

# U.P. TECHNICAL UNIVERSITY, LUCKNOW

## LIST OF OPEN ELECTIVES

Effective from the session – 2007-08

[List of Open Elective of 7<sup>th</sup> Semester for B.Tech. Civil/Electrical/Electrical and Electronics/Mechanical & Allied Courses/Manufacturing Technology/Electronics and Communications & Allied Courses/ Instrumentation and Control & Allied Courses/Computer Science and Engineering & Allied Courses/ Information Technology & Allied Courses/ Agriculture (Old)/ Biotechnology/Marine Engg./Biomedical Engg. Courses.]

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	Electronics & Communication
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**

**1. Introduction**

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

**2. Solar Cells:**

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

**3. Solar Thermal Energy:**

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

**4. Geothermal Energy:**

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

**5. Magneto-hydrodynamics (MHD):**

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

**6. Fuel Cells:**

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

**7. Thermo-electrical and thermionic Conversions:**

Principle of working, performance and limitations.

**8. 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.

**9. Bio-mass:**

Availability of bio-mass and its conversion theory.

**10. Ocean Thermal Energy Conversion (OTEC):**

Availability, theory and working principle, performance and limitations.

**11. Wave and Tidal Wave:**

Principle of working, performance and limitations. **Waste Recycling Plants**

**References:**

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

**1. Introduction:**

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

**2. 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.

**3. 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.

**4. Reliability Improvements:**

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

**5. 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 Wiely and Sons.
3. S.K. Sinha & B.K. Kale,"Life Testing and Reliability Estimation", Wiely 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

**1. Environment:**

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

**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.

**Solid waste:**

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

**Noise Pollution:**

Effect of noise on human health and its control.

**2. Ecology:**

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

**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.

**References:**

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

**TOE-04****GEOGRAPHIC INFORMATION SYSTEMS (GIS) TECHNOLOGY  
AND ITS APPLICATIONS:****UNIT - 1**

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, topography,

**UNIT - 2**

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 - 3**

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 - 4**

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

**UNIT - 5**

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.

**References:**

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 Longely, M.F. Goodchild, et.al, Jhon Wiley and Sons, Inc. 1999.

**TOE-05**

**ENTREPRENEURSHIP DEVELOPMENT PROGRAMME**

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.

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.

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.

**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.

Laws concerning entrepreneur viz, 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.

**Reference:**

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

**OE-06**

**ANCIENT INDIAN CULTURE**

**UNIT - 1**

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 - 2**

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 - 3**

Ideas and Institution

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

#### **UNIT - 4**

Achievements in Arts, Science and Technology

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

#### **UNIT - 5**

Values and disvalues

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

#### **References:**

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**

**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.

**Unit-I : Material and Societal value**

1. **Role of material values in promoting human wellbeing.**
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-actualising' 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 judgements: 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 practising the code.
8. Case studies.

#### ***Text Books & References :***

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**

#### **1. 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.

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

**References:**

1. Mohamad 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, Organisation 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**

Ferrography, 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****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.

**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.

**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 specialities.

**Fast Diagramming**

Cost models, life cycle costs.

**VE level of Effort**

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

**References:**

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

### A. Introduction to Physics of Solid State:

1. **Structure:** Size dependence of properties; crystal structures, face centered cubic nanoparticles; Tetrahedrally bounded semiconductor structures; lattice vibrations.
2. **Energy bounds:** Insulators, semiconductor and conductors; Reciprocal space; Energy bounds and gaps of semiconductors; effective masses; Fermi Surfaces.
3. **Localized Particles:** Acceptors and deep traps; mobility; Excitons.

### B. Methods of Measuring Properties:

1. Structure : Atomic Structures; Crystallography; Particle size determination, surface structure.
2. Microscopy : Transmission electron Microscopy; field ion microscopy Scanning Microscopy.
3. spectroscopy: Infrared and Raman Spectroscopy; Photoemission and X-ray Spectroscopy; Magnetic resonance, optical and vibrational Spectroscopy, Luminescence.

