Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(*An Autonomous Institute affiliated to Savitribai Phule Pune University*)

Structure & Syllabus of

Third Year B.Tech.

(Instrumentation and Control Engineering)

Pattern 'C20'

Effective from Academic Year 2020-21

Prepared by: - Board of Studies in Instrumentation & Control Engineering

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Signed by

Chairman – BOS **Chairman – Academic Board**

Contents

Vision statement of Institute

To be globally acclaimed Institute in Technical Education and Research for holistic Socio-economic development

Mission statement of Institute

- To endure that 100% students are employable in Industry, Higher studies, Become Entrepreneurs, Civil/Defense Services / Government Jobs and other areas like Sports and Theatre.
- To strengthen Academic Practices in terms of Curriculum, Pedagogy, Assessment and Faculty Competence.
- Promote Research Culture amongst Students and Faculty through Projects and Consultancy.
- To make students Socially Responsible Citizen.

Core Values

- Faculty Centric Initiatives
- Academic Practices
- Research Culture
- Use of Technology for Social and National Development

Vision statement of Department

To be recognized as a leading contributor in imparting technical education and research in Instrumentation & Control engineering for development of the society.

Mission statement of Department

- To deliver knowledge of Instrumentation and Control Engineering by strengthening involvement of Research institutions and industries in academics
- To build conducive environment for advanced learning through participation of faculty and students in collaborative research, consultancy projects, student exchange programs and internships
- To develop competent Engineers with entrepreneurial skills to address socio-economic needs.

Program Educational Objectives (PEO)

Programme: B. Tech. (Instrumentation and Control Engineering)

The Graduates would demonstrate

1. Core competency in Instrumentation and Control Engineering to cater to the industry and research needs.
2. Multi-disciplinary skills, team spirit and leadership qualities with professional ethics, to excel in professional career and/or higher studies.
3. Preparedness to learn and apply contemporary technologies for addressing impending challenges for the benefit of organization/society.
4. Knowledge of recommended standards and practices to design and implement automation solutions.

Program Outcomes

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research –based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

Graduates shall have the ability to:

1. Evaluate the performance of suitable sensors / Process components/ Electronic / Electrical components for building complete automation systems.
2. Analyze real-world engineering problems in the area of Instrumentation and Control.
3. Design or Develop measurement / electronic / embedded and control systems with computational algorithms to provide practical solutions to multidisciplinary engineering problems.

Vishwakarma Institute of Technology
Title : Course Structure

Issue 01 : Rev No. 1 : Dt. 01/07/18
FF No. 653

T.Y. B.Tech - Instrumentation and Control Engineering Structure for Pattern C-20, Module-5 with effect from Semester-1 of Academic Year 2020-21

Course Type	Course Code	Course Name	Teaching Learning Scheme (Hrs./Week)				Credits	Assessment Scheme (100 mark scale)							
			Th	Lab	Tut	Total		In Semester Assessment (65)					End Semester Assessment (35)		Total
								HA	Lab	Seminar	GD/PPT	MSE	ESE	Viva	100
S1	IC3201	Process Instrumentation	3	2	1	6	5	10	20	10	10	15	15	20	100
S2	IC3203	Measurement Systems	3	2	1	6	5	10	20	10	10	15	15	20	100
S3	IC3205	Vision Based Automation	3	2	1	6	5	10	20	10	10	15	15	20	100
S4	IC3213	Engineering Design - I	0	2	0	2	1		50				50		100
S5	IC3215	Software Design - I	0	2	0	2	1		50				50		100
S6	IC3207	Software Development Project - I	0	6	0	6	3		50				50		100
S7	IC3209	Engineering Design and Innovation - III	0	8	0	8	4		50				50		100
		Total	**9**	**24**	**3**	**36**	**24**								

Vishwakarma Institute of Technology
Title : Course Structure

Issue 01 : Rev No. 1 : Dt. 01/07/18
FF No. 653

T.Y. B.Tech - Instrumentation and Control Engineering Structure for Pattern C-20, Module-6 with effect from Semester-2 of Academic Year 2020-21

Course Type	Course Code	Course Name	Teaching Learning Scheme (Hrs./Week)				Credits	Assessment Scheme (100 mark scale)							
			Th	Lab	Tut	Total		In Semester Assessment (65)					End Semester Assessment (35)		Total
								HA	Lab	Seminar	GD/PPT	MSE	ESE	Viva	100
S1	IC3202	Building and Process Automation	3	2	1	6	5	10	20	10	10	15	15	20	100
S2	IC3204	IoT Analytics	3	2	1	6	5	10	20	10	10	15	15	20	100
S3	IC3206	Virtual Reality	3	2	1	6	5	10	20	10	10	15	15	20	100
S4	IC3214	Engineering Design - II	0	2	0	2	1		50				50		100
S5	IC3216	Software Design - II	0	2	0	2	1		50				50		100
S6	IC3208	Software Development Project - II	0	6	0	6	3		50				50		100
S7	IC3210	Engineering Design and Innovation - IV	0	8	0	8	4		50				50		100
		Total	**9**	**24**	**3**	**36**	**24**								

SEMESTER I

FF No. : 654

IC3201 :: PROCESS INSTRUMENTATION

Course Prerequisites: Fundamentals of Sensors and Transducers, Feedback control System.

Course Objectives:

1. To understand the basic concepts of process control loops.
2. To select, design, configure, install and calibrate the major and auxiliary process control components for given process conditions.
3. To understand the mathematical modeling and its importance in process control.
4. To apply suitable instrumentation and control schemes for different process equipment.
5. To analyze and design the multivariable controls and systems.

Credits: 5 **Teaching Scheme Theory: 3** Hours/Week
Tut : 1 Hour/Week
Lab : 2 Hours/Week

Course Relevance:

This is a core control and instrumentation course, where the syllabus is designed according to the elements of the control system and integrating them to monitor and control process equipment in a plant. This course introduces the fundamental concepts, principles and application of major and auxiliary control components to the students. Then it goes deeper into the various aspects of process control along with balanced theories and practical knowledge. The topics cover the control strategies such as feed-forward controller, cascade control structure, ratio control, split-range control, selective control for various process equipment of plant and preliminary concepts of adaptive control and multi-loop multivariable control.

There are numerous industries that utilize process control equipment and instrumentation systems, including, oil and gas, mining, food & beverages, marine, chemical, petrochemical, fertilizers, pulp and paper, pharmaceuticals, power stations, water/wastewater, etc. so this course is very useful for the students, who wish to build carrier in the process control domain.

After completion of the course students will have the ability to explain working of process control components, their selection and design and configure them to control plants. They need to apply basic knowledge of science, mathematics and instrumentation engineering fundamentals to design or develop control schemes for various process equipment used in plants. Students should be able to calibrate, characterize the process component, auxiliary process components, design safety circuits, tune controllers for given process loops and find their performance specifications. In labs while performing practical and assessment viva, students exhibit their teamwork and communication skills.

This will develop core competency among the students in the field of process automation.

SECTION-1 : [IC3201_CO1, IC3201_CO2, IC3201_CO3]

Process Instrumentation Components

Fundamentals of process control

Types of control systems, feedback and feed forward control systems, Elements and variables involved in process control loop, Process Characteristics in detail, Process control loop representation using standard symbols. P&ID for process loops like temperature, flow, level, pressure, etc.

Transmitters and Convertors

Need of transmitter and standardization of current, voltage, and pressure control signals, Concept of field area and control room area, live and dead zero.

Types of transmitters: Two and four wire configurations, electronic and pneumatic transmitters, Transmitter circuits, Electronic Differential Pressure Transmitter: Types, installation, calibration setup, application of DPT for level and flow measurement, zero elevation and suppression,

SMART: Comparison with conventional transmitter, block schematic, Specifications of DPT and Smart transmitter, Converters: Current to pressure and pressure to current converters.

Control Actions

Discontinuous: Two position, time-proportional control modes

Continuous: Proportional, integral, derivative, proportional-integral, proportional- derivative, proportional- integral-derivative (PID) control modes, Reset windup, rate before reset, bumpless transfer, effect of process characteristics on PID combination, tuning of controller. Digital PID controllers: Block schematic, faceplate of Digital controller.

Control Valves

Necessity and comparison with other final control elements.

Control valve terminology: rangeability, turndown, valve capacity, distortion coeff., AO, AC, fail-safe conditions, cavitation, flashing and noise, their effects and remedies.

Control valve characteristics: inherent and installed.

Control valve classification, their construction, advantages, disadvantages and applications of globe, 3-way, diaphragm, rotary, ball, butterfly.

Designing control valve for gas, vapor and liquid services: valve sizing by ANSI/ISA 75.01 std., high temperature-pressure service valves.

Control valve accessories and Actuators

Control valve accessories: Need of accessories, volume and pressure boosters, solenoid valves, air lock, limit switches, hand wheel. positioners: Need, applications, types, effect on performance of control valve.

Actuators: Types, construction, advantages, disadvantages and applications of spring and diaphragm, piston cylinder (power cylinder), pneumatic, hydraulic, electric, electro-hydraulic and smart actuators. Design of spring and diaphragm actuators.

Auxiliary process components

Auxiliary process components like Square root extractor, seals and snubbers, flow totalizer, High/low selectors, Alarm annunciator, Feeders, dampers, hazardous area classification,

Intrinsic safety and components.

