating Web Conferencing Tools – Collaborating via social networks and group ware - Collaborating on budgets.

References

1. Rajkumar Buyya, Christian Vacchiola, S Thamarai Selvi, “Mastering Cloud Computing”, First Edition ,McGraw Hill Publications, 2013.
2. Michael Miller, “Cloud Computing: Web-Based Applications that Change the way you Work and collaborate Online”, Pearson publications Aug 2008.
3. Dr.Kumar Saurabh, “Cloud Computing”, Wiley India Publictions, Second Edition Aug 2014.
4. Kai Hwang, Geoffrey C.Fox, Jack J.Dongarra, “Distributed and Cloud Computing: From Parallel Processing to the Internet of Things”, First Edition Morgan Kaufmann Publisher, an imprint Elsevier 2012.
5. Arshdeep Bahga, Vijay K.Madisetti, “Cloud Computing: A Hands on Approach", First Edition, VPT Publisher 2014.

UITG003	FUNDAMENTALS OF INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Course Objectives

The students should be made to:

- Understand various basic concepts related to Internet of Things.
- Understand the elements involved in Internet of Things.
- Explore the various real-time applications which can be automated using Internet of Things.

Course Content

Fundamentals of IOT

Introduction - Definition and Characteristics of IoT - Physical design - IoT Protocols Logical design - IoT communication models, IoT Communication APIs - Enabling technologies - Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates - Domain specific IoTs - IoT Architectural view - IoT and M2M- difference between IoT and M2M - IoT systems management – Needs - NETCONF, YANG - IoT design methodology.

Elements of IOT

Sensors and actuators - Communication modules – Zigbee - LoRa - RFID - Wi-Fi - Power sources- IoT platforms – Introduction to Arduino and Raspberry Pi - Cloud Computing in IoT - Cloud Connectivity - Big Data Analytics-Data Visualization.

Challenges in IOT and case studies

Security Concerns and Challenges - Real time applications of IoT – Home automation – Automatic lighting – Home intrusion detection – Cities – Smart parking – Environment – Weather monitoring system – Agriculture – Smart irrigation.

References

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things-A hands-on approach", Universities Press, 2015.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key applications and Protocols”, Wiley Publications 2nd edition, 2013.
3. Raj Kamal, “Internet of Things – Architecture and Design Principles”, Mc Graw Hill Education Pvt. Ltd., 2017.
4. “Internet of Things and Data Analytics”, HwaiyuGeng, P.E, Wiley Publications, 2017.
5. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014.

UITG004	INTRODUCTION TO DATABASE MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

Course Objectives

The students should be made to:

- Understand various basic concepts related to database.
- Understand the importance of relational modeling and normalization.
- Familiarize with the various queries that can be used for data retrieval.

Course Content

Introduction to DBMS

Overview - Purpose of Database System –- Views of data – Data Models – Database Languages –– Database System Architecture – Database users and Administrator – Entity–Relationship model (E-R model) – E-R Diagrams -- Introduction to relational databases

Relational model

The relational Model – The catalog- Types– Keys - Relational Algebra – Domain Relational Calculus – Tuple Relational Calculus – Normalization - Fundamental operations – Additional Operations- SQL fundamentals - Integrity – Triggers - Security – Advanced SQL features –Embedded SQL– Dynamic SQL- Missing Information– Views

Database applications

Proprietary DBMS vs Open Source DBMS –NoSQL – Databases for Social Networks – Introduction to Multimedia Databases.

References

1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, “Database System Concepts”, Sixth Edition, McGraw Hill Education India Pvt. Ltd., 2016.
2. Atul Kahate, “Introduction to Database Management Systems”, Pearson Education, New Delhi, 2006.
3. Alexis Leon and Mathews Leon, “Database Management Systems”, Vikas Publishing House Private Limited, New Delhi, 2003.
4. Raghu Ramakrishnan, “Database Management Systems”, McGraw-Hill, Third Edition, 2014.
5. Bipin C Desai, “An Introduction to Database Systems”, Galgotia Publications Pvt Limited, Revised edition 2012.

