INSTITUTE OF INFRASTRUCTURE TECHNOLOGY RESEARCH AND MANAGEMENT (IITRAM)

Electrical Engineering

M.Tech. Semester: I

Teaching Scheme

(Approved by Coordinator IITGN on 26-07-2017)

Course Code	Course Title	Lecture Hours	Tutorial Hours	Practical Hours	Credit
MA5003	Optimization Techniques	3	0	0	4
MA5002	Linear Algebra	3	0	0	4
EE5011	Adaptive and Nonlinear Control Systems	3	0	3	5
EE5012	Communication Infrastructure Systems	3	0	3	5
EE500x	Department Elective - I	3	0	0	4
	TOTAL	**15**	**0**	**6**	**22**

The following courses are offered as Department Elective – I for 2017-18.

Course Code	Course Title	Lecture Hours	Tutorial Hours	Practical Hours	Credit
EE5013	Digital Control Engineering	3	0	0	4

Coordinator
IIT Gandhinagar

Coordinator
IITRAM

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I	Course Code	**MA5003**			
II	Title of the course	**Optimization Techniques**			
III	Credit Structure	L	T	P	C
		3	0	0	4
IV	Prerequisite (if any for the student)	Nil			
V	Course Content	Introduction to Optimization: Introduction; Historical Development; Engineering Applications of Optimization; Statement of an Optimization Problem: Design Vector, Design Constraints, Constraint Surface, Objective Function, Objective Function Surfaces, Classification of Optimization Problems. Linear Programming: Introduction; Formulation of Linear Programming Problem (LPP); Solution of LPP: Some Important Definitions, Graphical Method, Simplex Method, Big-M Method, Two- Phase Method, Types of LPP Solutions; Duality in Linear Programming; Importance of Dual Problems; Parametric Analysis, Transportation Problems: North West Corner Method, Least Cost Method, Vogel's Approximation Method, Modified Distribution (MODI) Method, Stepping Stone Method, Variation in Transportation Problems; Assignment Problem (Variation in Assignment Problem); Game Theory: Two Person Zero Sum Game, Game with Saddle Point, Game without Saddle Point, Solving Game by Different Method. Introduction to Non-linear Programming: Classical Optimization Techniques			
VI	Text/Reference Books	1. S. S. Rao, Engineering Optimization: Theory and Practice, John Wiley & Sons, 2009. 2. N. H. Shah, R. M. Gor and H. Soni, Operations Research, PHI Learning Pvt. Ltd., 2007. 3. S. D. Sharma, Operations Research, Kedar Nath Ram Nath & Co., 2005. 4. H. A. Taha, Operations Research: An Introduction, 7th Edition, MacMillan Publishing Co, 2003. 5. J. K. Sharma, Operation Research: Theory and Applications, McMillan Publishers India, 2008. 6. J. C. Pant, Introduction to Optimization Techniques (Operations Research), 6th Edition, Jain Brothers, New Delhi, 2005.			

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M.Tech. Semester: I

I	Course Code	**MA5002**			
II	Title of the course	**Linear Algebra**			
III	Credit Structure	L	T	P	C
		3	0	0	4
IV	Prerequisite (if any for the student)	Nil			
V	Course Content	Introduction to Algebraic Structures: Groups, Rings, Fields, Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations. Algebra of matrices, rank and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem, canonical forms of matrices. Matrix representation of linear transformations. Inner product spaces, orthonormal basis. Quadratic forms, reduction and classification of quadratic forms Mathematical structures of signals and systems: Banach Spaces, Hilbert Spaces, Representation theory of Groups, Application of representation theory to signal processing, Harmonic analysis.			
VI	Text/Reference Books	References: 1. K. Hoffman and R. Kunze, Linear Algebra, Pearson Education (India), 2003. 2. Vivek Sahai and Vikas Bist, Linear Algebra, Narosa Publishing, 2002. 3. G. F. Simmons, Introduction to topology and modern analysis, 1983 4. B. V. Limaye, Functional Analysis, New age international publication, 2004 5. I. N. Hernstein, Topics in Algebra, Wiley India Pvt. Limited, 2006 6. M. Artin, Algebra, Prentice Hall of India, 1994.			

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M.Tech. Semester: I

I	Course Code	**EE5011**			
II	Title of the course	**Adaptive and Nonlinear Control Systems**			
III	Credit Structure	L	T	P	C
		3	0	3	5
IV	Prerequisite (if any for the student)	An Undergraduate Control Systems Course is mandatory for this Course.			
V	Course Content	Adaptive Control: Introduction, Recursive parameter estimation, Model reference adaptive control, Adaptive pole placement control, Robust adaptive control schemes, Averaging-based analysis, Adaptive control of nonlinear systems; Nonlinear Control: Introduction, Second-order systems and Phase Plane Analysis, Fundamentals of Lyapunov Stability Theory, Advanced Stability Theory, Stabilization and Global Feedback Linearization: differential geometric method, Nonlinear Control Design Tools: Lyapunov redesign, Backstepping, Nonlinear Observers, Nonlinear Output Regulation, Passivity and Dissipativity			
VI	Text/Reference Books	Petros Ioannou and Baris Fidan, Adaptive Control Tutorial, SIAM, 2006. - K. J. Astrom and B. Wittenmark, Adaptive Control, 2nd Edition, Addison-Wesley, 1995 -P. A. Ioannou and J. Sun, Robust Adaptive Control, Prentice-Hall, 1995 (available now at http://wwwrcf.usc.edu/~ioannou/RobustAdaptiveBook95pdf/Robust_Adaptive_Control.pdf) -K. S. Narendra and A. M. Annaswamy, Stable Adaptive Systems, Prentice-Hall, 1989 -S. Sastry and M. Bodson, Adaptive Control, Prentice-Hall, 1989 (available now at http://www.ece.utah.edu/%7Ebodson/acscr/index.html) -M. Krstic, I. Kanellakopoulos, and P. Kokotovic, Nonlinear and Adaptive Control Design, Wiley-Interscience, 1995 -H. K. Khalil, Nonlinear Systems, Prentice Hall, 3rd edition, 2002			