SECTION-2 : [IC3201_CO4, IC3201_CO5, IC3201_CO6]

Process Instrumentation Applications

Fundamental and empirical models

Balance equations: Material and energy balance (Examples: isothermal CSTR, heated mixing tank and non-isothermal CSTR), linearization of nonlinear models, FOPDT and SOPDT empirical models using step test data.

Instrumentation for heat exchanger and dryer

Operation of heat exchanger, controlled and manipulated variables in heat exchanger control problem, Degrees of freedom analysis, instrumentation for feedback, feed-forward, feedback-Feed forward control, cascade control strategies for heat exchanger, types and operation of dryers, controlled and manipulated variables in dryer control problem, instrumentation for feedback and feed-forward control of various types of dryers.PID Tuning methods for heat exchangers.

Boiler Instrumentation and control

Operation of boiler, manipulated and controlled variables in boiler control, safety interlocks and burner management system, instrumentation for boiler pressure controls, Air to fuel ratio controls, boiler drum level controls, steam temperature control, optimization of boiler efficiency, Boiler Blowdown, Furnace draft, Ratio control, Selective control, Split range control, Adaptive control. PID Tuning methods for boilers. Controller design strategies.

Instrumentation for Evaporators and Distillation

Types and operation of evaporators, Controlled and manipulated variables in evaporator control problem, instrumentation for feedback, feed-forward, cascade control strategies for evaporators,

Operation of distillation column, manipulated and controlled variables in distillation column control, instrumentation for flow control of distillate, top and bottom composition control, reflux ratio control, pressure control schemes. Degree of freedom analysis. Different methods to control distillation with case study.

Analysis of Multivariable Systems

Concept of Multivariable Control: Interactions and its effects, block representation and transfer function matrix of two input two output systems, interaction, relative gain array, resiliency, Morari resiliency index, Niederlinsky index, Inverse Nyquist array.

Multivariable control

Structure Of multi-loop SISO and multivariable controllers, decoupler, and decoupler design: ideal decoupler, simplified decoupler and static decoupler. Concept of decentralized control, Tuning methods for multivariable control like BLT tuning.

List of Tutorials: (Any Three)

1. Identification of different variables involved in Process control Loop.
2. To develop feedback or feedforward control schemes for a given process.
3. To understand and develop the process control loops using standard ISA S5.1 for a given process.
4. Study and calibration of pressure to current converter, two–wire RTD and Thermocouple temperature transmitter.
5. Design of two-position controller for temperature / level control loop and Numerical examples on P, PI, PD, PID Controller.
6. Design of Control valves for given application and Numericals on valve characteristics.
7. Design of control valve actuators for given application.
8. Design of advance control scheme for single/multi effect evaporators.
9. Determine relative gain array of MIMO system.
10. Study the effect of tuning parameters on PID controller performance.
11. Study of Boiler Interlocks.

List of Practicals: (Any Six)

1. Study and calibration of current to pressure converter.
2. Study and calibration of pressure to current converter.
3. Study and implementation of Square root extractor.
4. Demonstration and study of alarm annunciator for different working modes.
5. Implementation and characterization of Flow Totalizer.
6. Study and characterization of intelligent two–wire RTD temperature transmitter.
7. Develop op-amp based ON-OFF controller for temperature control loop.
8. Tuning of PID controller for temperature/pressure control loop.
9. Study of control valve types, parts, accessories, actuators and Plot the installed characteristics of control valves.
10. Design of feedback controller by direct controller synthesis.
11. Design Feedforward controller for heat exchanger.
12. Design Cascade controller for Boiler
13. Determine Morari resiliency index of MIMO system.
14. Design and development of Feedback controller for given process
15. Design and development of Feedback + Feedforward controller for given process
16. Design and Development different boiler interlock using PLC/DCS
17. Design and development Cascade controller for given process
18. Design and development of decouple for MIMO system
19. Design and develop split range control for given process

List of Projects:

1. Design RTD signal conditioning circuit for temperature range 25°C to 100°C to 0 to 5 Vdc.
2. Design RTD signal conditioning circuit temperature range 25°C to 100°C to 4 to 20 mA.
3. Design Signal conditioning circuit for Thermocouple for temperature range 25°C to 100°C to 0 to 5 Vdc.
4. Design Signal conditioning circuit for Thermocouple for temperature range 25°C to 100°C to 4 to 20 mA.
5. Develop pressure transmitter for pressure range 0 to 2 Kg/cm^2.
6. Develop square root extractor circuit for voltage range / current range.
7. Develop and Simulate flow totalizer unit.
8. Develop high selector / low selector using opamp circuit.
9. Design of intrinsic safety circuit.
10. Develop alarm annunciator using digital logic circuits / ladder program of PLC
11. Tune PID controller for level control application. Use PC lab setup
12. Tune PID controller for flow control application. Use PC lab setup
13. Tune PID controller for pressure control application. Use PC lab setup
14. Tune PID controller for temperature control application. Use PI lab setup
15. Develop op-amp based ON-OFF controller for temperature control loop.
16. Demonstrate different types of positioners available in PI Lab.
17. Demonstrate different types of control valves available in PI lab.
18. Design of PID controller for a SOPDT system by Ziegler Nichols method.
19. Design of feedback system for industrial dryers
20. Design of feedback control scheme for distillation column
21. Determine Niederlinsky index of MIMO system.
22. Observing the effect of interaction in the MIMO system**.**

List of Course Group Discussion Topics:

1. Matching of control valve characteristics with the process characteristics.
2. Feedback versus Feed-forward control scheme
3. Selection of control actions according to process characteristics.
4. Which actuator is the best for the control valve?
5. Wired versus Wireless transmitters : Pros and Cons
6. Parameters to be considered for design of alarm annunciator.
7. How to get the most from the control valve.
8. Hazardous area classification and Intrinsic safety components
9. Conventional versus Smart transmitters.
10. Selection of Control Valve for applications.
11. Digital PID Controller Vs Analog PID Controller
12. Conventional Transmitter Vs Smart Transmitter
13. Continuous control Vs Discontinuous control
14. Furnace Draft Control
15. SISO Vs MIMO
16. Ratio control Vs Selective control
17. Decoupler
18. Distillation control

List of Course Seminar Topics:

1. System Modelling
2. Instrumentation for heat exchanger control
3. Control schemes for Dryer controls.
4. Instrumentation and control schemes for Boiler.
5. Evaporator controls.
6. Distillation Column control
7. Compressor controls
8. Instrumentation and control schemes for Pumps.
9. Multivariable control systems.
10. Instrumentation for tyre manufacturing.
11. Mathematical modeling of different process
12. Boiler drum level control methods
13. Application of control valve
14. Hazardous area classification
15. Burner management system
16. Instrumentation and control in Dryer
17. Instrumentation and control in Evaporator
18. Instrumentation and control in Distillation column
19. Multivariable control
20. Valve Actuators

List of Home Assignments:

Design:

1. Design of RTD/Thermocouple Signal conditioning circuit various temperature ranges.
2. Design and Simulation of PID controller for any one application.
3. Design of Control valve for given process using Standard ISA S75.01.
4. Design of Spring and Diaphragm type actuator for given application.
5. Design of intrinsic safety circuit.
6. Design of multivariable controls.
7. Automatic control of single capacity process
8. Automatic control of two capacity process
9. Design and develop feedback and feedforward control using different tool
10. Design and develop PID tuning for multivariable control system
11. Design and development of Boiler interlock using PLC/DCS

Case Study:

1. Development of P&ID for Ammonia/Petroleum refinery/Wastewater Treatment process plant.
2. Interfacing of smart D.P. transmitter for level loop and its calibration using hand-held configurator.
3. Tuning of PID controller for level/flow control loop.
4. Design a feedback controller for a system with delay / RHP zero by IMC strategy.
5. PID interfacing and Demonstration of Heat exchanger setup available in DCS Lab.
6. Implementation of PID Controller for Temperature control system
7. Implementation of ON/Off controller for Temperature control system
8. Different types of control valve
9. Distillation column control
10. Instrumentation and control in Dryer

Blog:
1. Communication aspects in Smart and wireless transmitters.
2. Controls of Interacting process.
3. Intrinsic safety.
4. SIL and SIS.
5. Advanced process controllers.
6. Boiler interlock
7. P & I D
8. Control in spray dryer
9. Control valve
10. Transmitter

Surveys:
1. Calibration of Flow/Temperature transmitters.
2. Intelligent features in transmitters.
3. Control valve for adverse process conditions.
4. Process calibrators.
5. Process Analyzers.
6. PID Tuning methods for MIMO
7. FOPDT Process
8. Mathematical modeling for different process
9. Automation in Boiler control
10 Control in Evaporator

Assessment Scheme: Course Assessment: Total : 100 mks
1. Mid Semester Examination : 15 marks (Total : 30 marks based on Section I) *30 marks converted to 15*
2. End Semester Examination: 15 marks (Total : 30 marks based on on Section II) *30 marks converted to 15*
3. Lab Assessment: Lab Assignments - 10 marks (10 assignments-10 marks each) (*100 marks converted to 10)*
4. Course Project : 10 marks (*100 marks converted to 10)*
5. Home Assignment : 10 mks (Total : 100 marks: Case study, Design work, Survey, Blog) *100 marks converted to 10*
6. Viva : 20 mks (at the end of semester); *100 marks converted to 20*
7. Seminar : 10 mks (at the end semester); *100 marks converted to 10*
8. Group Discussion: 10 mks (at the Mid of semester); *100 marks converted to 20*

Text Books:

1. C. D. Johnson, "Process control and Instrument technology", Tata McGraw Hill Publications.
2. N.A. Anderson, Boca Ratan, "Instrumentation for Process measurement and control", Radnor Pennsylvania, CRC Press.
3. Stephanopoulos George, "Chemical Process Control", PHI, New Delhi.
4. Lindsey D, "Boiler Control System", McGraw Hill Publishing Company.
5. W. L. Luyben, Process, Modeling, Simulation and Control for Chemical Engineers, MGH.
6. B. Wayne Bequette, Process Control: Modeling, Design and Simulation, PHI.

