NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ENERGY AND ENVIRONMENT]

COURSE PLAN – PART I			
Name of the programme and specialization	**M.Tech. / Energy Engineering**		
Course Title	**Smart Energy Systems**		
Course Code	**EN 608**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)			
Session	**January 2023**	**Section (if, applicable)**	
Name of Faculty	**Dr. D. V. Siva Krishna Rao K**	**Department**	**ENERGY AND ENVIRONMENT**
Official Email	**damodharsiva@nitt.edu**	**Telephone No.**	
Name of Course Coordinator(s) (if, applicable)	**Dr D V Siva Krishna Rao K**		
Official E-mail	**damodharsiva@nitt.edu**	**Telephone No.**	
Course Type (please tick appropriately**)**	**Core course** ☐ **Elective course**		

Syllabus (approved in BoS)

Unit 1: Energy Efficiency and Civilization Introduction-Motivation for energy - Energy use and Industrialization-Global warming- Green and Renewable energy sources- Energy units and conversions-Estimating the cost of energy- Estimation of future Co2- Energy Utilization and Economic growth.

Unit 2: Design and Sizing of sub system controller Design 1phase and 3phase DC/AC Inverter - AC/DC Rectifier- DC/DC converter (Buck, boost, buck boost) - Pulse width modulation (PWM) Techniques for converters- Sizing of Inverter, Rectifier, DC/DC converter for MG operation

Unit 3: Microgrid Energy systems design and sizing Design of PV systems- Design of Wind energy systems- Design of energy storage -Systems (Batteries, pumped hydro, compressed air energy storage, and flywheel)- Load Estimation for Residential Building commercial building and Industrial load Case studies

Unit 4: Smart Energy monitoring & Management Global Information systems (GIS)- Intelligent electronic devices (IED) and application-Current, Voltage, power, kWh measurement sensors- Digital controllers(Arduino UNO, TMS320F28379D) - Analog to digital converters- Energy monitoring systems-Power monitoring and scheduling- Smart home automation- Smart meter, smart appliances, Automatic meter reading(AMR)

Unit-5 Internet of Things (IoT) on Energy sectors Definition -, Characteristics, Physical design, Logical design, Functional blocks of IoT, Communication models & Application Programming Interface (APIs) , Machine to Machine, Difference between IoT and M2M, Software defined Network - (SDN). Applications of IoT: Home automation, Industry, Surveillance, other IoT applications- Raspberry Pi Interfaces -Programming Raspberry Pi with Python. Application of IoT on Energy gadgets.

COURSE OBJECTIVES

- To familiarize various smart devices
- To familiarize Energy efficiency monitoring and control
- To familiarize micro grid energy systems
- To familiarize the basics of IoT

MAPPING OF COs with Pos

Course Outcomes	**Programme Outcomes (PO)** (Enter Numbers only)
1. Designing of Convertor /Invertor suitable for PV and WECS	**1,2,7,8,11,12,13,14**
2. Modelling of Energy Storage system	**1,2,5,6,7,8,11,12,13,14**
3. Understand the Smart Energy Monitoring systems	**1,2,5,7,8,11,12,13,14**
4. Identify suitable communication networks and IOT for smart energy applications	**1,2,6,7,8,9,10,11,12,13,14**

COURSE PLAN – PART II

COURSE OVERVIEW

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	**Week/Contact Hours**	**Topic**	**Mode of Delivery**
1	**Week 1 to 2**	Introduction-Motivation for energy - Energy use and Industrialization- Global warming- Green and Renewable energy sources	Chalk & Talk
2	**Week 3 to 4**	Energy units and conversions- Estimating the cost of energy- Estimation of future Co2- Energy Utilization and Economic growth **Project Assessment review**	Chalk & Talk
3	**Week 5 to 6**	Design 1phase and 3phase DC/AC Inverter - AC/DC Rectifier- DC/DC converter (Buck, boost, buck boost **Assessment -1**	Chalk & Talk

4	**Week 7 to 8**	Pulse width modulation (PWM) Techniques for converters- Sizing of Inverter, Rectifier, DC/DC converter for MG operation **Project Assessment Review**	Chalk & Talk
5	**Week 9 to 10**	Design of PV systems- Design of Wind energy systems- Design of energy storage -Systems - Batteries **Assessment 2**	Chalk & Talk
6	**Week 11 to 12**	Design of energy storage -Systems (Batteries, pumped hydro, compressed air energy storage, and flywheel)	Chalk & Talk
7	**Week 12 to 13**	Load Estimation for Residential Building commercial building and Industrial load Case studies.	Chalk & Talk
8	**Week 14 to 15**	Global Information systems (GIS)- Intelligent electronic devices (IED) and application-Current, Voltage, power, kWh measurement sensors- Digital controllers (Arduino UNO, TMS320F28379D)- Analog to digital converters	Chalk & Talk
9	**Week 16 to 17**	Energy monitoring systems-Power monitoring and scheduling- Smart home automation- Smart meter, smart appliances, Automatic meter reading (AMR)	Chalk & Talk
10	**Week 18 to 19**	Definition -, Characteristics, Physical design, Logical design, Functional blocks of IoT, Communication models & Application Programming Interface (APIs), Machine to Machine, Difference between IoT and M2M, Software defined Network- (SDN). **Compensation Assessment**	Chalk & Talk
11	**Week 19 to 20**	Applications of IoT: Home automation, Industry, Surveillance, other IoT applications- Raspberry Pi Interfaces -Programming Raspberry Pi with Python. Application of IoT on	Chalk & Talk

		Energy gadgets **Final Assessment** **Final project assessment**	

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

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	**Assessment -1**	Week 5	60 Minutes	20
2	**Assessment -2**	Week 9	60 Minutes	20
3	**Project work**	Week 13		30
4	**End semester evaluation**		120 minutes	30
CPA	Compensation Assessment*	Week 18	60 Minutes	

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

- Feedback from the student during class committee meeting
- Institute end semester feedback

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

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

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

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.

ADDITIONAL INFORMATION, IF ANY

Text Books and References

1. Ali Keyhani, " Design of Smart power grid renewable energy systems", Wiley IEEE,2011
2. Clark W. Gellings, "The smart grid Enabling Energy Efficiency and Demand Response
3. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach" Orient Blackswan Pvt. Ltd., New Delhi, 2015

FOR APPROVAL

Course Faculty _____ CC- Chairperson _____ HOD _____

Guidelines

a) The number of assessments for any theory course shall range from 4 to 6.

b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.

c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.