Sri Ramakrishna Institute of Technology
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Pachapalayam, Perur Chettipalayam, Coimbatore – 641 010
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B.E. – Mechanical Engineering

I to VIII Semester Curriculum and Syllabus

R-2017

B.E. – MECHANICAL 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	UICH010	Mechanical 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 Environment Science	**BS**	3	0	0	3	40	60	100
4	UICE002	Basic Electrical and Electronics Engineering	**ES**	4	0	0	4	40	60	100
5	UICE005	Computer Aided Drafting and Modeling Laboratory	**ES**	0	0	2	2	60	40	100
6	UICE012	Engineering Mechanics	**ES**	3	0	1	4	40	60	100
7	UICE014	Engineering Materials for Mechanical Engineering	**ES**	3	0	0	3	40	60	100
8	UICE015	Engineering Workshop	**ES**	0	0	2	2	60	40	100
			Total	**18**	**1**	**6**	**25**			

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	UCEC002	Fluid Mechanics and Machinery	**ES**	3	0	1	4	40	60	100
3	UICE009	Electrical Drives and Controls	**ES**	3	0	1	4	40	60	100
4	UICE019	Strength of Materials	**ES**	3	0	1	4	40	60	100
5	UMEC001	Engineering Thermodynamics	**PCC**	3	0	0	3	40	60	100
6	UMEC002	Manufacturing Processes I	**PCC**	3	0	1	4	40	60	100
7	UMEC003	Metallurgical Engineering	**PCC**	3	0	0	3	40	60	100
			Total	**21**	**1**	**4**	**26**			

SEMESTER IV										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UICM007	Probability and Statistics	**BS**	3	1	0	4	40	60	100
2	UMEC004	Thermal Engineering	**PCC**	3	0	1	4	40	60	100
3	UMEC005	Manufacturing Processes II	**PCC**	3	0	1	4	40	60	100
4	UMEC006	Kinematics of Machinery	**PCC**	3	0	0	3	40	60	100
5	UMEC201	Unconventional Machining Process	**PCC**	3	0	0	3	40	60	100
6	UMEC202	Composite Materials	**PCC**	3	0	0	3	40	60	100
7	UMEC203	Maintenance Engineering	**PCC**	3	0	0	3	40	60	100
			Total	**21**	**1**	**2**	**24**			

SEMESTER V										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UICH003	Economics for Engineers	**HS**	3	0	0	3	40	60	100
2	UMEC007	Heat and Mass Transfer	**PCC**	3	0	1	4	40	60	100
3	UMEC008	Dynamics of Machines	**PCC**	3	0	1	4	40	60	100
4	UMEC009	Design of Machine Elements	**PCC**	3	0	0	3	40	60	100
5	UMEC010	Engineering Metrology and Measurements	**PCC**	3	0	1	4	40	60	100
6	UMEC204	Production Planning and Control	**PCC**	3	0	0	3	40	60	100
7	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	UMEC011	CAD/CAM/CIM	**PCC**	3	0	1	4	40	60	100
2	UMEC012	Hydraulics and Pneumatics	**PCC**	3	0	1	4	40	60	100
3	UMEC013	Design of Transmission Systems	**PCC**	3	0	0	3	40	60	100
4	XXXXXXX	Professional Elective – I	**PE**	3	0	0	3	40	60	100
5	XXXXXXX	Professional Elective – II	**PE**	3	0	0	3	40	60	100
6	XXXXXXX	Generic Elective II	**GE**	3	0	0	3	40	60	100
7	UMEC014	Industrial Design Project (Course Work)	**IDP**	4	0	0	4	60	40	100
8	UMEC015	Industrial Design Project (Practical)	**IDP**	0	0	2	2	60	40	100
			Total	**22**	**0**	**4**	**26**			

SEMESTER VII										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UMEC205	Lean Manufacturing	**PCC**	3	0	0	3	40	60	100
2	XXXXXXX	Professional Elective – III	**PE**	3	0	0	3	40	60	100
3	XXXXXXX	Professional Elective – IV	**PE**	3	0	0	3	40	60	100
4	XXXXXXX	Professional Elective – V	**PE**	3	0	0	3	40	60	100
5	XXXXXXX	Generic Elective III	**GE**	3	0	0	3	40	60	100
6	UMEC016	Industrial Design Project (Phase – II)	**IDP**	0	0	6	6	60	40	100
7	UMEC017	Final Year Project – Phase I	**FYP**	0	0	2	2	60	40	100
			Total	**15**	**0**	**8**	**23**			

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	UMEC018	Final Year Project – Phase I	**FYP**	0	0	6	6	60	40	100
			Total	**6**	**0**	**6**	**12**			

PROFESSIONAL ELECTIVE I & II										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UMEE201	Casting and Welding Processes	**PE**	3	0	0	3	40	60	100
2	UMEE202	Statistical Process Control and Reliability Engineering	**PE**	3	0	0	3	40	60	100
3	UMEE203	Materials Characterization Techniques	**PE**	3	0	0	3	40	60	100
4	UMEE204	Micro Electro Mechanical Systems	**PE**	3	0	0	3	40	60	100
5	UMEC101	Automobile Engineering	**PE**	3	0	0	3	40	60	100
6	UMEC105	Gas Dynamics and Jet Propulsion	**PE**	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE III & IV										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UMEE205	Nano Technology	**PE**	3	0	0	3	40	60	100
2	UMEE206	Machine Vision	**PE**	3	0	0	3	40	60	100
3	UMEE207	Non-Destructive Testing and Evaluation	**PE**	3	0	0	3	40	60	100
4	UMEE208	Jigs, Fixtures and Press Tools	**PE**	3	0	0	3	40	60	100
5	UMEC301	Mechatronics	**PE**	3	0	0	3	40	60	100
6	UMEC305	Finite Element Analysis	**PE**	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE V & VI										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UMEE209	Operations Research	**PE**	3	0	0	3	40	60	100
2	UMEE210	Process Planning and Cost Estimation	**PE**	3	0	0	3	40	60	100
3	UMEE211	Sustainable and Green Manufacturing	**PE**	3	0	0	3	40	60	100
4	UMEE212	Industry 4.0	**PE**	3	0	0	3	40	60	100
5	UMEE213	Safety Engineering	**PE**	3	0	0	3	40	60	100
6	UMEC102	Power Plant Engineering	**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 Climatic 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 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 ELECTRICAL AND ELECTRONICS ENGINEERING										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UEEG001	Energy Management Systems	**GE**	3	0	0	3	40	60	100
2	UEEG002	Medical Instrumentation	**GE**	3	0	0	3	40	60	100
3	UEEG003	PLC Programming	**GE**	3	0	0	3	40	60	100
4	UEEG004	Renewable Energy Systems	**GE**	3	0	0	3	40	60	100
5	UEEG005	Virtual Instrumentation and Data Acquisition	**GE**	3	0	0	3	40	60	100

OFFERED BY DEPARTMENT OF ELECTRONICS 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	Micro Controllers 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 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 Database Management System	**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 DEPARTMENT OF SCIENCE AND HUMANITIES										
Sl. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CA**	**FE**	**Total**
1	UHSG001	Indian Constitution, Democracy & World Affairs	**GE**	3	0	0	3	40	60	100
2	UPHG002	Fundamentals of Astrophysics	**GE**	3	0	0	3	40	60	100
3	UCHG003	Fundamentals of Biochemistry	**GE**	3	0	0	3	40	60	100
4	UMHG004	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

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.

UICH010	MECHANICAL ENGINEERS AND SOCIETY	L	T	P	C
		2	0	0	2

Course Objectives

- To expose students about Graduate Attributes, Mechanical Engineering Education and their responsibilities in the society.
- To guide the students to evaluate and discuss issues related to code of ethics.

Course Content

Engineering – Definition – Engineering Education – Graduate Attributes – Engineering functions – Role and Responsibilities of Engineers – Professional Societies and their codes of ethics – Constraints in Engineering.

Introduction to Mechanical Engineering – Branches of Mechanical Engineering – scope of Mechanical Engineering – types of Manufacturing processes – Impact of industrial development on economy and environment of country – Role of Mechanical Engineer in Society.

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.

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.

References

1. Kim Strom Gottfried, “Straight Talk about Professional Ethics”, Lyceum Books, 2nd Edition, 2014.
2. Jonathan Wickert, Kemper Lewis “An Introduction to Mechanical Engineering”, Cengage Learning, 2012.
3. Mikell P. Groover, “Introduction to Manufacturing Processes”, John Wiley & Sons, Inc.2012.
4. Steven P. Nichols, “Professional responsibility: The role of the engineer in society”, Science and Engineering Ethics, September 1997, Vol. III, Issue 3, pp 327–337.
5. Kenneth K. Humphreys, “What Every Engineer Should Know about Ethics”, CRC Press, 1999.

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

Eigenvalue 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 - CO2 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 Ozonisation. 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

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”, Third Edition, Pearson Education Asia
2. Behrouz A. Forouzan, Richard F. Gilberg, “Computer Science: A Structured Programming Approach Using C”, Third Edition, Course Technology Inc, 2005
3. E Balagurusamy, “Computing Fundamentals And C Programming”, McGraw Hill Education; First edition, 2008
4. Greg Perry, Dean Miller, “C Programming Absolute Beginner’s Guide”, Third Edition, Pearson Education, 2014.
5. Henry S. Warren Jr., “Hacker’s Delight”, Second 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.

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, summarising), Preperation 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, summarising, 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.

UICH002	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.

UICE002	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		4	0	0	4

Course Objectives

- To impart the basic knowledge about the Electric and Magnetic circuits.
- To inculcate the knowledge about the AC fundamentals.
- To understand the working of various Electrical Machines and Electronic Components.

Course Content

Review of Ohm's Law & Kirchoff's laws - series and parallel circuits, equivalent resistance, star/delta conversion. Concepts of AC circuits –RMS value, average value, form and peak factors – real and reactive power – power factor, Mesh and Nodal Analysis.

Construction, Principle of operation and characteristics of DC generator and motor, transformer, synchronous machines and Induction machines. Basic ideas about energy audit and importance of energy saving.

Introduction to different types of electronic components (Diode, Transistor), Half and full wave rectifier (Qualitative analysis only), capacitive filters, zener voltage regulator, RC coupled amplifier, frequency response, colpitts oscillator.

References

1. A Fitzgerald , Charles Kingsley , Stephen Umans, "Electric Machinery", Seventh edition, McGraw-Hill, 2013.
2. Robert Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", Prentice Hall, Eleventh Edition 2015.
3. Mahmood Nahvi, Joseph A Edminister, "Electric Circuits", Mcgraw Hill Education, Fifth Edition, 2010.
4. Bhattacharya.S.K, "Basic Electrical and Electronics Engineering", First edition, Pearson Education, 2011.
5. P.S. Dhogal, "Basic Electrical Engineering – Vol. I& II", 42nd Reprint, McGraw-Hill, 2012.

UICE005	COMPUTER AIDED DRAFTING AND MODELLING LABORATORY	L	T	P	C
		0	0	2	2

Course Objectives

- To train the students to represent basic engineering drawings using CAD software.
- To train the students to represent Engineering components through CAD software.

List of Experiments

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone and dimensioning.
5. Drawing front view, top view and side view of simple machine components like machine vice, coupling, screw jack, plumber block.
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall,)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, and cone.
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-Dmodel.

References

1. 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.
2. George Omura, Brian C. Benton., “Mastering AutoCAD 2016 and AutoCAD LT 2016” Autodesk Official Press (SYBEX), 2015.
3. Linkan Sagar., “Autocad 2017 Training Guide”, BPB Publications, 2016.
4. Shan Tickoo, “AutoCAD 2016: A Problem-Solving Approach, Basic and Intermediate”, 22nd Edition, Auto Desk Press, 2016
5. James M. Kirkpatrick, “Basic Drafting Using Pencil Sketches and AutoCAD”, Prentice Hall, 2003.

UICE012	ENGINEERING MECHANICS	L	T	P	C
		3	0	1	4

Course Objectives

- The main objective of this course is to expose students about basic concepts of force and resultant force. They will also learn about Moment and Couple and friction. In terms of dynamics, the students will learn how to solve kinematics problems for particles and rigid bodies. They will also learn solutions for kinetics problems, which can be considered by using work and energy method.

Course Content

Mechanics and its relevance, concepts of forces, laws of mechanics – Force and Force Systems - parallelogram law – Resultant forces - Composition of forces concept of free-body diagram – Solutions to practical problems related to various components and element in machines and buildings.