Reference Books:

1. B. G. Liptak, "Process Control", Instrument Engineering Handbook CRC Press.
2. B.G.Liptak, Process Control, Instrument Engineering Handbook, Chilton Book Company, 1985.
3. Considine, Handbook of Process Instrumentation, McGraw Hill Publishing Company.
4. B.A.Ogunnaike and W. H. Ray, Process dynamics, modeling, and control Oxford University Press.
5. "Tuning of industrial control systems", ISA.
6. "Control valve Handbook", ISA.

Moocs Links and additional reading material:

1. https://onlinecourses.nptel.ac.in/
2. https://nptel.ac.in/courses/103/103/103103037/
3. https://www.udemy.com/course/introduction-to-process-control-and-instrumentation
4. https://automationforum.in/t/free-online-instrumentation-courses/4783/1
5. swayam-chemical-process-instrumentation-9999
6. https://www.udemy.com/course/instrumentation-detailed-engineering-1-epc-job
7. https://www.online.colostate.edu/courses/CBE/CBE430.dot
8. https://ocw.mit.edu/courses/chemical-engineering/10-450-process-dynamics-operations-and-control

Course Outcomes:

1. IC3201_CO1: Demonstrate the working of major and auxiliary process loop components. [1] (PO-1, 2, 3, 9, 10 PSO-1, 3)
2. IC3201_CO2: Comprehend and Develop the process control loops from given process description. [3] (PO-1, 2, 3, 9, 10 PSO-1, 2, 3)
3. IC3201_CO3: Select and Design the control valve and actuators to solve a problem. [5] (PO-1, 2, 3, 4, 5, 9, 10 PSO-1, 2, 3)
4. IC3201_CO1: Build a mathematical model for a given process. [4] (PO-1, 2, 3, 4, 5, 9, 10 PSO-1, 2, 3)
5. IC3201_CO4: Develop instrumentation and control scheme for different process equipments. [4] (PO-1, 2, 3, 4, 5, 9, 10 PSO-1, 2, 3)
6. IC3201_CO5: Analyze multivariable controls and systems. [5] (PO-1, 2, 3, 4, 5, 9, 10 PSO-1, 2, 3)

CO PO Map

CO	PO -1	PO-2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -1	PSO -2	PSO -3
1	3	2	2	-	-	-	-	-	1	2	-	-	3	-	1
2	3	3	2	-	-	-	-	-	1	2	-	-	2	1	2
3	3	3	3	1	1	-	-	-	1	2	-	-	3	2	3
4	3	3	3	2	2	-	-	-	1	2	-	-	2	2	3
5	3	3	3	1	1	-	-	-	1	2	-	-	2	2	3
6	3	3	3	2	2	-	-	-	1	2	-	-	2	2	3

CO attainment levels

CO No.	IC3201_CO1	IC3201_CO2	IC3201_CO3	IC3201_CO4	IC3201_CO5	IC3201_CO6
Attainment Level	1	3	5	4	4	5

Future Courses Mapping:

Digital Control, Advanced Process Control, Process Dynamics and Optimisation**,** Multivariable Control System, etc.

Job Mapping:

Process control engineers are responsible for designing, developing, installing, managing and maintaining process instruments that are used to monitor and control process plants. There are numerous industries that utilize process control equipment and instrumentation systems, including, oil and gas, mining, food & beverages, marine, chemical, petrochemical, fertilizers, pulp and paper, pharmaceuticals, power stations, water/wastewater, etc.

After completion of the course, the student who wish to build a career in the process control domain can work as design engineer, application engineer, calibration engineer, control engineer, installation and commissioning engineer, maintenance engineer in above mentioned industry verticals and also with system integrators, consulting firms, project divisions, etc.

FF No. : 654

IC3203 :: MEASUREMENT SYSTEMS

Course Prerequisites: Knowledge of basic physics, electronics and electrical engineering.

Course Objectives:

1. To get knowledge of various electrical and electronic instruments and their applications
2. To understand various type electromagnetic interferences and their reduction techniques
3. To understand the concepts of reliability and methods to improve a system reliability
4. To understand various analytical instruments and their measurement techniques
5. To understand the operation and applications of various biomedical instruments

Credits: 5

Teaching Scheme Theory: 3 Hours/Week
Tut : 1 Hour/Week
Lab : 2 Hours/Week

Course Relevance: This course is one of the important core subjects of instrumentation engineering. It deals with the study of various electronics analytical and biomedical instruments which are extensively used in various industries and laboratories, for testing electrical and electronics equipments systems necessary for various applications in industries

SECTION-1

Electrical and Electronic Measuring Instruments: Analog instruments such as PMMC and moving iron type AC / DC voltmeter and ammeter. Digital multimeter (DMM) construction, measurement techniques, specifications and applications. Introduction to cathode ray oscilloscope CRO, digital storage oscilloscope (DSO), operating modes, sampling techniques, specifications and applications. Instruments for waveform analysis such as distortion meter and spectrum analyzer. Insulation testers and LCR meters. Timers / counters techniques, operating modes, specifications and applications. ATE types, testing techniques and applications.

Electromagnetic Interference and Electromagnetic Compatibility: EMI/EMC, intrinsic and extrinsic noise, effects on instruments and minimization technique. ESD, causes, Human ESD model, minimization techniques H/W and S/W protection against ESD.

Reliability Engineering: Introduction to reliability of systems. Bathtub curve. Various causes of failure. Techniques for improvement of reliability. Redundancy techniques.

SECTION-2

Analytical Instruments and Measurement: Introduction and classification of analytical instruments, qualitative and quantitative analysis. Electromagnetic spectrum, beer lamberts law, optical filters and monochromators. Filter photometer, colorimeter and spectrophotometers. Gas analyzers. Gas and liquid chromatography instruments. Measurement of PH, viscosity, conductivity, humidity and turbidity.

Biomedical Instrumentation: Introduction to human physiology, Biopotential generation, sensors used for physiological measurement Cardiovascular system and related instruments (Blood pressure measurement, ECG recorder, Blood flow measurement, blood volume measurement). Life saving devices like pacemaker, defibrillator, heart lung system. Brain system and EEG recorder. Respiratory system and spirometers, IOT in Biomedical system.

List of Tutorials:

1. Conversion of a galvanometer into a voltmeter and ammeter
2. Digital multimeter circuits
3. Measurement of intrinsic noise in electronic components.
4. Testing using ATE systems
5. Calculation of reliability of a system.
6. Measurement of concentration using a filter photometer.
7. Sensors requirement for physiological measurement
8. Cardiovascular signal processing techniques
9. Spirometer measurement techniques
10. IOT in healthcare system

List of Practical: (Any Six)

1. Extension of analog voltmeter and ammeter ranges
2. Electronics components testing using a DMM
3. Demonstration of the operation of a digital storage oscilloscope.
4. Measurement of waveform distortion using a distortion meter
5. Insulation measurement using an insulation tester.
6. Frequency and time period measurement using a universal counter.
7. Quantitative analysis using a filter photometer or a spectrophotometer.
8. Blood pressure measurement using VI lab
9. ECG and EEG amplifier design
10. ECG and EEG filter design using

List of Projects:

1. Design a voltmeter or an ammeter using a galvanometer
2. Design of a digital voltmeter or ammeter
3. Design of a temperature measurement system
4. Design of pressure measurement system
5. Design of humidity measurement system
6. Design of a simple capacitance meter
7. PCB design for a given circuit
8. Design of a frequency counter
9. Design of an instrument for a given parameter measurement
10. Body temperature measurement system
11. PH measurement system
12. Measurement system for magnetic field strength measurement

List of Course Seminar Topics:

1. Applications of automatic test equipment
2. Redundancy techniques in various equipment
3. Calculation of MTTF and MTBF of a system.
4. DSO specifications and selection
5. Virtual instruments
6. PCB making process
7. EMI testing techniques
8. Shielding and grounding techniques.
9. Surface mount devices SMD
10. Smart energy meter
11. Lux meter
12. Gauss meter

List of Course Group Discussion Topics:

1. Selection of electronic instruments for waveform analysis
2. Design of an analog to digital converter
3. Design of an analog to digital converter
4. Problems in healthcare system and implementation
5. IOT implementation in biomedical system
6. Virtual training in Biomedical systems
7. Opportunities in biomedical system
8. Milliohm and micro ohm measurement techniques.
9. Weather parameter measurement and monitoring
10. Selection of electronic instruments for various electrical parameters

List of Home Assignments:

Design:

