Chhattisgarh Swami Vivekanand Technical University, Bhilai (C. G.)

Scheme of Teaching and Examination

B.E. VII SEMESTER

APPLIED ELECTRONICS AND INSTRUMENTATION

S. No.	Board of Studies	Subject Code	Subject Name	Periods Per Week			Scheme of Exam. (Theory/ Practical)			Total Marks	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1	Electronics and Instrumentation	312731(27)	Industrial Electronics	4	1		80	20	20	120	5
2	Electronics and Instrumentation	327732(27)	Analytical Instrumentation	3	1		80	20	20	120	4
3	Electronics and Instrumentation	327733(27)	Advanced Instrumentation	3	1		80	20	20	120	4
4	Applied Electronics and Instrumentation	312734(12)	Power Electronic Devices & Drives	3	1		80	20	20	120	4
5	Professional Elective -2		Refer Table – 2	3	1		80	20	20	120	4
6	Applied Electronics and Instrumentation	312761(12)	Analytical Instrumentation Lab			4	40	-	20	60	2
7	Applied Electronics and Instrumentation	312762(12)	Virtual Instrumentation Laboratory			4	40	-	20	60	2
8	Applied Electronics and Instrumentation	312763(12)	Power Electronic Devices & Drives Laboratory			4	40	-	20	60	2
9	Applied Electronics and Instrumentation	312764(12)	Minor Project			4	100	-	40	140	2
10	Management	312765(76)	Innovative & Entrepreneurial Skills			2	-	-	40	40	1
11	Applied Electronics and Instrumentation	312766(12)	*Practical Training Evaluation/ Library			1	-	-	40	40	1
			Total	**16**	**5**	**19**	**620**	**100**	**280**	**1000**	**31**

L-Lecture, T- Tutorial, P- Practical, ESE- End Semester Examination, CT- Class Test, TA- Teacher's Assessment

* To be completed after VI Semester and before the commencement of VII Semester

Table - 2 (Professional Electives -2)			
S. No.	**Board of Studies**	**Subject Code**	**Subject Name**
1	Applied Electronics and Instrumentation	312741(27)	Data Acquisition System & Technology
2	Electronics and Instrumentation	327742(27)	Instrumentation for Pollution Control
3	Electronics and Instrumentation	327743(27)	Instrumentation & Control in Iron & Steel Industries
4	Electronics and Instrumentation	327744(27)	Robotics & Automation
5	Electronics and Instrumentation	327745(27)	Instrumentation System Reliability
6	Electronics and Instrumentation	327746(27)	Neural Network & Fuzzy Logic Control

Note (1) - 1/4th of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a particular academic session.

Note (2) - Choice of elective course once made for an examination cannot be changed in future examinations

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Branch : **Applied Electronics & Instrumentation** **Semester: VII**
Subject: Industrial Electronics Code : **312731(27)**

Total Theory Periods: **40** Total Tutorial Periods: **10**

No. of class tests to be conducted: **2 (Minimum)** No. of assignment to be submitted: **2(Minimum)**

ESE Duration: Three Hours **Maximum Marks in ESE: 80** **Minimum Marks in ESE : 28**

Course Objective:

1. The course Intend to provide an overview of Industrial Electronics.
2. To study about the various Regulator, Power Supplies & Amplifiers.

Course Outcomes:

1. Completion of Course student will understand the Instruments used in Inudstries.
2. Student will be able to apply this knowledge to various industrial process.
3. Be able to apply this knowledge to design various projects in different field.

UNIT – I : DC Amplifiers

Need for DC amplifiers, DC amplifiers—Drift, Causes, Darlington Emitter Follower, Cascode amplifier, Stabilization, Differential amplifiers—Chopper stabilization, Operational Amplifiers, Ideal specifications of Operational Amplifiers, Instrumentation Amplifiers.

UNIT – II : Regulated Power Supplies

Block diagram, Principle of voltage regulation, Series and Shunt type Linear Voltage Regulators, Protection Techniques— Short Circuit, Over voltage and Thermal Protection.

UNIT – III : Switched Mode & IC Regulators

Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators, Servo Voltage Stabilizer, monolithic voltage regulators Fixed and Adjustable IC Voltage regulators, 3-terminal Voltage regulators-Current boosting .

UNIT – IV : Industrial Applications – I

Industrial timers -Classification, types, Electronic Timers – Classification, RC and Digital timers, Time base Generators. Electric Welding – Classification, types and methods of Resistance and ARC wielding, Electronic DC,Motor Control.

