Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Electronics & Communication Engineering

(Applicable from the academic session 2018-2019)

Semester-VI

EC601	**Control System and Instrumentation**	**3L:0T:0P**	**3 credits**

Introduction to control problem- Industrial control examples, Transfer function, open loop and closed loop (Feedback) control systems, Block diagram and Signal Flow Graph (SFG) analysis.

[6L].

Feedback control systems- Stability concept- relative stability, Routh stability criteria, steady state error (SE), steady state accuracy, disturbance rejection, insensitivity and robustness, proportional (P), integral (I) and derivative (D)controller, Realization of PID controllers with op-amp and digital implementation. Feed forward and multi loop control configurations.

[6L].

Time response of second order systems, Steady state Error (SE) and error constants, Performance specifications in time domain. Root locus method of design. Lead and Lag compensations.

[4L].

Frequency response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Performance specifications in frequency domain.

[6 L].

State Variable Analysis- Concepts of state, state variable, State Transition Matrix (STM), Solution for state variable of homogeneous and nonhomogeneous state equations, Transfer function with state space approach, Concepts of controllability and observability of systems.

[4 L].

Nonlinear control systems- Basic concepts and analysis- Describing function. Introduction to optimal control problem, regulator problem, output regulator, tracking problem.

[2 L].

CRO- measurement with it and its function with block diagram representation. Wave and Spectrum analyzers- requirements of these instruments and their functions with block diagrams. LVDT. DC and AC servomotors, tacho generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators.

[6L].

Text Books :

1. Automatic Control System: Benjamin Kuo, PHI
2. Modern Control Engineering, Katsuhiko Ogatha, PHI, 5e
3. A.D. Helfrick and W. D. Cooper., "Modern Electronic Instrumentation and Measurement Techniques" ,PHI (EEE).

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Reference

1. Ernest O. Doeblin., "Measurement Systems" , MGH.
2. Control System Engineering, I.J.Nagrath, M.Gopal, New Age, 5e
3. Design of Feedback Control System, Raymond T Stepfani, Oxford University Press, 4e

Course Outcomes (CO):

At the end of this course students will demonstrate the ability to:

1. Characterize a system and find its steady state behavior.
2. Investigate stability of a system using different tests.
3. Design various controllers.
4. Solve linear, non linearand optimal control problems.
5. Study with CRO, Wave analyzer, Spectrum analyzer knowing their functional details.

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EC602	**Computer Network**	**3L:0T:0P**	**3 credits**

Module I

Overview of Data Communication and Networking: [4L]

Introduction; Data communications: components, data representation (ASCII,ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN,WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Physical Level: [6L]

Overview of data(analog & digital), signal(analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;

Module II

Data link Layer: [5L]

Types of errors, framing(character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC;

Medium Access sub layer: [5L]

Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional

Ethernet, fast Ethernet(in brief);

Module III

Network layer: [8L]

Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : IP addressing, subnetting; Routing : techniques, static vs. dynamic routing , Unicast Routing Protocols: RIP, OSPF, BGP; Other Procols: ARP, IP, ICMP, IPV6;.

Transport layer: [4L]

Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm,

Module IV

Application Layer [5L]

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls.

Modern topics: [5L]

ISDN services & ATM, DSL technology, Cable Modem:
Architecture & Operation in brief Wireless LAN: IEEE 802.11,
Introduction to blue-tooth.

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Text Books:

1. B. A. Forouzan - "Data Communications and Networking (3rd Ed.) " - TMH
2. A. S. Tanenbaum - "Computer Networks (4th Ed.)" - Pearson Education/PHI
3. W. Stallings - "Data and Computer Communications (5th Ed.)" - PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas
7. Miller, Digital & Data Communication, Jaico
8. Shay, Understanding Data Communication & Network, Vikas

Reference Books:

1. Kurose and Rose - " Computer Networking -A top down approach featuring the internet" - Pearson Education
2. Leon, Garica, Widjaja - "Communication Networks" - TMH
3. Walrand - "Communication Networks" - TMH.
4. Comer - "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" - Pearson Education/PHI

HS-HU **601**	**Economics for Engineers**	**3L:0T:0P**	**3 credits**

Module-I

1. Economic Decisions Making - Overview, Problems, Role, Decision making process.
2. Engineering Costs & Estimation - Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - PerUnit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.

Module-II

3. Cash Flow, Interest and Equivalence: Cash Flow - Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest.
4. Cash Flow & Rate Of Return Analysis - Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.

Module-III

5. Inflation And Price Change - Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.
6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.
7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.

