



# NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

## DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	M.Tech. (Power Systems)		
Course Title	SMART GRID TECHNOLOGIES		
Course Code	EE 680	No. of Credits	3
Course Code of Pre/Co-requisite subject(s)	NONE		
Session	July 2023	Section (if, applicable)	-
Name of Faculty	Dr. M. P. SELVAN	Department	EEE
Email	selvanmp@nitt.edu	Telephone No.	9444170638
Name of Course Coordinator(s) (if, applicable)			NA
E-mail	-	Telephone No.	-
Course Type	<input type="checkbox"/> Core course <input checked="" type="checkbox"/> Elective course		
<b>Syllabus</b>			
<p>Introduction - Evolution of Electric Grid, Smart Grid Concept - Definitions and Need for Smart Grid – Functions – Opportunities – Benefits and challenges, Difference between conventional &amp; Smart Grid, Technology Drivers.</p> <p>Energy Management System (EMS) - Substation Automation - Feeder Automation – Protocols, Wide area monitoring protection and control - Smart integration of renewable energy resources — Energy Storage, Distribution Management System (DMS) – Network Reconfiguration, Outage management System, Customer Information System - Application of Geographical Information System.</p> <p>Introduction to Smart Meters – Advanced Metering infrastructure (AMI), AMI protocols – Standards and initiatives, Demand side management and demand response programs, Demand pricing - Time of Use, Critical Peak Pricing, Real Time Pricing.</p> <p>P2G paradigm – feed-in-tariff-net metering, P2P energy trading – community energy management – market operations – pricing mechanism, Plug in Hybrid Electric Vehicles – G2V – V2G – effect of grid interaction of electric vehicles – energy management.</p> <p>Elements of communication and networking – architectures, standards, PLC, Zigbee, GSM, BPL, Local Area Network (LAN) – HAN, NAN, FAN - Wide Area Network (WAN) - Basics of CLOUD Computing – Basics of Blockchain - Cyber Security for Smart Grid.</p> <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Stuart Borlase 'Smart Grid: Infrastructure, Technology and Solutions', CRC Press 2012.</li> <li>2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, 'Smart Grid: Technology and Applications', Wiley, 2012.</li> <li>3. Mini S. Thomas, John D McDonald, 'Power System SCADA and Smart Grids', CRC Press, 2015</li> <li>4. Kenneth C. Budka, Jayant G. Deshpande, Marina Thottan, 'Communication Networks for Smart Grids', Springer, 2014</li> <li>5. Wayes Tushar, Chau Yuen, Tapan K. Saha, Thomas Morstyn, Archie C. Chapman, M. Jan E. Alam, Sarmad Hanif, H. Vincent Poor, "Peer-to-peer energy systems for connected communities: A review of recent advances and emerging challenges," Applied Energy, Vol. 282, Part A, 2021. doi.org/10.1016/j.apenergy.2020.116131.</li> </ol>			



**COURSE OBJECTIVES**

1. To understand the need and concept of Smart Grid
2. To study different EMS and DMS functions and smart meters
3. To get familiarized with the communication networks for Smart Grid applications

**COURSE OUTCOMES (CO)**

Course Outcomes	Aligned Programme Outcomes (PO)		
	1	2	3
Upon completion of the course, the students will be able to			
1. Understand the EMS and DMS functionalities, AMI, and smart energy resources.	2	3	3
2. Analyze the operation of modern power distribution system with prosumers and EV owners.	3	3	3
3. Evaluate suitable information and communication technologies for smart grid applications.	2	3	3

**COURSE PLAN – PART II**

**COURSE OVERVIEW**

Students learn about power system in many power system courses such as power system analysis, power system operation and control, power system protection and switchgear, restructuring of power system, etc. All these subjects deal with the modeling, analysis and control of regulated and/or deregulated power system. On the other hand, Smart grid technology is a collection of existing and emerging technologies working together to achieve energy efficiency, automation and financial benefits in the production, transport and consumption of electrical energy. Smart grid technologies involve integration of renewable energy sources into the conventional power grid both at the transmission and distribution level, employing FACTS and HVDC transmission systems, realising wide area monitoring and protection systems and adopting information and communication technology for consumer participation in the grid operation. In this course, students learn about the requirement for a smart grid in future. Further, students will be exposed to several modern and evolving technologies that can be applied in transforming the present power grid into smart power grid. They will also be educated about the issues in the implementation of smart grid and present scenario in the national and international levels.

