Electrical Engg. Department

M. Tech – Electrical Engineering

Semester I

Teaching Scheme

Course Code	Course Title	Lecture Hours	Tutorial Hours	Practical Hours	Credit
MA5001	Optimization Methods	2	0	0	2
HS5002	Research Methodology	2	0	0	2
EE5001	Renewable Energy Infrastructure	3	0	0	3
EE5002	Communication Infrastructure	3	0	2	4
EE500x	Department Elective - I	3	0	0	3
	TOTAL	**13**	**0**	**2**	**14**

The following courses are offered as Department Elective – I for 2016-17.

- EE5003 Digital Control System

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<table>
<tr><td>I</td><td>Course Code</td><td colspan="4">HS5002</td></tr>
<tr><td>II</td><td>Title of the course</td><td colspan="4">Research Methodology</td></tr>
<tr><td rowspan="2">III</td><td rowspan="2">Credit Structure</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>IV</td><td>Preruqeisite(if any for the student)</td><td colspan="4">Nil</td></tr>
<tr><td>V</td><td>Course Content</td><td colspan="4">Research – Qualities of a Researcher – Ethics in Research; Components of a Research Problem – Various Steps in Engineering Research – Types of Research; Literature Survey; Hypotheses, Research Purposes - Research Design – Case Study Research, Comparative Research; Experiments that validate or invalidate the hypothesis; Analyzing the Results; Intellectual property Rights; What is Plagiarism? Introduction to tools to check Plagiarism.

Technical Writing, Research Reports – Structure and Components of Research Report – Types of Technical Report, Characteristics of Good, Research Report, Pictures and Graphs; Induction to Latex, Style files, Incorporation of figures and tables in reports; Adequacy of references; Writing style compatible to IEEE Conferences and Journals.</td></tr>
<tr><td>VI</td><td>Text/Reference Books</td><td colspan="4">- Research Methodology: Methods and Techniques, C.P. Kothari, New Age International, 2004.</td></tr>
</table>

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<table>
<tr><td>I</td><td>Course Code</td><td colspan="4">EE5001</td></tr>
<tr><td>II</td><td>Title of the course</td><td colspan="4">Renewable Energy Infrastructure</td></tr>
<tr><td rowspan="2">III</td><td rowspan="2">Credit Structure</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>IV</td><td>Preruqeisite(if any for the student)</td><td colspan="4">Nil</td></tr>
<tr><td>V</td><td>Course Content</td><td colspan="4">Sustainability: Why Energy Matters (and Money); Global Warming (Physics), History and Impact; Renewable Sources that are replenished: Wind, Solar, Ocean Waves, Geothermal; Wind Energy: Forecasting Challenges, Wind Turbines: Dynamics and Control, Wind Wakes; Solar Energy: Harnessing the Power of Sun: Science and Technology of Solar Photovoltaics (PV), Solar PV Connection to virtual Grid, Optimization issues; Renewable Energy storage Issues, Challenges; Hybrid Solar-Wind System; Wind Farm; Solar Farm; Policy and Ethical Issues; Energy Conservation related issues; Hydrogen and Fuel Cells; Bio-energy: The plants work and let us reap.</td></tr>
<tr><td>VI</td><td>Text/Reference Books</td><td colspan="4">1. Wind Energy Handbook, 2nd Edition, Tony Burton, Nick Jenkins, David Sharpe, Ervin Bossanyi, ISBN: 978-0-470-69975-1

2. Solar Electricity Handbook - 2015 Edition: A simple, practical guide to solar energy - designing and installing solar PV systems, Michael Boxwell, Greenstream Publishing; 2015 Edition, ISBN-13: 978-1907670459

3. Hydrogen and Fuel Cells: A volume in Sustainable World, Bent Sorensen, ISBN: 978-0-12-387709-3</td></tr>
</table>

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<table>
<tr><td>I</td><td>Course Code</td><td colspan="4">EE5002</td></tr>
<tr><td>II</td><td>Title of the course</td><td colspan="4">Communication Infrastructure</td></tr>
<tr><td rowspan="2">III</td><td rowspan="2">Credit Structure</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>2</td><td>4</td></tr>
<tr><td>IV</td><td>Prerequisite(if any for the student)</td><td colspan="4">Nil</td></tr>
<tr><td>V</td><td>Course Content</td><td colspan="4">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.</td></tr>
</table>

		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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<table>
<tr><td>I</td><td>Course Code</td><td colspan="4">EE5003</td></tr>
<tr><td>II</td><td>Title of the course</td><td colspan="4">Department Elective-I Digital Control System</td></tr>
<tr><td rowspan="2">III</td><td rowspan="2">Credit Structure</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>IV</td><td>Preruqeisite(if any for the student)</td><td colspan="4">Control Systems</td></tr>
<tr><td>V</td><td>Course Content</td><td colspan="4">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 S-plane 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.</td></tr>
</table>

VI	Text/Reference Books	1. B. C. Kuo, Digital Control Systems, Oxford University Press, 2/e, Indian Edition, 2007. 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.

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I	Course Code	MA5001			
II	Title of the course	Optimization Methods			
III	Credit Structure	L	T	P	C
		3	0	0	2
IV	Preruqeisite(if any for the student)	Nil			
V	Course Content				
VI	Text/Reference Books				