Detailed Syllabus

Course Code	17M15EC114	Semester Summer	Semester Summer Session 2020 - 2021 Month from: June 2021 – July 2021
Course Name	ECE DESIGN AND SIMULATION LAB -2		
Credits	1	Contact Hours	
Faculty (Names)	Coordinator(s)	Dr Amit Kumar Goyal	
	Teacher(s) (Alphabetically)	Dr Amit Kumar Goyal	

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Understand and Analyze the path loss exponent for wireless communication.	Analyzing (IV)
CO2	Design an efficient communication system having adequate signal strength for base station.	Applying (Level III)
CO3	Analyze the frequency reuse and handover probability for a given wireless communication system.	Applying (Level III)
CO4	Simulate the various performance metrics of the wireless communication system.	Analyzing (IV)

Module No.	Title of the Module	List of Experiments	CO
1	Introduction to Modelling of Wireless Channel	1. To understand the path loss prediction formula and Calculation of received signal strength as a function of distance of separation, antenna height and carrier frequency. **To understand the impact of :-** a) Transmitter Power, b) Path loss exponent, c) Carrier frequency, d) Receiver antenna height, e) Transmitter antenna height.	CO1
		2. Calculation of path loss exponent and variance of shadow fading.	CO1

2	Wireless Communication System Optimization	3. To find the 3dB beam-width of a base station antenna. (a) To study the horizontal beam pattern of the Base Station antenna and calculate the beamwidth for horizontal beam pattern (b) To study the vertical beam pattern of the Base Station antenna and calculate the beamwidth for vertical beam pattern	CO2
		4. To calculate the probability that the received signal level crosses a certain sensitivity level.	CO2
		5. To understand the concept of co-channel interference and hence Signal to Interference and Noise Ratio. A. Downlink: To calculate & plot SINR vs. distance at the Mobile Station for adaptation of the following parameters, (a) Shadowing effect, (b) Vertical Beam Pattern, B. Uplink: To calculate & plot SINR vs. distance at the base stations for different distance of two mobile stations from the base stations and different separation between them for adaptation of the following parameters, (a) Shadowing effect, (b) Vertical Beam Pattern,	CO2
		6. Understanding the impact of many different parameters influence the downlink C/I ratio. (a) Cell radios, (b) Tx power of B.S, (c) Frequency reuse, (d) Sectoring, (e) Shadowing effect, (f) B.S. height, (g) Path loss exponent, (h) Vertical beam tilt	CO2
3	Capacity Improvement Techniques	7. To understand the cellular frequency reuse concept fulfilling the following objectives: (a) Finding the co-channel cells for a particular cell. **(b)** Finding the cell clusters within certain geographic area**.**	CO3
		8. To study the effect of handover threshold and margin on SINR and call drop probability and handover probability	CO3

4	Analysis of various performance metrics of the wireless communication systems.	9. To study the outage probability, LCR & ADF in SISO for Selection Combining and MRC.	CO4
		10. To study the effect of delay spread on frequency selectivity.	CO4

Project Based Learning: ECE DESIGN AND SIMULATION LAB -2 is a lab course designed for integrated students. The course provides a thorough knowledge about various aspects of wireless communications system (WCS). This includes understanding and analysing the impact of various performance parameters on a designed WCS. Thus, students are provided a wide scope to do their projects in different modules of the course. The projects can be taken towards designing an efficient WCS. This includes optimization of various parameters like receiving and transmitting antenna height, transmitting power, estimating handoff probability to avoid call drop and to study outage probability, LCR & ADF in SISO for Selection Combining and MRC.

Evaluation Criteria

Components	Maximum Marks
Mid Viva	20
End Viva	20
TA	60
Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1	T. Rappaport, "Wireless Communication" prentice-hall, 2002.
2.	Gerd Keiser, Optical Fiber Communications, 3rd Edition, McGraw-Hill International edition, 2000.
3	John M. Senior, Optical Fiber Communications, 2nd Edition, PHI, 2002.
4.	D.K. Mynbaev, S.C. Gupta and Lowell L. Scheiner, Fiber Optic Communications, Pearson Education, 2005.
5.	Journal articles i.e. IEEE, Springer, IOPscience, Elsevier and Video lectures from nanohub, NPTEL, MIT video lectures
6.	http://fcmcvlab.iitkgp.ac.in/ http://vlabs.iitkgp.ernet.in/fcmc/#

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC417	**Semester** Odd **(specify Odd/Even)**	**Semester** 9th **Session** 2020 -2021 **Month from**June to July
Course Name	Satellite Communication		
Credits	4	**Contact Hours**	6-2-0

