DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the programme and specialization	**M.Tech and Power Electronics.**		
Course Title	**INDUSTRIAL CONTROL ELECTRONICS**		
Course Code	**EE656**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**-**		
Session	**January 2021**	**Section (if, applicable)**	**Ist Year M.Tech**
Name of Faculty	**Dr.S. Mageshwari**	**Department**	**EEE**
Email	**mageshwari@nitt.edu**	**Telephone No.**	**0431-2503260**
Name of Course Coordinator(s) (if, applicable)	**-**		
Course Type	[√] **Core course** [ ] **Elective course**		

Syllabus (approved in BoS)

Review of uninterrupted power supplies - offline and on-line topologies - analysis of UPS topologies, solid state circuit breakers and solid-state tap changing of transformer - advance energy storage systems, battery, ultra-capacitors, flywheel energy storage, fuel cells characteristics and applications.

Overview of sensors in industrial applications – current sensors, current transformer, hall effect sensors - voltage sensors, non-isolated measurement, hall effect, temperature sensors, thermal protection of power components – speed sensors – position sensors.

Analog controllers - proportional controllers, proportional – integral controllers, PID controllers, derivative overrun, integral windup, cascaded control, feed forward control. Signal conditioners - instrumentation amplifiers – voltage to current, current to voltage, voltage to frequency, frequency to voltage converters.

Solid state welding power source - introduction, classification, basic characteristics, volt ampere relationship and its measurements, control of volt ampere characteristics, volt control, slope control and dual control– pulsing techniques – testing of welding power source. Introduction to heating, classification, characteristics – applications

Introduction to programmable logic controllers, architecture, programming. Supervisory control and data acquisition (SCADA) Systems, components of SCADA systems, SCADA basic functions, SCADA application functions in electrical engineering. Energy saving in electrical drive systems.

COURSE OBJECTIVES	
This course gives a comprehensive coverage of various control electronics used in the industries. This combines the analog and digital concepts together with power electronics for the design of the controllers.	
COURSE OUTCOMES (CO)	
Course Outcomes	**Aligned Programme Outcomes (PO)**
1. To understand the working of various power electronic circuits and components used in industrial applications.	**1,3,4,6,7,8,9,14**
2. To analyse various analog controllers and signal conditioning circuits.	**1,2,3,4,6,7,8,9,14**
3. To design control circuits for industrial applications.	**1,2,3,4,6,7,8,9,14**

COURSE PLAN – PART II

COURSE OVERVIEW

A study on the operating principles of electronic devices,discrete control systems,heating system and controllers with an introduction to industrial control electronics.Topics will include methods of voltage control,storage applications,sensors used in industry,analog controllers,welding devices and PLC/SCADA.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	Week 1 19th Jan to 22nd Jan 2021 (3 contact hours)	Review of UPS -offline and on-line UPS topologies Analysis of UPS topologies	Online MS Teams
2.	Week 2 25th Jan to 29th Jan 2021 (2 contact hours)	Solid state circuit breakers and solid-state tap changing of transformer	Online MS Teams
3.	Week 3 1st Feb to 5th Feb 2021 (3 contact hours)	Advance energy storage systems, battery, ultra-capacitors, flywheel energy storage, fuel cells characteristics and applications	Online MS Teams
4.	Week 4 8th Feb to 12th Feb 2021 (3 contact hours)	Overview of sensors in industrial applications – current sensors, current transformer.	Online MS Teams
5.	Week 5 15th Feb to 19th Feb 2021 (3 contact hours)	Hall effect sensors – voltage sensors, non-isolated measurement, hall effect, temperature sensors	Online MS Teams
6.	Week 6 22nd Feb to 26th Feb 2021 (3 contact Hours)	Thermal protection of power components – speed sensors – position sensors.	Online MS Teams
7.	Week 7 1st March to 5th March 2021 (3 contact hours)	**Assessment -1** Analog controllers - proportional controllers, proportional – integral controllers, PID controllers	Online MS Teams

8.	Week 8 8th March to 12th March 2021(3 contact hours)	Derivative overrun, integral windup, cascaded control, feed forward control.	Online MS Teams
9.	Week 9 15th March to 19th March 2021 (3 contact hours)	Signal conditioners - instrumentation amplifiers – voltage to current, current to voltage, voltage to frequency, frequency to voltage converters.	Online MS Teams
10.	Week10 22nd March to 26th March 2021 (3 contact Hours)	Solid state welding power source - introduction, classification, basic characteristics.	Online MS Teams
11.	Week11 30th March to 2nd April 2021 (3 contact hours)	Volt ampere relationship and its measurements, control of volt ampere characteristics, volt control, slope control and dual control– pulsing techniques	Online MS Teams
12.	Week12 5th April to 9th April 2021 (3 contact hours)	**Assessment -2** Testing of welding power source. Introduction to heating, classification, characteristics – applications	Online MS Teams
13.	Week13 12th April to 16th April 2021 (3 contact hours)	Introduction to programmable logic controllers, architecture, programming.	Online MS Teams
14.	Week 14 19th April to 23rd April 2021 (3 contact hours)	Supervisory control and data acquisition (SCADA) Systems, components of SCADA systems, SCADA basic functions.	Online MS Teams
15.	Week 15 26th April to 30th April 2021 (3contact hours)	SCADA application functions in electrical engineering. Energy saving in electrical drive systems.	Online MS Teams
16.	Week 16 3rd May to 7th May 2021 (3 contact hours)	Compensation assessment	Online MS Teams
17.	Week 17/18/19 May 2021 (3 contact hours)	End Semester Examination (Final Assessment)	Online

COURSE ASSESSMENT METHODS (shall range from 4 to 6**)**

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment 1	Week 7	1 hr 20 minutes	20%
2	Assessment 2	Week12	1hr 40 minutes	25%
3	Assessment 3	Week13	-	10%
4	Assessment4	Week15	-	15%
CPA	Compensation Assessment	Week16	1hr 40 minutes	25%
5	Final Assessment	Week 17/18/19	2hrs	30%

Reference Books

1. Michael Jacob, 'Industrial Control Electronics – Applications and Design', Prentice Hall, 1995.

2. Thomas E. Kissell, 'Industrial Electronics', Prentice Hall India, 2003

3. Curtis D. Jhonson 'Process Control Instrumentation technology' Pearson New International Eighth edition,2014.

4. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi 'Modern Electric, Hybrid Electric and Fuel Cell Vehicles-Fundamentals, Theory and Design' CRC Press 2004.

5. Mini S. Thomas, John D McDonald, Power Systems SCADA and Smart Grid, CRC Press, Taylor and Francis.

6. Welding Handbook, Volume-2, Seventh Edition, American Welding Society.

7. Power Electronics Applied to Industrial Systems and Transports. Volume 5: Measurement Circuits, Safeguards and Energy Storage, Imprint - ISTE Press – Elsevier.

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

- Feedback from the students during class committee meetings
- Anonymous feedback through questionnaire (Mid of the semester & End of the semester)
- End semester feedback on course outcomes

COURSE POLICY (including compensation assessment to be specified**)**

1. Attending all the assessments mandatory for every student.
2. One compensation assessment will be conducted for those students who are being physically absent for the assessment 1 and/or 2, only for the valid reason.
3. At any case CPA will not be considered as an improvement test.
4. Absolute/Relative grading will be adopted for the course.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- Attending all the classes for this course is mandatory.
- Attendance policy will be as per the Institute's regulation for the on line classes.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

FOR APPROVAL

Course Faculty _____ **CC- Chairperson** _____ Approved by Mail **HOD** _____