Rigid body – Moment, Couple, Force – Couple system – Equilibrium of rigid bodies - Types of Supports – Support reactions for beams with different types of loading – Moment of a force about a point and about an axis –Solutions to problems involving equilibrium of rigid bodies from first principles of mechanics.

Centroids, center of gravity, area moment of inertia, mass moment of inertia – Solutions for a system of distributed particles and a body of arbitrary shapes. Friction – Angle of friction and coefficient of friction – Laws of dry friction – Solutions to practical problems related to frictional forces acting on wedge, ladder, screws and belts.

Kinematics - Fundamentals of rectilinear and curvilinear motion - application of general equations – Solution to practical problems using concept of relative velocity, analytical and graphical techniques. Kinetics – Introduction – D'Alembert principle – Conservation of energy – Principles of momentum and impulse – Collision of elastic bodies.

References

1. Beer, F. P., and Johnson Jr. E. R., "Vector Mechanics for Engineers", McGraw Hill, Year of publication: 2009.
2. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", , Pearson Education , 12th Edition , 2010.
3. Antony M. Bedford and Wellace Flower, " Engineering Mechanics: Statics and Dynamics", Pearson, 5th Edition, 2007.
4. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", Vikas Publishing House Pvt. Ltd., 2011.
5. Kumar, K.L., "Engineering Mechanics", Tata McGraw-Hill Publishing company, New Delhi 2011.

UICE014	ENGINEERING MATERIALS FOR MECHANICAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- Develop an ability to analyze the structure and properties of Engineering Materials.
- To identify the structure of advanced materials and its use in engineering applications.

Course Content

Structure of Materials

Lattice - Unit cell- Bravais Lattices - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - Packing factor for SC, BCC, FCC and HCP structures - Miller indices - d - spacing in cubic lattice. Structure of metals, ceramics, polymer and composites

Mechanical Properties of Metals

Elasticity and Plasticity of bulk material – Ductility – malleability and brittleness – Stress and strain behavior- Hooke's law - Yield strength-Impact strength - Tensile strength -Resilience - Hardness - Brinell hardness - Vicker's hardness - Micro indentation hardness. Failure of Metals: Fracture behavior - Ductile and Brittle fracture -Toughness-Fatigue-Endurance limit - SN curve-Creep - Stages of creep behavior.

Ceramics, Polymers and Composites

Mechanical properties of ceramics - Types and application of ceramics in Automobile industry. Mechanical behavior of polymer - Types and applications of polymer. Mechanical properties of composites - Types - composites in aerospace and transportation.

Advanced Engineering Materials

Metallic glasses - preparation, properties and applications - Shape Memory Alloy (SMA) – Characteristics and properties of NiTi alloy and applications - Nano Materials preparation and applications - Bio materials & applications - Pulse laser deposition - electro chemical deposition - plasma arching - chemical vapour deposition.

References

1. William D. Callister Jr, “Materials Science and Engineering-an Introduction”, John Wiley and Sons Inc., 6th Edition, New York, 2007.
2. Charles Kittel, "Introduction to Solid State Physics", Wiley India Pvt. Ltd, 7th Edition, 2007.
3. Rajendran.V, Marikani .A, "Materials Science" Tata McGraw-Hill, 2nd Edition, 2004.
4. George Murray, Charles White, Wolfgang Weise “Introduction to Engineering material” CRC Press, 2nd Edition, 2007.
5. Dr.S.Vijayakumar “Engineering Physics - II”, Tata McGraw Hill, New Delhi, 2014.

UICE015	ENGINEERING WORKSHOP	L	T	P	C
		0	0	2	2

Course Objectives

- 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.

Course Content

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

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

Machining practices

1. Simple turning, taper turning, drilling taping practice.

Study

1. Study of centrifugal pump
2. Study of air conditioner

Demonstration

1. 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

1. Study of Electronic Components and instruments– Resistors, Capacitors, Inductors, Diodes and multimeter.
2. Measurement of AC signal parameters (voltage, period, frequency) using CRO
3. Measurement of ripple factor of half wave rectifier and full wave rectifier.
4. Study of logic gates –AND, OR, XOR and NOT.
5. 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---5th 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",
6. Pearson Education Limited, Tenth Edition, 2017.

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

(Common to Civil Engineering, Mechanical engineering, Information Technology, Electronics and Communication Engineering and Electrical and electronics Engineering)

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

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2016.
2. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 3rd Edition, 2012.
3. Dennis G. Zill, "Advanced Engineering Mathematics", 6th Edition, Jones and Bartlett Learnig, LLC, an Ascend Learning Company, 2016.
4. Peter V. O'Neil, "Advanced Engineering Mathematics", 8th Edition, Cengage Learning, Boston, USA, 2016.

5. Donald. A. McQuarrie, “Mathematical Methods for Scientists and Engineers”, Viva Books Pvt. Ltd, New Delhi, 1st Edition, Reprint 2015.

UCEC002	FLUID MECHANICS AND MACHINERY	L	T	P	C
		3	0	1	4

Course Objectives

- To understand the conservation of mass, momentum and energy for fluid flow.
- To provide insights to the hydraulic machines and introduce dimensional analysis for fluid flow problems.
- To relate the theory and practice of problems in hydraulic engineering.

Course Content

Properties of fluids- types of fluids-classification of flows - continuity equation-flow net-momentum equation.-Laminar and turbulent flow-shear stress and pressure gradient-Hagen Poiseuille equation for flow through circular pipes. Boundary layer concepts - Boundary layer thickness-Major losses - Darcy-Weisbach equation- Chezy's equation for flow through circular pipe - friction factor-Moody's diagram - minor losses - pipes in series and parallel - equivalent length -Methods of dimensional analysis -Similitude and model studies, dimensionless numbers, model laws and their applications.

Turbines, Classification of Turbines-components, working and velocity triangles,draft tubes – Performance of turbines - Specific speed and their significance- Classification of pumps, working principles – priming – head, power and efficiency - characteristic curves - Indicator diagram -Air vessel - work done against friction with and without air vessels – Rotary pumps and classification.

List of Experiments

1. Flow through pipes
2. Major losses and minor losses
3. Characteristics curves of Pumps
4. Characteristics curves of Turbines

References

1. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics, 19th edition, Standard Book House, New Delhi, 2015.
2. Streeter V L and Wylie B.E, Fluid Mechanics, 6th edition McGraw Hill International Book Co., 2011.
3. L.Victor, Streeter and E, Benjamin Wylie, Fluid Mechanics, 9/e, 9th edition Tata McGraw Hill, 2013.
4. Roberson J.A and Crowe C.T., Engineering Fluid Mechanics. Jaico Books Mumbai, 2010.
5. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, 9th edition, Laxmi Publications Pvt. Ltd, New Delhi, 2015.

UICE009	ELECTRICAL DRIVES AND CONTROLS	L	T	P	C
		3	0	1	4

Course Objectives

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

Course Content

History of dc Drive, Electronic Control, Solid State Control , State of art of dc drive , block diagram of drive - part of electrical drive basic concept of electric drives, Requirements, types, selection and components of electric drives.

Introduction to DC motor drive, characteristics , starting and braking of DC motors, speed control of DC motors using single phase and three phase fully controlled and half controlled rectifiers, chopper controlled drives, Introduction to AC motor drive, characteristics, starting and braking methods, speed control of induction motors: inverters, slip power recovery scheme.

Applications of Electric Drives: Introduction to Solar and battery powered Drives. Introduction to traction Drives, Servo motor drive requirement – control and implementation

List of Experiments

1. Load test on DC Shunt & DC Series motor
2. O.C.C & amp; Load characteristics of DC Shunt and DC Series generator
3. Speed control of DC shunt motor (Armature, Field control)
4. Load test on three phase squirrel cage Induction motor
5. Speed control of three phase slip ring Induction Motor

References

1. Dubey G.K., “Fundamentals of Electrical Drives”, Narosa Publishing House, New Delhi, 2nd Ed. 2002.
2. Vedam Subramanyam, “Electric Drives Concepts & Applications” Tata McGraw Hill 2nd edition 2010.
3. NisitK.De and PrashantaK.Sen, “ Electric Drives”, PHI., 2001
4. R.Krishnan, “Electric motor Drives: Modelling, Analysis and control”, Prentice Hall,2001.
5. Pillai S.K., “A First Course on Electrical Drives”, Wiley Eastern Ltd.,Bombay,2nd Ed 2007.

UICE019	STRENGTH OF MATERIALS	L	T	P	C
		3	0	1	4

Course Objectives

- The aim of this course is to enable students to focus on Strength of materials which begins with the concept of stress and strain followed by shear force and bending moment diagrams for different types of beams.
- The students will be taught the applications of theory of simple bending and deflection of beams, torsion of shafts, stresses in shells, shafts and springs. Besides that the buckling of column also will be exposed to the student.
- The theories of failure and strain energy will be exposed to the student for prediction of the failure of materials subjected to a multi axial state of stress.

Course Content

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load –Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

Types of beams: Supports and Loads – Shear force and Bending Moment in beams –Cantilever, Simply supported and overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow.

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil spring sunder axial loads - stresses in helical coil springs under torsion loads

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment-area Method –Columns – End conditions – Equivalent length of a column – Euler equation –Slenderness ratio – Rankine formula for columns.

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane– Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

List of Experiments

1. Tension test on mild steel
2. Torsion test on mild steel rod
3. Impact test
4. Test on springs
5. Deflection test on simply supported beam steel and aluminium

References

1. S. S. Rattan, “Strength of Materials”, Tata McGraw Hill Education, Second Edition, 2011.
2. Rajput R. K., “Strength of Materials”, S. Chand & Co., Ltd., 2011.
3. Sadhu Singh, “Strength of Materials”, Khanna publishers, New Delhi, 2013
4. Popov E P, Balan T A, “Engineering mechanics of solids”, Pierson Education, 2010.
5. Bansal R K, “Strength of Materials’, Laxmi Publications, New Delhi, 2016.

UMEC001	ENGINEERING THERMODYNAMICS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the thermodynamics laws and their interactions with the world.
- To make the students to get insights into the properties of steam and their applications.
- To introduce the concept of psychometric processes and it's applications in various systems.

Course Content

First law of Thermodynamics

Basic Concepts-Concept of continuum, Thermodynamic systems - closed, open and isolated, Intensive and extensive, total and specific quantities .Thermodynamic equilibrium state ,path and process, quasi-static, reversible and irreversible processes, Heat and work transfer, Displacement work and other modes of work, Property, Zeroth law of thermodynamics, First law of thermodynamics – application to closed and open systems, Internal energy, specific heat capacities, enthalpy, steady and unsteady flow processes with reference to various thermal equipments.

Second law of Thermodynamics

Second law of thermodynamics – Kelvin's and Clausius statements of second law, Heat Reservoir, source and sink. Heat Engine, Refrigerator and Heat pump. Reversibility and irreversibility, Carnot theorem, Carnot cycle, reversed Carnot cycle, efficiency, COP, Thermodynamic temperature scale, Clausius in-equality, Concept of entropy, entropy of ideal gas, Principle of increase of entropy, availability

Properties of Pure Substance and Vapour Cycle

Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapor phases, Determination of dryness fraction, P-ase rule, PVT surfaces, P-V, P-T, T-V, T-S, H-S diagrams, Thermodynamic properties of steam, Calculations of work done and heat transfer in non-flow and flow processes, Standard Rankine cycle, Reheat and regenerative cycle.

Gas Mixtures and Thermodynamics Relations

Gas mixtures – properties ideal and real gases, equation state, Avogadro's Law, Vander Waal's equation of state, Compressibility factor, compressibility chart, Dalton's law of partial pressure Exact differentials, Tds equations, Maxwell's relations, Joule –Thomson coefficient. Properties of gas mixture – Molar mass, gas constant, density, enthalpy and entropy.

Psychometry

Psychometric properties, Psychrometric charts. Property calculations of air vapor mixtures by using chart and expressions. Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications.

References

1. Yunus. N.J, Cengel. A and Michael Boles. A, "Thermodynamics- An Engineering Approach" 8th Edition, McGraw Hill Education, New Delhi, 2016
2. Mahesh M. Rathore, "Thermal Engineering", Mc Graw Hill Education private limited, Reprint 2016.
3. Michael Moran.J, and Howard Shapiro.N, "Fundamentals of Engineering Thermodynamics", 4th Edition, John Wiley & Sons, New York, 2014.

4. Nag. P. K, “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, Fifth edition, 2014.
5. Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, Twelfth reprint, 2007.

UMEC002	MANUFACTURING PROCESSES I	L	T	P	C
		3	0	1	4

Course Objectives

- To introduce various forming processes available in manufacturing products.
- To impart knowledge on various fabrication techniques used in industries.