### C. Properties of Individual Nano particles

1. Metal Nano clusters: Magic Numbers; Theoretical Modelling of Nanoparticles; Geometric Structure; Electronic Structure; Reactivity; Fluctuations Magnetic Clusters; Bullets to Nano structure.
2. Semi conducting Nanoparticles: Optical Properties; Photofragmentation; Coulombic Explosion.
3. Rare Gas & Molecular Clusters: Inert Gas Clusters; Superfluid Clusters molecular clusters.
4. Method of Synthesis: RF Plasma; Chemical methods; thermolysis; pulsed laser methods.

### D. Carbon Nanoparticles:

1. **Carbon Molecule:** Nature of carbon bond; New carbon structures.
2. **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.
3. **Carbon Nano tubes:** Fabrication; structure, Electrical Properties; Vibrational properties, Mechanical Properties.
4. **Appls:** Field emission & Shielding; Computers; Fuel cells, chemicals sensors; catalysis, Mechanical reinforcement.

**E. Balle Nanostructured materials:**

1. Solid Disordered Nanostructure.
2. Nanostructured Crystals

**F. Nanostructured Ferromagnetism**

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

**G. Quantum Wells, Wires and Dots**

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

**H. Nano-machines & Nano-device**

Microelectromechanical systems (MEMS) Nanoelectromechanical systems (NEMS), Fabrication, Nanodevices and Nanomachines.

Molecular & Supermolecular switches Applications areas of Nanotechnology in Engineering .

**Books**

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

**TOE 12  
SOLAR ENERGY**

**UNIT-1**

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.

8

**UNIT-2**

Liquid flat- Plate Collectors: General performance analysis, Transmissivity-absorptivity product and overall loss coefficient and heat transfer correlations, Collector efficiency factor, Numericals,

Analysis of collectors similar to the conventional collector. Testing procedures, Alternatives to the conventional collector, Numericals.

8

**UNIT-3**

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, Numericals.

8

**UNIT-4**

Thermal energy storage: Sensible heat storage, Latent heat Storage, Thermo-chemical 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.	8
<b>UNIT-5</b>	
Photovoltaic Systems: Introduction doping Fermi level, P-N junction characteristics, Photovoltaic effect, Photovoltaic material, Module, Cell temperature, Numericals.	
Economic analysis: Introduction, cost analysis.	8

**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**

<b>Unit-I</b>	
Scope and Importance of Human Resource management, Historical background of Evolution of HRM and HRD in 20 <sup>th</sup> century, Outlining the contemporary role for HRM in organization. Goals of HRM. (Why behavioural approach?)	8
<b>Unit-II</b>	
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.	8
<b>Unit-III</b>	
Manpower planning and recruitment, Testing procedures and their limitations. Reservations in jobs, pre induction training.	5
<b>Unit-IV</b>	
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 individuals performance.	5
Goal setting and performance evaluation, promotion policy, employee satisfaction, turnover.	4
<b>Unit-V</b>	
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.	7
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.

**Fatigue & Creep**

Fatigue loading, Mechanisms of fatigue, fatigue curve, Fatigue tests. Design criteria in fatigue, Corrosion fatigue.

**UNIT II**

**Corrosion and its prevention**

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

**UNIT III**

**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 IV**

**Electrical and Electronics materials**

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

TOE-15  
**INDUSTRIAL INSTRUMENTATION**

**Unit-1**

1. Basic Measurement principles & Source of Errors.
2. 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-2**

3. 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- 3**

4. 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-4**

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

#### **Unit-5**

7. Measurement of moisture: Thermal drying method, Distillation Method, Chemical reaction Method, Electrical Method
8. 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 / Narosa Publishers, 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 -1**

1. 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.
2. Bioelectric potentials: Resting and action potentials, propagation of action potential, The Physiological potentials - ECG, EEG, EMG, ERG, EOG and Evoked responses.
3. Electrodes and Transducers: Electrode theory, Biopotential Electrodes - Surface electrodes, Needle electrodes, Microelectrodes. Biomedical Transducers.

#### **Unit-2**

4. Cardiovascular Measurements: Electrocardiography -ECG amplifiers, Electrodes and Leads, ECG recorders -Single channel, Three channel, Vector Cardiographs, ECG System for Stress 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-3**

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

### **Unit-4**

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

### **Unit-5**

- 10 Bio-telemetry: The components of a Bio-telemetry system, Implantable units, Telemetry for ECG measurements during exercise, for Emergency patient monitoring.
- 11 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 2<sup>nd</sup> Ed.

