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

Scheme of Teaching and Examination

B.E. VII SEMESTER

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	327731(27)	Virtual Instrumentation	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	Electronics and Instrumentation	327734(27)	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	Electronics and Instrumentation	327761(27)	Power Electronic Devices & Drives Laboratory			4	40	-	20	60	2
7	Electronics and Instrumentation	327762(27)	Virtual Instrumentation Laboratory			4	40	-	20	60	2
8	Electronics and Instrumentation	327763(27)	Advanced Instrumentation Laboratory			4	40	-	20	60	2
9	Electronics and Instrumentation	327764(27)	Minor Project			4	100	-	40	140	2
10	Management	327765(76)	Innovative & Entrepreneurial Skills			2	-	-	40	40	1
11	Electronics and Instrumentation	327766(27)	*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	Electronics and Instrumentation	327741(27)	Digital Process Control
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 : **Electronics & Instrumentation** **Semester: VIISubject: Virtual InstrumentationCode** : **327731(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 Virtual Instrumentation and programming
2. To study about the various toolkits available to design virtual instrument.

Course Outcomes:

1. Completion of Course student will understand the programming analysis of virtual Instrumentation.
2. Student will be able to apply this knowledge to various industrial process for graphical user interface programming and controlling of process.
3. Be able to apply this knowledge to design various projects in different fields by the use of toolkits.

Unit 1: **Introduction to LabVIEW:** Historical perspective, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with Conventional programming.Advantages of LabVIEW, creating and saving a VI, front panel and block diagram tool bar, palettes, front panel control and indicators, block diagram, data types & data flow program.

Unit 2: **Programming Techniques & Loops :** Modular programming in LabVIEW, build a VI front panel and block diagram, icon and connector pane, creating an icon, building a connector pane, creating SUB VIs from a section of VIs, opening and editing of VIs, placing SUB VIs on block diagrams, saving SUB VIS, Creating a stand-alone application, Loops: FOR loops, WHILE loops, structure tunnels, terminal inside or outside loops, shift register control timing, local variables, global variables.

Unit 3: **Advance Programming Techniques -** Arrays and clusters, types of waveforms, waveform graphs, waveform charts, waveform data type, XY graphs, intensity graphs and charts, digital waveform, customizing graphs and charts, Structures: case structure, sequence structure, formula nodes, event structure. Strings and file I/O: creating string control and indicators, string functions, formatting strings.

Unit 4: **Instrument Control & Data Acquisition Instrument Control –** Introduction, GPIB communication, hardware Specifications, Software Architecture, VISA, Serial Port Communications. **Data Acquisition –** Introduction, Transducers, Signal, DAQ hardware, Analog Inputs/Output, Counters, DIO, Selecting & Configuring a Data acquisition Device.

Unit 5: **Lab VIEW Tools & GSD Applications:** Digital Filter Design Toolkit, Sound & Vibration Toolkit, Data Logging & Supervisory Control, Biomedical Startup kit, PID control Toolkit, Express VI Development Toolkit, Report Generation Toolkit for Microsoft Office, Control Design Toolkit, GSD Applications.

Textbooks:

1. Jovitha Jerome, Virtual Instrumentation Using LabVIEW, Prentice Hall India.
2. Gary Johnson, LabVIEW Graphical programming, Second Edition, McGraw Hill.
3. S.Sumathi P.Surekha,LabVIEW Based Advanced Instrumentation System,Springer

Reference:

1. Sokoloff, Basic Concepts of LabVIEW 4, Prentice Hall.

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

Branch : **Electronics & Instrumentation** **Semester: VIISubject: 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 : **Electronics & Instrumentation** **Semester: VIISubject: Advanced InstrumentationCode** : **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 in 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 : **Electronics & Instrumentation** **Semester: VIISubject: Power Electronic Devices & Drives** Code : **327734(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 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 various turn on and commutation methods for thyristors.
8. Knowledge about power BJT, MOSFET and IGBT.

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 ratings, 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 : **Power Transistors :**
Power BJT - structure, operation, static characteristics, switching characteristics & safe operation area. **Power MOSFET -** structure, types, operation, static characteristics, transfer characteristics & switching characteristics. **IGBT –** structure, operation, static characteristics, transfer characteristics & switching characteristics. Comparison among SCR, Power BJT, MOSFET, and IGBT. Drive requirements and design of simple drive circuits for power BJT, MOSFET and IGBT. Spice models of the power devices

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 : **AC & DC Drives**: Concept of electric drives, DC drives, Basic performance equation of DC motors, Single phase & three phase DC drives, Chopper drives, AC drives, Induction motor drives, Speed control of three phase induction motors, Synchronous motor drives.