**COURSE TEACHING AND LEARNING ACTIVITIES**

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	Week 1 21-08-2023 to 25-08-2023 (1 Contact Hour)	Introduction	PPT
2	Week 2 28-08-2023 to 01-09-2023 (3 Contact Hours)	Module -1	PPT



3	Week 3 04-09-2023 to 08-09-2023 (3 Contact Hours)	Module -1 & Module -2	PPT
4	Week 4 11-09-2023 to 15-09-2023 (3 Contact Hours)	Module -2	PPT
5	Week 5 18-09-2023 to 22-09-2023 (2 Contact Hours)	Module -2	PPT
6	Week 6 25-09-2023 to 29-09-2023	Academic Break	PPT
7	Week 7 03-10-2023 to 06-10-2023 (1 Contact Hours)	<b>Assessment – 1</b>	PPT
8	Week 8 09-10-2023 to 13-10-2023 (3 Contact Hours)	Module -3	PPT
9	Week 9 16-10-2023 to 20-10-2023 (3 Contact Hour)	Module -3	PPT
10	Week 10 25-10-2023 to 27-10-2023 (1 Contact Hour)	Module -4	PPT
11	Week 11 30-10-2023 to 03-11-2023 (3 Contact Hours)	Module -4	PPT
12	Week 12 06-11-2023 to 10-11-2023 (1 Contact Hour)	<b>Assessment - 2</b>	
13	Week 13 13-11-2023 to 17-11-2023 (3 Contact Hours)	Module -4	PPT
14	Week 14 20-11-2023 to 24-11-2023 (3 Contact Hours)	Module -5 <b>Assessment 3 (Group Task)</b>	
15	Week 15 28-11-2023 to 01-12-2023 (3 Contact Hours)	<b>Assessment 3 (Group Task)</b>	
16	Week 16 04-12-2023 to 08-12-2023 (3 Contact Hours)	<b>Compensation Assessment</b>	
17	Week 17 11-12-2023 to 15-12-2023 (3 Contact Hours)	Additional Classes (If required)	
18	Week 18 18-12-2023 to 22-12-2023 (3 Contact Hours)	<b>Final Assessment</b>	



<b>COURSE ASSESSMENT METHODS (shall range from 4 to 6)</b>					
<b>S.No.</b>	<b>Mode of Assessment</b>	<b>Week/Date</b>	<b>Duration</b>	<b>% Weightage</b>	
1	Surprise Quiz			05	25
	Scheduled Quiz	Week 7	60 Minutes	20	
2	Surprise Quiz			05	25
	Scheduled Quiz	Week 12	60 Minutes	20	
3	Group Task	Week 14 & Week 15		10	
CPA	Compensation Assessment	Week 16	60 Minutes	20	
4	Final Assessment	Week 18	120 Minutes	40	
<p><b>COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)</b></p> <p>Feedback from the students during class committee meetings</p> <p>Institute end semester feedback</p>					
<p><b>COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)</b></p>					
<p><b><u>MODE OF CORRESPONDENCE (email/ phone etc.)</u></b></p> <p>1. All the students are advised to have account in MS Teams with NITT webmail id. Sharing of course material will be done through MS Teams. All the correspondence (schedule of classes/ schedule of assessment/ any other information regarding this course) will be done through MS Teams. Suitable platform/software tool will be chosen for the conduct of assessments (if required) and will be informed to the students.</p> <p>2. Queries (if required) to the course teacher shall only be emailed to <a href="mailto:selvanmp@nitt.edu">selvanmp@nitt.edu</a>.</p>					
<p><b><u>COMPENSATION ASSESSMENT POLICY</u></b></p> <p>1. Attending all the assessments are MANDATORY for every student.</p> <p>2. If any student is not able to attend anyone of or both the assessments (Scheduled Quiz of assessment 1 and 2 only) due to genuine reason, the student is permitted to attend the compensation assessment (CPA).</p> <p>3. At any case, CPA will not be considered as an improvement test.</p>					
<p><b><u>ATTENDANCE POLICY</u></b></p> <p>As directed by the Academic Office.</p>					



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### ACADEMIC DISHONESTY & PLAGIARISM

- Copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark will be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.

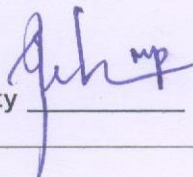
The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

### ADDITIONAL INFORMATION

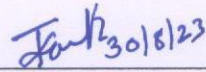
The faculty is available for consultation at times as per the intimation given by the faculty.

### FOR APPROVAL

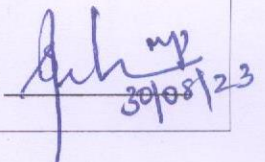
Course Faculty



CC-Chairperson

 30/8/23

HOD

 30/08/23