SYLLABUS EFFECTIVE FROM: 2017-18
M. Sc. (INSTRUMENTATION & CONTROL)

M. Sc. (INSTRUMENTATION & CONTROL) – SECOND SEMESTER
PS02CINC21: ANALYTICAL INSTRUMENTATION
Total Marks:100 (External – 70, Internal – 30)

Spectrophotometers (UltraViolet–Visible)**:** Beer-Lambert's Law, Absorption Instruments & Multi - Channel Photometer, Types of IR Spectrophotometers, Sample Handling Techniques, Fourier Transform IR Spectroscopy Technique, Flame Photometry**:** Principle, Components & Interferences

Atomic Absorption Spectrophotometers**:** Instrumentation, Sources of Interferences, Fluorimeters**:** Principle, Measurement & Phosphorescence Spectrometer, Raman Spectrometer, Photo-Acoustic & Photo-Thermal Spectrometers,

Types of Mass Spectrometers, Nuclear Magnetic Resonance Spectrometer, Electron Spin Resonance Spectrometer, Surface Spectroscopic Techniques, Radioactive Radiation Detectors, pH measurement

Chromatography**:** Gas & Liquid (Components & Detection Systems), Thermo Gravimetric Analysis, Differential Thermal Analysis, Differential Scanning Calorimetry, Electrophoresis Techniques, Analyzers**:** Paramagnetic Oxygen, Infrared Gas, Gas Density & Ionization of Gases, Air Pollution Monitoring, Water Pollution Monitoring Techniques.

BOOKS:
1. *Handbook of Analytical Instruments,* R. S. Khandpur, Tata McGraw-Hill.

2. *Principles of Instrumental Analysis,* Douglas A. Skoog, F. James Holler & Timothy A. Nieman, Thomson- Brooks/Cole.

3. *Instrumental Methods of Analysis,* Hobart H. Willard, Lynne L. Merritt Jr., John A. Dean & Frank A. Settle Jr., CBS Publishers & Distributors.

4. *Instrumental Methods of Chemical Analysis,* Gurdeep R. Chatwal & Sham Anand, Himalaya Publishing House.

M. Sc. (INSTRUMENTATION & CONTROL) – SECOND SEMESTER
PS02CINC22: ADVANCED MICROPROCESSOR & MICROCONTROLLERS
Total Marks:100 (External – 70, Internal – 30)

8086 Microprocessor**:** Software Model, Memory Address Space, Input-Output (IO) Address Space, Data Organization, Segment Registers, Memory Segmentation, Dedicated, Reserved & General Use Memory, All Pointers & All Registers, Generating Memory Address, Addressing Modes, Debug Program & Commands, X86 Instructions**:** Data Transfer, Arithmetic, Logic, Shift, Rotate, Flag-Control, Compare, Jump, Subroutine- Handling, Loop-Handling & String Handling and Examples.

System Clock, Bus Cycle & Time States, 8086 Minimum & Maximum Modes, 8086 Memory**:** Hardware Organization of Address Space, Interface Signals, Read & Write Bus Cycles, Interface Circuits, ROM, RAM, Flash Memory.

8086 Minimum & Maximum Mode Input-Output**:** Types, Data Transfers, Instructions, Bus Cycles, Byte Wide Input-Output Ports using Isolated IO, Handshaking & Parallel Printer Interface, Interrupts, Instructions, 82C59A PIC.

ATmega328: Overview and features: internal architecture, memory organization interrupts, inbuilt controller features (ADC, PWM and Timer), Programming concepts, Applications, Arduino platform: Hardware & Software, Types, Implementation of project.

BOOKS:
1. *The 8088 and 8086 Microprocessors - Programming, Interfacing, Software, Hardware and Applications,* Walter A. Triebel and Avtar Singh, Prentice Hall of India Private Limited, New Delhi.

2. *The Intel Microprocessors – Architecture, Programming and Interfacing,* Barry B. Brey, Prentice Hall of India Private Limited, New Delhi.

3. *Microprocessors and Interfacing,* Douglas V. Hall, Tata McGraw-Hill Publishing Company Limited.

4. *Microcomputer Systems: The 8086/8088 Family- Architecture, Programming and Design,* Yu-cheng Liu and Glenn A. Gibson, Prentice Hall of India Private Limited, New Delhi.

5. *Microprocessor Microcomputer and their Applications,* A. K. Mukhopadhyay, Narosa Publishing House.

6. *Programming and Customizing the AVR Microcontroller,* Dhananjay Gadre, TMH

Process Control**:** Definition, Block Diagram, Process Dynamics, Process Variables, Degrees of Freedom, Electromechanical Systems, Techniques & Application based Classification, Actions, Actuator based Control & Examples.

