

# UTTARAKHAND TECHNICAL UNIVERSITY

## SESSION 2009-10

### LIST OF OPEN ELECTIVES-VII SEMESTER

Effective from the session – 2009-10

[List of Open Elective of 7th Semester for B.Tech. Civil/Electrical/Electrical and Electronics/  
Mechanical & Allied Courses/ Electronics and Communications & Allied Courses/ Instrumentation  
and Control & Allied Courses/Computer Science and Engineering & Allied Courses/ Information  
Technology & Allied Courses/ Biotechnology]

S.No.	P.Code	Subject	Dept.
1.	TOE 01	Non-conventional Energy Resources	Electrical
2.	TOE 02	Reliability Engineering	Electrical
3.	TOE 03	Environment & Ecology	Civil
4.	TOE 04	Geographic Inf. System (GIS) Technology & its Applications	Civil
5.	TOE 05	Entrepreneurship Development Programme	Humanities
6.	TOE 06	Ancient Indian Culture	Humanities
7.	TOE 07	Human Values	Humanities
8.	TOE 08	Quality System & Management	Mechanical
8.	TOE 09	Condition Monitoring & Diagnostics	Mechanical
10.	TOE 10	Value Engineering	Mechanical
11.	TOE 11	Nanotechnology	Mechanical
12.	TOE 12	Solar Energy	Mechanical
13.	TOE 13	Human Resource Management	Mechanical
14.	TOE 14	Advance Material Science	Mechanical
15.	TOE 15	Industrial Instrumentation	Instrumentation & Control
16.	TOE 16	Biomedical Engineering	Instrumentation & Control
17.	TOE 17	Fundamentals of Coding Theory	Electronics & Communication
18.	TOE 18	Consumer Electronics	Electronics & Communication
19.	TOE 19	Artificial Neural Networks & Fuzzy Logic	Electrical
20.	TOE 20	Human Computer Interaction	Computer Science
21.	TOE 21	I T in Business	Information Technology
22.	TOE 22	Artificial Intelligence in Manufacturing	Manufacturing Technology
23.	TOE 23	Health, Hospital and Equipment Management	Biomedical Engineering
24.	TOE 24	Introduction to Medical Physics	Biomedical Engineering
25.	TOE 25	Modern Control System	Electrical
26.	TOE 26	Mechatronics	Electrical
27.	TOE 27	SCADA & Energy Management System	Electrical

**Note: The students will choose any one subject of the course of other than their Engineering Branch.**

## TOE-01 NON-CONVENTIONAL ENERGY RESOURCES

### **Unit I: Introduction**

Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits.

### **Unit II: Solar Cells**

Theory of solar cells. Solar cell materials, solar cell power plant, limitations.

#### **Solar Thermal Energy**

Solar radiation flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

### **Unit III: Geothermal Energy**

Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations.

#### **Magneto-hydrodynamics (MHD)**

Principle of working of MHD Power plant, performance and limitations.

### **Unit IV: Fuel Cells**

Principle of working of various types of fuel cells and their working, performance and limitations.

#### **Thermo-electrical and thermionic Conversions**

Principle of working, performance and limitations.

#### **Wind Energy:**

Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. performance and limitations of energy conversion systems.

### **Unit V: Bio-mass**

Availability of bio-mass and its conversion theory.

#### **Ocean Thermal Energy Conversion (OTEC)**

Availability, theory and working principle, performance and limitations.

#### **Wave and Tidal Wave**

Principle of working, performance and limitations. Waste Recycling Plants

### **Books Recommended:**

1. Andra Gabdel, "A Handbook for Engineers and Economists".
2. A. Mani, "Handbook of Solar radiation Data for India".
3. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.
4. F.R. the MITTRE, "Wind Machines" by Energy Resources and Environmental Series.
5. Frank Kreith, "Solar Energy Hand Book".
6. N. Chermisinogg and Thomes, C. Regin, "Principles and Application of Solar Energy".
7. N.G. Calvert, " Wind Power Principles".
8. W. Palz., P. Chartier and D.O. Hall," Energy from Biomass".

## TOE – 02 RELIABILITY ENGINEERING

### **Unit I: Introduction**

Definition of reliability, types of failures, definition and factors influencing, system effectiveness, various parameters of system effectiveness.

### **Unit II: Reliability Mathematics**

Definition of probability, laws of probability, conditional probability, Bay's theorem; various distributions; data collection, recovery of data, data analysis procedures, empirical reliability calculations.

### **Unit III: Reliability**

Types of system- series, parallel, series parallel, stand by and complex; development of logic diagram, methods of reliability evaluation; cut set and tie set methods, matrix methods event trees and fault trees methods, reliability evaluation using probability distributions, Markov method, frequency and duration method.

### **Unit IV: Reliability Improvements**

Methods of reliability improvement, component redundancy, system redundancy, types of redundancies-series, parallel, series - parallel, stand by and hybrid, effect of maintenance.

### **Unit V: Reliability Testing**

Life testing, requirements, methods, test planning, data reporting system, data reduction and analysis, reliability test standards.

### **Books Recommended:**

1. R.Billintan & R.N. Allan," Reliability Evaluation of Engineering and Systems", Plenum Press.
2. K.C. Kapoor & L.R. Lamberson,"Reliability in Engineering and Design", John Wiley and Sons.
3. S.K. Sinha & B.K. Kale, "Life Testing and Reliability Estimation", Wiley Eastern Ltd.
4. M.L. Shooman, "Probabilistic Reliability, An Engineering Approach", McGraw Hill.
5. G.H.Sandler,"System Reliability Engineering", Prentice Hall.