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M.Tech. Semester: I

I	Course Code	**EE5012**			
II	Title of the course	**Communication Infrastructure Systems**			
III	Credit Structure	L	T	P	C
		3	0	3	5
IV	Prerequisite(if any for the student)				
V	Course Content	Analog and Digital Communication: Basic blocks of Communication System, AM, Linear Modulation - DSB-SC, SSB and VSB, Frequency Translation, Frequency-Division Multiplexing, Angle Modulation - Frequency and Phase modulation, Transmission Bandwidth of FM signals, FM Stereo Multiplexing, Super heterodyne receiver, Circuits for generation and detection of AM, DSBSC, SSBSC, FM signal, Pre-emphasis and de-emphasis, Noise in Communication subsystems - Internal and external noise. Pulse code modulation (PCM), DM, Destination SNR in PCM systems with noise, Matched filter, Nyquist criterion for zero ISI, Optimum transmit and receive filters, Digital modulation techniques – binary ASK, FSK, and PSK, Spread spectrum (SS) techniques; direct S,S and frequency hop S,S, Processing gain and jamming margin, CDMA. Mobile Communication: GSM architecture, Location tracking and call setup, Mobility management, Handover, frequency management, Cell splitting, Security, call recording functions, Mobile Number portability, VoIP service for Mobile Networks, GPRS Architecture, 2G, 3G, 4G and LTE, Broadband wireless systems, Types of Network, OSI Model, TCP/IP Protocol. Optical Fibers: Structure, Wave guiding, Step-index and graded index optical fibers, Modal analysis, Classification of modes, Single Mode Fibers, Pulse dispersion, Material and waveguide dispersion, Polarization Mode Dispersion, Absorption, scattering and bending losses, Dispersion Shifted Fibers, Dispersion Compensating Fibers, Optical Power Launching and Coupling, Lensing schemes for coupling improvement, Fiber-to-fiber joints, Splicing techniques, Optical fiber connectors, Optical sources and detectors, Semiconductor Laser basics, LEDs, PIN and Avalanche photodiodes, Design considerations of fiber optic systems: Analog and digital modulation, WDM.			

		Satellite Communication system: Elements of orbital mechanics, Equations of motion, Tracking and orbit determination, Orbital correction/control, Elements of communication satellite design, Spacecraft subsystems, Reliability considerations, Multiple access techniques, FDMA, TDMA, CDMA, Satellite - based personal communication, Antenna and tracking systems, Satellite broadcasting.
VI	Text/Reference Books	1. K. Iizuka, Elements of Photonics, Volume II, Wiley, 2002. 2. B. P. Lathi, Zhi Ding, Modern Digital and Analog Communication Systems, Oxford; Fourth edition. 3. William C.Y. Lee "Mobile Communications Design Fundamentals" by Wiley; Second edition 2011. 4. R. P. Singh and S. Sapre "Communication Systems: Analog and Digital" McGraw Hill Education; 3 edition 2012. 5. Timothy Pratt, Charles Bostian, Jeremy Allnutt "Satellite Communications", Wiley; Second edition 2006.

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M.Tech. Semester: I

I	Course Code	**EE5013**			
II	Title of the course	**Department Elective-I Digital Control Engineering**			
III	Credit Structure	L	T	P	C
		3	0	0	4
IV	Prerequisite (if any for the student)	Control Systems			
V	Course Content	Introduction to digital control : Basic building blocks of Discrete time Control system, Sampling Theorem, Z transform and Inverse Z transform for applications for solving differential equations, Mapping between the Splane and the Zplane, Impulse sampling and Data Hold. Pulse Transfer Function and Digital PID Controllers: The pulse transfer function, pulse transfer function of Closed Loop systems, Pulse transfer function of Digital PID controller, Velocity & Position forms of Digital PID Controller, Realization of Digital Controllers, Deadbeat response and ringing of poles. Design of Discrete Time Control System by conventional methods: Stability analysis in Z-plane, Jury stability criterion, Bilinear transformations, Design based on the root locus method, Digital Controller Design using Analytical Design Method. State Space Analysis of Discrete Time Control System : State space representation of discrete time systems, Solution of discrete time state space equations, Pulse transfer function matrix, Eigen Values, Eigen Vectors and Matrix Diagonalization, Discretization of continuous time state space equations, Similarity transformations. Pole Placement and Observer Design: Concept of Controllability and Observability, Useful transformations in state space analysis and design, Stability improvement by state feedback, Design via pole placement, State observers. Optimal Control: Quadratic Optimal Control and Quadratic performance index, Optimal state regulator through the matrix Riccati equations, Steady State Quadratic Optimal Control.			
		1. B. C. Kuo, Digital Control Systems, Oxford University Press, 2/e, Indian Edition, 2007.			

VI	Text/Reference Books	2. K. Ogata, Discrete Time Control Systems, Prentice Hall, 2/e, 1995. 3. M. Gopal, Digital Control and State Variable Methods, Tata Mcgraw Hill, 2/e, 2003. 4. G. F. Franklin, J. D. Powell and M. L. Workman, Digital Control of Dynamic Systems, Addison Wesley, 1998, Pearson Education, Asia, 3/e, 2000. 5. K. J. Astroms and B. Wittenmark, Computer Controlled Systems - Theory and Design, Prentice Hall, 3/e, 1997.