1. Design of a DMM circuit.
2. IOT in measurement systems.
3. Various static and dynamic characteristics of measuring instruments.
4. Atomic absorption spectroscopy and applications
5. Design of a measurement system for a given parameter

.**Case Study:**

1. Testing of SMPS for electromagnetic interference
2. IOT for biomedical applications
3. Applications of a spectrophotometer in a pathology lab.
4. Vehicle pollution measurement technique
5. Instruments in flight

Blog

1. Analog to digital converter techniques
2. Digital to analog converter techniques
3. True RMS multimeters
4. Flame photometer and applications
5. Spirometer

Surveys

1. IOT based measuring instruments
2. Various applications of a spectrophotometer
3. Types of oscilloscopes
4. ATE application in electronic industries
5. Virtual instruments

Assessment Scheme: Course Assessment: Total : 100 mks

1. Mid Semester Examination : 15 marks (Total : 30 marks based on Section I)
   30 marks converted to 15
2. End Semester Examination: 15 marks (Total : 30 marks based on on Section II)
   30 marks converted to 15
3. Lab Assessment: Lab Assignments - 10 marks (6 assignments-10 marks each)
   (*60 marks converted to 12)*
4. Course Project : 10 marks (*40 marks converted to 8)*
5. Home Assignment : 10 mks (Total : 100 marks: Case study, Design work, Survey, Blog)
   100 marks converted to 10
6. Viva : 20 mks (at the end of semester); *100 marks converted to 20*
7. Seminar : 10 mks (at the end semester); *100 marks converted to 10*
8. Group Discussion: 10 mks (at the Mid of semester); *100 marks converted to 10*

Text Books:

1. Kalsi H S; Electronic Instrumentation; Tata McGraw-Hill.
2. A. J. Bowens; Digital Instrumentation; Tata McGraw-Hill.
3. Balagurusamy; Reliability Engineering; Tata McGraw-Hill
3. R S Khandpur; Handbook of Analytical Instruments; McGraw Hill Education; 2 edition
4. Willard, H. H., Merritt Jr, L. L., Dean, J. A., & Settle Jr, F. A. Instrumental methods of analysis. 7th edition. CBS Publishers & Distributors.
5. R.S. Khandpur; Handbook of Biomedical Instrumentation; Third Edition; 2014, McGraw Hill Education (India) Private Limited.

Reference Books:

1. Sawhney, A. K; Electrical and electronic Measurements and Instrumentation. Dhanpar Rai and Sons.
2. Ananda R. Natarajan; Biomedical Instrumentation and Measurements; PHI Learning.

Moocs Links and additional reading material: www.nptelvideos.in
http://www.nptelvideos.in/2012/11/industrial-instrumentation.html

Course Outcomes: After completing the course the students will be able to

1) Demonstrate the operation of various electronic instruments
2) Select an electronic instrument for a given application
3) Contribute in the design or development of a measurement system
4) Select and use analytical instrument for measuring chemical parameters
5) Understand and demonstrate the operation of various biomedical instruments

CO PO Map

CO	PO -1	PO-2	PO -3	PO -4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO -1	PSO -2	PSO -3
1	2	2	1	1	1	1	1	0	0	0	1	1	2	2	2
2	2	3	1	1	1	1	1	0	0	0	1	1	2	2	2
3	2	3	1	1	1	1	1	0	0	0	1	1	3	3	3
4	2	2	1	1	1	1	1	0	0	0	1	1	2	1	1
5	2	2	1	1	1	1	1	0	0	0	1	1	1	1	1

CO attainment levels

CO No.	IC3203_CO1	IC3203_CO2	IC3203_CO3	IC3203_CO4	IC3203_CO5
Attainment Level	2	3	5	4	3

Job Mapping:

Electronic instruments manufacturing industries. Electronic testing labs. Biomedical and analytical instruments manufacturing industries and services. Electronic industries.
Electrical equipment manufacturing industries.

FF No. : 654

IC3205 :: VISION BASED AUTOMATION

Course Prerequisites: Fundamentals of signal processing and linear algebra

Course Objectives:

1. To understand basics of image and its attributes
2. To understand the fundamentals of various image pre processing techniques
3. To understand the image registration basics
4. To understand fundamental of 2D transform
5. To understand basics of Robot vision
6. To understand and realize a case study (vision based application)

Credits: 5

Teaching Scheme Theory: 3 Hours/Week
Tut : 1 Hour/Week
Lab : 2 Hours/Week

Course Relevance: This course is an integral component of Industry 4.0. Vision based automation along with IOT leads to SMART factory. Vision based applications are dominating the technologies such as machine learning, Automated Biomedical imaging, Autonomous vehicles, automatic Surveillance systems, video analytics and automated scene analysis.

SECTION-1

Basics of vision based automation, basic building elements of vision based automation.

Fundamentals of image: Spatial attributes such as Resolution, dpi, pixel connectivity. Frame rate, 2D geometric representation, complex representation, frequency attribute in image. Edge detection by various derivative operators. Image texture.

Image Preprocessing and analysis: Histogram representation, segmentation, inters class and intra class measures. Intensity enhancement using Gaussian filtering, high pass filtering, various image normalization techniques.

Image Registration and analysis: Importance of TRS parameters in image analysis, Estimation of translation, rotation and scale using Geometrical Transformation, Motion detection, optical flow, object tracking.

SECTION-1I

Feature Extraction Techniques and analysis: Indirect method of image feature extraction using various transforms; Fundamental of 2D transform, their mathematical representation and interpretation and properties. Transforms such as Fourier transform, Gabor transform, wavelet transform, and Radon transform. Feature selection methods.

Understanding Robot Vision: Review robotics system, Building blocks of vision based robotics system, robot vision system specifications, rotation matrix, displacement matrix, homogeneous transformation (forward kinematics), inverse kinematics, Jacobean matrix (joint velocity), and path planning.

Image/object classifiers and Vision based Automation Case Studies: Image Classifiers such as distance metrics, KNN, K Mean, and Neural net. Case studies such as Printed circuit board verification, object detection, Geometric parameter measurement.

List of Tutorials: (Any Three)

1. Camera specification parameters and discussion.
2. Image normalization using Log transformation and discussion
3. Histogram and its importance in image processing
4. Spatial domain and frequency domain image processing
5. Understanding a motion estimation and deliberations
6. Motion estimation using wavelet transform
7. Demonstration of 2D Fourier transform of an image and interpretation
8. Gabor transform features for directional object representation
9. Linear vs Nonlinear classifiers is image classification
10. Demonstration of Robot coordinates using homogeneous transformation

List of Practicals: (Any Six)

1. Image normalization using Log transformation
2. Histogram equalization based image normalization
3. Frequency domain image low pass filtering
4. Object segmentation using spatial features
5. Object segmentation using frequency domain features
6. Gabor transform based object feature representation
7. Demonstration of 2D Fourier transform of an image and interpretation
8. Radon transform features for directional object representation
9. Distance metric for image classification
10. Neural network based object classification

List of Projects:

1. Gabor feature based object type recognition
2. Color map based object sorting
3. Feature based object grading
4. QR code verification algorithm
5. Person auto-tracking in high security zone
6. Automated computation of biomedical pathology from brain image
7. Object measurement algorithm
8. Deep learning for object classification
9. Person authentication for Industrial application based on
10. Deep learning for automated handwritten signature recognition

List of Course Seminar Topics:

1. Deep learning in image processing
2. Motion and its importance in image applications
3. Depth estimation techniques
4. Vision robot and its applications
5. Vision based automation: Future of Automation

List of Course Group Discussion Topics:

1. Selection of image classifier
2. Selection criteria of image preprocessing
3. Wavelet or Fourier transform for image based applications
4. Image feature extraction and selection
5. Vision based Project completion cycle

List of Home Assignments:

Design:

1. Design of suitable image preprocessing technique in case of poor illumination
2. An algorithm with pseudocode for automated Person identification based on palm print
3. An Automation system for measurement of geometric features of an object
4. Schema for the Autonomous vehicle
5. Schema for automated GV for industrial application

Case Study:

1. Image restoration application
2. Computation of feature parameters of directional object
3. Application of image processing in PCB manufacturing
4. Color based object sorting
5. Object grading based on geometric attributes

Blog

1. Vision based automation
2. Image quality measurement
3. Vision Camera types and applications
4. Image preprocessing: limitations and advantages
5. Future of vision based automation

Surveys

1. Vision based automation applications
2. Different image feature extraction techniques
3. Image processing and machine learning applications
4. Vision in biometrics applications
5. Vision based automation: its advantages and threats

Assessment Scheme: 100 marks

1. MSE: 30 marks and 15 percent weightage
2. ESE: 30 marks and 15 percent weightage
3. Lab assessment: 6 labs with 10 marks each. Converted to 12 percent
4. Course project: 8 percent weightage
5. HA: weightage 10 percent
6. Seminar: 10 percent weightage (based on section 1)
7. Viva: 20 percent weightage
8. GD: 10 percent weightage

Text Books:

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010.

2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.

3. Willliam K Pratt, "Digital Image Processing", John Willey, 2002.

Reference Books:

1. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.