## TOE-03 ENVIRONMENT AND ECOLOGY

### **Unit I: Environment**

Environment and its components, pollution of environment by human activity, kinds of pollution.

### **Unit II: Water Quality**

Measure of water quality, water quality standards, water treatment; waste water transport and treatment, sludge treatment and disposal.

### **Air Quality**

Sources and effects of air pollution, major air pollutants, air quality control, treatment of emissions, dispersion of air pollutants.

### **Unit III: Solid waste**

Collection of refuse, removal and transport, disposal of refuse.

### **Noise Pollution**

Effect of noise on human health and its control.

### **Unit IV: Ecology**

Ecology and Ecosystems, concept of ecological imbalances, physical and climate factors, biotic components, energy and material flows in ecosystems, human influence on ecosystems.

### **Unit V: Conservation of Natural Resources**

water resources, mineral resources, agricultural and forestry resources, agriculture soil and need of nutrients, fertilizers and pesticides. Brief introduction about environmental legislation and environmental audit.

**Books Recommended:**

1. Vesilind, " Introduction to Environmental Engineering," Thomson Asia Pvt. Ltd. Singapore.

**TOE-04 GEOGRAPHIC INFORMATION SYSTEMS (GIS) TECHNOLOGY AND ITS APPLICATIONS:**

**Unit I**

Definition of GIS, Cartography and GIS, GIS database: spatial and attribute data; Spatial models: Semantics, spatial information, temporal information, conceptual models of spatial information, representation of geographic information: point, line and area features, topology,

**Unit II**

Raster and vector data, raster to vector data conversion, map projection, analytical transformation, rubber sheet transformation, manual digitizing and semi-automatic line following digitizer; Remote sensing data as an input to GIS data;

**Unit III**

Attribute database: scale and source of inaccuracy; GIS functionality; data storage and data retrieval through query, generalization, classification, containment search within a spatial region;

**Unit IV**

Overlay: arithmetical, logical and conditional overlay, buffers, inter visibility, aggregation; Network analysis;

**Unit V**

Applications of GIS in planning and management of utility lines and in the field of environmental engineering, geotechnical engineering, transportation engineering and water resources engineering.

**Books Recommended:**

1. Geographic Information Systems: A Management Perspective, by Stan Arnoff, WDL Publications.
2. Fundamentals of Spatial Information Systems by Robert Laurini and Derek Thompson, Academic Press.
3. Geographical Information Systems, Vo. I and II edited by Paul Longley, M.F. Goodchild, et.al, John Wiley and Sons, Inc. 1999.

**TOE-05 ENTREPRENEURSHIP DEVELOPMENT PROGRAMME**

**Unit I: Entrepreneur**

definition. Growth of small scale industries in developing countries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control type. Government policy for small scale industry; stages in starting a small scale industry.

**Unit II: Project identification**

assessment of viability, formulation, Evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods.

**Unit III: Accountancy**

Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control. Quality control. marketing, industrial relations. sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies.

**Unit IV: Project Planning and control**

The financial functions, cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. Profit planning and programming, planning cash flow, capital expenditure and operations, control of financial flows, control and communication.

### **Unit V: Laws concerning entrepreneur**

partnership laws, business ownership, sales and income taxes and workman compensation act. Role of various national and state agencies which render assistance to small scale industries.

#### **Books Recommended:**

1. Joseph, L. Massod, " Essential of Management", Prentice Hall of India.

### **TOE-06 ANCIENT INDIAN CULTURE**

### **Unit I: Main features of Indian Culture**

- (a) The orient list view                      (b) The nationalist view  
(c) The Marxist view                        (d) Analysis and formulations

#### **Principal Components – historical and archeo-ethic perspective**

- (a) Indian Civilization                      (b) Vedic culture  
(c) Tribal and folk culture                (d) Foreign elements

### **Unit II: Impact of integrating, disintegrating and proliferating forces of History.**

- (a) Eras of political unification            (b) Foreign invasions  
(c) Regional conflicts                        (d) Religious movements  
(e) Trade and Dissemination

### **Unit III: Ideas and Institution**

- a. Political      b. Social  
c. Economic    d. Religious

### **Unit IV: Achievements in Arts, Science and Technology**

- (a) Literature                                  (b) Art and Architecture  
(c) Music and Dance                        (d) Astronomy and Mathematics  
(e) Medicine

### **Unit V: Values and disvalues**

- a. Humanism and spiritualism            b. Ahinsa  
c. Altmism                                      d Caste  
e. Unsociability                              f. Religious suicide and superstition  
g. Degradation of women and prostitution.

#### **Books Recommended:**

1. Ghose Aurobindo, Foundations of Indian culture.
2. Pande, G.C., Foundations of Indian culture, 2 Vols.
3. Coomarswami, dance of Siva
4. Thapar Ramila, Ancient Indian Social History
5. R.s. Sharma, (ed.), Indian Society Historical Probing, People's Publishing House, New Delhi, 1977.
6. Kossambi, Introduction to Indian History.
7. Altekar, A.S., State and Government in Ancient India.
8. Altekar, A.S., Position of Women in Hindu Civilization
9. Prakash, Om, conceptualization and History.
10. Bartam, A.I., Wonder that was India.

## TOE 07 HUMAN VALUES

### **Unit I: Introduction**

1. Nature of value crisis in the contemporary Indian society and the larger human community.
2. Meaning and nature of values; holistic view of life and its value.
3. Conceptualizing 'good' life and its value dimensions.

