ECE 3031 : Introduction to Green Communication and Networking

Programme: B.Tech. ECE, CCE **Year:** 3rd **Semester :** Even
Course Type: Programme Elective **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 CO2 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 and standards required for Communication system and networks to be converted into GREEN.

Prerequisites Courses: Nil

Course outcomes(COs):

On completion of this course, the students will have the
CO1:knowledge of parameters, definition, taxonomy and need of Green Communication
CO2 the ability to use appropriate metrics, evaluate performances and tradeoffs of communication systems and networks.
CO3 understanding of design concepts of energy saving back bone networks and data centers
CO4 ability to analyze state of the art of current research trends and practices for Green Energy enabler technologies and Protocols and Standards.

Course Topics:

Topics	**Lecture Hours**	
UNIT - I **1. Basic definitions and concepts**	**9**	
1.1 Origin of Green Communications and Networking	1	9
1.2 Why Save Energy? Energy Saving Concepts.	1	
1.3 Quantifying Energy Efficiency in ICT	1	
1.4 Taxonomy of Undertaken Approaches for Green Energy	1	
1.5 Basic building blocks of a wired communication system.	1	
1.6 Introduction to Wireless Communication system	4	
UNIT - II **2. Energy Efficiency Metrics and Performance Trade-offs of GREEN Systems**	**12**	
2.1 Energy Efficiency metrics and their application	2	12
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	

2.5 Energy efficiency analysis of some cooperative and non-cooperative transmission schemes	2	
UNIT-III **3. Energy reduction in data centers and backbone networks**	**10**	
3.1 Introduction to Data center.	1	10
3.2 Taxonomy and Energy saving Techniques for Data Center	2	
3.3 Energy reduction in content distribution from the data center to end user	2	
3.4 Energy-Efficient Data Center : Server Consolidation, SDN as a key enabler of the energy efficiency	1	
3.5 Reducing network energy consumption via sleeping and rate-adaptation	1	
3.6 Optical network	1	
3.7 Greening the Optical Backbone Network by Decomposing the Energy Consumption	2	
UNIT-IV **4. Green case study and Global activities**	**9**	
4.1 Introduction to Global activities	1	9
4.2 Case study 1. Content distribution in IPTV, IPTV over the public Internet	1	
4.3 Case study 2. The Internet of Things	2	
4.4 Case Study 3:Green Mobile Broadband Communication Networks	1	
4.5 Global activities in Green networking	1	
4.6 Energy Efficiency Standards	1	
4.7 Unified Architecture for Energy Efficiency Evaluation (3E)	2	

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

[4] E. Hossain, V. K. Bhargava, G. Fettweis, Green Radio Communication Networks, Cambridge, U.K.:Cambridge Univ. Press, 2012.

Reference book:

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

Paper:

[1] G. Auer et al., "How much energy is needed to run a wireless network", *IEEE Wireless Commun.*, vol. 18, no. 5, pp. 40-49, Oct. 2011.

Additional Resources (Web resources etc.):

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

Evaluation Methods:

Item	Weightage
Quiz (4 quizzes)	20
Assignment (2)	20
Mid Term	30
End Term	30

Attendance: As per institute Rules

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