Module-IV

8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.
9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.
10. Accounting - Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.

Readings

1. James L.Riggs,David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP

3. John A. White, Kenneth E.Case,David B.Pratt : Principle of Engineering Economic Analysis, John Wiley

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4. Sullivan and Wicks: Engineering Economy, Pearson
5. R.Paneer Seelvan: Engineering Economics, PHI
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

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EC692	**Computer Network Lab**	**0L:0T:2P**	**1 credits**

- IPC (Message queue)
- NIC Installation & Configuration (Windows/Linux)
- Familiarization with o Networking cables (CAT5, UTP) o Connectors (RJ45, T-connector) o Hubs, Switches
- TCP/UDP Socket Programming
- Multicast & Broadcast Sockets
- Implementation of a Prototype Multithreaded Server
- Implementation of o Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window) o Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check) o Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

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EC691	**Control and Instrumentation Laboratory**	**0L:0T:2P**	**1 credits**

1. Familiarization with MATLAB control system toolbox and representation of pole zero and transfer function of control system.
2. Determination of transfer function of a given system from its state model and its vice-versa.
3. Determination of impulse & step response for 2^{nd} order under damped system on CRO & calculation of control system specifications for variation of system design.
4. Determination of root Locus from transfer function and evaluation of system parameters like marginal value of gain, frequency etc. of a given control system.
5. Drawing of Nyquist plot and Bode plot from transfer function of a control system and estimation of relative system parameters like gain margin, phase margin etc.
6. Design PI, PD and PID controller for specified system requirements.
7. Study of static (accuracy, precision, repeatability, linearity) and dynamic (fidelity, speed of response) characteristics of a measuring instrument.
8. Design and study of Instrumentation Amplifier.
9. Study and analysis of electrical signal with CRO.

EC681	**Mini Project/ Electronic Design Workshop**	**0L:0T:4P**	**2 credits**

Guidelines:

1. The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The mini project may be a complete hardware or a combination of hardware and software.

The software part in mini project should be less than 50% of the total work.

3. Mini Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.

8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.

10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing. **Course Outcomes:**

At the end of the course, students will demonstrate the ability to:

1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
2. Design, implement and test the prototype/algorithm in order to solve the conceived problem.
3. Write comprehensive report on mini project work.

MC681	Universal Human Values	2L:0T:0P	0 credits

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and ExperientialValidation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail 12. Programs to ensureSanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-

friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations 28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

3. READINGS:

3.1 Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

3.2 **Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

PE-EC603A	**Introduction to MEMS**	**3L:0T:0P**	**3 credits**

Introduction and Historical Background,

Scaling Effects.

Micro/Nano Sensors, Actuators and Systems overview: Case studies. Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching. Micromachining: Surface Micromachining, sacrificial layer processes, Stiction;

Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding. Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear
Thermal Expansion, Bending; Energy methods, Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.

Text/Reference Book:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

Course Outcomes:

At the end of the course the students will be able to

1. Appreciate the underlying working principles of MEMS and NEMS devices.
2. Design and model MEM devices.

PE-EC603B	**Bio-Medical Electronics**	**3L:0T:0P**	**3 credits**

Brief introduction to human physiology.

Biomedical transducers: displacement,velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases. Bio-electrodes and bio-potential amplifiers for ECG, EMG, EEG, etc.

Measurement of blood temperature, pressure and flow. Impedanceplethysmography. Ultrasonic, X-ray and nuclear imaging.

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificialkidney, aids for the handicapped. Safety aspects.

Text/Reference Books:

1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the application of the electronic systems in biological and medical applications.
2. Understand the practical limitations on the electronic components while handling bio-substances.
3. Understand and analyze the biological processes like other electronic processes.

PE-EC603C	**CMOS VLSI Design**	**3L:0T:0P**	**3 credits**

VLSI Methodologies: Introduction to VLSI design, Moore's Law, VLSI Design flow, Design hierarchy, VLSI

Design style: Full custom, Gate array, standard-cell, Macro cell based design, Field programmable devices, design quality.

MOSFET: Electrical characteristics of MOSFET, Threshold voltage, Body effect, current expression (gradual channel approximation method), Channel length modulation, MOSFET scaling: constant field and constant voltage scaling, Short-channel effects.

Unit process in VLSI and IC fabrication: Unit process in VLSI: Wafer preparation, Oxidation, Diffusion, Ion implantation, Deposition, Metallization, Etching and Lithography. nMOS fabrication, n-well and p-well process .