UNIT – V : Industrial Applications – II

High Frequency heating – principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating – principle, material properties, Electrodes and their Coupling to RF generator, Thermal losses and Applications. Ultrasonic – Generation and Applications.

- Text Books:
- Industrial and Power Electronics – G.K. Mithal and Maneesha Gupta, Khanna Publishers.
- Industrial Electronics and Power Control, H.C. Rai, Umesh Publications.
- Reference Books:
- Thyristors and applications – M. Rammurthy, East-West Press.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Branch : **Applied Electronics & Instrumentation** **Semester: VII**

Subject: Analytical Instrumentation Code : **327732(27)**

Total Theory Periods: **40** Total Tutorial Periods: **10**

No. of class tests to be conducted: **2 (Minimum)** No. of assignment to be submitted: **2(Minimum)**

ESE Duration: Three Hours **Maximum Marks in ESE : 80** **Minimum Marks in ESE : 28**

Course Objective:

1. Students will have knowledge about basic analytical instruments.
2. To provide proficient in basic analysis, design, and measurement of analyzers for different gases and chemical compounds.

Course Outcomes:

1. Students' gain knowledge about basic Analytical Instrumentation.
2. Students' gain knowledge about applications of Analytical Instrumentation.
3. Students' gain knowledge about basic types of gas analyzers.

Unit-I: **Fundamental of Analytical Instrumentation:-** Elements of an Analytical Instrument, Sensor And Transducer, Signal Conditioning in Analytical Instruments, Display System, Intelligent Analytical Instrumentation System, PC Based Analytical Instruments.

Unit-II: **Spectrochemical Analysis:-**UV –IR Spectrophotometer: Electromagnetic Spectrum, Law Relating To Absorption Radiation, Absorption Instruments, UV Absorption Spectrophotometers, Photometers. Infrared Spectroscopy: Basic Components of IR Spectrophotometers X – ray spectrometers: X – ray spectrum, Instrumentation for X – ray spectrometry.

Unit-III: **Chromatography:-** Basic Definitions, Gas Chromatography: Basic Parts of Gas Chromatograph, Carrier Gas Supply, Sample Injection System, Detection System. Liquid Chromatography: Column Chromatography, Thin Layer Chromatography, Paper Partition Chromatography.

Unit-VI: **Molecular Analysis:-** Mass Spectrometer: Basic Mass Spectrometer, Principle of Operation, Magnetic Deflection Mass Spectrometer, Time of Flight Mass Spectrometer, Quadrupole Mass Spectrometer, Components of A Mass Spectrometer, Application of Mass Spectrometer. Nuclear Magnetic Resonance Spectrometer: Principle of NMR, Types of NMR Spectrometers. Radiation detector, liquid scintillation counters, pulse height analyzer.

Unit-V: **Industrial Gas Analyzers:-** Types of Gas Analyzers, Paramagnetic Oxygen Analyzer, Magnetic Wind Instruments, Carbon Monoxide, Hydrocarbons, Nitrogen Oxides, Sulphur Dioxide.

Text Books:

1. Khandpur R.S., Hand book of Analytical Instrumentation, TMH

Reference Books:

1. Patranabis, D., Principles of Industrial Instrumentation, TMs Publication, New Delhi.
2. Jones, E.B., Instrument Technology Vol.II, Analytical Instruments, Butterworths Scientific Publication, London.
3. O Riggins, P.T., Basic Instrumentation in Industrial Measurement, Mc-Graw Hill Book Co.
4. Holman, J.P. Experimental Methods of Engineers, Mc-Graw Hill Book Co., Int. Student edition.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Branch : **Applied Electronics & Instrumentation** **Semester: VII**
Subject: Advanced Instrumentation Code : **327733(27)**

Total Theory Periods: **40** Total Tutorial Periods: **10**

No. of class tests to be conducted: **2 (Minimum)** No. of assignment to be submitted: **2(Minimum)**
ESE Duration: Three Hours **Maximum Marks in ESE: 80** **Minimum Marks ESE: 28**

Course Objective:
1. To learn the concept and operation of advance instruments with their application.
2. To provide an overview of nuclear instrument and non destructive instruments.
3. Understanding the concept and working of high frequency measurement and digital instruments.

Course Outcomes:
1. Graduates will have knowledge of principle and working of speed measuring instrument.
2. Graduates will know the concept of non destructive instrument which is used in modern industry.
3. Graduates will have knowledge about EMC and nuclear instruments.
4. Graduates will have knowledge about radiation measurement from various electrical and electronic equipment.
5. Graduate will have knowledge about high frequency measurement.
6. Graduate will have knowledge about analog to digital convertor and digital instruments.