### **Material and Societal value**

1. Role of material values in promoting human well being.
2. Role of Science and technology; problems of material development.
3. Socio-political ideologies for promoting material wellbeing
4. Conceptualizing 'good' society and 'social goods'
5. Justice as a societal value.
6. Democracy and rule of law.
7. Values in the Indian Constitution.
8. Gandhian concepts of good society; gram swaraj, sarvodaya, antyodaya

### **Unit II : Psychological and Aesthetic Values**

1. Humanistic psychology; meaning of 'personhood'
2. Maslow's hierarchy of human need; characteristics of 'self-actualizing' persons.
3. Mental health
4. Psycho-spiritual Indian concepts.
5. Areas and nature of aesthetic experiences.
6. Nature of beauty; aesthetic sensibilities.

### **Unit III : Ethical and Spiritual Values**

1. Bases for moral judgments : customary morality, religious morality, reflective morality.
2. Some principles of ethics; ethical canons and their significance in modern life.
3. Virtue ethics; personal virtues for the modern times.
4. Ethics of duty and ethics of responsibility.
5. Factors to be considered in making ethical judgments: motives, means and consequences.
6. Spirituality and spiritual values : spiritual wisdom of the Upanishads; Buddha's view.
7. Science, materialism and spirituality.
8. Spirituality in the modern times.

### **Unit IV : Human Values**

1. Different meaning of human values: foundational human values – freedom, creativity, love and wisdom.
2. Nature of Human freedom; individual freedom, intellectual freedom, freedom of will, spiritual freedom.
3. Creativity: its meaning and nature; different kinds of creativity.
4. Creative problem solving.
5. Creative personality, creative environment.
6. Love as a foundational human value; different kinds of love.
7. Human wisdom; characteristics of a wise person.
8. Concepts & Principles of interdependence.

### **Unit V : Work Ethics and Professional Ethics**

1. Different attitudes to work.
2. Demands of work-ethics, ethics at work place.
3. 'Good' organization and its values.
4. What is a profession?
5. Professional ethos and code of professional ethics.
6. IEEE Code of professional ethics.
7. Problems in practicing the code.
8. Case studies.

**Books Recommended:**

1. Human Values By : Prof. A.N. Tripathi New Age International.
2. 7 Habits of Highly By : Dr. Stephen R. Covey Effective People Harper Publications.
3. Wisdom Leadership By : Prof. S.K. Chakraborty Wheeler Publication.

**TOE-08 QUALITY SYSTEM & MANAGEMENT****Introduction**

Definition, need of quality systems, role of quality standards, stages of quality assurance systems. quality charts, control charts for variables and attributes, acceptance sampling.

**Quality Systems**

Overall responsibility for progress of quality systems. quality manuals, procedures and role of auditing, auditing for conformance versus quality for effectiveness, auditing a tool for quality improvement. ISO 9000 quality systems, British Standards BS5750/ISO 9000 origin of standards, requirements, issues associated with implementation.

**Registration**

registration and accreditation in quality system-certification, approval, registration of leading accessors.

**Recommended Books:**

1. Mohamed Isiri, " Total Quality Management for Engineers".
2. Juran, J., " Quality Planning and Analysis, Mc-Graw Hill.
3. James R. Evans,& J.W. Dean," Total Quality-management, Organization and Strategy," Thomson Asia Pvt. Ltd., Singapore.

**TOE – 09 CONDITION MONITORING & DIAGNOSTICS****Unit I**

Productivity, Quality circle in Maintenance, Reliability, Reliability assurance, Maintainability vs. Reliability. Failure analysis, Equipment downtime analysis, breakdown analysis.

**Unit II**

Maintenance type, Breakdown maintenance, Corrective maintenance, Opportunity maintenance, Routine maintenance, Preventive and predictive maintenance, Condition based maintenance systems, Design-out maintenance.

**Unit III**

Equipment health monitoring, Signals, Online & off-line monitoring, Visual & temp. Monitoring, Leakage monitoring, Lubricant monitoring.

**Unit IV**

Ferroggraphy, Spectroscopy, Crack monitoring, Corrosion monitoring, thickness monitoring. Noise/sound monitoring, Smell/Odour monitoring, Thermography.

**Unit V**

Vibration-characteristics, Vibration monitoring-causes, identification, measurement of machine vibration. C.M.of lubes and hydraulic systems, C.M. of pipe lines, Selection of C.M. Techniques, Advantages.

## TOE – 10 VALUE ENGINEERING

### **Unit I: An Overview**

Definition, value engineering recommendations, programmes, advantages. Approach of function  
Evaluation of function, determining function, classifying function, evaluation of costs, evaluation of worth,  
determining worth, evaluation of value.

### **Unit II: VE Job Plan**

Introduction, orientation, information phase, speculation phase, analysis phase. Selection of Evaluation of  
**VE Projects**  
Projects selection, Methods selection, value standards, application of VE methodology.

### **Unit III: Versatility of VE**

VE operation in maintenance and repair activities, value engineering in non hardware projects.

### **Initiating A VE Programme**

Introduction, training plan, career development for VE specialties.

### **Unit IV: Fast Diagramming**

Cost models, life cycle costs

### **Unit V: VE level of Effort**

VE team, Co-coordinator, designer, different services, definitions, construction management contracts,  
value engineering case studies.

### **Recommended Books:**

1. Tufty Herald, G., "Compendium on Value Engineering" The Indo American Society, First Edition, 1983.
2. Miles, L.D., "Techniques of Value Engineering and Analysis:", McGraw Hill second Edition, 1972.
3. Khanna, O.P., "Industrial Engineering and Management", Dhanpat Rai & Sons, 1993.



## TOE-11 NANOTECHNOLOGY

### **Unit I: Introduction to Physics of Solid State**

**Structure:** Size dependence of properties; crystal structures, face centered cubic nano particles; Tetrahedral bounded semiconductor structures; lattice vibrations.