Faculty (Names)	**Coordinator(s)**	Dr. Ajay Kumar
	Teacher(s) (Alphabetically)	Dr. Ajay Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C433-4.1	Define Satellite and its historical background, outline the basic concepts of Satellite communications, recall the Kepler's laws of planetary motion.	RememberingLevel (C1)
C433-4.2	Develop the equations of the orbit, explain the satellite launching and launch vehicles and outline terminology of earth-orbiting Satellites.	AnalyzingLevel(C4)
C433-4.3	Demonstrate the space segment, antenna subsystem, estimate different parameters and design uplink and downlink.	Creating Level (C6)
C433-4.4	Apply various multiple access techniques for satellite communication and analyze Noise and Bandwidth. Also Interpret applications of various types of satellites established in different earth orbits.	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Introduction to the Subject and its Importance. Contents. Books and Reading References. Evaluation. Space Environment. Artificial Satellites. Communication Satellites.	4
2.	Satellite Orbits and Frequency Bands	Orbital Mechanics. Orbits Employed for Satellite Communication like LEO, MEO & GEO, their Merits and Demerits. Satellite Launching. Launch Vehicles. Radio Wave Propagation Effects. Communication Window.	8
3.	Communication Satellites and Link Design	Geostationary Communication Satellite-Transponder. Ground Station System. Communication Link-Consideration, Calculation and Design. Power and Bandwidth Limitations and Budget.	8
4.	Modulation Techniques	Modulation and Demodulation Techniques. Performance Analysis- Noise and Bandwidth.	6
5.	Multiple Access	Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA)	7

6.	Different Communication Satellite Systems	VSAT. Navigational Satellites. Broadcasting Satellites. Remote Sensing Satellites. Low and Medium Earth Orbit Satellites. INSAT. INTELSAT.	5
7.	Some Communication Satellite Applications	DBS TV. Multimedia Transmission Related Issues, Advantages& Bit Rates for Digital TV, HDTV, Bandwidth Considerations, and Introduction to Compression Standards. Convergence of Communication, Introduction to IPTV.	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
Mid-Term	30
End Semester Examination	40
TA	30
Total	**100**

Project based learning: Each student in a group of 3 studentsselect a topic related to latest development in the technology of satellite communication. This method of learning will help students to understand latest development in the industry like ISRO, once they land into entry it will be a simple task to design and implement any given task. Knowledge acquired during this course will boost their confidence and clarity while attending any Interview related to placement activities and establishment of their own application-based startup company related with latest and cutting-edge technologies

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	T. Pratt, C.W. Bostian and J.E. Allnut, Satellite Communications, 2 Ed, John Wiley & Sons (Asia), 2003
2.	Dennis Roddy, Satellite Communications, 4 Ed, Tata Mcgraw Hill, 2006
3.	G. Maral & M. Bousquet, Satellite Communications Systems- Systems, Techniques and Technology, 4 Ed, John Wiley and Sons, 2002.
4.	Richard Brice, Newness Guide to Digital TV, 2Ed, 2003.
5.	Gerard O' Driscoll, Next Generation IPTV Services and Technologies, John Wiley & Sons, 2008

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC413	**Semester** Int. Sem	**Semester IX Session** 2020 -2021 **Month from** June-July
Course Name	Digital Control System		
Credits	4	**Contact Hours**	6L+2T

Faculty (Names)	**Coordinator(s)**	Ritesh Kumar Sharma
	Teacher(s) (Alphabetically)	Ritesh Kumar Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C433-2.1	To represent the systems in the Z domain and in state space representation.	Remembering Level(C1)
C433-2.2	To analyze transient and steady state behaviors of linear discrete time control systems with modified transfer function.	Analyzing Level (C4)
C433-2.3	To understand and gain knowledge in stability analysis of digital control systems.	Understanding Level (C2)
C433-2.4	To Design Digital Control Systems	Designing Level (C6)

Module No.	**Subtitle of the Module**	**Topics**	**No. of Lectures**
1.	Review of Z transform	z transform and inverse z transform . Relationship between s- plane and z- plane- Difference equation . Solution by recursion and z-transform.	3
2.	Review of state space techniques	Review of state space techniques to continuous data systems, state space representation of discrete time systems- Transfer function from state space model-various canonical forms- conversion of transfer function model to state space model-characteristics equation-solution to discrete state equations.	5
3.	Introduction to Digital Control System	Basic Elements of discrete data control systems, advantages of discrete data control systems, examples. Signal conversion & processing: Digital signals & coding, data conversion & quantization, sample and hold devices, Mathematical modeling of the sampling process; Data reconstruction and filtering of sampled signals: Zero order hold, first order Hold.	8

4.	Analysis of Digital Control Systems	Digital control systems- Pulse transfer function . z transform analysis of closed loop and open loop systems- Modified z- transfer function- Stability of linear digital control systems and Jury's stability test	8
5.	Stability tests	Stability tests- Steady state error analysis- Root loci - Frequency domain analysis- Bode plots- Gain margin and phase margin.	8
6.	State feedback concept	Controllability and Observability - Response between sampling instants using state variable approach-Pole placement using state feedback .	5
7.	Digital System Design	Observer Design for digital control, Pole placement design based on input-output models.	5
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Project Based Learning: Students will learn about the analysis and Design of Digital controllers with the help of assignments/simulations based projects. Additionally, students in group sizes of two-three are required to prepare a review of any one application of the Digital Control System using one or more research publications.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	B. C. Kuo , "Digital control systems" (Second Edition) , Oxford University Press,2007.
2.	K. Ogatta, "Discrete Time control systems ", 2nd ed. PHI),1995
3.	M. Gopal, "Digital Control and State Variable Methods", 3rd Edition, TMH, Sep-2008.
4.	G. F. Franklin, J. D. Powell, M. Workman, Digital Control of Dynamic Systems, 3rd Edition, Longman, 1998.