UNIT I: **SPEED & POSITION MEASUREMENT:** Stroboscope, Strobotron, Electrical Tachometer- AC & DC types, Photoelectric Tachometer, velocity measurement: Synchros, Gyroscope, and Introduction of SONAR for navigational system, Introduction of LIDAR & RADAR for speed measurement.

UNIT:II: **NON-DESTRUCTIVE TESTING (NDT):** Introduction, Types of NDT techniques – Microscopic, physical inspection, Dye penetrant, Ultrasonic flaw detection, X-ray, features of smart and intelligent transmitters, Smart and Intelligent temperature, pressure transmitter.

UNIT:III: **EMC & NUCLEAR INSTRUMENTATION:** EMC: Standards, Aspect, Requirement for electronic circuit, Commercial and military requirement, Effect of power supply, grounding, shielding, Instrumentation in hazardous area: classification, intrinsically safe design, NEMA types.Nuclear Instrumentation: Introduction, Types of Radiation, Geiger Muller Tube, Ionization Chamber, Scintillation Counter.

UNIT IV: **FREQUENCY MEASURMENT :** Spectral Analysis, Sept super heterodyne Frequency analysis; Multifilter Real – time spectrum Analyzer, Bolo meter method, calorimeter method, power measurement & monitoring using Directional couplers.

UNIT V: **DIGITAL INSTRUMENTS:** Simultaneous A/D Converter, Stair step – Ramp type A/D converter, signal slope A/D converter, Dual slope A/D converter, SAR (Successive Approximation) type A/D converter, Weighted – Resister D/A converter, Ladder type D/A converter. Digital Multi-meters, Digital frequency meter, Universal Counter, Decade counter, Electronic Counter, Digital P- H meter, Digital phase meter, Digital capacitance meter.

Name of Text Books:

1. Shawney A.K., “Measurement & Measuring Instrument”, Dhanpat Rai & Co
2. H.S. Kalsi “Electronic Instrumentation” second Edition, Tata McGraw Hill publishing company Ltd., New Delhi.
3. Electronic Instruments and Instrumentation Technology, By M. M. S. ANAND. “Instrumentation Measurement and Analysis”,

Name of Reference Books:

1. Oliver cage, “Electronic measurement & Instrumentation” McGraw Hill internationals.
2. Clayton R. Paul, “Introduction to Electromagnetic compatibility ” John Willey & Sons inc 1992.
3. Instrumentation, Measurement and Analysis by Nakra-Chaudhary, Tata McGraw Hill Publications

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Branch : **Applied Electronics & Instrumentation** **Semester: VII**
Subject: Power Electronic Devices & Drives Code : **312734(12)**

Total Theory Periods: **40** Total Tutorial Periods: **10**

No. of class tests to be conducted: **2 (Minimum)** No. of assignment to be submitted: **2(Minimum)**
ESE Duration: Three Hours **Maximum Marks in ESE : 80** **Minimum Marks ESE:28**

Course Objectives –

1. To introduce to students the theory and applications of power electronics systems.
2. To prepare students to know the characteristics of different power electronics switches, drivers and selection of components for different applications.
3. To develop students with an understanding of the switching behavior and design of power electronics circuits.

Course Outcomes –

1. Knowledge about structure and principle of basic components involved in power electronic system.
2. Knowledge about different drives used in power electronic systems.
3. Knowledge about the basic types of power diodes.
4. Knowledge about the various applications of power electronic devices.
5. Knowledge about the need of power electronic devices and controllers.
6. Knowledge about thyristor and its operation.
7. Knowledge about Electric Drives and Fundamental.

UNIT – I : **Fundamental of Power Electronics:** Concept of power electronics, Power electronic converters : Types, advantages, & disadvantages, Power diodes: Structure, Operation, VI characteristics & switching characteristics. Types of power diode, Diode circuits and rectifiers: Diode circuits with DC source, R, RC, RL, LC and RLC loads, Free wheeling diodes, Single phase diode rectifiers.

UNIT – II : **Thyristors:** Structure, Principle of Operation, static VI characteristics, Thyristor turn-on methods, Switching characteristics, Thyristor gate characteristics, Two transistor model of thyristor, Thyristor protection, Other members of thyristor family, GTO, Firing circuits, Thyristor commutation techniques - Class A, Class B, Class C, Class D, Class E & Class F.

UNIT – III : **Rectifier :**
Principle of phase control, performance parameters, single-phase half wave and full wave controlled rectifiers, midpoint and bridge converters, full controlled converters, half controlled converters, comparison between full and half controlled converters, effect and source inductance in single-phase bridge converter.