2.J. C. Russ. The Image Processing Handbook. CRC, Boca Raton, FL, 4th edn., 2002

Moocs Links and additional reading material:

www.nptelvideos.in

Course Outcomes:

1. Understanding basics of image and its attributes
2. Understanding the fundamentals of various image pre processing techniques
3. Understanding the image registration basics
4. Understanding fundamentals of 2D transform
5. Understanding the basics of Robot vision

CO PO Map

CO	PO -1	PO-2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -1	PSO -2	PSO -3
1	2	2	1	1	1	1	0	0	0	0	0	0	1	2	2
2	2	3	1	1	2	1	0	0	0	0	0	0	2	1	2
3	2	3	1	1	1	1	0	0	0	0	0	0	1	1	1
4	2	2	1	1	1	1	0	0	0	0	0	0	2	1	1
5	2	2	1	1	0	1	0	0	0	0	0	0	1	1	1

CO attainment levels

CO	1	2	3	4	5
level	2	2	3	5	4

Future Courses Mapping: *Machine Intelligence*

Job Mapping:

Students may get advantage in getting jobs in Industries which deals with

1. Machine learning
2. Automobile manufacturing
3. Autonomous vehicle manufacturing
4. Artificial Intelligence
5. Biomedical imaging
6. Biomedical instrumentation
7. Medical data analytics
8. Video analytics

FF No. : 654

IC3213 :: ENGINEERING DESIGN- I

Course Prerequisites:

No Prerequisites

Course Objectives: The student will be able to

1. Understand the importance of choosing socially relevant areas for project work
2. Understand the importance of Project centric learning
3. Plan and execute systematic strategy to complete the Project work
4. Document and present the completed project work in proper scientific format

Credits: 1

Teaching Scheme Theory: Hours/Week

Tut: Hours/Week

Lab: 2 Hours/Week

Course Relevance: This course will develop

1. Awareness about project centric learning will be quite useful in professional work in future
2. Self learning ability to up skill and upgrade once knowledge continuously
3. Ability to work in a Team and Team leadership which will be useful while doing B.Tech Major projects

Topics and Contents
Basics for Projects Importance of Project Centric Learning, Concept of Domains, Tools and Technology**,** Socially Relevant Project Areas **Domain Project Areas:** Awareness and identification of appropriate areas for project work such as: Agriculture, Defense, Healthcare, Smart city, Smart energy, Security Systems, Automobile, Space, Green Earth, Automobiles, Assistive Aid, Water Management, Swachh Bharat (any other socially relevant research area) ***Tools:*** *Self learning Activity* Learn and use latest engineering tools as per the project need. A few are listed below **Tools in Computer Engineering:** **Programming / Coding Tools** :- JavaScript, Python, Java, C#, C++, PHP, **Computer Vision Tools** :- OPENCV,MATLAB), **Single board computers:** Raspberry Pi, **Neural network simulators Tools:- Neural Lab, NEST , Machine Learning Tools:- Torch, TensorFlow, Data Science Tools :-** R language programming**,** SQL, **Tools in Electronics and Electronics & Telecommunication Engineering:** **Electronic Design Simulation Integrated Circuit Tools**:- VHDL, Xilinx, Modelsim , Cadence learn, **Embedded System Tools**:- AVR Studio, Arduino ,Kiel µvision, **Circuit Simulation Tools:-** Pspice, Simulink, Workbench, Tinkercad, ThingSpeak, Proteus, CircuitPro ,**Processor based integrated circuits** :Microcontroller, electronic prototype platforms: Arduino,**Networking Tools** :- Wired / Wireless and Ad-hoc Networking NS-2 , Packet Tracer, **Signal Processing Tools**:- Code Composer Studio along with Integrated circuits

Tools in Instrumentation and Control Engineering:-
System Automation Tools :- PLC , SCADA , PADS, ORCAD ,Eagle, Kicad,
Tools in Mechanical, Industrial, Production, Engineering:-
Engineering Design Tools:- AutoCAD, CATIA,COMSOL Multiphysics, Solidworks, Inventor, PTC Creo **Fluid Dynamics:-** Fluent, HyperWorks, **Finite Element/ Structural Analysis:-** Ansy's, Ansy's Free Student software **Thermal Simulation:-** FlowTherm, Ansys Icepak
Tools in Chemical Engineering :-
Chemical process simulator:- DWSIM - Open Source Process Simulator, **chemical simulation software:-** Schrödinger,
(any other suitable tool as per the project requirement)

Technology: Map the appropriate technology**:**
Emerging Technologies :- Artifical Intelligence, 5G networks, IoT, Serverless Computing, Blockchain , Virtual reality (VR)/Augmented reality (AR), Drone, Quantum Computing, Robotics

Interdisciplinary Technologies:- Nanotechnology, Nanomaterials, Nanoelectronics, Quantum Computing , Spintronics

Computer Technologies:- Big Data, Cloud Computing, Human Machine Interface (HMI),Cyber Security

Medical and Healthcare Technologies:- Biomedical Technology,

Energy Technologies :- Solar Energy Based Technologies, Wind energy, Green energy Technologies, Energy Storage
Electronics, Communication Technologies:- Wireless, GPS, Bluetooth, Mobile/social Internet Automation, Mobile Technologies, Voice Assistants, signal processing, image processing, Machine vision, Sensors, Optoelectronics,
Other imp Technologies:- Automobile ,3 D printing
(any other technology as per the project requirement)

Project Implementation: Selection of the domain area, Literature review, Identify and finalize the Problem Statement (student in consultation with Guide), Understand and select and use the appropriate tools, Map the technologies learned with the project needs (refer available online offline Resources, books, soft materials, relevant MOOCs, consult with domain expertise) Self Learning:- learn the required tools, skill sets, acquire knowledge to do the project

Designing & Testing: Designing of project prototype based on domain areas by incorporating appropriate tools and technology, validation and Testing of the prototype to give the best possible solution

Documentation and Final Assessment : Develop and demonstrate the optimized prototype /working model of project , Documentation of project report in stipulated standard format as per the preset norms i.e. IEEE Research paper format, Present Project work at final viva voce

FF No. : 654

IC3215:: SOFTWARE DESIGN – I

Guidelines to the students regarding Software Development Lab

The objectives of these courses are to enhance coding skills and programming ability among the students. To cope up with rapid technology changes, these courses offer every student to learn new-age programming techniques and languages. The focus of these courses is on learning programming fundamentals and techniques.

- Software Development course would be conducted as single student activity.
- Students can choose any software projects to upgrade and enhance their coding skills using any open source tools.
- Complexity of the project should be sufficient and approved by course supervisor.
- Students are allowed to use libraries as needed.
- Major thrust areas of Software Development Project course are Artificial Intelligence / Machine Learning / Data Analytics / Vision based Automation
- A suggestive list of possible domains for SDP is given below
    1. Mobile app development
    2. Responsive Web development
    3. Database / Back end development
    4. MySQL / RDBMS
    5. Gamification
    6. GUI Development
- Mid-Semester review and End Semester Assessment would be conducted.

Course Outcome: Students will be able to

1. Map the technologies learned with the project needs
2. Apply the technological knowledge to design various feasible solution
3. Select best possible solution to solve a the problem

FF No. : 654

IC3207:: SOFTWARE DESIGN PROJECT– I

Guidelines to the students regarding Software Development Project Course

The objectives of these courses are to enhance coding skills and programming ability among the students. To cope up with rapid technology changes, these courses offer every student to learn new-age programming techniques and languages. The focus of these courses is on learning programming fundamentals and techniques.

- Software Development course would be conducted as single student activity.
- Students can choose any software projects to upgrade and enhance their coding skills using any open source tools.
- Complexity of the project should be sufficient and approved by course supervisor.
- Students are allowed to use libraries as needed.
- Major thrust areas of Software Development Project course are Artificial Intelligence / Machine Learning / Data Analytics / Vision based Automation
- A suggestive list of possible domains for SDP is given below
    1. Mobile app development
    2. Responsive Web development
    3. Database / Back end development
    4. MySQL / RDBMS
    5. Gamification
    6. GUI Development
- Mid-Semester review and End Semester Assessment would be conducted.

Course Outcome: Students will be able to

1. Map the technologies learned with the project needs
2. Apply the technological knowledge to design various feasible solution
3. Select best possible solution to solve a the problem

FF No. : 654

IC3209:: ENGINEERING DESIGN AND INNOVATION-III

Course Prerequisites: Electronic design, simulation, MATLAB, Labview, PCB design

Course Objectives:

1. To gain practical knowledge
2. To understand the concepts
3. Familiarity with the usage of modern tool

Credits: 4

Teaching Scheme Theory: - Hours/Week
Tut : - Hours/Week
Lab : 8 Hours/Week

Course Relevance:.....

SECTION-1
Topics and Contents **It is based on Real time project implementation in the chosen specific defined area.** Agriculture Healthcare Automotive Process Control IoT

Course Outcomes:

1) Design solutions for given engineering problem
2) Demonstrate practical knowledge by constructing models/algorithms for real time applications
3) Express effectively in written and oral communication
4) Exhibit the skills to work in a team
5) Prepare a time chart and financial record for execution of the project

SEMESTER II

FF No. : 654

IC3202 :: BUILDING AND PROCESS AUTOMATION

Course Prerequisites:

Course Objectives:

Credits: 5 **Teaching Scheme Theory: 3** Hours/Week
Tut : 1 Hour/Week
Lab : 2 Hours/Week

Course Relevance:.....