**Energy bounds:** Insulators, semiconductor and conductors; Reciprocal space; Energy bounds and gaps of semiconductors; effective masses; Fermi Surfaces.

**Localized Particles:** Acceptors and deep traps; mobility; Excitons.

### **Unit II: Methods of Measuring Properties**

**Structure:** Atomic Structures; Crystallography; Particle size determination, surface structure.

**Microscopy:** Transmission electron Microscopy; field ion microscopy Scanning Microscopy.

**Spectroscopy:** Infrared and Raman Spectroscopy; Photoemission and X-ray Spectroscopy; Magnetic resonance, optical and vibrational Spectroscopy, Luminescence.

### **Unit III: Properties of Individual Nano particles**

**Metal Nano clusters:** Magic Numbers; Theoretical Modelling of nano particles, Geometric Structure; Electronic Structure; Reactivity; Fluctuations Magnetic Clusters; Bullets to Nano structure.

**Semi conducting Nanoparticles:** Optical Properties; Photofragmentation; Columbic Explosion.

**Rare Gas & Molecular Clusters:** Inert Gas Clusters; Superfluid Clusters molecular clusters.

**Method of Synthesis:** RF Plasma; Chemical methods; thermolysis; pulsed laser methods.

### **Unit IV: Carbon Nanoparticles**

**Carbon Molecule:** Nature of carbon bond; New carbon structures.

**Carbon Clusters:** Small carbon clusters; Discovery of  $C_{60}$ ; Structures of  $C_{60}$ , Alkali doped  $C_{60}$ ; superconductivity in  $C_{60}$ ; Large and smaller fullerenes; other buckyballs.

**Carbon Nano tubes:** Fabrication; structure, Electrical Properties; Vibrational properties, Mechanical Properties. Field emission & Shielding; Computers; Fuel cells, chemicals sensors; catalysis, Mechanical reinforcement.

### **Balle Nanostructure materials:**

Solid Disordered Nanostructure, Nano structured Crystals, Nano structured Ferromagnetism

Basics of Ferromagnetism; Effect of structuring of Magnetic properties, Dynamics of Nanomagnets; Nanopore containment of magnetic particles, Nanocarbon Ferromagnets, Giant & colossal magnetoresistance; Ferrofluids.

### **Unit V: Quantum Wells, Wires and Dots**

Preparation of Quantum Nanostructure; Size and Dimensionality effect, Fermi gas; Potential wells; Partial confinement; Excitons; Single electron Tunneling, Infrared detectors; Quantum dot laser Superconductivity.

Nano-machines & Nano-device, Microelectromechanical systems (MEMS) Nanoelectromechanical systems (NEMS), Fabrication, Nanodevices and Nanomachines. Molecular & Supermolecular switches Applications areas of Nanotechnology in Engineering .

### **Recommended Books**

1. Introduction to Nanotechnology – C.P.Poole Jr F.J. Owens
2. Introduction to S.S. Physics - (7th Edn.) Wiley 1996.
3. Microcluster Physics – S. Sugano & H. Koizuoni Springer 1998
4. Handbook of Nanostructured Materials & Nanotechnology vol.-5. Academic Press 2000

## TOE 12 SOLAR ENERGY

### **Unit I:**

Introduction, Energy alternative, Devices for thermal collection and storage, Thermal applications.

Solar radiation: Instruments for measuring solar radiation, Solar radiation geometry, Empirical equations for prediction the availability of solar radiation, Solar radiation on tilted surfaces.

### **Unit II:**

Liquid flat- Plate Collectors: General performance analysis, Transmissivity, absorptivity, product and overall loss coefficient and heat transfer correlations, Collector efficiency factor, Numerical, Analysis of collectors similar to the conventional collector. Testing procedures, Alternatives to the conventional collector, Numerical.

### **Unit III:**

Solar Air Heaters: Performance analysis of a conventional air heater, Other types of air heaters. Concentrating Collectors: Flat plate collectors with plane reflectors, Cylindrical parabolic collector, Compound parabolic dish collector, Central receiver collector, Numerical.

### **Unit IV:**

Thermal energy storage: Sensible heat storage, Latent heat Storage, Thermochemical storage .Solar distillation: Introduction, working principal of solar distillation, Thermal efficiency of distiller unit, External heat transfer, Top loss coefficient, Bottom and side loss coefficient, Internal heat transfer, Radioactive loss coefficient, connective loss coefficient, Evaporative loss coefficient, Overall heat Evaluation of distillation output, Passive solar stills, Conventional solar still, Basin construction, Thermal analysis of conventional solar still.

### **Unit V:**

Photovoltaic Systems: Introduction doping Fermi level, P-N junction characteristics, Photovoltaic effect, Photovoltaic material, Module, Cell temperature, Numerical. Economic analysis: Introduction, cost analysis.

### **Recommended Books**

1. Solar Energy: Thermal Processes, by Duffie John A, and Beckman W.A, John Wiley and Sons.
2. Solar Energy, by S.P Sukhatme, Tata Mc Graw Hill.
3. Treatise on Solar Energy, by H.P Garg, John Wiley and Sons.

## TOE-13 HUMAN RESOURCE MANAGEMENT

### Unit I

Scope and Importance of Human Resource management, Historical background of Evolution of HRM and HRD in 20th century, Outlining the contemporary role for HRM in organization. Goals of HRM. (Why behavioural approach?)

### Unit II

Manpower as a resource in job related behaviour and individual motivation in a work setting. Various theories of human motivation, Maslow's hierarchy of needs. Needs for achievement, power and affiliation, other theories, group motivation and conflicts.