UNIT – IV: **Choppers:** AC link chopper, DC choppers, Principle of chopper operation, Control strategies, Step down & step up choppers, Types of chopper circuits - Type A, B, C, D & E choppers, Analysis of type A chopper with RLE load. Thyristor chopper circuits : Voltage, Current & load commutated choppers.

UNIT – V: **Electric Drives**
Basic concept of electric drives, choice of electric drives, fundamental torque equation, speed torque Converter and multi quadrant operation, equivalent values of drive parameters, concept of load torque, Calculation of time and energy loss in transient operation, steady state stability

and load equalization,

Text Books:

1. “Power Electronics”, Dr. P.S. Bimbhra, Khanna Publishers.
2. “Industrial & Power Electronics”, Deodatta Shingare, Electrotech Publication.

Reference Books:

1. “Power Electronics Principle and Application”, Michael Jacob, Thomson Delmar Series.
2. “Modern Power Electronics”, P.C Sen, Wheeler Publishers.
3. “Power Electronics: Circuits, Devices & Applications”, Md. H. Rashid, PHI.
4. “Power electronic Systems: Theory and Design”, Jai P. Agrawal, Pearson Education

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C. G.)

Name of Program: **Bachelor of Engineering**
Branch : **Applied Electronics & Instrumentation** **Semester: VII**
Subject : **Analytical Instrumentation Laboratory** Code : **312761(12)**
Total Practical Periods: **36** **Batch Size : 30**
Maximum Marks: **40** **Minimum Marks: 20**

AIM:
This purpose of training in this lab is to impart an adequate knowledge and expertise to handle equipment generally available in an industry.

List of Experiments: (At least ten experiments are to be performed by each student)

Experiments to be performed:

- To measure pH value of given solution pH meter.
- To determine suspended particular matter using right volume air samples.
- Find out concentration of (Na or K) by flame photo meter in the given sample.
- To measure transmittance and absorption of a solution using Single beam spectro photo meter.
- To study water analysis kit & measure pH, temperature, conducitivity,dissolved O2 of a given solution.
- To measure the conductivity of solution indicator controller.
- To study the analysis of flue gases.
- To study ion selective electrode.
- To study pH monitor and controller.
- Study of silica analyzer and zirconia based oxygen analyzer.
- Study calibration technique of analysis.
- Study gas/liquid chromatography.

List of equipments:

pH Meter, Flame photometer, Spectrophotometer, Conductivity meter, Oxygen Analyzer, Chromatograph, Mathanometer and related instruments and chemicals.

- Reference Book:

1. Khandpur R.S., Hand book of Analytical Instrumentation, TMH

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C. G.)

Name of Program: **Bachelor of Engineering**
Branch : **Applied Electronics & Instrumentation** **Semester: VII**
Subject : **Virtual Instrumentation Laboratory** Code : **312762(12)**
Total Practical Periods: **36** **Batch Size : 30**
Maximum Marks: **40** **Minimum Marks: 20**

List of Experiments :(At least ten experiments are to be performed by each student)

1. Getting Started with Lab VIEW – Basic operations, controls and indicators
2. Build a VI to add and multiply two given numbers and display the results
3. To write a VI for the Multiplication of a random number with 10 and displaying the result continuously, until it is stopped.
4. Create a VI to find whether the given number is odd or even.
5. Write a program in Lab VIEW to print the no., the square & the cube of only even number from 0 to 100.
6. Compute the equation (x1+2) * Log(x1) using function, expression node & express formula for the given input x1
7. Create a one dimensional (1D) numeric array using the build array function which gets array elements from numeric control.
8. Build a VI to find the sum & Product of array elements.
9. Write a VI to convert a given temperature value from Degrees C to Degrees F.
10. Build a thermometer, which measures temperature and displays temperature values using the C to F converter.
11. To build a VI to monitor the temperature continuously.

Hardware/Software Required:

Pentium core i3, 1/2 GB RAM, 500 GB HDD, National Instrumentation's Lab View 2011 SP1

Recommended Books:

Jerome, Jovitha. ***Virtual Instrumentation Using Lab VIEW***. PHI Learning Pvt. Ltd., 2012.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C. G.)