CMOS Logic Circuits: General CMOS logic structure, VTC of inverter, noise margin, Different types of inverter (resistive load, enhancement and depletion nMOS load and CMOS), Switching

characteristic (propagation delay and parasitic capacitance estimation), NAND, NOR and other complex CMOS logic circuits, Sizing of CMOS logic circuits, CMOS Power: static and dynamic power dissipation, latch-up, sizing for large capacitive load,. Dynamic CMOS logic circuits, charge leakage and charge sharing problem, dynamic gate cascading problem, Domino and NORA logic, Introduction of sequential CMOS logic circuits, Stick diagram. Layout and Layout design rules**.**

Physical Design Automation: Objectives and goals of partitioning, floor planning and placement, Global routing**.**

Text Book

1. CMOS Digital Integrated Circuits – S. Mo. Kang and Yusuf Leblebici, 3rd Ed, TMH 314

Reference Book

1. Digital Integrated Circuits A Design Perspective -Jan M. Rabaey, Prentice-Hall Publication, 2nd Edition.
2. VLSI Design and EDA Tools – Angsuman Sarkar, Swapnadip De & Chandan Kumar Sarkar, Scitech Publication(India) PVT, LTD
3. Basic VLSI Design – D. Pucknell & Eshraghian _PHI, 3rd Edition.
4. Principle of CMOS VLSI Design – Neil H. E. Weste – Pearson Edition, 2nd Edition.
5. CMOS Circuit Design – R. Jacob Baker, Harry W. Li, David E. Boyce – PHI,2003.

PE-EC603D	**Information Theory and Coding**	**3L:0T:0P**	**3 credits**

Basics of information theory, entropy for discrete ensembles; Shannon's noiseless codingtheorem; Encoding of discrete sources.

Markov sources; Shannon's noisy coding theorem and converse for discrete channels;Calculation of channel capacity and bounds for discrete channels; Application to continuous channels.

Techniques of coding and decoding; Huffman codes and uniquely detectable codes;Cyclic codes, convolutional arithmetic codes.

Text/Reference Books:

1. N. Abramson, Information and Coding, McGraw Hill, 1963.

2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
3. R.B. Ash, Information Theory, Prentice Hall, 1970.
4. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the concept of information and entropy
2. Understand Shannon's theorem for coding
3. Calculation of channel capacity
4. Apply coding techniques

OE-EC604A	**Electronic Measurement & Measuring Instruments**	**3L:0T:0P**	**3 credits**

UNIT I:

Block Schematics of Measuring Systems:

Performance characteristics, Static characteristics, Accuracy, Precision,Resolution, Types of Errors, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag;

Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

UNIT II:

Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Capacitance-Voltage Meters, Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulseand Square wave Generators, Function Generators, Arbitrary waveform Generator.

UNIT III:

Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measure ment of Time, Period and Frequency.

Special Purpose Oscilloscopes:Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

UNIT IV:

Transducers:Classification, Strain Gauges, Bounded, unbounded; Force and Displacement

Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Piezoelectric Transducers, MagnetoStrictive Transducers.

UNIT V:

Bridges:Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.

Measurement of Physical Parameters:Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Pressure

-High Pressure,

Vacuum level, Temperature

-Measurements, Data Acquisition Systems.

TEXTBOOKS:

1.Electronic instrumentation: H.S.Kalsi, TMH, 2nd Edition 2004.

2.Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D. Cooper: PHI, 5th Edition, 2003

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REFERENCES:

1. Electronic Instrumentation and Measurements, David A. Bell, Oxford Uiv. Press, 1997.
2.Electronic Measurements and Instrumentation: B. M. Oliver, J. M. Cage TMH Reprint.
3. Measurement Systems, Emest O. Doebelin and Dhanesh N Manik, 6th Ed., TMH.
4. Electronic Measurements and Instrumentations by K. Lal Kishore, Pearson Education, 2010.
5. Industrial Instrumentation: T. R. Padmanabham Spiriger 2009.

OUTCOMES

Upon a successful completion of this course, the student will be able to:

1. Describe the fundamental concepts and principles of instrumentation
2. Explain the operation of various instruments required in measurements
3. Apply the measurement techniques for different types of tests 4. To select specific instruments for specific measurement function.

5.Understand principle of operation and working of different electronic instruments Students will understand functioning, specification and application of signal analyzing instruments

OE-EC604B	**Operating System**	**3L:0T:0P**	**3 credits**

Introduction:
Operating system and functions, Evolution of operating system, Batch, Interactive, Time Sharing, Real Time System, Multi-Threading System.

Operating System Structure:
System Components, System structure, Operating System Services.