UITG005	WEB INTERFACE DESIGN AND DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives

The students should be made to:

- Understand various basic concepts related to web designing.
- Understand the role of CSS in designing web pages.
- Understand the role of Java script in the design of interactive web pages.

Course Content

Html5

Introduction, New Elements, Canvas, SVG, Drag/Drop, Geolocation, Video, Audio, Input Types, Form Elements, Attributes, Semantic, Web Storage, App Cache, Web Workers, SSE.

CASCADING STYLE SHEETS

Introduction, Syntax, Id & Class, Backgrounds, Text, Fonts, Links, Lists, Tables, Box Model, Border, Outline, Margin, Padding, Grouping/Nesting, Dimension, Display, Positioning, Floating, Align, Pseudo-class, Pseudo-element, Navigation Bar, Image Gallery, Image Opacity, Image Sprites, Media Types, Attribute Selectors, CSS3 Introduction, Gradients, Text Effects, Fonts, 2D Transforms, 3D Transforms, Transitions, Animations, Multiple Columns.

JAVASCRIPT

Introduction, Comment, Variable, Global Variable, Data Types, Operators, If Statement, Switch, Loop: for and while, Function, Objects, Array, Browser Object Model, Validation.

JQuery: Introduction, Selectors, Events, CSS Classes, Dimensions.

References

1. Harvey Deitel, Abbey Deitel, “Internet and World Wide Web: How to Program”, 5th Edition, Pearson Education 2012.
2. DJ Editorial Services, “HTML5 Black Book”, Second Edition, Dream tech Press 2016.
3. Thomas A.Powell, “HTML & CSS: The Complete Reference”, Fifth Edition, Tata McGraw-Hill 2010.
4. Thomas A.Powell and Fritz Schneider, “JavaScript: The Complete Reference”, Third Edition, Tata McGraw-Hill, 2013.
5. Thomas A.Powell, “Web Design: The Complete Reference”, Second Edition, Tata McGraw-Hill, 2003.

GENERIC ELECTIVES OFFERED BY THE DEPARTMENT OF SCIENCE AND HUMANITIES

UHSG001	INDIAN CONSTITUTION, DEMOCRACY AND WORLD AFFAIRS	L	T	P	C
		3	0	0	3

Course Objectives

- To the study the Indian political system is a window to understanding politics in society.
- To learn the idea of political system and the account of the making and working of constitutional institutions
- To expose the students to the methods of qualitative and quantitative assessment of environmental impacts due to developmental activities.

Course Content

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review. State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.
Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries – Assessment of working of the Parliamentary System in India.

Current World Political Leaders- World Geography Issue Analysis - international politics - international security issues, nuclear proliferation, arms control, environmental politics, foreign policy analysis – Migration - Global wealth and poverty – Globalization - an overview - Territorial Conflicts.

References

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi.
2. Granville Austin, "Indian Constitution Cornerstone of a Nation", Oxford Publication.
3. Granville Austin (1999), "Working Democratic Constitution: The Indian Experience", Oxford Publication.
4. Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi.
5. Timothy Dunne and Steve Smith, eds., "International Relations Theories: Discipline and Diversity", Oxford University Press, 2007.

UPHG001	FUNDAMENTALS OF ASTROPHYSICS	L	T	P	C
		3	0	0	3

Course Objectives

- To learn the fundamental concepts in astrophysics that will equip in better understanding of the stellar classification, spectroscopy, solar system and planetary motion.
- To provide students with a detailed overview of galactic and extragalactic astronomy as well as solar system studies.

Course Content

Historical Astronomy of Indian and western - astronomy - Aryabhatta, Tycho Brahe, Copernicus, Galileo - Olbers paradox - solar system satellites, planets, comets, meteorites, asteroids. Size and Time Scales - Stars – Spectra – Classification - Stellar Structure Equations and Survey of Stellar Evolution - Stellar Oscillations - Degenerate and Collapsed Stars - Radio Pulsars.

Interacting Binary Systems - Accretion Disks - X-ray Sources - Gravitational Lenses - Dark Matter - Interstellar Medium - HII Regions - Supernova Remnants - Molecular Clouds – Dust - Radiative Transfer - Jeans' Mass - Star Formation.