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 : **Electronics & Instrumentation Engineering**
Semester: **VII**

Subject : **Power Electronic Devices & Drives Laboratory** Code : **327761(27)**

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.)

Name of Program: **Bachelor of Engineering**Branch : **Electronics & Instrumentation Engineering**
Semester: **VII**

Subject : **Virtual Instrumentation Laboratory** Code : **327762(27)**
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 : **Electronics & Instrumentation Engineering**
Semester: **VII**

Subject : **Advanced Instrumentation Laboratory** Code : **327763(27)**
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)

1. Study of Hall –Effect characteristics in speed measurement.
2. Measurement of pressure using pressure Transducer.
3. To measure flow rate using electromagnetic flow meter.
4. Study of hot wire anemometer.
5. Study of Ultrasonic transducer trainer.
6. To determine the flow rate using Rota meter.
7. To study the Humidity measurement.
8. Study of Magnetic flux measurement.
9. Study of Vibration measurement.
10. To determine the Temp. Measurement using radiation sensor
11. To study the Discharge coefficient of orifice plate
12. To perform the Calibration of temperature and pressure sensor.
13. Study of Viscosity measurement
14. Study of intensity of light measurement
15. Measurement of speed using optical & inductive (MAG.) transducer

List of Equipments/Machine Required:

Discrete Components, Function Generator, Power Supply, CRO, AVO Meter, Multimeter, Voltmeter

Recommended Books:

Liptak, B.G.,: “Process measurement & analysis” , IV edition Chilton Book company 1995.
Considine, D.M.,: “Process instruments and control & handbook", McGraw Hill 1985.
D.S. Kumar, “Mechanical Measurement & Control”, Metropolition Publication

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

Branch : **Electronics & Instrumentation** **Semester: VIISubject: Digital Process Control** Code : **327741(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 of sampling and converters.
2. This course provides the knowledge of different types of system responses.
3. During this course student will have knowledge about Digital process design and algorithms.
4. During this course student will have knowledge about system modeling , control algorithms and interfacing of stepper motor with microprocessor.

rse Outcomes:

1. Students' gain knowledge about basic Digital Process control.
2. Students' gain knowledge about designing and its Controllability and observability.
3. Students' gain knowledge about various algorithms like Dead-beat algorithm-Ringing - Dahlin's and Kaman's algorithms.
4. Students' gain knowledge about system modeling and interfacing.

Unit – I : **Sampling Theorem and Converters:** Review of Sample theory ,Shannon's sampling theorems , Sampled Data Control system, Digital to Analog conversion ,Analog to Digital conversion, Ramp type A/D, Dual slope A/D, Successive approximation , A/D & D/A converters , Review of Z and Inverse Z transform , Reconstruction , Zero Order Hold.

Unit – II : **Response of the system & stability:** Response of sampled data systems to step and ramp inputs ,Steady state errors , Z domain equivalent Stability studies ,Bilinear transformation ,Jury's stability test, Lyapunov stability theorem

Unit – III : **State Space analysis of sampled data system:** Introduction, discrete time state equations, similarity transformation ,caley hamiton theorem, realization of pulse transfer function ,state equations for sampled data system, design example of mixing tank, concept of controllability and observability, system with dead time.

Unit – IV : **Digital Process Control Design:** Digital PID algorithm - Positional and incremental forms - Dead-beat algorithm-Ringing - Dahlin's and Kaman's algorithms , Implementation of control algorithms using microprocessors - General description of microcontrollers - Digital quantization.

Unit – V : **Applications:** System models, control algorithms and their implementation for micro processor based position and temperature control systems , Operational features of stepper motors , Drive circuits ,Interfacing of stepper motor to microprocessors.

Text Book

1. Gopal.M: "Digital Control Engineering", Wiley Eastern Publications.

Reference Books:

1. Ahson, S.I., : " Microprocessors with Applications in Process Control" , TMH.
2. Nagrath, J.J, and Gopal, M, "Control System Engineering" , Wiley & Sons.
3. Constantine Houpis, and Garry Lamont., "Discrete Control systems" - Theory, Hardware and Software,

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

Branch : **Electronics & Instrumentation** **Semester: VIISubject:**
Instrumentation for Pollution Control 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 : **Electronics & Instrumentation** **Semester: VIISubject: 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 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 : **Electronics & Instrumentation** **Semester: VIISubject: 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 : **Electronics & Instrumentation** **Semester: VIISubject: 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 : **Electronics & Instrumentation** **Semester: VIISubject: 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.