### Unit III

Manpower planning and recruitment, Testing procedures and their limitations. Reservations in jobs, pre induction training.

### Unit IV

Wage and salary administration-pay roll and compensation. Job analysis and job specification, other pay plans, employment contracts, special compensation plans for example personnel, effect of Financial rewards on individual's performance. Goal setting and performance evaluation, promotion policy, employee satisfaction, turnover.

### Unit V

Assessment of training needs, forces promoting investment in HRD, Human resource development through individual and group efforts. Training analyses and training methods guidelines for individual development, job enlargement and job enrichment, job rotation, special assignment, Sponsored courses cost benefit exercise. Importance of unions, industrial petitions and conflict analysis and resolution . Relevant labour laws.

## TOE-14 ADVANCED MATERIAL SCIENCE

### Unit I: Introduction

**Solid Solution:** Properties of solid solutions and alloys, types binary alloys, Thermal Equilibrium Diagrams, Cooling curves, Eutectic and peritectic alloys, Intermetallic compounds. Heat Treatment Heat treatment principles and processes for Ferrous and non-ferrous metals and alloys, Effect on structures and Properties.

**Unit II: Fatigue & Creep:** Fatigue loading, Mechanisms of fatigue, fatigue curve, Fatigue tests. Design criteria in fatigue, Corrosion fatigue.

### Unit III: Corrosion and its prevention

Mechanism of corrosion, Chemical Corrosion, Electro chemical corrosion, Anodic and Cathodic protection, Forms of metallic coatings. Anodizing, Phosphating.

### Unit IV: Selection of materials for hazardous/ saline environment

Selection of materials of saline/ hazardous environment - Boilers, Steam and Gas turbine and Diesel engine components, Pumping, Machinery, Piping, Engine seating, Propellers and Rudders, Composition strength value and other requirements for materials used. Material standards.

### Unit V: Electrical and Electronics materials

Science and engineering of electrical and electronics materials such as semiconductor, super conductor, its devices and applications.

## TOE-15 INDUSTRIAL INSTRUMENTATION

### Unit I

Basic Measurement principles & Source of Errors, Units of pressure and vacuum, different type of manometer, diaphragm gauges, bellows and force balance type sensors, bourdon gauge, and piezoelectric, capacitive and inductive pressure pickups. Vacuum pressure measurements: McLeod gauge, pirani gauge, thermocouple gauge, Knudsen gauge ionization calibration procedures,

### Unit II

Temperature Measurements: Standards and calibration, Thermal expansion methods, bimetallic thermometer, Liquid-in-gas (thermocouples) common thermocouples, Resistance thermometers, Bulk semiconductor sensors, Radiation thermometers, automatic null balance radiation thermometers. Optical parameters, Case studies of temperature controllers.

### Unit III

Differential pressure flow meters: Bernoulli's theorem, pitot tube orifice, venturi, and flow nozzle. Hot wire and hot film anemometers, constant pressure drop, variable area meters (rotameter), Turbine meters. Electromagnetic flow meters, Ultrasonic flow meter. Measurement of level. Float type gauge, purge method, differential pressure method, conductive and capacitive method, and electromechanical method, use of radio scope for level measurement.

### Unit IV

Measurement of weight: Load cell method, strain gauge, LVDT, piezoelectric, pneumatic and hydraulic load cell, null balance method. Density, Viscosity, pH and conductivity measurement.

### Unit V

Measurement of moisture: Thermal drying method, Distillation Method, Chemical reaction Method, Electrical Method Recorders: Graphic Recorders, Strip Chart Recorders, Circular-chart recorders, Multipoint Recorders and X-Y Recorders.

### **Text Books:**

1. Doebelin / Measurements systems: Application and Design, 4th edition / Tata Mc Graw Hill.
2. S.K Singh, / Industrial instrumentation and control/TMH 2nd edition
3. Eckman/Industrial Instrumentation / Wiley Eastern Ltd.

### **Reference Books: -**

4. Beckwith & Beck /Mechanical Measurements / NaronaPublishers,1988
5. Nakara/Instrumentation: measurements & Analysis/ Tata Mc Graw Hill.
6. Douglas, D.Considine / Handbook of Instrumentation Measurement and Control Mc Graw Hill.

## TOE-16 BIOMEDICAL ENGINEERING

### **Unit I: Introduction:**

Specifications of bio-medical instrumentation system, Man- Instrumentation system Components, Problems encountered in measuring a living system. Basics of Anatomy and Physiology of the body.

**Bioelectric potentials:** Resting and action potentials, propagation of action potential, The Physiological potentials – ECG, EEG, EMG, ERG, EOG and Evoked responses.

**Electrodes and Transducers:** Electrode theory, Biopotential Electrodes – Surface electrodes, Needle electrodes, Microelectrodes. Biomedical Transducers.

### **Unit II: Cardiovascular Measurements:**

Electrocardiography –ECG amplifiers, Electrodes and Leads, ECG recorders –Single channel, Three channel, Vector Cardiographs, ECG System for Stresses testing, Holter recording, Blood pressure measurement, Heart sound measurement. Pacemakers and Defibrillators.

5. Patient Care & Monitoring: Elements of intensive care monitoring, displays, diagnosis, Calibration & Reparability of patient monitoring equipment.

### **Unit III: Respiratory system Measurements:**

Physiology of Respiratory system .Measurement of breathing mechanism – Spirometer. Respiratory Therapy equipments: Inhalators, Ventilators &Respirators, Humidifiers, and Nebulizers & Aspirators. Nervous System Measurements: Physiology of nervous system, Neuronal communication, Neuronal firing measurements.

