

## ECE3091: Introduction to Green Communication and Networking

Programme: B.Tech. (ECE, CSE, CCE)

Year: 3<sup>rd</sup>

Semester : V

Course : Core/Program/HSS/ Other : **Other**

Credits :3

Hours :40

### Course Context and Overview (100 words):

In 2012, close to 4.7 percent of the world's electrical energy was consumed by ICT, releasing into the atmosphere roughly 1.7 percent of the total CO<sub>2</sub> emissions. It is increasing 16-20% per year., although the improving energy efficiency of ICT equipment leads to a slower growth of these metrics than the increase of ICT's usage worldwide. In this scenario enabling technologies required for Communication system and networks to convert it GREEN.

**Prerequisites Courses: Nil**

### Course outcomes(COs):

On completion of this course, the students will have
CO1:knowledge of definition, taxonomy and need of Green Communication
CO2 the ability to use appropriate metrics and analyze performance tradeoffs of communication systems and networks.
CO3 the ability to understand energy saving mechanism for back bone networks and data centers
CO4 understand state of the art of current research trends and practices for Green energy enabler technologies and protocols.

### Course Topics:

Topics	Lecture Hours
<b>UNIT - I</b>	<b>8</b>
<b>1. Basic definitions and concepts</b>	
1.1 Origin of Green Communications and Networking	
1.2 Why Save Energy? Energy Saving Concepts.	
1.3 Quantifying Energy Efficiency in ICT	
1.4 Taxonomy of Undertaken Approaches for Green Energy	
1.5 Basic building blocks of a wired communication system.	
1.6 Introduction to Wireless Communication system	
<b>UNIT - II</b>	<b>10</b>
<b>2. Energy Efficiency Metrics and Performance Trade-offs of GREEN Systems</b>	
2.1 Energy Efficiency metrics and their application	
2.2 Overview of Next Generation Communication networks and their needs	2

2.3 Addressing the Energy Efficiency Challenge	1	
2.4 Energy Consumption modeling from device to network level for a communication system	5	
<b>UNIT - III</b>		
<b>3. Speed Scaling in practice</b>	<b>7</b>	
3.1 Speed scaling basics Computer architecture techniques for power-efficiency	2	
3.2 Algorithmic thinking about speed scaling	2	
3.3 Power Nap: Eliminating server idle power	1	
3.4 Optimality, fairness, and robustness in speed scaling designs	2	
<b>UNIT-IV</b>		
<b>4. Energy reduction in data centers and backbone networks</b>	<b>8</b>	
4.1 Introduction to Data center.	1	
4.2 Energy reduction in content distribution from the data center to end user	2	
4.3 Energy-Efficient Data Center : New infrastructures, Server Consolidation, SDN as a key enabler of the energy efficiency	2	
4.4 Reducing network energy consumption via sleeping and rate-adaptation	1	
4.5 Greening the Optical Backbone Network by Decomposing the Energy Consumption	2	
<b>UNIT-V</b>		
<b>5. Green case study and Global activities</b>	<b>7</b>	
5.1 Introduction	1	
5.2 Case study 1. Content distribution: IPTV, IPTV over the public Internet	1	
5.3 Case study 2. The Internet of Things	2	
5.4 Global activities in Green networking	1	
5.5 Unified Architecture for Energy Efficiency Evaluation (3E)	2	

### Textbook references :

#### Text Books:

- [1] Samdanis, K., Rost, P., Maeder, A., Meo, M. and Verikoukis, C. (eds) (2015) ,” Green Communications: Principles, Concepts and Practice”, John Wiley & Sons, Ltd, Chichester, UK. doi: 10.1002/9781118759257.
- [2] Shafiullah Khan, Jaime Lloret Mauri, "Green Networking and Communications: ICT for Sustainability", CRC Press, 2013
- [3]F. Richard Yu, Xi Zhang, Victor C.M. Leung(2012) , " Green Communications and Networking , ISBN 9781439899137 - CAT# K14341

#### Reference book:

Minoli, Daniel (2011), “Designing Green Networks and Network Operations” , CRC Press, ISBN 978143986387

#### Additional Resources (Web resources etc.):

<http://www.comsoc.org/best-readings/topics/green-communications>

**Evaluation Methods:**

Item	Weightage
Quiz	15
Assignment	10
Midterm	25
Final Examination	50

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