Course Content

Metal Casting Processes

Moulding sands - Types and Properties, Patterns - types of patterns, selection of materials for patterns - pattern allowances, Gating and Riser, Sand moulding processes, Moulding machines, Core requirements, Core making processes, Core making machines, Permanent casting processes, Melting furnaces, Casting defects and remedies

Metal Fabrication Processes

Classification of welding processes: Principle of Gas welding, Arc welding, resistance welding, Solid State Welding, Thermo chemical welding and radiant energy welding – Welding defect and remedies-Brazing and soldering.

Metal Forming Processes

Forging: Classification of forging processes, Rolling: Classification of rolling processes - rolling mill - rolling of bars and shapes. Extrusion: Classification of extrusion processes - extrusion equipments - examples. Drawing: Drawing of rods, wires and tubes.

Sheet Metal and Powder Metallurgy Processes

Sheet metal forming methods: Shearing, Blanking, Bending, Stretch Forming, deep forming. Spinning: Spinning processes, High Velocity Forming. Powder Metallurgy: Methods of producing powder. Pressing, sintering, sizing-Advantages and limitations

Plastics Manufacturing Processes

Plastics Working: Types of plastics - plastic moulding processes- Injection moulding - Compression Moulding – Transfer Moulding – Extrusion – Blow moulding – Thermoforming - Rotational Moulding

List of Experiments:

1. Preparation of Mould with solid patterns
2. Preparation of Mould with split patterns
3. Preparation of Mould with core
4. Arc welding of two similar metals
5. Sheet metal fabrication

References

1. Serope Kalpakjian , Steven Schmid , “Manufacturing Engineering & Technology”, Pearson, Seventh Edition, 2014.
2. M.P.Groover, “Fundamentals of Modern Manufacturing Materials, Processes and Systems”, John Wiley & Sons, 2010.
3. P N Rao, “Manufacturing Technology Volume 1: Foundry, Forming and Welding”, Tata McGraw Hill, Fourth Edition, 2013.

4. Helmi A. Youssef, Hassan A. El-Hofy, Mahmoud H. Ahmed, “Manufacturing Technology: Materials, Processes, and Equipment”, CRC Press, 2011.s
5. Nee, Andrew Yeh Ching (Ed), “Handbook of Manufacturing Engineering and Technology”, Springer, 2015.

UMEC003	METALLURGICAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- Impart knowledge on various types of metals, non-metals and engineering alloys.
- Enable the students to understand the various heat treatment processes.
- To develop knowledge on material properties and their testing.

Course Content

Phase Diagrams

Constitution of alloys – phase diagrams, Isomorphism, eutectoid, eutectic, peritectic, and peritectoid reactions, Iron – Iron carbide equilibrium diagram.

Ferrous and Non Ferrous Metals

Classification of steel and cast Iron, microstructure, properties and applications, Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti & W) - stainless and tool steels – HSLA - Maraging steels – Cast Irons - Grey, White malleable, spheroidal Graphite, Alloy cast irons, Copper and Copper alloys - Brass, Bronze and Cupronickel – Aluminum and Al-Cu alloy – Bearing alloys.

Non-metallic Materials

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers – Urea and Phenol Formaldehydes – Engineering Ceramics – Introduction to Fibre reinforced plastics.

Heat Treatment

Full annealing, stress relief, recrystallisation and spheroidizing –normalising, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram, CCR - Hardenability, Jominy end quench test – Austempering, martempering – case hardening - carburising, nitriding, cyaniding, carbonitriding, flame and induction hardening.

Testing of Materials

Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, Fatigue and creep tests, fracture toughness tests.

References

1. Kenneth G. Budinski and Michael K. Budinski “Engineering Materials” Prentice-Hall of India Private Limited, Fourth Indian Reprint 2011.
2. William D Callister “Material Science and Engineering”, John Wiley and Sons 2012.
3. Raghavan. V “Materials Science and Engineering”, Prentice Hall of India Pvt., Ltd., 2011.
4. Sydney H. Avner ,“Introduction to Physical Metallurgy” McGraw Hill Book Company, 2014.
5. Dieter G. E., “Mechanical Metallurgy”, Mc Graw Hill Book Company, 2011.

UICM007	PROBABILITY AND STATISTICS	L	T	P	C
		3	1	0	4

Course Objectives

- To understand the basic concepts of probability theory and mathematical statistics.
- To learn commonly used probability distributions and able to use basic statistical inference.

Course Content

Random Variables & Distributions

Random variables - Discrete and continuous. Probability distributions, mass function/density function of probability distribution. Mathematical Expectation, Moment about origin, Central moments Moment generating function of probability distribution. Binomial, Poisson & normal distributions and their properties.

Two Dimensional Random variables

Joint probability distributions- Joint probability mass / density function, Marginal probability mass / density functions. Applications: Open channel flow, Warehouse construction. Covariance of two random variables, Correlation Coefficient, rank correlation. Regression- Regression Coefficient, The lines of regression and multiple correlation & regression.

Sampling and Estimation

Measures of central tendency - Sampling - Definitions of population, sampling, statistic and parameter. Types of sampling, Expected values of Sample mean and variance, sampling distribution, Standard error, Sampling distribution of mean and sampling distribution of variance.

Testing of Hypothesis

Null hypothesis, Alternate hypothesis, type I & type II errors - critical region, confidence interval, Level of significance, One sided test, Two sided test, t-test, F-test, Chi-square test of goodness of fit, Large sample tests. Applications: Test of two sample means for car speed, Test of two sample variance for car speed.

Analysis of Variance

Analysis of variance: One way classifications, two way classifications, completely Randomized design, Randomized block design, Latin Square method

References

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, 10th Edition, Wiley India, 2016.
2. J. S. Milton and J.C. Arnold, “Introduction to Probability and Statistics”, Tata McGraw Hill, 2012.
3. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, “Probability and Statistics for Engineers and Scientists”, Pearson Education, Delhi, 2012.
4. Bital M. Ayyub and Richard H. McCuen, “Probability, Statistics and Reliability for Engineers and Scientists” , Second edition, CRC Press, 2011.
5. R.A. Johnson and C. B. Gupta, “Miller and Freund’s Probability and Statistics for Engineers”, 7th edition, Pearson Education, Asia, 2007.

UMEC004	THERMAL ENGINEERING	L	T	P	C
		3	0	1	4

Course Objectives

- To impart knowledge on various thermodynamic cycles and their analysis
- To acquire knowledge on working of internal combustion engines, compressors and refrigeration and Air conditioning systems.

Course Content

Power Cycles

Basic considerations in the analysis of power cycles - Carnot cycle and its value in engineering, Otto cycle, diesel cycle, dual cycle, Brayton cycle- air standard efficiency- comparison of cycles.

Internal Combustion Engines

Classification - Components. Valve timing diagram and port timing diagram – actual and theoretical p-V diagram of four stroke engines- Principles of Combustion and knocking in SI and CI Engines. Lubrication and Cooling systems - Internal Combustion. Engine testing - Measurement of friction power - Indicated power - Brake power.

Compressors

Classification and working principle of various types of compressors, work of compression with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency of reciprocating compressors, Multistage air compressor and inter cooling –work of multistage air compressor.

Refrigeration and Air-Conditioning systems

Refrigeration machines - Classification of Refrigerants and properties - ammonia - water and lithium bromide vapour absorption systems - vapour compression system. Air conditioning systems- Types and performance evaluation - Psychrometric processes - Cooling Tower- types and performance evaluation.

List of Experiments

1. Determine the flash point, fire point and viscosity of various fuels / lubricants.
2. Determine the performance of a single cylinder diesel engine using electric loading
3. Draw the port timing diagram for two stroke single cylinder petrol engine, inlet and exhaust valve timings for a four stroke diesel engine
4. Determine the volumetric efficiency and isothermal efficiency of a reciprocating air compressor at various delivery pressures.
5. Determine the COP of a Refrigeration system

References

1. Mahesh M. Rathore, “Thermal Engineering”, Tata McGraw-Hill Education, Reprint 2010.
2. Cengel. Y and M. Boles, "Thermodynamics - An Engineering Approach", Mcgraw Higher Ed, Eight Edition, 2015.
3. Ganesan V, Internal Combustion Engine; Tata McGraw Hill Publishers Co. Ltd., New Delhi, 2013.
4. Arora C.P. “Refrigeration and Air Conditioning” Tata McGraw Hill, 3rd Edition 2008.

5. John Tomczyk, Eugene Silberstein, Bill Whitman and Bill Johnson, “Refrigeration and Air Conditioning Technology”, Delmar Cengage Learning, Eighth edition, 2016.

UMEC005	MANUFACTURING PROCESSES II	L	T	P	C
		3	0	1	4

Course Objectives

- Enable students to understand the use of conventional and modern machining processes.
- Develop knowledge on machining time estimation and machining cost calculations.

Course Content

Theory of Metal Cutting

Mechanism of metal cutting — types — cutting force — chip formation — Merchant's circle diagram — calculations — tool geometry — machinability — tool wear — tool life — cutting tool materials — cutting fluids — types.

Automats, Shaping And Planing Machines

Capstan and turret lathes — construction - indexing mechanism - operations - working principle of single and multi-spindle automats — shaping and planning machines — types — construction - mechanism — principle of operation — different shaping operations - work holding devices.

Drilling, Broaching and Grinding Machines

Drilling machines — specifications, types - feed mechanism, operations — drill tool nomenclature —broaching —specifications, types, tool nomenclature, broaching operations — grinding — types of grinding machines — grinding wheels, specifications — bonds — mounting and reconditioning of grinding wheels.

Milling and Gear Generating Machines

Milling — specifications — types - cutter nomenclature — types of cutters — milling processes — indexing — gear forming in milling — gear generation - gear shaping and gear hobbing — specifications - cutters — cutting spur and helical gears - bevel gear generators — gear finishing methods.

List of Experiments

1. Step turning and knurling using capstan and turret lathes
2. Drilling, reaming and tapping for a given dimension hole
3. Spur gear / Helical gear cutting using milling machine
4. Gear generation using hobbing and gear shaping machine
5. Plain Surface and cylindrical grinding

References

1. Serope Kalpakjian , Steven Schmid , “Manufacturing Engineering & Technology”, Pearson, Seventh Edition, 2018.
2. M.P.Groover, “Fundamentals of Modern Manufacturing Materials, Processes and Systems”, John Wiley & Sons, 2010.
3. Hajra Choudhury, "Elements of Workshop Technology", Vol.II., Media Promoters, 2004.
4. Milton C Shaw, “Metal Cutting Principles”, Oxford University Press, 2012.
5. Singh D K “Manufacturing Technology”, Pearson Education, 2nd Edition 2008.

UMEC006	KINEMATICS OF MACHINERY	L	T	P	C
		3	0	0	3

Course Objectives

- To comprehend the fundamentals of kinematics and to apply the concept of mechanisms and related terminologies in design.
- To formulate the concept and analysis of different mechanisms, machines and other power transmitting elements.

Course Content

Basics of mechanisms

Basics of kinematics- Degree of freedom- criterion's in planar mechanisms- Basic Mechanisms and their inversions- Quick return motion mechanisms

Kinematic analysis of mechanisms

Displacement, velocity and acceleration analysis in simple mechanisms using graphical method. Coriollis component of acceleration.

Kinematics of Cams

Displacement diagrams - Parabolic, Simple harmonic and Cycloidal motions – Graphical construction of displacement diagrams and layout of plate cam profiles - Pressure angle and undercutting.

Gears and Gear Trains

Law of toothed gearing – Involutes and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

Friction in Machine Elements

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes - Band and Block brakes.

References

1. Beven T, "Theory of Machines", CBS Publishers and Distributors, Third Edition, New Delhi, 2005.
2. Ghosh and Mallick, "Theory of Mechanisms and Machines" Affiliated East-West Pvt. Ltd, Third Edition , New Delhi, 2006.
3. Rattan S S, "Theory of Machines", Tata McGraw -Hill Publishers, fourth Edition, New Delhi, 2017.
4. Rao J S and Dukkipati, "Mechanism and Machine Theory", Wiley- Eastern Ltd., New Delhi, 1992.
5. John Hannah and Stephens R C, "Mechanisms of Machines", Viva Low Price Student Edition, New Delhi, 1999.

UMEC201	UNCONVENTIONAL MACHINING PROCESS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the concept of Unconventional machining process
- To study applications of Unconventional machining process

Course Content

Introduction

Unconventional machining Process – Need – classification – Brief overview.

Mechanical Energy Based Processes

Abrasive Jet Machining (AJM) – Water Jet Machining (WJM) – Ultrasonic Machining (USM) – Material Removal Rate (MRR) -Variation in techniques used – Applications.