SECTION-1

DCS Introduction: Location of DCS in Plant, advantages and limitations, Comparison of DCS with PLC, DCS components/ block diagram DCS Architecture Functional requirements at each level, Database management.
DCS Hardware: Controller Details Redundancy, I/O Card Details Junction Box and Marshalling Cabinets Operator Interface, Workstation Layout different types of control panels, types of Operating Station Programming as per IEC 61131-3,Database management, Historical data using in log, report and trend display. System status display.
Database and Alarm management Database management, Historical data using in log, report and trend display.
Network topology : bridges, routers and gateways, Instrumentation and control devices Explain functions of following network devices: Repeater, Hub, Bridge, Switch, Router, Gateway, Access point, Wireless Access points.
Serial data communications: Serial data communications interface standards, balanced and unbalanced transmission lines, RS-232 standard, RS-449 interface standard, RS-423 interface standard, RS-422 interface standard, Comparison .
HART Communication Protocol: Architecture - physical, data link, application layer, communication technique

SECTION-1I

Introduction Fieldbus and ProfiBus Introduction to Foundation Fieldbus : Physical layer and wiring rules Data Link layer Application layer User layer Wiring and installation practice with Fieldbus Termination Preparation ,Installation of the complete system. Introduction to ProfiBus standard: ProfiBus protocol stack Physical layer Data Link layer Application layer
Introduction of building automation: Introduction of Components used in building automation system. Concept and application of Building Management System and Automation. Communication protocols used in Building Automation.
Light Control System Need of Light control in Building Automation. Occupancy sensors and Daylight harvesting methods. Use of DALI communication protocol HVAC system Principles

of HVAC system design and analysis. Different components of HVAC system like heating, cooling system, chillers, air circulation, humidifying and dehumidifying processes. Control systems and techniques.

Access Control & Security System Concept of automation in access control system for safety. Manual security system. RFID enabled access control with components like active, passive cards, controllers, and antennas, Biometric Intrusion alarm system, Components of public access (PA) System like speakers, Indicators, control panels, switches. Design aspects of PA system.

Fire &Alarm System Different fire sensors, smoke detectors and their types.CO and CO2 sensors.Fire control panels. Design considerations for the FA system. Concept of IP enabled Fire & Alarm system. Design consideration of EPBX system and its components.

List of Tutorials: (Any Three)

1). Develop PID tuning using DCS.
2). Design and development of cascade loop using FBD
3).Apply ratio control strategy on heat exchanger loop using FBD.
4).Develop different control strategy using DCS on boiler drum level control.
5).Develop interfacing serial card to DCS.
6) Study different serial communication protocols.
7).Study different HAVC system.
8).Study different access security system.
9).Study different fire security system.
10) Study different light control system.

List of Practicals: (Any Six)

1) Tune Delta –V PID control for any single loop process.
2). Develop feed forward control for SLPC using DCS.
3). Develop cascade control for process loop using DCS.
4). Develop override control for process loop using DCS.
5). Develop split range control for process loop using DCS.
6). Develop ratio control for process loop using DCS.
7). Develop three element drums level control using DCS
8). Develop different boiler interlock using DCS.
9). Develop boiler combustion control using DCS.
10). Develop interfacing serial communication using DCS.
11). Develop HART card communication using DCS.
12). Develop distillation column control using DCS.

List of Projects:

1).To Interfacing of Level/Temperature control loop using Delta-V 4.
2).To develop communication between HART/MODBUS to DCS system
3). To develop simulation of boiler control
4). To develop simulation of distillation column
5).Development of Light control systems
6). Development of Home automation systems
7). Development of Home Security systems
8). Development of CCTV system for Surveillance application
9). Development of Fire Alarm system.

10).Design of PA system for given application

List of Course Seminar Topics:
1.Apply different alarm management on distillation column
2 Detail network topology used in Delta-V DCS.
3.different cable and there characteristic used in DCS communication.
4.Delta-V DCS Hardware detail
5.Delta-V workstation
6.DCS junction box and marshall cabinet.
7.DCS electronics marshelling
8.Database management in DCS
9.DCS PID configuration
10.DCS advance function block

List of Course Group Discussion Topics:
1.Compare performance for foundation fieldbus and profbus
2.Compare HART and MODBUS communication for control CSTR loop
3.Latest technology in DCS manufacturing
4.Different mode communication between PLC and DCS
5.Compare DCS and PLC for Batch process control .
6.Light control in Building Automation.
7.HVAC system design and analysis.
8.Access Control & Security System automation
9.Fire &Alarm system automation
10.Trends in HART protocol

List of Home Assignments:
Design:
1.Design of Access control system for different applications
2.Design of Fire control system for different applications
3.Design of FA for different applications
4.Design of CCTV system for Surveillance application
5.Design of Access control system for different applications
Case Study:
1.Case study - startup sequence of boiler
2.Case study of a distillation column of chemical industry
3.Network Topology used in DeltaV DCS
4.Profibus DP in automobile industry
5.Foundation fieldbus in process industry
Blog
1.Comparison of control strategies for distillation column.
2.Use modbus card in DCS for communication
3.Latest trends profibus
4.Latest trends Foundation fieldbus
5.Latest trends HART
Surveys
1.Survey of Distillation column
2.Serial data communication in DCS
3.Automation on Spray dryer

4.Application of Heat exchanger
5.Profibus DP application in industry

Text Books

1. 1. J. Sinopoli, Smart Buildings, Fairmont Press.
2. B. Capehart, Web Based Enterprise Energy and Building Automation Systems, C.E.M, Editor.
3.Computer Based Process Control", Krishna Kant, Prentice Hall of India.
4. Computer Networks Tannebaum Andrew Pearson, New Delhi, 5th Edition, 2011

Reference Books:

1. N.Budiardjo, Building Automation Beyond the Simple Web Server, Clasma Events, Inc.
2. P. Ehrlich, What is an Intelligent Building?, Building Intelligence.
3.Distributed Computer Control for Industrial Automation", Popovik-Bhatkar, Dekkar Publications

Moocs Links and additional reading material: www.nptelvideos.in

Course Outcomes:

1)IC3202_CO1: Understand working of DCS system [1] (PO1, 5, PSO3)

2).IC3202_CO2: Select medium for various types of data transmission. [4] (PO1, 5, 12, PSO3)

3).IC3202_CO3:Understand the Serial data communications and HART protocol[3] (PO12, PSO3)

4).IC3202_CO4: Choose different sensors and components used in building automation [4] (PO (PO 1,2,3,7,11,12,PSO1,2,3)

5). IC3202_CO2: Design of light control system for real world application automation [3] (PO 1,2,3,7,11,12,PSO1,2,3)

6).IC3202_CO3: Explain the use of HVAC's for different applications [2] (PO 1,2,3,4,7, PSO 1,2)

CO PO Map

CO attainment levels

Future Courses Mapping:

Mention other courses that can be taken after completion of this course

Job Mapping:

In automation Industry

FF No. : 654

IC3204 :: IOT ANALYTICS

Course Prerequisites: basic programming language, electronics basics

Course Objectives:

1.To understand the basics of the IOT

2.To understand the architecture of IOT

3.To understand the IOT Communication Technology

4.To understand Cloud communication

5. To understand the implementation of use cases

Credits: 5

Teaching Scheme Theory: 3 Hours/Week
Tut : 1 Hour/Week
Lab : 2 Hours/Week

Course Relevance:.....

SECTION-1
Physical Design of IOT, Logical Design of IOT, IOT Enabling technologies, IOT Levels & Deployment Templates, IoT and M2M, IoT System Management with NETCONF-YANG IOT Platform Design Methodology – Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information model Specification, Service specification, IOT level Specifications, Functional View Specifications, Operational View Specification, device and component integration, application development, case study on IOT system for weather monitoring Wireless Sensor Networks: WSN Architecture, the node, Connecting nodes, Networking Nodes, Securing Communication WSN specific IoT applications, Connectivity Technologies and Communication Protocols in IOT RFID: Introduction, Principle of RFID, Components of an RFID system Logical Design with Python Embedded suite for IoT Physical device – Arduino / Raspberry Pi Interfaces,Hardware requirement of Arduino / Raspberry Pi

SECTION-1I

Topics and Contents

Protocol standardization of IOT

Protocols in IOT: CoAP, XMPP, AMQP, MQTT, Communication Protocols: IEEE 802.15.4, Zigbee, 6LoWPAN, Bluetooth, WirelessHART

IOT Physical Server and Cloud Offerings cloud architecture standards and interoperability-Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public, private clouds community cloud, IoT cloud providers - AWS IoT, Google Cloud and Azure

Fog Computing, Web Application Messaging Protocol (WAMP), SkyNet IoT Messaging Platform, SDN Cloud Storage Models

Python web application framework – Django

Data Anaytics for IOT: Overview of Hadoop Ecosystem, MapReduce Architecture

List of Tutorials: (Any Three)

1. OT basic building blocks
2. IOT Embedded suit
3. IOT ISO layers
4. IOT protocol suit
5. IOT device protocols
6. IOT securities
7. Smart city
8. Smart factory
9. Connected cars
10. SDN

List of Practicals: (Any Six)

1. Python programming – data type & data structure,
2. Python Programming - functions, File handling, control flow
3. Json format implementation
4. Arduino / Raspberry Pi interface to GSM module
5. Arduino / Raspberry Pi interface to Bluetooth module
6. Arduino / Raspberry Pi interface to Wi-fi module
7. MQTT protocol implementation
8. Django application development
9. Cloud interface
10. Zigee protocol implementation

List of Projects:

1. IOT system for Agriculture system
2. IOT system for Smart Home automation
3. IOT system for irrigation system
4. Wireless weather monitoring system
5. IOT for SMART city
6. IOT for Retail system
7. IoT for smart parking
8. IOT for healthcare system
9. IOT for Smart building
10. IOT for energy sector

List of Course Seminar Topics:

1. Wirelss HART protocol
2. IOT Protocol security
3. IOT protocol standardization
4. IOT protocol – Zigbee
5. IOT in Healthcare system
6. WSN protocol and implementation
7. Django application
8. SDN system
9. IOT in retail syste
10. Cybersecurity and IOT

List of Course Group Discussion Topics:

1. IOT protocol standardization
2. IOT system implementation issues
3. IOT embedded requirement
4. Challenges in IOT healthcare syste
5. Protocol requirements

List of Home Assignments:
Design:
1.Design of irrigation system

2. Desi gn of RFID luggage tracking system

3. Design of Cloud system for sensor information tracking

4. Design for WSN for weather monitoring

5. Design of cloud system

Case Study:

MQTT used in agriculture

WSN used in health care system

RFID used in luggage tracking

AWS service Raspberry pi used in IOT

IOT in Industrial applications

.