High-energy Astrophysics - Compton Scattering – Bremsstrahlung - Synchrotron Radiation - Cosmic Rays - Galactic Stellar Distributions and Populations - Oort Constants - Oort Limit. White Dwarfs - Neutron Stars - Black Holes - Hubble Expansion - Charting the Expansion - Astronomical Instrumentation -Telescopes & Observations.

References

1. Hansen, Carl J, Steven D. Kawaler, and Virginia Trimble, “Stellar Interiors: Physical Principles, Structure and Evolution”, New York, NY: Springer, 2004. ISBN: 9780387200897.
2. Carroll, Bradley W, and Dale A. Ostlie, “An Introduction to Modern Astrophysics. Reading”, MA: Addison-Wesley Pub., 1995. ISBN: 9780201547306.
3. Kippenhahn, Rudolf, and Alfred Weigert, “Stellar Structure and Evolution”, New York, NY: Springer-Verlag, 1990. ISBN: 9780387502113.
4. Shapiro, Stuart L, and Saul A. Teukolsky, “Black Holes, White Dwarfs, and Neutron Stars”, New York, NY: Wiley, 1983. ISBN: 9780471873167.
5. William Marshall Smart, and Robin Michael Green, “On Spherical Astronomy”, (Editor) Carroll, Bradley W Cambridge University Press, 1977.

UCHG001	FUNDAMENTALS OF BIOCHEMISTRY	L	T	P	C
		3	0	0	3

Course Objectives

- To provide an integrated knowledge to understand the structure and functions of biomolecules.
- To interpret the biochemical process using analytical techniques.

Course Content

Proteins and Amino acids: Introduction to amino acid, structure, properties (physical, chemical) Titration of amino acid. Essential and non-essential amino acid. Protein Introduction to protein, classification of protein based on solubility, shape, composition, function and polarity. Peptide bond – Structure of peptide bond. Denaturation– renaturation of protein, properties of protein. Introduction to lipoprotein, glycoprotein and nucleoprotein. Biological function of protein. Protein structure-Primary, Secondary, tertiary and Quaternary type.

Carbohydrates: Monosaccharides, disaccharides, oligosaccharides- and polysaccharides- types, characteristics and properties, biological significance. Lipids-Classification, structure, properties, biological significance.

Separation techniques: Chromatography- Thin-layer, paper chromatography, Column chromatography, High Performance Liquid Chromatography (HPLC)- Analytical techniques - Basic principle, laws of absorption (Lambert - Beers law). Instrumentation for UV -Visible and IR Spectrophotometry and their applications.

References

1. Sadasivam S and Manickam A, “Biochemical methods”, New Age International Pvt Ltd, Revised Edition, 2018.
2. Albert Lehninger, Michael Cox and David L. Nelson, “Principles of Biochemistry”, W. H. Freeman & Company, 2017
3. Elsa Lundanes, Leon Reubsaet and Tyge Greibrokk, “Chromatography”, Wiley VCH Revised Edition 2013
4. Donald Voet, Judith G. Voet and Charlotte W. Pratt, “Principles of Biochemistry”, John Wiley & Sons,2012
5. Rastogi S C, “Biochemistry”, McGraw Hill Inc., New Delhi, 2nd edition,2003.

UMHG001	STATISTICAL INFERENCES AND APPLICATIONS	L	T	P	C
		3	0	0	3

Course Objectives

- To provide students with theoretical foundations and methods of theory of statistics.
- Understand basic theory behind the development and assessment of statistical analysis techniques in the areas of point and interval estimation, as well as hypothesis testing
- To learn basic theoretical knowledge about fundamental principles for statistical inference.

Course Content

Data collection and treatment: Data Collection and organization, diagrammatic representation of data (bar, pie, 2-D and 3-D diagrams), standard deviation and standard error of means, co-efficient of variation, Correlation and regression analysis. Probability and Distributions: Bayer's theorem, probability theorem, elements of binomial and Poisson distribution, normal distribution curve and properties.