Electrical Energy Based Processes

Electric Discharge Machining (EDM)- working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

Chemical and Electro-Chemical Energy Based Processes

Chemical machining (CHM) - Etchants - maskant-techniques of applying maskants-Process Parameters – Surface finish and MRR-Applications. Electro-Chemical machining (ECM) - Principles of ECM-equipments-Surface Roughness and MRR Electrical circuit-Process Parameters-ECG and ECH - Applications

Thermal Energy Based Processes

Laser Beam Machining and drilling (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques –Applications.

References

1. Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi, 2007
2. Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi,2007.
3. Benedict. G.F. “Nontraditional Manufacturing Processes”, Marcel Dekker Inc., New York,1987.
4. Mc Geough, “Advanced Methods of Machining”, Chapman and Hall, London, 1998.
5. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, “Material and Processes in Manufacturing”Prentice Hall of India Pvt. Ltd., 8thEdition, New Delhi , 2001.

UMEC202	COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the fundamentals and need of composite materials and their types
- To identify the application fields of composites and use the composite materials effectively

Course Content

Introduction to Composites

Fundamentals of composites - need for composites – Enhancement of properties - Matrix- Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

Polymer Matrix Composites

Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – various types of fibres - PMC processes - Hand lay up processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).

Metal Matrix Composites

Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix - Reinforcements – particles – fibres. Effect of reinforcement - Volume fraction – Rule of mixtures. Processing of MMC - Powder metallurgy process – diffusion bonding – stir casting – squeeze casting.

Ceramic Matrix Composites

Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics - Need for Ceramic Matrix composites (CMC) – Ceramic matrix - Various types of Ceramic Matrix composites- Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

Special Composites

Carbon / carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform preform. Sol gel technique. Composites for aerospace applications.

References

1. Mathews F. L. and Rawlings R.D., “Composite materials: Engineering and Science”, Chapman and Hall, London, England, Fifth edition, 2012.
2. Chawla K. K., “Composite materials”, Springer – Verlag, 2012
3. Clyne T. W. and Withers P.J., “Introduction to Metal Matrix Composites”, Cambridge University Press, 2011.
4. Strong A. B., “Fundamentals of Composite Manufacturing”, SME, 2013.
5. Sharma S. C., “Composite materials”, Narosa Publications, 2010.

UMEC203	MAINTENANCE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To import knowledge on repair methods for material handling equipment

Course Content

Principles and Practices of Maintenance Planning

Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems - Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

Maintenance Policies – Preventive Maintenance

Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repairs cycle - Principles and methods of lubrication – TPM.

Condition Monitoring

Condition Monitoring – Cost comparison with and without CM – On-load testing and off-load testing – Methods and instruments for CM.

Repair Methods for Basic Machine Elements and Material Handling Equipment

Repair methods for beds, slide ways, spindles, gears, lead screws and bearings – Failure analysis – Logical fault location methods – Sequential fault location - Repair methods for Material handling equipment - Equipment records – Job order systems –Use of computers in maintenance.

References

1. Srivastava S. K., “Industrial Maintenance Management”, - S. Chand and Co., 2012
2. Bhattacharya S. N., “Installation, Servicing and Maintenance”, S. Chand and Co., 2014
3. White E. N., “Maintenance Planning”, I Documentation, Gower Press, 2010. A
4. Garg M. R., “Industrial Maintenance”, S. Chand & Co., 2013.
5. Higgins L. R., “Maintenance Engineering Hand book”, McGraw Hill, Fifth Edition, 2012.

UICH003	ECONOMICS FOR ENGINEERS	L	T	P	C
		3	0	0	3

Course Objectives

- To provide a broad understanding of various perspectives of economics.
- To equip students with knowledge on economic concepts applied to real life scenarios

Course Content

Introduction

Economics – Policy and scope-Micro and macroeconomics–Relationship between Science, Engineering, Technology and Economic Development

Production and Demand

Production: Factors of production - Production Possibility Curve - Demand analysis: Law of Demand, exceptions- Elasticity of Demand

Cost and Break Even Analysis

Concepts of cost of production- different types of costs; accounting cost, sunk cost, marginal cost, opportunity cost–Break even analysis

Capital Budgeting

Capital budgeting techniques: Payback period method, IRR and NPV –Replacement and maintenance analysis – types of maintenance – replacement of an asset

Inflation and Globalization

Inflation – types – measures to control inflation – fiscal policy – monetary policy - Globalization and international business

References

1. Gupta, G.S. Managerial Economics , 2nd Edition, Tata McGraw Hill , 2013
2. Joel Dean, Managerial Economics , Prentice Hall India, 2014
3. John A. White, Kellie S. Grasman, Kenneth E. Case, Kim LaScola Needy, and David B. Pratt, Fundamentals of Engineering Economic Analysis first edition, Wiley, August 2013.
4. R.M.Joshi, International Business, Oxford higher Education 2012.
5. P K Jain and M. Y Khan, Financial Management: Text, Problems and Cases 7th Edition, McGraw Hill Education, 2014.

UMEC007	HEAT AND MASS TRANSFER	L	T	P	C
		3	0	1	4

Course Objectives

- The students will be taught about conduction and convection mode heat transfer and correlations of free and forced convective internal and external flows.
- Students also will be able to analyze the radiation laws, black and grey body radiation. In this subject, student will be introduced to types of heat exchanger and LMTD and NTU methods, boiling and condensation..
- Students will also learn mass transfer concept of diffusion and convective mass transfer.

Course Content

Conduction - General one dimensional equation for Cartesian and polar coordinates – Fourier law of heat conduction - Critical thinness of insulation, Heat generation problems – steady state heat conduction - Unsteady state heat conduction, Heat transfer from fins. Lumped system analysis, Semi-infinite and infinite solids-Heisler charts

Convection –Free convection, Forced Convection - Boundary layer theory - External and internal flows Correlations. External flows over plate, cylinders and internal flows over tubes.

Radiation Laws - Black and Gray bodies - Radiation exchange between surfaces – Radiation shields Greenhouse effect. Radiation through gases.

Heat exchangers - Fouling factor, LMTD and NTU methods. Boiling and condensation regimes and correlations, Nusselt's theory - Condensation over surfaces.

Mass transfer - Fick's law –steady state molecular diffusion- Similarities between heat and mass transfer. Diffusion and Convective mass transfer- Convective mass transfer correlations.

List of Experiments:

1. Determination of Thermal conductivity using heat transfer equipments.
2. Determination of Heat transfer coefficient using heat transfer equipments.
3. Conducting experiments and to find emissivity of grey body and Stefan Boltzman constant using heat transfer equipments.
4. Determination of effectiveness of a parallel and counter flow heat exchanger.
5. Conducting experiments and drawing the characteristic curves of temperature distribution in PIN-FIN apparatus.

References

1. Yunus.A.Cengel, Afstin J.Ghajar, “Heat and Mass Transfer – Fundamentals and Applications”, McGraw Hill, Fifth Edition, 2016.
2. Cengel Y. A., “Heat Transfer - A Practical Approach”, McGraw-Hill, 2014.
3. Kothandaraman C.P “Fundamentals of Heat and Mass Transfer” New Age International,New Delhi, 2012
4. Incropera, F. P. and Dewitt D. P., “Fundamentals of Heat and Mass Transfer”, John Wiley, Fifth Edition.,2011.

5. Sachdeva R C, “Fundamentals of Engineering Heat and Mass Transfer” New Age International, 2010.

UMEC008	DYNAMICS OF MACHINES	L	T	P	C
		3	0	1	4

Course Objectives

- The students will be taught about concepts of generalized forces and the Principles of Force Analysis
- Students will taught about the Vibratory mechanism and
- Students will also learn about the approaches and mathematical models used dynamic analysis of machinery.

Course Content

Dynamic force analysis – Inertia force and Inertia torque– D Alembert's principle –Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod– Bearing loads – Crank shaft torque – Turning moment diagrams –Fly Wheels – Dynamics of Cam follower mechanism

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing of Multi-cylinder inline – Partial balancing in engines

Basic features of vibratory systems – Degrees of freedom – Free vibration – Equations of motion – Natural frequency – Types of Damping – Damped vibration– Torsional vibration of shaft – Critical speeds of shafts – Torsional vibration – Two and three rotor torsional systems

Response of one degree freedom systems to periodic forcing – Harmonic disturbances – Disturbances caused by unbalance forces – Support motion –transmissibility – Vibration isolation vibration measurement.

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force curves. Gyroscopes –Gyroscopic forces and torques

List of Experiments:

1. Kinematics of Four Bar, Slider Crank, Crank Rocker Mechanisms.
2. Governors –Watt and Porter.
3. Gyroscope
4. Moment of Inertia of disc and ring
5. Kinematics of Universal Joints.

References

1. Uicker, J. J., Pennock G. R and Shigley, J. E., "Theory of Machines and Mechanisms", Oxford University Press, Third Edition, 2014.
2. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, Third Edition, 2010
3. William Cleghorn, Nikolai Dechev "Mechanisms of Machines", Oxford University Press, 2016
4. Rattan S. S, "Theory of Machines", Tata McGraw-Hill, Fourth Edition, 2014
5. Ghosh. A and Mallick A. K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt.Ltd., New Delhi, 2012.

6. William T. Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan, “Theory of Vibration with Application”, Pearson Education, Fifth edition, 2011.

UMEC009	DESIGN OF MACHINE ELEMENTS	L	T	P	C
		3	0	0	3

(Use of Approved P S G Design Data Book is Permitted)

Course Objectives

- The students will be familiarize the various steps involved in the design process.
- The students will be acquire design knowledge of the different types of elements and joints used in the engineering applications, subjected to various types of stresses.
- The students will be learn to use standard practices and standard data
- The students will be acquire knowledge on design catalogues and design standards.

Course Content

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and 'C' frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

Threaded fastners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints for structures - theory of bonded joints.

Various types of springs, optimization of helical springs - rubber springs – Flywheels Considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, - Selection of Rolling Contact bearings

References

1. Bhandari V. B, "Design of Machine Elements", McGraw-Hill Education, Fourth Edition, 2016.
2. Joseph Edward Shigley, Richard Budynas and J Keith Nisbett "Mechanical Engineering Design", New York McGraw-Hill, Ninth Edition, 2011.
3. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Component Design", John Willey & sons, Fifth Edition, 2012.
4. Ugural A. C, "Mechanical Design an Integral Approach", McGraw-Hill Book Co, 2004.
5. Spotts M. F., Shoup T. E, "Design and Machine Elements", Pearson education, 2004.
6. Bernard Hamrock, Steven Schmid,Bo Jacobson, "Fundamentals of Machine lements",2nd Edition, Tata McGraw-Hill Book Co., 2006.
7. "Design Data" – P.S.G. College of Technology, Kalaikathir Achchagam, 2012.

UMEC010	ENGINEERING METROLOGY AND MEASUREMENTS	L	T	P	C
		3	0	1	4

Course Objectives

- To impart knowledge on basic principles and errors in measurements
- To acquire knowledge on various measuring instruments and principles of form, strain, force, torque, pressure, temperature and flow measurements

Course Content

Definition of metrology ,Elements , Work piece, Instruments, Persons ,Environment , their effect on Precision and Accuracy, Errors , Errors in Measurements, Types, Control ,Types of standards.

Fits and Tolerances, Linear measuring instruments, Vernier, micrometer, Slip gauges and classification, interferometer, optical flats, limit gauges. Comparators, Angular measurements, Sine bar, optical bevel protractor, angle Decker, Taper measurements Measurement of screw thread

Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Roundness measurement – Applications.

Basic concept of lasers, Precision instruments based on laser, Principles, laser interferometer - Coordinate measuring machine (CMM), Digital devices, Computer aided inspection – 3D Scanning, Machine Vision Systems

Temperature Measuring Devices- Thermocouples, Resistance Temperature Detectors, Thermistor, Liquid in glass Thermometers, Pressure Thermometers, Pyrometer, Bimetallic strip. Calibration of temperature measuring devices, Numerical Examples on Flow Measurement. Force measurement: load cells, proving rings, differential transformers. Measurement of torque Power Measurements- Electrical strain gauges, strain gauge: materials - bridge arrangement- temperature compensation.