Surveys
1.MQTT protocol used in Industry

2.WSN

3. RFID used in tracking ffered

4. Embedded suit for IOT

5. Cloud services offered

Suggest an assessment Scheme:

- MSE
- ESE
- Lab Assessment
- Course project
- HA
- GD
- PPT

Text Books: ***(As per IEEE format)***

1.Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
2.Raj Kamal, "Internet of Things: Architecture and Design Principle,s", McGrawHill Education,2017

Reference Books: ***(As per IEEE format)***

1. Pethuru Raj, Anupama C. Raman, The Internet of Things Enabling Technologies, Platforms, and Use Cases, CRC Press Taylor & Francis Group, International Standard Book Number-13: 978-1- 4987-6128-4

2. Rajkumar Buyya, Amir Vahid Dastjerdi Internet of Things – Principals and Paradigms, Morgan Kaufmann is an imprint of Elsevier, ISBN: 978-0-12-805395-9 Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821- 140-7, Willy Publications

3. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2 nd Edition, Willy Publications

4. Daniel Kellmereit, Daniel Obodovski, "The Silent Intelligence: The Internet of Things",. Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700, ISBN-13: 978- 0989973700.

5. Fang Zhaho, Leonidas Guibas, "Wireless Sensor Network: An information processing approach", Elsevier, ISBN: 978-81-8147-642-5.

6. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications 7. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer

Moocs Links and additional reading material: www.nptelvideos.in

Course Outcomes:

1. Learn and demonstrate concepts of Internet of Things [1]
2. Develop and demonstrate embedded tools usage for IOT. [2]
3. Demonstrate Python programming skills for IOT [3]
4. Understand, develop and demonstrate the connectivity technologies and protocols in IOT, Demonstrate Cloud technology concepts [3]
5. Develop Web Application framework using Django [5]
6. Illustrate IOT design for application of Home automation, Smart Parking, Environment, Agriculture, Productivity applications etc [4] (

CO PO Map

CO1- (PO 1, 2, 3, 4, 12) (PSO 2, 3)
CO2- (PO 1, 2, 3, 4, 5, 12) (PSO 2, 3)
CO3-(PO 1, 2, 3, 4, 5, 12) (PSO 2, 3)
CO4- (PO 1, 2, 3, 4, 12) (PSO 2, 3)
CO5- (PO 1, 2, 3, 4, 5, 12) (PSO 2, 3)
CO6- PO 1, 2, 3, 4, 12) (PSO 2, 3)

CO attainment levels

CO1- 1
CO2-2
CO3- 3
CO4-3
CO5-4
CO6-5

Future Courses Mapping:

Big Data Analytics
Cybersucrity
AR/VR
Data Analytics
AI

Job Mapping:

1. Process Industry
2. Manufacturing Industry
3. Software industry

FF No. : 654

IC3206 :: VIRTUAL REALITY

Course Objectives:

1. To understand the basics of virtual reality
2. To know about the hardware requirement about virtual reality
3. To familiarize about the software requirement about virtual reality the
4. Understanding the game development requirement

Credits: 5 **Teaching Scheme Theory: 3** Hours/Week
Tut : 1 Hour/Week
Lab : 2 Hours/Week

Course Relevance:.....

SECTION-1

Virtual Reality

Computer-Mediated Reality. Milgram's Reality-Virtuality continuum: A Brief History of Virtual Reality , The five Classic Components of a VR System Reality, Augmented Reality, Augmented Virtuality, Virtual Environment and Mixed Reality. Taxonomy of Mixed Reality: real, virtual, Extent of Work Knowledge (EWK), Reproduction Fidelity (RF), Extent of Presence Metaphor (EPM).

Introduction to AR, VR and MR: Differentiation, Features, use-cases and examples

Introduction to VR hardware : Position and Motion Trackers ,Inside Out/Outside In, Tracker Performance Parameters, Optical - Active and Passive Trackers, Inertial and Hybrid Trackers - HMD Trackers , Magnetic Trackers, Mechanical Trackers, Ultrasonic Trackers, IR tracker

Tracking: Orientation tracking, tilt and yaw drift correction. Tracking with camera, Position tracking techniques. Interaction: selection, manipulation, isomorphic and non-isomorphic, exocentric and ego-centric interaction. Locomotion and Design consideration Data Gloves and Gesture Interfaces

The Human behind the lenses: Human Perception and Cognition,The Human Visual System, The Human Auditory System, The Human Vestibular System, Physiology, Psychology and the Human Experience , Adaptation and Artefacts

Software for VR: Geometry of Virtual World and Illumination: Birds-Eye View. Geometric Modelling, display resolution, high dynamic resolution, Matrix algebra and 2D rotations. 3D rotations and Yaw, Pitch and Roll. Axis angle representation. Quaternions. Convewarerting and multiplying rotations. Homogeneous transforms. The chain of viewing transforms. Eye transforms. Viewport transforms. Three interpretations of light. Refraction. Visual Perception: Depth perception, motion perception and frame rates. Visual Rendering: Overview, Shading models, rasterization, Pixel shading, Distortion shading.
Camera tracking and 3D Rendering for Immersive Environments

SECTION-1I

Augmented Reality

Basics of Image Processing: Color model: RGB andgrey. Basic linear and nonlinear operations. Image Enhancement Algorithms: contrast enhancement, histogram equalization. Segmentation.

Object Recognition and Tracking: edge and transition detection, circle, line and corner detection, smoothing, blurring, perspective recovery, feature point extraction: SIFT, Harris Corner Detection.

Marker based Vision based AR: Marker creation and marker tracking. Object tracking: Lucas Kanade Tracker, Optical Flow. Pose estimation. Rendering Techniques: Drawbacks of standard graphics libraries, artificial looks and aliasing artifacts due to rasterization. Lighting conditions, reflective properties estimation.

Local illumination, secondary illumination, global illumination. 3D rendering, specialized rendering, wireframe rendering, and polygon-based rendering. Occlusion handling. Image and object rendering Unity handles

Markerless AR- slam algorithm

Location based Augmented Reality: GPS, gyroscope working and features. Sensor data fusion.

List of Tutorials: (Any Three)

1. Introduction to game development

2. Types of Games and brief of Game users Process

3. Games Platforms – PC, Xbox, PlayStation, Mobile, VR

4. Game Development and 3D Tools

5. Game Components, 3d Assets, scenes, Characters,Real Time rendering and Animations and AI

6. Concepts – of Camera, Co-ordinate system, point cloud, Raycast

7. World Tracking, Object and Face Tracking

8.Development tools:Native Google and Apple tools, Unreal and Unity for AR

9. Creating and manipulating virtual objects

10.Developing AR Assets

List of Practicals: (Any Six)

1. Introduction to unity and 3D workspace and assets
2. Scripting in Unity, creating virtual environment and deploying app
3. Testing Cardboard unity sdk
4. Configuring cardboard sdk default app with Forest Environment with auto-locomotion
5. Introduction to Vuforia SDK
6. Creating a marker and rendering virtual object

App development

List of Projects:

1. Learn a Game Development Tool - Unreal Engine: Maze Game, Treasure Hunt
.2 3d design the assets required for game - Blender
3.. Deploy Game in Mobile, PC and V
4. Use of Hand Controllers in VR
5. Create a VR Museum
6. Pokeman style game
7. Face detection and tracking

List of Course Seminar Topics:

1.VR
2.components of VR
3. Rendering technique
4. Tracker system
5. Virtual environment
6. Mixed reality
7. Extended reality
8. IP for virtual reality
9. Geometric modelling

ingList of Course Group Discussion Topics:

1. Game components
2. Object recognition
3. Markerless AR
4. Location based Augmented Reality
5. Rendering Techniques
6. Sensor data fusion.
7. feature point extraction
8. Camera tracking
9. 3D Rendering for Immersive Environments
10. Data Gloves and Gesture Interfaces

List of Home Assignments:

Design:

1. IR tracker
2.
3.
4.
5.

Case Study:

1.
2.
3.
4.
5.

Blog

1.
2.
3.
4.
5.