### **Unit IV: Ophthalmology Instruments:**

Electroretinogram, Electro-oculogram, Ophthalmoscope, Tonometer for eye pressure measurement. Diagnostic techniques: Ultrasonic diagnosis, Eco-cardiography, Ecoencephalography, Ophthalmic scans, X-ray &Radio-isotope diagnosis and therapy, CAT-Scan, Emission computerized tomography, MRI.

### **Unit V: Bio-telemetry:**

The components of a Bio-telemetry system, Implantable units, Telemetry for ECG measurements during exercise, for Emergency patient monitoring.

**Prosthetic Devices and Therapies:** Hearing Aides, Myoelectric Arm, Dia-thermy, Laser applications in medicine.

### **Text Books:**

1. Khandpur R.S.- Biomedical Instrumentation- TMH
2. Venkata Ram,S.K.-Bio-Medical Electronics & Instrumentation (Revised)- Galgotia.

### **Reference Books::**

3. Cromwell- Biomedical Instrumentation and Measurements- PHI
4. Webster, J.G. –Bio- Instrumentation ,Wiley (2004)
5. Ananthi, S. –A Text Book of Medical Instruments-2005-New Age International
6. Carr &Brown –Introduction to Biomedical Equipment Technology – Pearson
7. Pandey & Kumar-Biomedical Electronics and Instrumentation. - Kataria

## TOE-17 FUNDAMENTALS OF CODING THEORY

### Unit I

Purpose of encoding, separable binary codes, Shannon-fano encoding, noiseless coding. Shannon binary encoding, Huffman encoding, discrete coding in presence of noise.

### Unit II

Error detecting and error correcting codes, Hamming single error correcting code, Elias's iteration technique for coding.

### Unit III

Block codes, encoders and decoders for block codes, syndrome and syndrome decoding.

### Unit IV

Cyclic codes. Encoders and decoders for cyclic code, Golay code, BCH code, Reed soloman code.

### Unit V

Convolution coding, code generation, decoding of convolution code, sequential decoding, state and trellis diagram.

### **Text Book:**

1. F. M. Reza, "An introduction to Information theory", Dover Publication Inc.
2. H. Taub and D. L. Schilling, "Principles of communication system" TMH 2nd Ed.

## TOE-18 CONSUMER ELECTRONICS

### Unit I

Audio Systems: Microphones, Loudspeakers, Speaker baffle and enclosure, Acoustics, Mono, Stereo, Quad, Amplifying Systems, Equalizers and Mixers, Electronic Music Synthesizers, Commercial Sound, Theater Sound System

### Unit II

Video Systems and Displays: Monochrome TV, Colour TV standards and systems, TFT, Plasma, HDTV, Digital TV, Video Telephone and Video Conferencing

### Unit III

Domestic Appliances: Washing machines, Microwave ovens, Air- conditioners and Refrigerators, In car computers Office Systems: FAX, Xerox, Telephone Switching System, Mobile Radio System

### Unit IV

Recording and Reproduction Systems: Disc recording and reproduction, Magnetic recording and reproduction, Video tape recording and reproduction, Video disc recording and play back, Distortion and Noise reduction in Audio and Video System

### Unit V

Power Supplies and other systems: SMPS, UPS and Preventive Maintenance, Set Top Boxes, Remote controls, Bar codes, ATM

### **Text Books:**

1. Consumer Electronics S P Bali Pearson ed 2005

## TOE-19 ARTIFICIAL NEURAL NETWORKS & FUZZY LOGIC

### **Unit I: Fundamental Concepts**

Introduction and history, human brain, biological neuron, models of neuron, network architecture, knowledge representation. Error correction learning, Hebbian learning, competitive learning, Boltzmann learning, learning with and without teacher. Artificial neurons. Neural networks and architectures Introduction, neuron signal function, mathematical preliminaries, Feedforward & feedback architecture.

### **Unit II: Geometry of Binary threshold neurons and their networks**

Pattern recognition, convex sets and convex hulls, space of Boolean functions, binary neurons for pattern classification, non linear separable problems, capacity of TLN, XOR solution. Perceptions and LMS Learning objective of TLN, pattern space & weight space, perception learning algorithm, perception convergence theorem, pocket algorithm, a - LMS learning, MSE error surface, steepest descent search,  $\mu$  - LMS and application.

### **Unit III: Back propagation algorithm**

Multilayered architecture, back propagation learning algorithm, practical considerations, structure growing algorithms, applications of FFNN. Statistical Pattern Recognition Bayes' theorem, classical decisions with bayes' theorem, probabilistic interpretation of neuron function, interpreting neuron signals as probabilities, multilayered networks & posterior probabilities, error functions for classification problems.

### **Unit IV: Self Organizing Feature MAP**

Introduction, Maximal eigenvector filtering, principal component analysis, generalized learning laws, competitive learning, vector quantization, maxican hat networks, SOFM, applications of SOFM. Other Networks Generalized RBF networks. Stochastic Machines: simulated annealing, Boltzmann machine, ART.

### **Unit V: Fuzzy Logic**

Introduction, classical & Fuzzy sets, classical & fuzzy relations, membership function, geometry & operations of fuzzy sets, fuzzy rules, rule composition & defuzzification, fuzzy engineering applications, Neural network & fuzzy logic. Fuzzy Neural Control

### **Text Books**

1. Simon Haykin, "Neural Networks", Peal-son Education 2nd edition.
2. Satish Kumar, 'Neural Networks,' Tata McGraw-Hill.

### **Reference Books**

1. Jack M. Zurada, " Introduction to Artificial Neural System," Jaico Publishing House.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications," McGraw-Hill Inc.