Point Estimation: : Estimator and methods of estimation, Properties of an estimator: Consistency, Unbiasedness, Efficiency and Sufficiency- Neyman Factorization, Cramer-Rao Bound Testing of Hypotheses: Tests of hypotheses, simple and composite hypotheses, types of error, Neyman-Pearson Lemma, families with monotone likelihood ratio, UMP, UMP unbiased and UMP invariant tests. Likelihood ratio tests - applications to one sample and two sample problems, Chi-square tests. Wald's sequential probability ratio test.
Interval estimation: methods for finding confidence intervals, shortest length confidence intervals.

Classical inference: Frequentist and Bayesian inference, maximum likelihood estimation. Traditional computer-based methods: Empirical Bayes, ridge regression, generalized linear models, regression trees, survival analysis and the EM-algorithm. Computer-intensive methods as resampling, resampling based confidence intervals, cross validation, large-scale hypothesis testing, sparse regression models, random forests, and boosting. Bioinformatic application examples.

References

1. Roger E. Kirk, Statistics an introduction, Thomson Wadsworth, 2008.
2. V.K. Rohatgi & A.K. Md. E.Saleh, "An Introduction to Probability and Statistics", 3rd Edition, Wiley, 2015
3. E.J. Dudewicz & S.N. Mishra, "Modern Mathematical Statsitics", Wiley, 1988.
4. Introduction to the Theory of Statistics by A.M. Mood, F.A. Graybill and D.C. Boes, McGraw-Hill 1974.
5. Efron, Bradley; Hastie, Trevor, "Computer age statistical inference: algorithms, evidence, and data science", New York, NY: Cambridge University Press, 2016.

GENERIC ELECTIVES OFFERED BY MASTER OF BUSINESS ADMINISTRATION

UMGG001	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives

- To develop necessary knowledge and skills for entrepreneurship
- Develop and strengthen entrepreneurial quality
- Understand the process and procedure involved in setting up enterprises

Course Content

Entrepreneurship concept, Characteristics of Successful Entrepreneur, Knowledge and Skills of Entrepreneur, Central and State Government Industrial Policies and Regulations.

Prefeasibility Study, Criteria for Selection of Product, Capital Budgeting, Feasibility Report Preparation and Evaluation Criteria

Finance and Human Resource Mobilization, Operations Planning, Market and Channel Selection, Growth Strategies, Product Launching, Incubation, Venture capital

References

1. S.S.Khanka, "Entrepreneurial Development"; S. Chand & Co. Ltd., 2011.
2. Hisrich R D and Peters M P, "Entrepreneurship"; Tata McGraw-Hill, 5th Edition, 2012.
3. Mathew Manimala, "Entrepreneurship Theory at the Crossroads", Paradigms & Praxis, Biztrantra 2nd Edition , 2009
4. Prasanna Chandra, "Projects – Planning, Analysis, Selection, Implementation and Reviews", Tata McGraw-Hill, 2015.
5. Rabindra N. Kanungo; "Entrepreneurship and Innovation"; Sage Publications, 2014.

UMGG002	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

Course Objectives

- To acquire knowledge about the intellectual property rights.
- To learn the procedure for registering Patents, Copy Rights, Trademarks and Geographical Indication
- To protect one's intellectual property rights

Course Content

Introduction to IPR, International cooperation on IPR, Major Treaties, International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

Nature &Importance of Patents, Copy Rights, Trade Marks, Geographical Indication. Procedure to file Application for grant of Patents, Copy rights, Trade Marks and Geographic Indication.

Emerging trends in IPR, IPR litigation, Case Studies on Patents, Copyright and related rights, Trade Marks, geographic indications

References

1. Bare Acts (Up-to-date)
2. Subbaram N. R., and Viswanathan S., "Handbook of Indian Patent Law and Practice", Printers and Publishers Pvt. Ltd., 2008.
3. Susan K. Sell, "Private Power, Public Law: The globalization of Intellectual Property Rights", Cambridge studies in International relations, Cambridge University Press, 2013.
4. Wadehra, B.L., "Law relating to Intellectual Property", University law publishing company Pvt Ltd, 4th Edition, 2010.
5. Bhandari, M.K., "Law Relating to Intellectual Property Rights", Central Law Publications, 4th Edition, 2015.

UMGG003	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives

- To determine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization.
- To apply and evaluate best practices for the attainment of total quality.
- To expose the students to the quality management systems and standards.