Surveys

1.
2.
3.
4.
5.

Suggest an assessment Scheme:
Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Blooms Taxonomy.

Text Books: ***(As per IEEE format)***

1. *Name(s) of author(s); Title of the book; Edition No., Publisher*
2
3
4

Reference Books: ***(As per IEEE format)***

1. *Name(s) of author(s); Title of the book; Edition No., Publisher*
2
3
4

Moocs Links and additional reading material:
www.nptelvideos.in
https://www.coursera.org/learn/xr-introduction

Course Outcomes:
1) Identify the most suitable technique for a given use case based on the understanding of the similarities and differences between virtual, augmented and mixed reality with the help of Flynn's taxonomy
2)Design various transformations for manipulating an object in 3 dimensional vector space
3)Analyze rendering problems and rectify to provide realistic experience
4)Track visual cues for marker-based and marker-less augmented reality experience
5)Create local, global and secondary illumination for higher extent of presence metaphor
6)Extract sensory data to implement location based augmented reality experience

CO PO Map

CO1- Identify the most suitable technique for a given use case based on the understanding of the similarities and differences between virtual, augmented and mixed reality with the help of Flynn's taxonomy -3
Co2- Design various transformations for manipulating an object in 3 dimensional vector space - 1
CO 3- Analyze rendering problems and rectify to provide realistic experience 4
CO4 - Track visual cues for marker-based and marker-less augmented reality experience 5
CO5- Create local, global and secondary illumination for higher extent of presence metaphor 7
CO6-Extract sensory data to implement location based augmented reality experience 6

CO attainment levels
CO1 3
CO2 3
CO3 3
Co4 2
Co5 3
Co6 2

Future Courses Mapping:

Game development, AI , Machine vision,

Job Mapping:
Training modules for the companies, Game developer

FF No. : 654

IC3214 :: ENGINEERING DESIGN- II

Course Prerequisites:

No Prerequisites

Course Objectives: The student will be able to

1. Understand the importance of choosing socially relevant areas for project work
2. Understand the importance of Project centric learning
3. Plan and execute systematic strategy to complete the Project work
4. Document and present the completed project work in proper scientific format

Credits: 1

Teaching Scheme Theory: Hours/Week

Tut: Hours/Week

Lab: 2 Hours/Week

Course Relevance: This course will develop

1. Awareness about project centric learning will be quite useful in professional work in future
2. Self learning ability to up skill and upgrade once knowledge continuously
3. Ability to work in a Team and Team leadership which will be useful while doing B.Tech Major projects

Topics and Contents
Basics for Projects Importance of Project Centric Learning, Concept of Domains, Tools and Technology**,** Socially Relevant Project Areas **Domain Project Areas:** Awareness and identification of appropriate areas for project work such as: Agriculture, Defense, Healthcare, Smart city, Smart energy, Security Systems, Automobile, Space, Green Earth, Automobiles, Assistive Aid, Water Management, Swachh Bharat (any other socially relevant research area) ***Tools:*** *Self learning Activity* Learn and use latest engineering tools as per the project need. A few are listed below **Tools in Computer Engineering:** **Programming / Coding Tools** :- JavaScript, Python, Java, C#, C++, PHP, **Computer Vision Tools** :- OPENCV,MATLAB), **Single board computers:** Raspberry Pi, **Neural network simulators Tools:- Neural Lab, NEST , Machine Learning Tools:- Torch, TensorFlow, Data Science Tools :-** R language programming**,** SQL, **Tools in Electronics and Electronics & Telecommunication Engineering:** **Electronic Design Simulation Integrated Circuit Tools**:- VHDL, Xilinx, Modelsim , Cadence learn, **Embedded System Tools**:- AVR Studio, Arduino ,Kiel µvision, **Circuit Simulation Tools:-** Pspice, Simulink, Workbench, Tinkercad, ThingSpeak, Proteus, CircuitPro ,**Processor based integrated circuits** :Microcontroller, electronic prototype platforms: Arduino,**Networking Tools** :- Wired / Wireless and Ad-hoc Networking NS-2 , Packet Tracer, **Signal Processing Tools**:- Code Composer Studio along with Integrated circuits

Tools in Instrumentation and Control Engineering:-
System Automation Tools :- PLC , SCADA , PADS, ORCAD ,Eagle, Kicad,
Tools in Mechanical, Industrial, Production, Engineering:-
Engineering Design Tools:- AutoCAD, CATIA,COMSOL Multiphysics, Solidworks, Inventor, PTC Creo **Fluid Dynamics:-** Fluent, HyperWorks, **Finite Element/ Structural Analysis:-** Ansy's, Ansy's Free Student software **Thermal Simulation:-** FlowTherm, Ansys Icepak
Tools in Chemical Engineering :-
Chemical process simulator:- DWSIM - Open Source Process Simulator, **chemical simulation software:-** Schrödinger,
(any other suitable tool as per the project requirement)

Technology: Map the appropriate technology**:**
Emerging Technologies :- Artifical Intelligence, 5G networks, IoT, Serverless Computing, Blockchain , Virtual reality (VR)/Augmented reality (AR), Drone, Quantum Computing, Robotics

Interdisciplinary Technologies:- Nanotechnology, Nanomaterials, Nanoelectronics, Quantum Computing , Spintronics

Computer Technologies:- Big Data, Cloud Computing, Human Machine Interface (HMI),Cyber Security

Medical and Healthcare Technologies:- Biomedical Technology,

Energy Technologies :- Solar Energy Based Technologies, Wind energy, Green energy Technologies, Energy Storage
Electronics, Communication Technologies:- Wireless, GPS, Bluetooth, Mobile/social Internet Automation, Mobile Technologies, Voice Assistants, signal processing, image processing, Machine vision, Sensors, Optoelectronics,
Other imp Technologies:- Automobile ,3 D printing
(any other technology as per the project requirement)

Project Implementation: Selection of the domain area, Literature review, Identify and finalize the Problem Statement (student in consultation with Guide), Understand and select and use the appropriate tools, Map the technologies learned with the project needs (refer available online offline Resources, books, soft materials, relevant MOOCs, consult with domain expertise) Self Learning:- learn the required tools, skill sets, acquire knowledge to do the project

Designing & Testing: Designing of project prototype based on domain areas by incorporating appropriate tools and technology, validation and Testing of the prototype to give the best possible solution

Documentation and Final Assessment : Develop and demonstrate the optimized prototype /working model of project , Documentation of project report in stipulated standard format as per the preset norms i.e. IEEE Research paper format, Present Project work at final viva voce

FF No. : 654

IC3216:: SOFTWARE DESIGN – II

Guidelines to the students regarding Software Development Lab

The objectives of these courses are to enhance coding skills and programming ability among the students. To cope up with rapid technology changes, these courses offer every student to learn new-age programming techniques and languages. The focus of these courses is on learning programming fundamentals and techniques.

- Software Development course would be conducted as single student activity.
- Students can choose any software projects to upgrade and enhance their coding skills using any open source tools.
- Complexity of the project should be sufficient and approved by course supervisor.
- Students are allowed to use libraries as needed.
- Major thrust areas of Software Development Project course are Artificial Intelligence / Machine Learning / Data Analytics / Vision based Automation
- A suggestive list of possible domains for SDP is given below
    1. Mobile app development
    2. Responsive Web development
    3. Database / Back end development
    4. MySQL / RDBMS
    5. Gamification
    6. GUI Development
- Mid-Semester review and End Semester Assessment would be conducted.

Course Outcome: Students will be able to

1. Map the technologies learned with the project needs
2. Apply the technological knowledge to design various feasible solution
3. Select best possible solution to solve a the problem

FF No. : 654

IC3208:: SOFTWARE DESIGN PROJECT– II

Guidelines to the students regarding Software Development Project Course

The objectives of these courses are to enhance coding skills and programming ability among the students. To cope up with rapid technology changes, these courses offer every student to learn new-age programming techniques and languages. The focus of these courses is on learning programming fundamentals and techniques.

- Software Development course would be conducted as single student activity.
- Students can choose any software projects to upgrade and enhance their coding skills using any open source tools.
- Complexity of the project should be sufficient and approved by course supervisor.
- Students are allowed to use libraries as needed.
- Major thrust areas of Software Development Project course are Artificial Intelligence / Machine Learning / Data Analytics / Vision based Automation
- A suggestive list of possible domains for SDP is given below
    1. Mobile app development
    2. Responsive Web development
    3. Database / Back end development
    4. MySQL / RDBMS
    5. Gamification
    6. GUI Development
- Mid-Semester review and End Semester Assessment would be conducted.

Course Outcome: Students will be able to

1. Map the technologies learned with the project needs
2. Apply the technological knowledge to design various feasible solution
3. Select best possible solution to solve a the problem

FF No. : 654

IC3210:: ENGINEERING DESIGN AND INNOVATION-IV

Course Prerequisites: Electronic design, simulation, MATLAB, Labview, PCB design

Course Objectives:

1. To gain practical knowledge
2. To understand the concepts
3. Familiarity with the usage of modern tool

Credits: 4

Teaching Scheme Theory: - Hours/Week
Tut : - Hours/Week
Lab : 8 Hours/Week

Course Relevance:.....

SECTION-1
Topics and Contents **It is based on Real time project implementation in the chosen specific defined area.** Agriculture Healthcare Automotive Process Control IoT