## TOE- 20 HUMAN COMPUTER INTERACTION

### Unit I

User centered design of system & interfaces, anatomy and rational of WIMP (Window, Icon, Menus & Pointing Devices ) interfaces.

### Unit II

Dialogue design, Presentation design, user documentation, evaluation / usability testing of user interface.

### Unit III

Ergonomics and Cognitive issues, hypertext and the World Wide Web.

### Unit IV

User centered design, human factors in user-centered design, development & evaluation, Interactive design rapid prototyping.

### Unit V

Designing for usability –effectiveness, learnability, flexibility, attitude and usability goals, criteria for acceptability.

#### **Books Recommended:**

1. Sudifte AG , “Human Computer Interface Design” , 2nd ed, Macmillan ,1995
2. Sheiderman B Designing the user interface, “Strategies for Effective Human Computer Interaction” , 2nd ed. Addison Wesley , 1992

## TOE – 21 IT IN BUSINESS

### Unit I

Business Drivers IT's Competitive Potential Strategic Alignment Strategic Management and Competitive Strategy

### Unit II

Rethinking Business through IT Developing a Competitive Strategy Interorganization Information Systems Business-To-Business Systems Electronic Commerce and Market Systems

### Unit III

Forming a Corporate IT Strategy Developing an Information Architecture

### Unit IV

Incorporating Business Innovation into the Corporate IT Strategy The Changing Role of IT In International business The Changing Global IT Practices

### Unit V

The Impact and value of Information Technology in Competitive Strategy Changing the Focus of Strategy Trends: Beyond 2000

#### **Books Recommended:**

1. Callon, Jack D., “Competitive Advantage Through Information Technology”, McGraw - Hill, 1996
2. Tapscott, Don, “The Digital Economy”, McGraw-Hill, 1996. [DIGI]



## **TOE –22 ARTIFICIAL INTELLIGENCE IN MANUFACTURING**

### **Unit I: Artificial Intelligence**

Definition - Components - Scope - Application Areas; Knowledge - Based Systems (Expert Systems) - Definition - Justification -Structure – Characterization

### **Unit II: Knowledge Sources**

Expert - Knowledge Acquisition – Knowledge Representation - Knowledge Base - Interference Strategies - Forward and Backward Chaining

### **Unit III: Expert System Languages**

ES Building Tools or Shells; Typical examples of Shells. Expert System software for manufacturing applications in CAD, CAPP, MRP , Adaptive control,

### **Unit IV: Robotics**

Robotics, Process control, Fault diagnosis, Failure Analysis; Process Selection, GT etc. Linking expert systems to other software such as DBMS, MIS, MDB.

### **Unit V: Process control and Office automation**

Process control and Office automation. Case studies of typical applications in tool selection, Process selection, Part classification, inventory control, Process Planning etc.

### **Books Recommended:**

1. Artificial Intelligent Hand book, Jhon & Andrew Kusiak.
2. Artificial Intelligent, T. Barnold.
3. Introduction to Artificial Manufacturing Export system, Dan. W. Patterson

## **TOE 23 HEALTH, HOSPITAL AND EQUIPMENT MANAGEMENT**

### **Unit I: HEALTH SYSTEM**

Health organization of the country, the state, the cities and the region, Health Financing System, Organization of Technical Section.

### **Unit II: HOSPITAL ORGANIZATION AND MANAGEMENT**

Management of Hospital organization, Nursing section Medical Sector, Central Services, Technical Department, Definition and Practice of Management by Objective, Transaction Analysis Human relation in Hospital, Importance to Team Work, Legal aspect in Hospital Management.

### **Unit III: REGULATORY REQUIREMENT AND HEALTH CARE CODES**

FDA Regulation, joint commission of Accreditation for Hospitals, National Fire Protection Association Standard, IRPC.

### **Unit IV: EQUIPMENT MAINTENANCE MANAGEMENT**

Organizing Maintenance Operations, Paper Work Control, Maintenance Job, Planning Maintenance Work Measurement and Standards, Preventive Maintenance, Maintenance Budgeting and Forecasting, Maintenance Training, Contract Mainframe.

### **Unit V: TRAINED TECHNICAL PERSONNEL**

Function of Clinical Engineer, Role to be performed in Hospital, Man power Market, Professional Registration, Structure in hospital.

### **Books Recommended:**

1. Cesar A. Caceres and Albert Zara, The practice of Clinical Engineering, Academic Press, 1977.

2. Webster, J.G. and Albert M. Cook, Clinical Engineering Principles and Practices, Prentice Hall Inc. Englewood Cliffs, 1979.
3. Anatomy Kelly, Maintenance planning and control, Butterworth's London, 1984.
4. Hans Pfeiff, Vera Dammann (Ed.) Hospital Engineering in Developing Countries, Z report Eschborn, 1986.
5. Jacob Kline, Handbook of Bio Medical Engineering, Academic Press, San Diego

## **TOE 24 INTRODUCTION TO MEDICAL PHYSICS**

### **Unit I: ATOMIC PHYSICS**

Traditional definition of atom, periodic system of elements, mechanical properties of atom, emission of light and its frequencies. Electromagnetic spectra. Principles of Nuclear Physics — Natural radioactivity, Decay series, type of radiation and their applications, artificially produced isotopes and its application, accelerator principles; Radionuclide used in Medicine and technology.

### **Unit II: INTERACTION WITH LIVING CELLS**

Target theory, single hit and multi target theory, cellular effects of radiation, DNA damage, depression of Macro molecular synthesis, Chromosomal damage.

### **Unit III: SOMATIC EFFECT OF RADIATION**

Radio sensitivity protocol of different tissues in human, LD 50/30 effect of radiation on skin, blood forming organs, lenses of eye, embryo and Endocrinal glands.