Name of Program: **Bachelor of Engineering**
Branch : **Applied Electronics & Instrumentation Engineering** Semester: **VII**
Subject : **Power Electronic Devices & Drives Laboratory** Code : **312763(12)**
Total Practical Periods: **36** **Batch Size: 30**
Maximum Marks: **40** **Minimum Marks: 20**

List of Experiments: (At least ten experiments are to be performed by each student)

1. SCR characteristics.
2. DIAC characteristics.
3. TRIAC characteristics
4. UJT characteristics.
5. Power control using SCR.
6. Power control using TRIAC.
7. Commutation of SCR class A,B,C,D,E,F.
8. Single phase half controlled rectifier.
9. Single phase full controlled rectifier.
10. Buck, boost and buck-boost regulators.
11. single phase PWM inverter.
12. Study and obtain the waveforms for single-phase fully controlled bridge converter.
13. Perform experiment on triggering circuits for SCR.
    - R-triggering circuit.
    - R-C triggering circuit.
    - UJT triggering circuit.

List of Equipments – Discrete Components, AC and DC Voltage Sources, Voltmeter, Ammeter, CRO, Function Generator, Trainer Kits.

Reference Book:

Industrial Electronics and Power Control, H.C. Rai, Umesh Publications.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Branch: **Applied Electronics & Instrumentation** **Semester: VII**

Subject: Data Acquisition System & Technology Code : **312741(27)**

Total Theory Periods: **40** Total Tutorial Periods: **10**

No. of class tests to be conducted: **2 (Minimum)** No. of assignment to be submitted: **2(Minimum)**

ESE Duration: Three Hours **Maximum Marks in ESE : 80** **Minimum Marks ESE:28**

Course Objectives

1. To Understand the SCADA Programming and their Application.
2. This course provides the knowledge of different types of system responses.
3. During this course student will have knowledge about SCADA Programming used in industrial area.

Course Outcomes:

1. Students' gain knowledge about SCADA.
2. Students' gain knowledge about designing and its Controllability and observability.
3. Students' gain knowledge about various Process of Plant Automation.

UNIT – I: Instrumentation System

Classification of instrumentation system. Block diagram of analog & digital data acquisition system with detailed study of different blocks.

UNIT – II: Signal Conditioning

Block Diagram of Signal Conditioning System, AC & DC Signal Conditioning Instrumentation Amplifier, AC Amplifier, Direct coupled, Chopped Amplifier. Operational Amplifier and its Applications compensation and Modulation. Amplifier and its Applications, compensation and Modulation. Active & Passive filter, Bridge circuits, Calculation of SNR and other Parameters.

UNIT – III: Multiplexing

Analog & Digital multiplexer, digital to Analog multiplexing, Analog to digital multiplexing, Different types of multiplexing. Single channel and multi channel data acquisition system.

UNIT – IV: Data Converters:

Analog to Digital and Digital to Analog converters. Sample and Hold circuits. Grounding and Shielding Techniques: Noise analysis, effect of noise, various techniques of grounding and shielding.

UNIT – V: Data Acquisition and System Design

Design Cycle, different designing aspects, Hardware & Software requirement for designing Data processing, Programmable DAS, Distributed DAS., Role of Microcontrollers in DAS.

Text Books:

Krishna Kant, Microprocessor Based Data Acquisition System, PHI.

Reference Books:

Tobey-Graeme-Huelsman, Operational Amplifier System & Design, Mc-Graw Hill.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Branch: **Applied Electronics & Instrumentation** **Semester: VII**
Subject: Instrumentation for Pollution Code : **327742(27)**

Total Theory Periods: **40** Total Tutorial Periods: **10**

No. of class tests to be conducted: **2 (Minimum)** No. of assignment to be submitted: **2(Minimum)**
ESE Duration: Three Hours **Maximum Marks in ESE : 80** **Minimum Marks ESE:28**

Course Objectives:
1. To make students aware about role of instrumentation in pollution prevention.
2. To study about air pollution, water and industrial pollution and their control mechanism.

Course Outcomes:
1. Analyze a methodology to determine the performance of air pollution control techniques.
2. Evaluate air quality management the causes and effects of water pollution.
3. Contrast how industrial pollution is controlled through modern technology, pollution prevention.

UNIT – I : **Environmental Monitoring :** Environmental Monitoring: Water Quality Monitoring, Air Quality Monitoring: ambient air quality monitoring, source air quality monitoring, Problems associated with monitoring.

UNIT – II : **Air Pollution Sampling and Measurement:** Air pollution: definitions, sources and classification of air pollutants, Sampling Methods: sedimentation, filtration, impingement method, electrostatic precipitation, thermal precipitation, centrifugal methods, difficulties encountered in sampling, Instruments for Sampling Waste Gases and Atmospheric Sampling, Analytical methods for air pollution: Chemical and Instrumental Methods.