List of Experiments

1. Linear Measurements – Vernier calliper, Vernier height gauge, Micrometer and Comparator
2. Angular Measurements - Sine Bar, Bevel Protractor, Profile Projector and Toolmakers Microscope
3. Bore diameter measurements – Telescopic gauge and Dial bore indicator
4. Coordinate Measuring Machine
5. Toque and Temperature measurements

References

1. Richard S. Figliola, Donald E. Beasley, “Theory and Design for Mechanical Measurements, 3rd Edition International Student Version”, Wiley India Private Limited, Third edition, 2008.
2. Bucher, Jay L “The Metrology handbook ”, Second Edition, Quality press, 2012.
3. R.K.Rajput, “Engineering Metrology and Instrumentation”, S.K. Kataria & Sons Publications, 2014.

4. Bewoor and Vinay Kulkarni, “Metrology & Measurement”, Tata Mc Graw Hill Publishing Company Pvt Ltd, New Delhi, 2017.
5. Raghavendra, Krishnamurthy, “Engineering Metrology and Measurements” Oxford University Press, 2013.

UMEE204	PRODUCTION PLANNING AND CONTROL	L	T	P	C
		3	0	0	3

Course Objectives

- To enable students to understand importance of production planning in an industry
- To introduce the various concepts involved in production planning to the students.

Course Content

History of Group Technology, role of G.T in CAD/CAM Integration, part families, facility design using G.T, benefits of G.T, cellular manufacturing. Process planning, approaches to computer aided processes planning, CAPP and CMPP systems.

Process planning, aims of process planning, steps to prepare the detailed work sheets for manufacturing a given component, Break even analysis, Forecasting, Purpose and Methods of forecasting, Time series, Regression and Correlation.

Types of inventory, Inventory classification methods, Inventory costs Inventory models- deterministic models, probabilistic models - safety stock and reorder points – Inventory control systems.

Production Activity Control, Just-in-time systems, Scheduling in Manufacturing, Theory of constraints and synchronous manufacturing.

Capacity planning- short term and long term capacity, capacity of facilities, break even capacity, use of decision trees, aggregate production planning - strategies, methods, Master Production Schedule, MRP- lot sizing, MRP II, CRP, ERP.

References

1. Mikell. P. Groover "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education 2010.
2. Dr. R. Kesavan, C.Elanchezian and B.Vijayaramnath, Production Planning and Control, Anuratha Publications, Chennai – 2011
3. Lee J.Krajewski, Larry P.Ritzman, "Operations Management", Pearson Education, 2016.
4. Panneerselvam,R. Production and operations management, PHI, 2010.
5. Mahadevan,B. Operations- Theory & Practice, Pearson Education, 2007
6. Seetharama L.Narasimhan, Dennis W.McLeavey, Peter J.Billington,"Production Planning and Inventory Control" , PHI, 2012.

UMEC011	CAD/CAM/CIM	L	T	P	C
		3	0	1	4

Course Objectives

- To acquire knowledge in the fields of CAD/CAM, automation, FMS & CIM.
- To provide knowledge on operations and use of CNC machines.

Course Content

Introduction to CAD. Clipping, viewing transformation 2 D & 3 D. Curves and Surfaces. Visual realism – Solid removal Algorithms. Shading, Colouring and animation.

Surface modelling – curves and surface representation – composite surfaces –Case studies in CAD/CAM

Introduction to G-Codes and M-Codes and part programming techniques. Fundamentals of NC/CNC, NC Part Programming, Conventional versus CNC Machines, NC Programming through CAD/CAM.

Fundamentals of CIM, Group Technology and Computer Aided Process Planning, Automated Storage and Retrieval Systems (ASRS), Computer Aided Inspection. Advanced topics in Computer-Integrated Manufacturing, including control systems, group technology, cellular manufacturing, and flexible manufacturing systems.

CAD / CAM / CIM, CNC, Computer Assisted Process Planning, Design for Manufacturing and Assembly, Manufacturing Automation & Control, Intelligent Manufacturing Systems, Rapid Prototyping and Tooling.

List of Experiments

1. Assembly of Couplings – Universal and Flange coupling
2. Assembly of Plummer Block
3. Part Programming – Milling
4. Stress and deflection analysis in beams with different support conditions
5. Thermal stress analysis of cylindrical shells.

References

1. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill Publishing Co.2007.
2. Xun Xu, “Integrating Advanced Computer-Aided Design, Manufacturing and Numerical Control”, IGI Global, 2009.
3. Mikell P. Groover, “Automation, Production Systems and Computer –Integrated Manufacturing” Pearson Education, Fourth edition, 2016.
4. Chris McMahon and Jimmie Browne “CAD CAM Principles, Practice and Manufacturing Management” Prentice Hall 2 edition, 1988.
5. Roger Hannam ,”Computer Integrated Manufacturing” Prentice Hall, 1st edition, 1997.

UMEC012	HYDRAULICS AND PNEUMATICS	L	T	P	C
		3	0	1	4

Course Objectives

- To provide exposure on the basic principles in design of hydraulic and pneumatics systems for various engineering applications
- To impart knowledge on oil hydraulic systems, hydraulic & pneumatic actuators, circuits, regulating elements and their control

Course Content

Hydraulic Power Generators – Selection and specification of pumps, pump characteristics. Linear and Rotary Actuators – selection, specification and characteristics, Hydrostatic drives, types, selection-Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems- Electrical control solenoid valves, relays - Electro hydraulic servo valves.

Reciprocation - Quick return, sequencing, synchronizing circuits - Accumulator circuits - Industrial circuits - press circuits - Hydraulic milling machine - Grinding, planning, copying - Forklift, earth mover circuits- Design and selection of components - Safety and emergency mandrels.

Pneumatic fundamentals - Control elements, position and pressure sensing - Logic circuits - Switching circuits - Sequential circuits -Cascade methods - Mapping methods - Step counter method - Compound circuit design -Combination circuit design.

Electrical control of pneumatic circuits – use of relays, counters, timers, ladder diagrams, use of microprocessor in circuit design – use of PLC in hydraulic and pneumatic circuits – Fault finding– application -fault finding - hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits.

List of Experiments:

1. Study of Hydraulic, Pneumatic and Electro Pneumatic circuits
2. Modeling and Simulation of basic Hydraulic, Pneumatic and Electro Pneumatic circuits using software.
3. Circuits with multiple cylinder sequences with Programmable Logic Controller.
4. Controlling of a DC motor using PID Controller.
5. Interfacing Stepper Motor with 8051 Micro controller

References

1. Antony Espossito, “Fluid Power with Applications”, Prentice Hall, 2008.
2. Dudleyt, A. Pease and John J. Pippenger, “Basic fluid power”, Prentice Hall, 1987.
3. Andrew Parr, “Hydraulic and Pneumatics” (HB), Jaico Publishing House, 2005.
4. Bolton. W., “Pneumatic and Hydraulic Systems “, Butterworth –Heinemann, 1997.
5. Pease, Dudleyt, A. and Pippenger, John J., “Industrial Hydraulics”, Tata McGraw-Hill, New Delhi,1985.

UMEC013	DESIGN OF TRANSMISSION SYSTEMS	L	T	P	C
		3	0	0	3

(Use of Approved Design Data Book is Permitted)

Course Objectives

- The students will be facilitate in learning design procedures for machine elements like belt drives, gears, brakes and clutches in power transmission systems.
- The students will be inculcate in using standard data and design catalogues

Course Content

Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

Kinematics – force analysis in gears – stress analysis – dynamic effects – gear blank design - estimating gear size, module and face width -Design of straight tooth spur & helical gears-power rating calculations based on strength and wear considerations, crossed helical gear terminology - estimating the size of the pair of crossed-helical gears.

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth, estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits – Terminology. Thermal Capacity, Materials-forces and stresses, efficiency, estimating the size of the worm gear pair.

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - Speed reducer unit. – Variable speed gear box.

Design of plate clutches – axial clutches-cone clutches-internal expanding rim clutches-internal and external shoe brakes.

References

1. Juvinall R. C., Marshek K.M.," Fundamentals of Machine component Design, "John Wiley & Sons Fifth Edition, 2011.
2. Bhandari, V. B, "Design of Machine Elements", Tata McGraw-Hill Publishing Company Ltd., 2010.
3. Maitra G.M., Prasad L.V., "Hand book of Mechanical Design," Tata McGraw-Hill, Second Edition, 2004.
4. Joseph Edward Shigley, Richard Budynas and J Keith Nisbett, "Mechanical Engineering Design", New York McGraw-Hill, Ninth Edition, 2011.
5. Robert L. Norton, "Machine Design: An Integrated Approach", Pearson Education, 2013.
6. Hamrock B. J., Jacobson B., Schmid S.R., "Fundamentals of Machine Elements", McGraw-Hill Book Co, 2013.
7. "Design Data" – P.S.G. College of Technology, Kalaikathir Achchagam, 2012.

UMEC014	INDUSTRIAL DESIGN PROJECT (COURSE WORK)	L	T	P	C
		4	0	0	4

Course Objectives

Industrial design project offers a distinctive opportunity to play a key role as part of a team working on a realistic design project in an industry or organization. It's about creating and testing ideas to solve real-world problems and also aides in getting firsthand experience. It will improve technical knowledge, communication, practical skills and employability of the student's at a stroke.

The students should undergo Industrial design project from third year (Sixth Semester) of study. Industrial design project is designed into three courses **UMEC014 Industrial Design Project (Course Work), UMEC015 Industrial Design Project (Practical) and UMEC016 Industrial Design Project (Phase – II)** it will be a platform for the students to gain full experience the breadth and depth of mechanical systems and engineering design.

Course Content

A project-based course in which students are required to undertake a course work that gives emphasis to Engineering design, Computer Aided Manufacturing(CAM) and Thermal systems and thereby leading to the design and development of a viable and suitable product that conforms to its applicability and novelty.

UMEC015	INDUSTRIAL DESIGN PROJECT (PRACTICAL)	L	T	P	C
		0	0	2	2

A project based practical course in which students are required to complete and manufacture a product with higher quality and thereby leading to emancipation of society. The course is to be carried out through an organization / institution. At the end of the course students have to submit a certificate of completion and appear for final practical examination.

UMEC205	LEAN MANUFACTURING	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the important tools in lean Manufacturing
- To acquire knowledge on lean manufacturing system adopted in an Organization

Course content

Introduction, background, and lean thinking. Importance of philosophy, strategy, culture, alignment, focuses and systems view.

Discussion of Toyota Production System. Lean production preparation – System assessment, process and value-stream mapping – Sources of waste.

Lean production processes, approaches and techniques. Importance of focusing upon flow. Tools include: Workplace organization – 5S, Stability, Just-In-Time – One piece flow – Pull, Cellular systems, Quick change and set-up reduction methods, Total productive maintenance, Poka-Yoke – mistake proofing. Employee involvement, communication, Start-up of lean processes and examples of applications. Sustaining improvement and change, auditing, follow-up actions.

References

1. Lonnie Wilson, How To Implement Lean Manufacturing, Second Edition, McGraw Hill Inc., New York, 2015.
2. Jon Miller , Mike Wroblewski , Jaime Villafuerte , “Creating a Kaizen Culture: Align the Organization, Achieve Breakthrough Results, and Sustain the Gains” (Mechanical Engineering), McGraw Hill Inc., New York, 1st Edition,2013.
3. Jacob Stoller, “The Lean CEO: Leading The Way To World-Class Excellence”, McGraw Hill Inc., New York, First Edition, 2015.
4. Kimberly Watson-Hemphill and Kristine Nissen Bradley, “Innovating Lean Six Sigma: A Strategic Guide To Deploying The World's Most Effective Business Improvement Process”, McGraw Hill Inc., New York, First Edition, 2016.
5. Ola Johansson, Martin Broman,Dan Blucher, Henric Alsterman Per Petersson , “Lean - Turn Deviations Into Success”, (First Indian Edition, 2015).

UMEC016	INDUSTRIAL DESIGN PROJECT (PHASE – II)	L	T	P	C
		0	0	6	6

The objective of this course is to impart and improvise the designing and manufacturing capability of the student using various designing and analyzing software tools along with the concept of simulation. This course comprehends purely a problem in any one of the disciplines of Mechanical Engineering; e.g., Design of jigs and Fixtures, Design of intricate shapes and Design of Cast able products etc., The project 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 and complete set of drawings which follow the design.

UMEC017	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 Mechanical 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.

UMEC018	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 be evaluated based on the report as well as by conducting 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 & II

UMEE201	CASTING AND WELDING PROCESSES	L	T	P	C
		3	0	0	3

Course Objectives

- The students will be taught sand casting processes, special casting processes, melting and modernization and mechanization of foundries.
- Students also will be able to analyze casting defects and remedies as well as to understand nonferrous foundry practices.
- Students will also learn arc welding processes and resistance welding processes. The course will also impart knowledge on special welding processes, soldering, brazing, welding defects and their remedies.