### **Unit IV: GENETIC EFFECT OF RADIATION**

Threshold of linear dose effect, relationship, factors affecting frequency of radiation induced mutation, Gene controlled hereditary disease, biological effect of microwave and RF wave. Variation in dielectric constant and specific conductivity of tissues. Penetration and propagation of signals effects in various vital organs, Protection standards.

### **Unit V: PHOTO MEDICINE**

Synthesis of Vitamin D in early and late cataneous effects, Phototherapy, Photo hemotherapy, exposure level, hazards and maximum permissible exposure.

**LASER PHYSICS** — Characteristics of Laser radiation, Laser speckle, biological effects, laser safety

### **Books Recommended:**

1. Moselly, Non Ionising Radiation Adam Hilgar Brustol 1988.
2. Branski. S and Cherski. P 'Biological Effects of Microwave' -Hutchinson & ROSS Inc.

## TOE – 25 MODERN CONTROL SYSTEM

### **Unit I: Introduction to control systems**

Introduction to control systems, properties of signals and systems. Convolution integral, Ordinary differential equation, Transfer function, Pole zero concepts, effect of pole location on performance specification.

### **Unit II: State Space analysis**

State equations for dynamic systems, State equations using phase, physical and canonical variables, realization of transfer matrices, Solution of state equation, concepts of controllability, observability, Controllability and Observability tests.

### **Unit III: Discrete time control systems**

Sampling theorem, Sampled-data systems, the sample and hold element, pulse transfer function, The Z-transform, stability analysis.

### **Unit IV: Stability**

Liapunov's method, generation of Liapunov's function, Popov's criteria, design of state observers and controllers, adaptive control systems, model reference.

### **Unit V: Optimal Control**

Introduction, formation of optimal control problems, calculus of variation, minimization of functions, constrained optimization, dynamic programming, performance index, optimality principles, Hamilton – Jacobian equation, linear quadratic problem, Riccati II equation and its solution, solution of two point boundary value problem

### **Text Books:**

1. K. Ogata, "Modern Control Engineering", Prentice Hall of India.
2. M. Gopal, "Modern Control System", Wiley Eastern.

### **Reference Books:**

3. B.D.O. Anderson and IB. Moore, "Optimal Control System: Linear Quadratic Methods", Prentice Hall International.
4. U. Itkis, "Control System of Variable Structure", John Wiley and Sons.
5. H. Kwakernaak and R. Sivan, "Linear Optimal Control System", Wiley Interscience.

## TOE 26 MECHATRONICS

### **Unit I: Mechatronics and its scope**

Sensors and transducers- Displacement, position & proximity, velocity, force, pressure and level. Signal conditioning amplification, filtering & data acquisition.

### **Unit II: Pneumatic and Hydraulic actuation systems**

Directional control valves, pressure control valves and cylinders. process control valves. Mechanical actuation system-kinematic chains, cams, geartrains. Ratchet & Pawl, dampers, bearings. Electrical actuation system. Mechanical switches- solenoid operated solid state switches, DC, AC & stepper motors. Building blocks of Mechanical spring, mass and damper. Drives- Electrical Drives, Fluid systems, hydraulic, servo, closed loop controllers.

### **Unit III: Elements of Microprocessors & Microcontrollers**

Elements of Microprocessors & Microcontrollers Programmable logic controllers & Communication interface.

### **Unit IV: Case Studies of Mechatronic Systems**

Industrial Robot and its control Automobile Engine Control Electromechanical disc-control.

## **Unit V: Veil suspension Control**

Micro mechanical systems. Computer Printer, VCR, Fax Machine, NC Machine.

### **Books Recommended:**

1. Rolf Isennann, " Mechatronics Systems", Springer, 2005.
2. W. Bolten, "Mechatronics", Pearson Education 2003.

## **TOE 27 SCADA & ENERGY MANAGEMENT SYSTEM**

### **Unit I: SCADA**

Purpose and necessity, general structure, data acquisition, transmission & monitoring. general power system hierarchical Structure. Overview of the methods of data acquisition systems, commonly acquired data, transducers, RTUs, data concentrators, various communication channels- cables, telephone lines, power line carrier, microwaves, fiber optical channels and satellites.

### **Unit II: Supervisory and Control Functions**

Data acquisitions, status indications, majored values, energy values, monitoring alarm and event application processing. Control Function: ON/ OFF control of lines, transformers, capacitors and applications in process in industry - valve, opening, closing etc. Regulatory functions: Set points and feed back loops, time tagged data, disturbance data collection and analysis. Calculation and report preparation.

### **Unit III: MAN- Machine Communication**

Operator consoles and VDUs, displays, operator dialogues, alarm and event loggers, mimic diagrams, report and printing facilities.

### **Unit IV: Data basis**

SCADA, EMS and network data basis. SCADA system structure - local system, communication system and central system. Configuration- NON-redundant- single processor, redundant dual processor. multicontrol centers, system configuration. Performance considerations: real time operation system requirements, modularization of software programming languages.

### **Unit V: Energy Management Center**

Functions performed at a centralized management center, production control and load management economic dispatch, distributed centers and power pool management.

### **Books Recommended:**

1. Torsten Cergrell, " Power System Control Technology", Prentice Hall International.
2. George L Kusic "Computer Aided Power System Analysis", Prentice Hall of India,
3. A. J. Wood and B. Woolenberg, "Power Generation Operation and Control", John Wiley & Sons.
4. Sunil S Rao, "Switchgear Protection & Control System" Khanna Publishers 11<sup>th</sup> Edition.