UNIT-III : **Air Pollution Control Method and Equipment:** Control of Air Pollution by Equipment: Objectives of using control equipment, Types of Collection Equipment: Settling Chambers, Inertial Separators, Cyclones, Filters, Control of Gaseous Contaminants: Combustion, Absorption and Adsorption, Smoke and its control.

UNIT – IV : **Waste Water Monitoring and Control :** Water pollutants: sources and classification of water pollutants, waste water sampling and analysis: sampling, methods of analysis, determination of organic matter, determination of inorganic substances, physical characteristics, Waste Water Treatment: Basic process of Water Treatment, Primary Treatment: Pretreatment, sedimentation and flotation, Secondary Treatment: Role of Microorganisms, Decomposition of Organic Waste, Advanced Waste Water Treatment: Removal of Suspended Solids and Dissolved Solids.

UNIT – V : **Industrial Pollutants and its monitoring:** Solid Waste Management: Sources and classification, methods of collection, Disposal method: open damping, sanitary landfill, Potential methods of disposal: utilization, recovery and recycling, Hazardous waste management: definition and sources, hazardous waste rules, hazardous waste classification, treatment methods.

Text Books

1. M. N. Rao, H V N Rao, "Air Pollution", Tata McGraw Hill, 2000,ISBN-0-07-457871-2.
2. C. S. Rao, "Environmental Pollution Control Engineering", New Age International Limited.

Reference Book

1. Faith W.L., and Atkinson A.A., : "Air pollution", 2nd edition Wiley Interscience Inc., New York, 1972.

2. B.C. Punmia, Ashok Jain, "Waste Water Engineering", Laxmi Publication, 1998, ISBN – 81-7008-

091-6.
3. S. K. Agarwal, “ Environmental Monitoring, APH Publishing Corporation.
4. V.P. Kuderia, “Noise Pollution & Its Control”, Pragari Prakasan, 2000, ISBN-81-7556-186-6.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Branch : **Applied Electronics & Instrumentation** **Semester: VII**

Subject: Instrumentation & Control in Iron & Steel Industries Code : **327743(27)**

Total Theory Periods: **40** Total Tutorial Periods: **10**

No. of class tests to be conducted: **2 (Minimum)** No. of assignment to be submitted: **2(Minimum)**

ESE Duration: Three Hours **Maximum Marks in ESE : 80** **Minimum Marks in ESE : 28**

Course Objectives:

To enable the students to

1. Have an in-depth understanding of the various unit operations in the industry
2. To get knowledge about various process parameters in industry.
3. To provide an overview of computer application in iron industry.

Course Outcomes:

At the end of the course, the student will be able

1. To implement the concept of different measurement techniques and control
2. Systems in Iron and steel Industry.
3. To implement the methods of computer control in Iron and steel industry.

Unit I : **HISTORY OF STEEL MAKING**; per-capita consumption of steel in India and in other countries. Process description in diagrammatic and functional block details; raw materials preparation; operation of blast furnace (BF) , iron making, raw steel and auxiliary units including stoves; basic oxygen furnace (BoF); electric furnace (EF); open hearth furnace (OHF); relative merits of various steel making furnaces.

Unit II: **CASTING OF STEEL**; impurities present and allowed limits for usable steel; waste recycling. Continuous casting and batch casting of steel; primary and secondary rolling; features of cold rolling; steel finishing operations.

Unit III: **IDENTIFICATION OF VARIOUS PROCESS PARAMETERS IN THE INDUSTRY**; selection of suitable measurement hardware for temperature, pressure, level, flow, weighing and proportioning; special gauges for measurement of thickness and shape; Control room layout for mill operations; graphic displays; alarm management.

Unit IV: **APPLICATIONS FOR CONTROLS**; Blast Furnace (BF) Stove combustion control system; gas and water control system in Basic Oxygen Furnace (BoF), Mould Level control system in Strand Casting operations.

Unit :V: **COMPUTER APPLICATIONS IN THE INDUSTRY**; Review of data logging, SCADA, DDC and DCS. Practices for model calculating and data logging; steel rolling mill control; annealing process control; utilities management with computer system.

Text Books:

1. Liptak, Bela G, Instrumentation in the Processing Industries, Chilton Publishers, 1973.
2. Considine D. M., Process/Industrial Instruments and control Handbook, McGraw Hill, 4th edition 1993.