Process Control**:** Objectives, Advantages, Process Model, Physical Model, Control Model, Process Modeling,   Frequency & Time Domain Modeling, Modeling Procedure & Examples, Computer Aided Process Control**:** Role of Computers, Elements, Classification, Architecture, Man Machine Interface & Software Types,

Real Time Operating System & Software, PC based Data Acquisition System, Specifications of Control Systems, Control System Design using Heuristics & Models, Controller Design, Delay in Digital Controllers

Design of Software for Process Control Systems, Software for Modelling & Simulating Control Systems, Cascade Control, Predictive Control, Adaptive Control, Inferential Control, Intelligent Control, Stastical Process Control, Optimal Control, Industrial Control Applications: Cement Plant, Thermal Plant

BOOKS:
1. *Computer-Aided Process Control,* S. K. Singh, Prentice Hall of India Private Limited.

2. *Computer-Based Industrial Control,* Krishna Kant, Prentice Hall of India Private Limited.

3. *Process Control Instrumentation Technology,* Curtis D. Johnson, Pearson Education.

4. *Principles of Computer-Integrated Manufacturing,* S. Kant Vajpayee, Prentice Hall of India Private Limited

Thyristors**:** Turn-On Methods, Series & Parallel Operations, Introduction to Thyristor Family**:** PUT, SUS, SCS, SITH, ASCR , RCT, LASCR, GATT, Diac & Triac, Power Transistors**:** BJT, MOSFET, IGBT & SIT,
Gate Turn Off Thyristor, Field–Controlled Thyristor, MOS-Controlled Thyristor, Power Integrated Circuit

Commutation Techniques**,** Phase Controlled Rectifiers, Three Phase Thyristor Converter, Effect of Source Impedance on the Performance of Converters, Inverters**:** Voltage Control in Single-phase, Series & Parallel

Choppers**:** Principle of Operation, Control Strategies, Step-up, Types & Thyristor Chopper Circuits, Cycloconverters**:** Principle of Operation, Step-up, Step-down, Three-phase to Single –phase, Three-phase to Three –phase, SMPS, UPS

DC Drives**:** Basic Machine Equations, Braking Modes, Schemes for DC Motor Speed Control, Power Factor Improvement, AC Drives**:** Principle of Operation, Induction Motor Equations, Squirrel Cage Rotor Design, Stator Voltage Control, Variable Frequency Control, Rotor Resistance Control & Synchronous Motor Drives.

BOOKS:
1. *Power Electronics,* P. S. Bhimbhra, Khanna Publishers.

2. *Power Electronics,* M. D. Singh & K. B. Khnachandani, Tata McGraw-Hill Publishing Company Limited.

3. *Power Electronics-Circuits, Devices and Applications,* Muhammad H. Rashid, Prentice Hall of India Private Limited.

4. *Power Electronics-Devices and Circuits,* C. M. Pauddar, Jain Brothers.

M. Sc. (INSTRUMENTATION & CONTROL) – SECOND SEMESTER
PS02EINC22 : BOILER INSTRUMENTATION
Total Marks:100 (External – 70, Internal – 30)

Boiler Control and Optimization, Boiler Equipment, Role of Sensors, Safety Interlocks, Boiler Dynamics, Boiler types & classification, Deaeration, Boiler Feed Pump, Introduction of Steam Generator / Boiler, Classification of Boiler, Application of Steam,

Study of different types of Boilers, IBR & Non-IBR Boilers, Boiler mountings & accessories, Draft system, Basic Steam Generator Control, Traditional Air Control, Feed Water & Drum level control, Steam Pressure control, Steam Temperature control, Fuel control, Furnace draft control, Interaction between Airflow & Furnace pressure, Feed Water Control, Single element, Two element, Three element feed-forward control system

Advantages of using Condensers in Power plant, Types of condensers, Introduction of Steam Turbine, Classification of Steam Turbine, Methods to govern Steam Turbine, Turbine – Boiler coordinate system, Types of Pulverizers, Stoker Fired Boiler**:** Principle, Types & Control systems & Working, Fluidized Bed Combustion (FBC) Types, Advantage of FBC Boilers over Conventional Boiler

Conventional-Fossil Fuel Power Plants**:** Steam **/** Thermal, Gas Turbine (GTPP), Diesel & Nuclear Power, GTPP Types, Comparison with Thermal Power Plant & Methods to improve the performance, Non Conventional Power Plants

BOOKS

1. *Process Control (Inst Engineers Handbook),* Liptak, Butterworth Heinemann, Elsevier.

2. *An Introduction to Power Plant Technology*, G. D. Rai, Khanna Publisher.

3. *The Control of Boilers,* S. G. Dukelow .

4. *A Course in Power Plant Engineering*, Arora and Domkundwar, Dhanpat Rai & Co.