Course Content

Moulding sands - Types and Properties, Patterns - types of patterns, selection of materials for patterns - pattern allowances, Gating and Risering, Sand moulding processes, Moulding machines, Core requirements, Core making processes, Core making machines,

Melting furnaces ,Die Casting, Investment Casting, Centrifugal Casting, Shell Moulding, Gravity die/ permanent mold, casting, Continuous Casting, pressure die casting, Slush Casting, Non-metal Molding /Ceramic Molding, squeeze casting. Modernization and Mechanization of Foundry, Pollution Control in Foundry,Casting defects and remedies

Aluminum castings – Advantages, limitations, melting of aluminum using lift-out type crucible furnace. Hardeners used, drossing, gas absorption, fluxing and flushing, grain refining, pouring temperature. Stir casting set up, procedure, uses, advantages and limitations

Definition, Principles, Classification, Application, Advantages & limitations of welding. Arc welding: Principle, Metal arc welding (MAW), Flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding (AHW).

Resistance welding principles, Seam welding, Butt welding, Spot welding and Projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and electron beam welding. Welding defect and remedies, Brazing and soldering.

References

1. Serope Kalpakjian , Steven Schmid , “Manufacturing Engineering & Technology”, Pearson, SeventhEdition, 2014.
2. M.P.Groover, “ Fundamentals of Modern Manufacturing Materials, Processes and Systems”, John Wiley& Sons, 2010.
3. P N Rao, “Manufacturing Technology Volume 1: Foundry, Forming and Welding”, Tata McGraw Hill, Fourth Edition, 2013.
4. Richard L. Little, “Welding and Welding Technology”, McGraw Hill Education, 2001, Processes, and Equipment”, CRC Press, 2011.
5. L.Carl Love, Welding Procedures and Applications, Prentice Hall Inc”, 2013.

UMEE202	STATISTICAL PROCESS CONTROL AND RELIABILITY ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- The students can apply the concept of SQC in process control for reliable component production.

Course content

Introduction and Process control for Variables

Introduction, basic concept of quality, SQC, Quality assurance, Quality control: Quality Cost-Variation in process causes of variation – Control chart for variables – X chart, R chart and X chart - Six sigma concepts

Process control for Attributes

Control chart for attributes –control chart for non-conforming– p chart and np chart – control chart for nonconformities– C and U charts.

Acceptance Sampling

Lot by lot sampling – types –O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts.

Life Testing - Reliability

Life testing – Objective – failure data analysis, mean failure rate, mean time to failure, mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems.

Quality and Reliability

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

References

1. Douglas.C. Montgomery, "Introduction to Statistical quality control", 7th edition, John Wiley, 2009.
2. Srinath. L.S., "Reliability Engineering", Affiliated East west press, 2005.
3. John.S. Oakland. "Statistical process control", 6th edition, Elsevier, 2007
4. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai & Sons, 2014.
5. Eugene Grant, Richard Leavenworth, Statistical Quality Control, McGraw-Hill, 7th edition, 1998.

UMEE203	MATERIALS CHARACTERIZATION	L	T	P	C
		3	0	0	3

Course Objectives

- To develop knowledge in characterizing materials to analyze the structure and interpret their properties.
- The students study the theoretical foundations of metallography, X-ray diffraction, electron diffraction, scanning electron microscopy.
- The students can apply the concept of chemical and thermal analysis for identifying the different characteristics of materials.

Course content

Metallographic techniques

Resolution – depth of focus and components of microscope polarized light – phase contrast – interference microscopy – hot stage and quantitative metallographic techniques – specimen preparation techniques.

X-ray diffraction techniques

Crystallography basics, characteristic spectrum, Bragg's law, Diffraction methods – Laue, rotating crystal and powder methods. Stereographic projection. Intensity of diffracted beams – structure factor calculations and other factors. Cameras- Laue, Debye-Scherer cameras – Seeman – Bohlin focusing cameras.

Application of X-ray diffraction

Diffractometer – general feature and optics, proportional, scintillating and Geiger counters. X-ray diffraction application in the determination of crystal structure, lattice parameter, phase diagram and residual stress – quantitative phase estimation, ASTM catalogue of Materials identification

Electron microscopy

Construction and operation of Transmission electron microscope – Diffraction effects and image formation, specimen preparation techniques. Construction, modes of operation and application of Scanning electron microscope, EDX. Electron probe micro analysis, basics of scanning Tunnelling Microscope (STM) and Atomic Force Microscope.

Advanced chemical and thermal analysis

Basic principles, practice and applications of X-ray spectrometry, X-ray photoelectron spectrometry, Auger spectroscopy, Differential thermal analysis DTA, Differential scanning calorimetry DSC and thermogravimetric analysis TGA.

References

1. Brandon D. G, "Modern Techniques in Metallography", Von Nostrand Inc. NJ, USA, 2006.
2. Gareth Thomas, "Transmission electron microscopy of metals", John Wiley, 2006.

3. Weinberg, F., “Tools and Techniques in Physical Metallurgy”, Volume II, Marcel and Decker, 2008.
4. Phillips, V. A., “Modern metallographic techniques and their application”, John-Wiley & sons, 2012.
5. Haines, P. J., “Principles of Thermal Analysis and Calorimetry”, Royal Society of Chemistry (RSC), Cambridge, 2002.

UMEE204	MICRO ELECTRO MECHANICAL SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

- To give exposure to the students in the area of MEMS and Microsystems and to provide essential information to design simple micro sensors and MEMS systems.

Course content

Introduction to Microsystems and Materials

Overview - Microsystems and Microelectronics – Working principle of Microsystems – Si as a substrate material - Mechanical properties - Silicon compounds -Silicon piezo resistors - Gallium arsenide - Quartz-piezoelectric crystals - Polymer -Scaling laws in Miniaturization.

Micro sensors and Micro actuators

Micro sensors – Types- Micro actuation techniques - Micro actuators, Micro pump, Micro motors, Micro valves, Micro grippers, Micro accelerometers.

Fabrication process

Substrates - Single crystal silicon wafer formation – Photolithography, Ion implantation, Diffusion, Oxidation, Physical vapor deposition - Deposition by epitaxy - Etching process.

Micro system manufacturing and packaging

Bulk Micro Manufacturing - Surface Micro Machining – LIGA – SLIGA - Micro system packaging materials - Die level - Device level - System level - Packaging techniques – Die preparation – Surface bonding - Wire bonding - Sealing.

Microsystems design and Applications

Design considerations - Process design - Mechanical Design - Mechanical Design using Finite Element Method - Applications of micro system in automotive industry, Bio medical, Aerospace and Telecommunications.

References

1. Rai - Choudhury P. “MEMS and MOEMS Technology and Applications”, PHI Learning Private Limited, 2009.
2. “MEMS and Microsystems Design and Manufacture” by Tai-Ran Hsu. Tata McGraw-Hill Publishing Company Ltd.
3. Maluf, Nadim, “An introduction to Micro electro mechanical Systems Engineering”, AR Tech house, Boston 2000.
4. Julian W.Gardner, Vijay K.Varadan, Osama O. Awadel Karim, “Micro sensors MEMS and Smart Devices”, John Wiby & sons Ltd., 2001

UMEC101	AUTOMOBILE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objective

- To understand the structure and components of the automobile vehicles
- To be familiar with the working Principle of IC engines and their auxiliary system.
- To be exposed to the basic concepts of transmission system.
- To understand the fundamental concepts steering, brakes and suspension systems.
- To learn about the alternate energy sources and emission control techniques.

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, Types of wheels, construction, Tyres- construction, Radial, bias & belted bias, slip angle, Tread patterns, Tyre retreading cold & hot, Tubeless tyres. Tyres wear and causes.

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, Hotchkiss Drive and Torque Tube Drive.

Steering, Brakes and Suspension Systems

Steering system: Steering geometry, wheel Alignment and balancing and types of steering gear box-Power Steering. 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).

Reference

1. Kirpal Singh, “Automobile Engineering”, Standard Publishers, Vol-I & II. Thirteenth Edition. New Delhi, 2014.
2. R. K. Rajput, “A Text book of Automobile Engineering”, Lakshmi publication, Second Edition. 2014
3. Heniz Heisler, “Vehicle and Engine Technology, SAE, Second 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.
6. C.R. Ferguson, A. T. Kirkpatrick, Internal Combustion Engines, 2nd Edition, John Wiley & Sons, 2016.

UMEC105	GAS DYNAMICS AND JET PROPULSION	L	T	P	C
		3	0	0	3

Course Objectives

- To provide fundamental knowledge on compressible and incompressible flows and effect of frictions
- To import knowledge on flow through the ducts, diffuser, nozzle and different shock waves, aircraft propulsions.

Course content

Fundamentals of Isentropic Flows

Introduction to compressible flow – continuity, momentum and energy equations for compressible flow –wave propagation in incompressible, subsonic, sonic and supersonic flows.

Flow through Nozzle and Diffusers

Isentropic flow through variable area ducts, T-s and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles.

Flow through Ducts and flow properties

Flow in constant area ducts with friction (Fanno flow), variation of flow properties, variation of Mach number with duct length. Isothermal flow with friction in constant area ducts. Flow in constant area ducts with heat transfer (Rayleigh flow).

Normal and Oblique Shocks

Governing equations, variation of flow parameters across the normal shock, Flow with normal shock waves – Prandtl-Mayer relation - impossibility of shock in subsonic flows.

Jet and Space Propulsion

Aircraft propulsion – types of jet engines, Propulsive Devices: turbo jet, turbo prop engine, turbo shaft engine, Ram jet, pulse jet, Rocket Propulsion, Principle of rocket propulsion, solid and liquid propellants.

References

1. Anderson, J.D., “Modern Compressible flow”, McGraw Hill, 2013.
2. S.M. Yahya, Fundamentals of Compressible Flow with Aircraft and Rocket propulsion, New Age International (P) Limited, 4th Edition, 2010.
3. Sutton, G.P. Rocket Propulsion Elements, John wiley, 2010, New York.
4. Radhakrishnan, E., Gas Dynamics, Printice Hall of India, 8th edition, 2010.
5. Shapiro, Dynamics and Thermodynamics of Compressible Fluid Flow, prentice hall, 6th edition, 2009.
6. Yahya. S. M., “Fundamental of compressible flow”, New Age International (p) Ltd., New Delhi, Seventh Edition (2007).
7. Patrich.H. Oosthvizen, William E. Carscallen, “Compressible fluid flow”, McGraw-Hill, Second edition 2013.
8. Ahmed F. El-Sayed “Aircraft Propulsion and Gas Turbine Engines”, CRC Press, 2008.

PROFESSIONAL ELECTIVE – III & IV

UMEE205	NANO TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives

- To present and provide a broad view of the emerging field of Nano science and Nano technology to undergraduates
- To introduce students to inter- and multi-disciplinary science and engineering.
- The students can apply the concept of Nano Technology.

Course Content

History of nanoscience -revolution of nanotechnology, Properties at nanoscale (optical, electronic and magnetic). Theory, definitions and scaling. Metal and Semiconductor Nanomaterials, Quantum Dots, Wells and Wires, Molecule to bulk transitions Bucky balls and Carbon Nanotubes.

Top-down and bottom up approaches- (Photolithography and its limitation-Electron-beam lithography (EBL)- Nano imprint – Soft lithography patterning)-Chemical Methods: Metal Nanocrystals by Reduction – Solvothermal Synthesis- Photochemical Synthesis - Sonochemical Routes- Sol-gel processing-Chemical Vapor Deposition (CVD) – Metal Oxide - Chemical Vapor Deposition (MOCVD).

Physical Methods: Ball Milling – Electrode position - Spray Pyrolysis - Flame Pyrolysis - DC/RF Magnetron Sputtering - Molecular Beam Epitaxy (MBE). XRD, TEM, SEM and SPM technique, Fluorescence Microscopy and Imaging.

Solar energy conversion and catalysis, Molecular electronics and printed electronics Nanoelectronics, Polymers with a special architecture, Liquid crystalline systems, Linear and nonlinear optical and electro optical properties, Applications in displays and other devices, Advanced organic materials for data storage, Photonics, Plasmonics ,Chemical and biosensors, Nanomedicine and Nanobiotechnology.

References

1. Pradeep T., “A Textbook of Nanoscience and Nanotechnology”, Tata McGraw Hill Education Pvt. Ltd., 2012.
2. Hari Singh Nalwa, “Nanostructured Materials and Nanotechnology”, Academic Press, 2002.
3. Nabok A., “Organic and Inorganic Nanostructures”, Artech House, 2005.
4. Dupas C., Houdy P., Lahmani M., “Nanoscience: Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
5. Jeremy J. Ramsden., “Applied Nanotechnology: The Conversion of Research Results to Products”, William Andrew, 2018.