Reference Books

1. Tupkary R.H, "Introduction to Modern Iron Making", 2nd edition, Khanna Publishers, New Delhi, 1986
2. Tupkary R.H., "Introduction to Modern Steel Making", 4th edition, Khanna Publishers, New Delhi, 1989.
3. Serope Kalpakjian, Manufacturing Engineering and Technology, Addison Wesley Publishing Company, Massachusetts,3rd edition, 1995.
4. Robert H. Perry, D.W. Green and J.O. Maloney, Perry's Chemical Engineers, Handbook, McGraw Hill Inc, New York, 7th ed, 1998.
5. Liptak B. G, "Instrument Engineers Handbook", Volume 2, Process Control, 3rd edition, CRC press, London, 1995
6. Considine D.M, "Process / Industrial Instruments and Control Handbook", 4th edition, McGraw Hill, Singapore, 1993 – ISBN-0-07-012445-0
7. D. Patrnabis, "Principle of Industrial Instrumentation", Tata Mcgraw Hill publishing company, 3rd Edition, 2010.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Branch : **Applied Electronics & Instrumentation** **Semester: VII**

Subject: Robotics and Automation Code : **327744(27)**

Total Theory Periods: **40** Total Tutorial Periods: **10**

No. of class tests to be conducted: **2 (Minimum)** No. of assignment to be submitted: **2(Minimum)**

ESE Duration: Three Hours **Maximum Marks in ESE : 80** **Minimum Marks ESE:28**

Course Objectives:

1. The students will gain the basic concepts of robotics.
2. The students will gain the knowledge about drives and kinematics of robotics.
3. The students will gain the knowledge of smart sensors and artificial intelligence.
4. The students will get the knowledge of basic applications of robot.

Course Outcomes:

1. Students' gain knowledge about basic Robotics and Automation.
2. Students' gain knowledge about industrial applications of Robotics and Automation.
3. Students' gain knowledge about smart sensors and kinematics.

UNIT – I: **BASIC CONCEPTS IN ROBOTICS :** Advantages, Applications, Basic structure of robots, Numerical control of machine tools, Resolution, Accessories and Repeatability. Classification and Structure: Point to point Robotic system, control tool of Robotic systems, Manipulator, The wrist motors and the grips, structure of continuous path rot Robot systems.

UNIT – II: **DRIVES AND CONTROL SYSTEMS:** Hydraulic system Direct current serve motors, Control approaches of Robots, Control and loops using current amplifier, Control loop using voltage amplifier, Elimination of Stationary position errors, Control loop in CNC system.
Kinematics Analysis and Coordinate Transformation: - Direct Kinetic problems in Robotics, Geometry based Direct Kinematics Analysis, Co-ordinate and vector Transformations using matrices, Denourt – Hartenberg convention, Applications of the DH method , Quaternion and rotation vector representations .

UNIT – III: **TRAJECTORY INTERPOLATORS:** Necessity of Interpolators, Generation of motion commands Trajectory planning , Basic structure of Interpolators , Particular Solutions for the Inverse Kinetics problem Resolved motion state control method , solving the Inverse Kinetic problem using rotation vector .

UNIT – IV: **SENSORS AND INTELLIGENT ROBOTS :** Introduction to Robotic Sensors, Vision System, Range detectors, Assembly aid devices, Force and torques Sensors Brief concept of Artificial Intelligence .Installing a Robot: Plant Survey, Selecting Robots, Economic Analysis, case study, Robot safety.

UNIT – V: **APPLICATION OF ROBOTS:** Handing , Loading and Unloading , the manufacturing cell , Wielding , Spray painting , Assembly , Machining , Press work & Forging , Heat treatment applications , Robots in Electroplating .

Text Books :-

1. Mikell P. Grooveretal, "Industrial Robots – Technology Programming & Applications" McGraw Hill Ltd.
2. KoremYoram ROBOTICS FOR Engineering : Tata McGraw Hall

Reference Books:-

1. Koyreu Yu. Industrial Robotics –(Mir Publishers Moscow)
2. Anthony CMC Donad, Robot Technology: (Theory Design and Application) (Prentice Hall)

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Branch: **Applied Electronics & Instrumentation** **Semester: VII**
Subject: Instrumentation System Reliability Code :**327745(27)**

Total Theory Periods: **40** Total Tutorial Periods: **10**

No. of class tests to be conducted: **2 (Minimum)** No. of assignment to be submitted: **2(Minimum)**
ESE Duration: Three Hours **Maximum Marks in ESE: 80** **Minimum Marks ESE:28**

Course Objectives:

1. To develop and apply mathematical principle to formulate and calculate the reliability of a system.
2. This course provides the knowledge of different types of approach for analysis of reliability improvement for industrial products.
3. During this course student will have knowledge about predictability & availability of normal performance of instruments.