Concurrent Processes:
Process concept, Principle of Concurrency, Critical Section problem, Semaphores, Classical problems in Concurrency, Inter Process Communication, Introduction to monitor, Process Generation, Process Scheduling.

CPU Scheduling:
Scheduling Concept, Performance Criteria SchedulingAlgorithm, Evolution, Multiprocessor Scheduling**.**

Deadlock:
System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock combined, approach**.**

Memory Management:
Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Page replacement algorithms, Allocation of frames, Thrashing.

I/O Management & Disk Scheduling:
I/O devices and organization of I/O function, I/O Buffering, DISK I/O, Operating System Design Issues.

File System:
File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues.

Operating system Protection & Security:
Introduction to distributed operating system, Case Studies - The UNIX operating system

Text Book

1. Operating System Concepts, A. Silverschwatz, P. Galvin & G.Gange , Willey

Reference Book

1. Operating System Concepts, Milenekovic, McGraw Hill
2. An introduction to operating system, Dietel, Addision Wesley

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Course Outcome: At the end of the course, the students will be able to:

1. understand the difference between different types of modern operating systems, virtual machines and their structure of implementation and applications.
2. understand the difference between process & thread, issues of scheduling of user-level processes / threads and their issues & use of locks, semaphores, monitors for synchronizing multiprogramming with multithreaded systems and implement them in multithreaded programs.
3. understand the concepts of deadlock in operating systems and how they can be managed / avoided and implement them in multiprogramming system.
4. understand the design and management concepts along with issues and challenges of main memory, virtual memory and file system.
5. understand the types of I/O management, disk scheduling, protection and security problems faced byoperating systems and how to minimize these problems.

OE-EC604C	**Object Oriented Programming**	**3L:0T:0P**	**3 credits**

paradigm:
Evolution of programming paradigm, structured versus object-oriented development, Introduction to Object oriented programming concepts: Objects, classes, encapsulation and abstraction, inheritance, polymorphism, dynamic binding, message passing.

Moving from C to C++:
Introduction to C++, streams based I/O, name space, scope resolution operator (::), variable declaration at the point of use, variable aliases-reference variables, strict type checking, parameter passing by reference, inline function, function overloading, default arguments.

Object and Classes:
Specifying and using classes, access specifies: private, public, functions and data members, default arguments, function overloading, friend functions, static members.
Objects: memory considerations for objects, new and delete operators.
Constructors - default constructor, parameterized constructor, constructor with dynamic allocation, copy constructor, destructors.
Operator overloading- overloading through friend and member functionsBinary operators: arithmetic, relational, assignment , insertion, extractionUnary operators: unary minus , post and pre-increment, post and pre- decrement, Conversion functions : class to basic, basic to class, class to class.

Inheritance:
Derived and base classes, Class hierarchies, public, private, and protected derivations, constructors in derived classes, destructors in derived classes, constructors invocation and data members initialization in derived classes, classes within classes, virtual base class.

Polymorphism:
Pointer to objects, pointer to derived class object, this pointer, run time and compile time polymorphism, virtual functions, pure virtual functions, abstract class, virtual destructor.

Files and Streams:
Introduction to file handling, hierarchy of file stream classes, opening and closing of files, file modes, file pointers and their manipulators, sequential access, random access.

Exception handling and Templates :
Introduction to exception handling, throw point outside try, Multiple catch, Catch-all, throwing objects. Introduction to templates, class templates, function templates

Text Book
1. Object Oriented Programming with C++, E. Balaguruswamy, 6th Edition, 2013 TMG Hill

(Applicable from the academic session 2018-2019)

Reference Book

1. Object Oriented Programming with C++, Reema Thareja, OXFORD University Press, 1st Edition, 2015.
2. C++ completes reference, Herbert Schildt, TMG Hill, 4th Edition, 2002.
3. C++ How to Program, Deitel and Deitel, Pearson Education Asia, 8th Edition, 2011.
4. Object Oriented Programming with Ansi and Turbo C++, Ashok N Kamthane, Pearson Education, 1stEdition, 2003.
5. Object-Oriented Programming in C++, Robert Lafore, CourseSams Publishing, 4th Edition

Course Outcome: At the end of the course, the students will be able to :

1. differentiate between structures oriented programming and object oriented programming.
2. use object oriented programming language like C++ and associated libraries to develop object orientedprograms.
3. understand and apply various object oriented features like inheritance, data abstraction, encapsulation andpolymorphism to solve various computing problems using C++ language.
4. apply concepts of operator-overloading, constructors and destructors.
5. apply exception handling and use built-in classes from STL.