UMEE206	MACHINE VISION	L	T	P	C
		3	0	0	3

Course Objectives

- To develop an in depth understanding of the machine vision system and its components applied to various disciplines with an ability to design advanced control systems in real life problems.

Course content

Machine vision fundamental

Machine vision: image acquisition, digital images-sampling and quantization-levels of computation Feature extraction-windowing technique-segmentation-Thresholding-edge detection-binary morphology - grey morphology

Machine vision systems

Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction: Edge detection, Segmentation Feature Extraction and Object Recognition - Algorithms. Applications – Inspection, Identification, Visual Serving and Navigation.

Digital image fundamentals

Elements of digital image processing systems, Vidicon and Digital Camera working principles, Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals - RGB, HSI models, Image sampling, Quantization, dither, Two - dimensional mathematical preliminaries, 2D transforms - DFT, DCT, KLT, SVD.

Image enhancement

Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contra harmonic mean filters, Homomorphic filtering, Color image enhancement

References

1. Kenneth R. Castleman, Digital Image Processing, Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB', Pearson Education, Inc., 2004.
3. D,E. Dudgeon and RM. Mersereau, , Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 2005.
4. William K. Pratt, , Digital Image Processing' , John Wiley, New York, 2012
5. Milan SonkaetaI, 'IMAGE PROCESSING, ANALYSIS AND MACHINE VISION', Brookes/Cole, Vikas Publishing House, 2nd edition, 2009.

UMEE207	NON DESTRUCTIVE TESTING AND EVALUATION	L	T	P	C
		3	0	0	3

Course Objectives

- To study and understand the various Non - Destructive Testing and Evaluation methods, theory and their industrial applications
- To provide a basic understanding with case studies on different surface NDE techniques and apply them for inspecting materials in accordance with industry specifications and standards.
- To familiarize the student with the fundamental principles of nondestructive materials characterization and to introduce them to the most important engineering applications of nondestructive testing (NDT).

Course Content

Introduction to NDT, Visual Optical methods, Dye penetrant testing, Basic principle, Types of dye and methods of application, Developer

Magnetic particle testing, basic theory of magnetism, Magnetization methods, Field indicators, Particle application, Inspection.

Eddy current testing, Basic principle; Faraday's law, Inductance, Lenz's law, Self and Mutual Inductance, Impedance plane, Inspection sy

Ultrasonic testing: Basics of ultrasonic waves, Pulse and beam shapes, Ultrasonic transducers. Test method, Distance and Area calibration, and Weld inspection by UT.

Acoustic emission testing: Basic principle, Sources of acoustic emission, Source parameters, Kaiser-Felicity theory, Equipment and Data Radiography: X-rays and their properties-ray generation-ray absorption and atomic scattering.

Image formation, Image quality, Digital Radiography, Image interpretation, Radiation Shielding. Comparison and selection of NDT methods,

References

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.
2. Ravi Prakash, "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010
3. ASM Metals Handbook, "on Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 2000, Volume-17.
4. Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition New Jersey, 2005
5. Charles, J. Hellier," Handbook of Non-destructive evaluation", McGraw Hill, New York 2001.
6. ASNT, American Society for Non- Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol.7, Ultrasonic Testing
7. Krautkramer, Josef and Hebert Krautkramer, "Ultrasonic Testing of Materials", 3rd Ed, Newyork, Springer- verlag, 1983.

UMEE208	JIGS, FIXTURES AND PRESS TOOLS	L	T	P	C
		3	0	0	3

Course Objectives

- The students will be taught various types of jigs, fixtures and design jigs and fixtures for given components
- Students also will be able to estimate the tonnage requirements of various dies and learn various components of dies.
- Students will also learn cutting, bending, drawing and forming dies. The course will also impart knowledge on combination dies also.

Course Content

Tool design objectives, Materials used in Jigs and Fixtures, Types of Jigs, Types of Fixtures, Mechanical actuation, pneumatic and hydraulic actuation. Analysis of clamping force, Tolerance and error analysis.

Types of jigs, plate, latch, channel, box, post, angle plate, angular post, turnover, pot jigs. Automatic drill jigs. General principles of boring, lathe, milling, broaching, grinding, planning, shaping, assembly, inspection, welding and modular fixtures. Design and development of jigs and fixtures for given components

Press working terminology, Presses and accessories. Computation tonnage requirements. Elements of progressive, combination and compound dies. Die block, die shoe, bolster plate, punch plate, punch holder guide pins and bushes. Strippers, knockouts, stops, pilots. Selection of standard die sets, strip lay out calculations.

Design and development of progressive and compound dies for blanking and piercing operations. Design of combination dies. Design and development of bending, drawing and forming dies.

Use of Design Data book is permitted.

References:

1. Cyrll Donaldson, George H. LeCain, V.C. Goold, “Tool Design”, Tata McGraw Hill Publishing Company Ltd., 2012.
2. Edward G Hoffman, “Jigs and Fixture Design”, Ceneage Learning India Pvt Limited, New Delhi, 2008(Fifth edition).
3. Joshi, P.H., “Jigs and Fixtures”, Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2010.
4. Joshi, P.H., “Press Tools Design and Construction”, S. Chand and Company Limited, New Delhi, Reprint 2012.
5. Albert A Dowd “Tool Engineering: Jigs and Fixtures” Classic edition, Forgotten books Reprint 2017.

UMEE301	MECHATRONICS	L	T	P	C
		3	0	0	3

Course Objectives

- To impart knowledge to the students about fundamentals of mechatronics systems, various sensors and actuation systems.
- To understand the concepts of microprocessor, microcontroller, PLC. The students will also learn about the programming methods and integration of peripherals to the microcontroller.
- Students will also learn to design a mechatronic system for commercial applications and MEMS.

Course Content

Introduction to Mechatronics – Basic Elements in Mechatronic System-Systems and its Types-Sensors and its Performance Characteristics–LVDT, Strain gauge, Capacitive Sensor, Hall Effect Sensor, Float Sensor, Temperature Sensors and Vision Sensor-Sensors in Manufacturing Systems

Introduction to Actuators-Types Actuation-Fluid Power Actuation Systems-Electrical Actuation Systems–Mechanical Switches–Solenoids–Construction and working principle of Stepper Motor, Servo Motor and its Types-Smart Materials based Actuators

Introduction to Microprocessors-Architecture of Intel 8085-Functions of various blocks and signals- Addressing Modes-Instruction Set-Basic Timing Diagrams-Block Diagram of 8051-Interfacing of Traffic Light, DAC, ADC and Stepper Motor

Introduction to Programmable Logic Controller – Basic Structure – Input / Output Processing – Programming – Mnemonics – Data Handling – Input / Output – Selection of a PLC.

Design Stages in Mechatronics Systems –Traditional and Mechatronic Design Concepts-Case Studies of Mechatronics Systems – Pick and Place Robot-Engine Management System-Automatic Car Park Barrier-Overview of MEMS.

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References

1. Michael B. Histand and David G. Alciatore, “Introduction to Mechatronics and Measurement Systems”, McGraw-Hill International Editions, 2012.
2. Musa Jouaneh, “Fundamentals of Mechatronics,” Cengage Learning, 2011.
3. Lawrence J. Kamm, “Understanding Electro Mechanical Engineering”, An Introduction to Mechatronics, Prentice –Hall of India Pvt., Ltd., 2013.
4. De Silva, "Mechatronics: A Foundation Course", Taylor & Francis, Indian Reprint, 2013.
5. Bolton W, Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, 4th Edition, Pearson Publisher, 2010.

UMEC305	FINITE ELEMENT ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives

- The students will be taught about Mathematical Modeling of field problems in Engineering using Finite Element Analysis technique.
- Students also will be able to analyze one dimensional finite element and two dimensional scalar problems.
- Students will also learn two dimensional vector variable problems. The course will also provide the isoparametric formulation of elements and numerical integration.

Course Content

Introduction - Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Variational formulational of boundary value problems-Weighted Residual Methods. Ritz Technique

One-dimensional second order finite element analysis; bar element- beam element- truss element – solid mechanics and heat transfer problems.One dimensional second order equations-Derivations of shape functions ,stiffness matrix and force vectors-Assembly of matrices.

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation – Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Applicationto Field Problems - Thermal problems

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperatureeffects – Jacobian matrix-Stress calculations – Plate elements.

Iso parametric elements – Shape functions for iso- parametric elements – One and two dimensions –Numerical integration and application to plane stress problems - Matrix solution techniques-Solution techniques to dynamic problems-Introduction to analysis software.

References

1. Seshu, P., “Textbook of Finite Element Analysis”, Prentice-Hall, India, 2010.
2. Segerlind, L.J., “Applied Finite Element Analysis”, John Wiley, 2012.
3. Rao, S.S., “The Finite Element Method in Engineering”, Butterworth Heinemann, 2014
4. Bhatti Asghar M, "Fundamental Finite Element Analysis and Applications", John Wiley & Sons,2013
5. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2002.

PROFESSIONAL ELECTIVE – V & VI

UMEE209	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

Course Objectives

- To provide knowledge and practice using Operations Research Techniques under limited resources for the engineering and business problems.

Course content

Linear Models

The phase of an operation research study – linear programming – graphical method– simplex algorithm – duality – dual simplex methods.

Transportation Models and Network Models

Transportation - assignment models –traveling salesman problem - networks models – shortest route – minimal spanning tree – maximum flow models –project network – CPM and PERT networks – critical path scheduling – sequencing models.

Inventory Models

Inventory models – economic order quantity models – safety stock – reorder point – lead time - quantity discount models - stochastic inventory models

Queuing Models

Queuing models - queuing systems and structures – notation parameter – single server and multi server models – poisson arrival – exponential service – simulation – monte carlo technique – use of random numbers.

Decision Models

Decision models – game theory – two person zero sum games – graphical solution- algebraic solution–replacement models – models based on service life – economic life– single / multi variable search technique.

References

1. Taha Hamdy .A, “Operations Research”, Prentice Hall of India Pvt Ltd., 2016.
2. Frederick K. Hiller, Geralld J. Lieberman, “Introduction to Operations Research”, Tata McGraw Hill Education, 2012.
3. Don. T. Philips, Ravindran A and James Solberg, “Operations Research”, John Wiley and Sons, 2007.
4. Shennoy G.V. and Srivastava U.K., “Operation Research for Management”, Wiley Eastern, 2005.
5. Carl-Louis Sandblom, Giorgio Pederzoli “Operations Research: A Model-Based Approach”, Springer Berlin Heidelberg, 2010.

UMEE210	PROCESS PLANNING AND COST ESTIMATION	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce the process planning concepts to make cost estimation for various products after process planning

Course content

Introduction

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

Process Planning Activities

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning case studies.

Cost Estimation

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of overhead charges- Calculation of depreciation cost

Production Cost Estimation

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop.

Machine time calculations

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding.

References

1. Peter scalon, “Process planning, Design/Manufacture Interface”, Elsevier science technology Books, Dec 2002.
2. Ostwalal P.F. and Munez J., “Manufacturing Processes and systems”, 9 th Edition, John Wiley, 1998.
3. Russell R.S and Tailor B.W, “Operations Management”, 4th Edition, PHI, 2003.
4. Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, 2nd Edition, PHI, 2002.

UMEE211	SUSTAINABLE AND GREEN MANUFACTURING	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the concept, methods, tools, some technologies and operations of sustainable lean and green manufacturing systems.
- To understand the assessment, audit, design and maintenance of sustainable green manufacturing products, processes, service systems, and leads towards the entire green process.

Course Content

Introduction to lean sustainable green manufacturing - Analytical methods - computational assessment and design tools for evaluating - designing green manufacturing sustainability processes, requirements, and risks.

Energy sources - Renewable – Non renewable sources of energy, Environmental effects of energy extraction - conversion and use - sources of pollution from energy technologies (both renewable and non renewable) - primary and secondary pollutants - consequence of pollution and population growth - air, water, soil, thermal, noise pollution - cause and effect; pollution control methods - sources and impacts - environmental laws on pollution control

Criteria for choosing appropriate green energy technologies - life cycle cost; the emerging trends – process/product innovation, The sustainable lean - green audit process. International green manufacturing standards - compliance. Green rapid prototyping - Green flexible automation. - Green collaboration processes via the Internet - Alternative energy resources

Globally green manufacturing supply chains - logistic networks. Sustainable green manufacturing system design - project management. International industrial and research case studies from the USA, Europe, Japan, Hong Kong, China and elsewhere.