Course Outcomes:

1. Graduates will have to knowledge about various techniques for calculation of reliability.
2. Graduates will understand the basic concept of various distributions such as Weibull, Gaussian etc.
3. Graduates will develop skills for solving the system complexity using various method.
4. Graduates will have knowledge of maintainability & availability of a system for achieving their effective outcome.
5. Graduates will learn the basic techniques of design of reliability.

UNIT – I : **Reliability Concepts:** Introduction, reliability, importance of reliability in system instrumentation, failures and failure mode, cause of failures, instantaneous failure rate, general reliability function, Bathtub Curve.

UNIT – II : **Component Reliability & Hazard Model:** Component reliability from test data, failure data (Failure density, failure rate reliability, probability of failure), mean failure rate, mean time to failure, mean time between failure, MTTF in terms of failure density, hazard models, linear hazard model, non linear hazard model.

UNIT – III : **System reliability :** Logic diagram of system instrumentation, series configuration, parallel configuration, stand by configuration, K-out of configuration, complex system, markov method, standby, load sharing system, fault tree technique, event space method, tie set method.

UNIT – IV : **Reliability Improvement :** Introduction, Component versus unit redundancy, weakest link technique, mixed redundancy, stand by redundancy, Reliability Design Process, Reliability optimization, Reliability growth testing.

UNIT – V : **Maintainability & Availability :** Introduction, Maintainability function, Availability function & types, frequency of failure two unit parallel system with repair allocation of redundancy failure rate, time of continuous operation, mean repair time.

Text Books:

1. An Introduction to Reliability and Maintainability Engineering - *Ebeling;* Tata McGraw Hill
2. Reliabilty Engineering - E . Balagurusamy, TMH, New Delhi
3. Probabilistic Reliability - An Engineering Approach, *M.L. Shooman*, McGraw-Hill Publ

Reference Books:

1. Fault-Diagnosis Systems: An Introduction from Fault Detection to Fault Tolerance, *Rolf Isermann*
2. Engineering Design Reliability Handbook, *Boca Raton*; CRC Press

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Branch : **Applied Electronics & Instrumentation** **Semester: VII**
Subject: Neural Network & Fuzzy Logic Control Code : **327746(27)**

Total Theory Periods: **40** Total Tutorial Periods: **10**

No. of class tests to be conducted: **2 (Minimum)** No. of assignment to be submitted: **2(Minimum)**
ESE Duration: Three Hours **Maximum Marks in ESE : 80** **Minimum Marks ESE:28**

Course Objectives:

1. The goal of neural network research is to realize an artificial intelligent system using the human brain as the model. This course introduces the basic models, learning algorithms, and some applications of neural networks.
2. The goal of fuzzy logics to provide an understanding of the basic mathematical elements of the theory of fuzzy sets.

Course Outcomes :

1. After this course, students will be able to know how to use neural networks for solving different problems related to pattern recognition, function approximation & data visualization.
2. Knowledge about Fuzzy sets, fuzzy relations, fuzzy conditional statements, fuzzy rules, fuzzy learning algorithms.
3. Knowledge about various Fuzzy Logic for different Control Systems.

UNIT – I: **Introduction to Neural Networks:** Different architectures of neural networks, Rosenblott's perceptrons, multi layer perceptrons, back propagation algorithm, Hopfield's networks, Kohnen's self organizing maps, adaptive resonance theory.

UNIT – II: **Neural Networks for Control Systems:** Schemes of neuro-control, identification and control of dynamical systems, case studies (Inverted Pendulum, Articulation Control)

UNIT – III: **Introduction to Fuzzy Logic:** Fuzzy sets, fuzzy relations, fuzzy conditional statements, fuzzy rules, fuzzy learning algorithms.

UNIT – IV: **Fuzzy Logic for Control Systems:** Fuzzy logic controllers, fuzzification interface, knowledge/rule base, decision making logic, defuzzification interface, design of fuzzy logic controllers, case studies(Inverted Pendulum, Articulation Control)

UNIT – V: **Neuro-fuzzy and Fuzzy-neural Control Systems:** Adaptive fuzzy systems, optimizing the membership functions and the rule base of fuzzy logic controllers using neural networks, fuzzy transfer functions in neural networks.

Text Books:

1. Kosko, B, "Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence", Prentice Hall, New Delhi.

2. J.Ross, "Fuzzy Logic with Engineering Applications", Prentice Hall International.

Reference Books:

1. Jacek M. Zurada, "Introduction to Artificial Neural Systems", Jaico Publication House.

2. Wasserman P.D, "Neural Computing Theory & Practice", Van North-Hland.