**TOE-18**  
**CONSUMER ELECTRONICS**

**UNIT 1**

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

**UNIT 2**

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

**UNIT 3**

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

**UNIT 4**

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 5**

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,  $\alpha$  - 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-HIII.

**Reference Books**

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

#### **References:**

1. Sudifite AG , "Human Computer Interface Design" , 2<sup>nd</sup> ed, Macmillan ,1995
2. Sheiderman B Designing the user interface, "Strategies for Effective Human Computer Interaction" , 2<sup>nd</sup> 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

#### **References:**

1. Callon, Jack D., "Competitive Advantage Through Information Technology", McGraw - Hill, 1996 [CALL]
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 - Inference 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, 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. Case studies of typical applications in tool selection, Process selection, Part classification, inventory control, Process Planning etc.

### **References**

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 organisation of the country, the state, the cities and the region, Health Financing System, Organisation of Technical Section.

### **UNIT II**

#### **HOSPITAL ORGANIZATION AND MANAGEMENT**

Management of Hospital organisation, 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 Foirecasting, 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.

### REFERENCES BOOKS

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, Butterworths 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 1988.
6. R.C. Goyal, Handbook of Hospital Personal Management, Prentice Hall of India, 1993.

## 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; Radionuclides 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 cutaneous effects, Phototherapy, Photo hemotherapy, exposure level, hazards and maximum permissible exposure.

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

### REFERENCE BOOKS

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

## TOE - 25

### MODERN CONTROL SYSTEM

#### 1. Design of Control System in State Space:

Review of controllability and observability, controller design by pole placement, Ackermann's formula, design of full order and minimum order state observers, steady state error design via integral control.

#### 2. Robust Control Systems:

Robust control. Quadratic Performance Index, state regulator and output regulator problems. control configurations, state regulator design through the Lyapunov equation, optimal state regulator through the matrix Riccati equation, model reference control.

#### 3. Optimal Control:

Basic mathematical concepts, conditions for optimality, variational calculus approach, Pontryagin's maximum principle and Hamilton Jacobi-Bellman theory, structures and properties of optimal systems.

#### 4. Variable Structure System:

Concept of variable structure system (VSS), switching of structure in **sliding** region, VSS for control of second order system, applications of VSS in power system.

#### References:

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

## MECHATRONICS

### 1. Mechatronics and its scope:

**Sensors and transducers- Displacement, position & proximity, velocity, force, pressure and level.**

Signal conditioning amplification, filtering & data acquisition.

### 2. 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, closedloop controllers.

### 3. Elements of Microprocessors & Microcontrollers, Programmable **logic controllers & Communication interface.**

### 4. Case Studies of Mechatronic Systems:

Industrial Robot and its control

Automobile Engine Control

Electromechanical disc-control.

### 5. Vehicle suspension Control:

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

### References:

1. Rolf Isenmann, " Mechatronics Systems", Springer, 2005.
2. W. Bolten, "Mechatronics", Pearson Education 2003.
3. HMT Ltd, "Mechatronics:", Tata McGraw Hill 1998.

## SCADA & ENERGY MANAGEMENT SYSTEM

### 1. SCADA:

Purpose and necessity, general structure, data acquisition, transmission & monitoring. general power system hierachial 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.

### 2. 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.

### 3. MAN- Machine Communication:

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

### 4. 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.

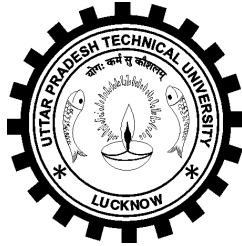
### 5. Energy Management Center:

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

### References:

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.

# U.P. TECHNICAL UNIVERSITY, LUCKNOW



## SYLLABUS OF OPEN ELECTIVES

[Effective from the session – 2007-08]

[B.Tech. Civil/Electrical/Electrical and Electronics/Mechanical & Allied Courses/Manufacturing Technology/Electronics and Communications & Allied Courses/ Instrumentation and Control & Allied Courses/Computer Science and Engineering & Allied Courses/ Information Technology & Allied Courses/ Agriculture (Old)/ Biotechnology/Marine Engg./Biomedical Engg. Courses]