References

1. Charles Wankel “21st century management : a reference handbook” SAGE Publications, Inc., 2012.
2. Christian N. Madu “Handbook of environmentally conscious manufacturing” London : Kluwer Academic Publishers, 2011.
3. T.E. Graedel & B.R. Allenby “Industrial Ecology” Pearson Education, Inc. 2013.
4. Joseph Sarkis “Greener manufacturing and operations: from design to delivery and back’ Greenleaf Pub., 2015.
5. Energy and the Environment, 2nd Edition, John Wiley, 2010, ISBN:9780471172482; Authors: Ristinen, Robert

UMEE2012	INDUSTRY 4.0	L	T	P	C
		3	0	0	3

Course Objectives

- The objective of the course is to help the students to understand the constraints and opportunities involving around evolution of automation industry with help of modern day computers.

Course content

Introduction

Introduction to industrial revolution-First Industrial revolution- Second Industrial revolution-Third industrial revolution-Fourth industrial revolution(4.0)-Definition of Industry 4.0-evloving reality-work groups and design principles-benefits and challenges involved in implementation.

Principles of Industry 4.0

Introduction to Integration systems-Horizontal integration-Vertical Integration-levels of automation pyramids-sensors and actuators-systems and connectivity- Interoperability, interconnection, connectivity- Real-time capability- Modularity- Decentralization, autonomous decisions and autonomy

Cyber Physical Systems

Introduction to cyber physical systems-cyber physical system before industry 4.0-Building blocks-Maturity models-roadmaps-characteristics of cyber physical system-evolution of mechatronics systems-adaptronics-condition monitoring-case studies on real time applications of cyber physical systems-track and trace-structural health monitoring.

Internet of Things

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Knowledge Management. Case studies-sensor body-area-network and control of a smart home.

Cloud Computing

Introduction to Cloud Computing including benefits, challenges, and risks-Cloud Computing Models including Infrastructure/Platform/Software – as-a-service-Public cloud, private cloud and hybrid clouds-characteristics of cloud computing-virtualization concepts-Hadoop.

References

1. Computer networking: a top-down approach 5th ed., international ed.: Boston, Mass.: Pearson, cop. 2010
2. John Rhoton ,Cloud Computing Explained: Handbook for Enterprise Implementation 2013 edition, 2013, recursive press
3. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand,StamatisKarnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014
4. Bolton, “Mechatronics”, Printice Hall, 2008

UMEE213	SAFETY ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- The objective of this course is to make students familiar with the important concepts such as environmental safety, fire prevention and electrical safety.
- To gain knowledge on risk and hazard assessment techniques.

Course content

Concepts and Techniques

History of Safety movement –Evolution of modern safety concept- general concepts of management –planning for safety for optimization of productivity –safety policy- Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, safety sampling, evaluation of performance of supervisors on safety.

Environmental Safety

Classification and properties of air pollutants – Pollution sources – Effects of air pollutants on human beings, Animals, Plants and Materials. Classification of water pollutants-health hazards-sampling and analysis of water-water treatment - different industrial effluents and their treatment and disposal – dust monitor – gas analyser, particle size analyser – lux meter-pH meter –gas chromatograph – atomic absorption spectrometer.

Fire Prevention and Explosion Control

Sources of ignition – fire triangle – principles of fire extinguishing – active and passive fire protection- Systems – various classes of fires – A, B, C, D, E – types of fire extinguishers – fire stoppers. Sprinkler-hydrants-stand pipes – special fire suppression systems like deluge and emulsifier, selection criteria of the above installations, reliability, maintenance, evaluation and standards – alarm and detection systems.

Electrical Safety

Energy leakage-clearances and insulation-classes of insulation-voltage classifications-excess energy- current surges-Safety in handling of war equipment-over current and short circuit current-heating effects of current-electromagnetic forces-corona effect. Fuse, circuit breakers and overload relays – protection against over voltage and under voltage – safe limits of amperage – voltage –safe distance from lines-capacity and protection of conductor-joints-and connections

Hazard, Risk Issues and Hazard Assessment

Introduction, hazard, hazard monitoring-risk issue, group or societal risk, individual risk, voluntary and involuntary risk, approaches for establishing risk acceptance levels, Risk estimation. Hazard assessment, procedure, methodology; safety audit, checklist analysis, what-if analysis, safety review, preliminary hazard analysis (PHA), human error analysis, hazard operability studies (HAZOP), safety warning systems.

References

1. C.Ray Asfahl “Industrial Safety and Health management” Pearson Prentice Hall,2003
2. Philip E. Hagan, John Franklin Montgomery, James T. O'Reilly “Accident Prevention Manual” – NSC, Chicago, 2009.
3. John Cadick, “Electrical safety Handbook”, Third Edition, Mc Graw Hill, 2006
4. Gupta, R.S., “Hand Book of Fire Technology” Orient Blackswan,2010
5. Trividi, P,R, “Environmental Pollution and Control”, Paragon-Nivin Shahdara, New Delhi, 2008.

UMEC102	POWER PLANT ENGINEERING	L	T	P	C
		3	0	0	3

Course Objective

- To be familiar with the layout of power plants.
- To be exposed to the basic concepts of cooling, fuel and waste handling system.
- To understand the working principle of nuclear and hydro power plant.
- To understand the working principle of diesel and gas power plant.
- To learn about the economic issues of power plant.

Course content

Layout of power plants

Layout of Steam, Hydel, Diesel, Nuclear and Gas Turbine Power Plants - Combined Power Cycles – Comparison and Selection– Super Critical Boilers, Cogeneration Systems.

Cooling, Fuel and Waste handling systems

Fuel and Ash Handling, Mechanical Stokers, Electrostatic Precipitator, Draught different types, Condenser Types, Cooling Towers.

Nuclear and Hydro power plants

Nuclear Energy – Fission, Fusion Reaction, Types of Reactors, pressurized water reactor, Boiling Water Reactor, Waste Disposal and safety. Hydroelectric power plants – runoff storage and pumped storage type, Selection of Turbines, Governing of Turbines- Micro Hydel developments.

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 - Pumped storage - 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, Second 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.

GENERIC ELECTIVES OFFERED BY DEPARTMENT OF CIVIL ENGINEERING

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

Course Objectives

- To provides 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 Second 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 CHANGES	L	T	P	C
		3	0	0	3

Course Objectives

- To understanding of 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. Henderson-Sellers, A. & K. 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

- The students will be introduced to the components of GIS, Data models and analysis.
- 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. Second. 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. Second 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. Seventh (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. Fifth Edition. Springer, 2012.
5. Anji Reddy M, Remote Sensing and Geographical Information System, Fourth Edition, B S Publications, 2012

GENERIC ELECTIVES OFFERED BY 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 Reengineering-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 PROGRMMING 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 (http://greenteapress.com/wp/thinkpython/)
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, 2005.

GENERIC ELECTIVES OFFERED BY DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UEEG001	ENERGY MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

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

Course Content

Introduction to Energy Management, Buildings assessment, Electrical Systems-Supply Demand Side-Economic operation.

Electric motors-Energy efficient controls and Load Analysis, Efficient Control strategies-Optimal operation, Transformer Loading- Efficiency analysis, Feeder and cable loss evaluation, Optimal Load scheduling, Energy conservation in Lighting Schemes, Power quality issues. Cogeneration-Types and Schemes, Electric loads of Air conditioning & Refrigeration, case studies.

Electricity tariff types; Computer Controls- software-EMS- 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 DeGunther, "Alternative energy for dummies", John Wiley & Sons, May 2010.
4. 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.

UEEG002	MEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objective

- To impart knowledge on operation of instruments used for various physiological measurements and the blood flow measurement techniques.

Course Content

Components of Medical Instrumentation; System Origin of Bio potential; Bioamplifiers: Isolation Amplifier, Differential amplifier, Chopper Amplifier, Instrumentation Amplifier, Bioelectric signals:ECG, EMG,EEG, EOG & ERG and their characteristics; Electrodes for ECG, EEG and EMG; Einthoven triangle; Standard 12-lead configurations; ECG Machine; EMGmachine; 10-20 electrodes placement system for EEG; Heartsound and characteristics; PCG.

Measurement of Blood pressure: Direct Methods and Indirect Methods; Temperature; Respiration rate; Heart rate measurement; Oximetry: Pulse-oximeter; Computerized patient monitoring system; Biotelemetry: Basics components, andits different types; Cardiac output Measuring techniques: Dye Dilution method, Thermo dilutionMethod.

Blood flow measuring techniques: Electromagnetic Type; Ultrasound Blood Flow meter; CardiacArrhythmias; Plethysmography; Cardiac Pacemakers; Defibrillator: ACandDC-types; Heart- Lung Machine; Optical method: Colorimeter, Spectro photometer, Flame photometer; Safety in medical field: Electrical hazard, Micro and Macro shock; Patient safetyprocedures.

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.

UEEG003	PLC PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives

- To understand Programmable Logic Controller and its functions.
- To impart knowledge in various PLC programming methods.

Course Content

Programmable Logic controller-Brief history, difference between PC & PLC, architecture, benefits, PLC cycle Application.

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. Comparison and manipulation instructions, PID instructions, PTO / PWM generation.

Applications of PLC- Case studies of Machine automation, Process automation, Selection parameters for PLC. Introduction to Programmable Automation Controller.

References

1. John W Webb, Ronald A Reis, “Programmable logic controllers: Principles and Applications”, Prentice Hall India, 2003.
2. Frank D Petruzella, “Programmable Logic Controllers ", McGraw Hill Inc, 2005.
3. Kelvin T Erikson, “Programmable Logic Controllers ", Dogwood Valley Press, 2005.
4. Garry Duning, “Introduction to Programmable Logic Controller”, Cengage Learning third Edition, 2006
5. W. Bolten, “Programmable Logic Controller”, Elsevier Newnes Publication fifth Edition, 2009.

UEEG004	RENEWABLE ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives

- To provide knowledge about various renewable energy technologies.
- To gain knowledge about application of various renewable energy technologies.

Course Content

Primary energy sources, renewable vs. non-renewable primary energy sources, renewable energy resources in India, Current usage of renewable energy sources in India, future potential of renewable energy in power production and development of renewable energy technologies.

Solar and wind Power Generation, Energy from Biomass Bio gas generation, types of biogas plants, Application of biomass and biogas plants and their economics.

Energy conversion from Hydrogen and Fuel cells, Geo thermal energy Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, Principles utilization, setting of OTEC plants. Tidal and wave energy: Potential and conversion techniques, mini hydal power plants and their economics.

References

1. John Twidell and Tony Weir, “Renewable Energy Resources” Tyalor and Francis Publications, 2005.
2. Clark W Gellings, “The Smart Grid, Enabling Energy Efficiency and Demand Side Response”, CRC Press, 2009.
3. Krzysztof Iniewski, “Smart Grid & Infrastructure networking”, TATA Mc Graw Hill, 2012 edition.
4. Bin Wu, Yongqiang Lang, Navid Zargari, Power Conversion and Control of Wind Energy Systems. WILEY 2011.
5. J. W. Tester, E. M. Drake, M. W. Golay, M. J. Driscoll, and W. A. Peters, Sustainable Energy: Choosing Among Options. The MIT Press, ISBN 978-0-262-20153-7.

UEEG005	VIRTUAL INSTRUMENTATION & DATA ACQUISITION	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 andInput/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.

GENERIC ELECTIVES OFFERED BY DEPARTMENT OF ELECTRONICS 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 nanoelectronic 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 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 SYSTEMS	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 Javascript 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 DEPARTMENT OF SCIENCE AND HUMANITIES

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

Course Objectives

- To the study of 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
6. 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 by 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. An Introduction to Probability and Statistics by V.K. Rohatgi & A.K. Md. E.Saleh, 3rd Edition, Wiley, 2015
3. Modern Mathematical Statsitics by E.J. Dudewicz & S.N. Mishra, 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.

GNERIC ELECTIVES OFFERED BY DEPARTMENT OF
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)Subbaram N. R., and Viswanathan S., "Handbook of Indian Patent Law and Practice", Printers and Publishers Pvt. Ltd., 2008.
2. Susan K. Sell, "Private Power, Public Law: The globalization of Intellectual Property Rights", Cambridge studies in International relations, Cambridge University Press, 2013.
3. Wadehra, B.L., "Law relating to Intellectual Property", University law publishing company Pvt Ltd, 4th Edition, 2010.
4. 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 ,F.Robert Jacobs ," Operations and Supply Chain Management", SIE , 2014.
5. Leenders, Johnson, Flyn, Fearon, "Purchasing and Supply Management", Tata McGraw Hill, 2010.