Course Content

Quality, TQM framework, Customer Focus, Customer retention, Product and service quality, Quality Cost,, Taguchi techniques, Quality circle, Japanese 5S principles and 8D methodology.

Statistical process control, Control charts, Process capability, Six sigma, Reliability, and Business process re-engineering (BPR). Tools and Techniques for Quality Management - Quality Functions Deployment (QFD), Failure Mode Effect Analysis (FMEA), Total Productivity Maintenance (TPM).

Quality management systems, IS/ISO 9000, Performance improvements, Quality Audits, TQM culture, Leadership, Quality council, Employee involvement, Motivation, Empowerment, Recognition and Reward.

References

1. Dale H. Besterfield, et. al., "Total Quality Management", Pearson Education, Revised 3rd Edition, 2011.
2. Lal, H., "Total Quality Management: A Practical Approach", New Age International publication, 2015.
3. Douglas C. Montgomory, "Introduction to Statistical Quality Control", Wiley Student Edition, Wiley India Pvt Limited, 7th Edition, 2012.
4. James R. Evans and William M. Lindsay, "The Management and Control of Quality", Thomson, 8th Edition, 2010.
5. Indian standard – "Quality Management Systems – Guidelines for performance improvement", Bureau of Indian standards, New Delhi.

UMGG004	HUMAN RIGHTS AND HUMAN VALUES	L	T	P	C
		3	0	0	3

Course Objectives

- To understand values and its importance
- To know human rights and duties.
- To understand the duty towards women and society.

Course Content

Values and Self-Development - Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non-moral valuation, Standards and principles, Value judgments. Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National unity, Patriotism, Love for nature, Discipline.

Human Rights and Duties: United Nations declaration, Role of various agencies in protection and promotion of human rights. Computer Ethics: Social Impact of Computer, Gender-Issues and Privacy, Cyber Crime, Ethical use of Software. Protection of women at work place.

The Constitution of India - Philosophy of Constitution, Fundamental Rights and Fundamental Duties, Organs of the State - Legislature, Executive, and Judiciary – their composition scope and activities, Judiciary as the guardian of fundamental rights – Writs as constitutional remedies –types of Writs.

References

1. Basu D. D, “Introduction to the Constitution of India”, Lexis Nexis, New Delhi, 2014.
2. “Value Education and Human Rights”, Isha books, New Delhi, 2012
3. Kapoor S.K, “International Law and Human Rights”, Central Law Agency, New Delhi, 2016.
4. Chakraborty S.K, “Values and Ethics for organizations: Theory and Practice”, Oxford University Press, New Delhi, 2001.

UMGG005	SUPPLY CHAIN MANAGEMENT AND LOGISTICS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the Logistics and SCM Role in the Organization
- To apply theory on logistics in Customer Service, Procurement and Outsourcing
- To enhance the knowledge about supply chain processes and its management.

Course Content

Introduction: Definition –Scope and Importance of logistics – Logistics-"A system concept"-Logistics functions – Customer value chain – The importance of supply chain flows –Logistics and Competitive advantage –Drivers of supply chain and performance –Integrating logistics within organization.

Supply Chain Management: Introduction- Objectives – Role of logistics in supply chain –Functions and contribution of supply chain management –Warehouse function –Purpose of warehouses – Modes of transport –Freight Management

Logistics Outsourcing and Logistics Information System: Role of sourcing in a supply chain – Supplier selection and contracts –The procurement process –Supplier selection –The role of IT in the supply chain –Supplier relationship management – Logistics information needs –The role of e-business in supply chain.

References

1. Vinod V. Sople, "Logistics Management-The Supply Chain Imperative", Pearson, 2012.
2. Sunil Chopra, Peter Meindl and Kalra, "Supply Chain Management Strategy, Planning and Operations", Pearsons Education, 2016.
3. Martin Christopher, "Logistics and Supply Chain Management", Pearsons Education, 2016.
4. Richard B.Chase, Ravi Shankar, Robert Jacobs," Operations and Supply Chain Management", SIE, 2014.
5. Leenders, Johnson, Flyn, Fearon, "Purchasing and Supply Management", Tata McGraw Hill, 2010.