Institute of Infrastructure Technology Research and Management

Department of Electrical Engineering

M. Tech – Electrical Engineering

Semester II

Teaching Scheme

Course Code	Course Title	Lecture Hours	Tutorial Hours	Practical Hours	Credit
EE5004	Linear Algebra in Electrical Engineering	3	0	0	3
EE5005	Deregulated Power System	3	0	0	4
EE5006	Adaptive and Nonlinear Control	3	0	3	4
EE5007	Artificial Intelligence	3	0	0	3
EE500x	Department Elective - II	3	0	0	3
	Total	15	0	3	17

Department Elective – II for 2016-17.

Course Code	Course Title	Lecture Hours	Tutorial Hours	Practical Hours	Credit
EE5008	Satellite Communication	3	0	0	3
EE5009	Special Electrical Machines	3	0	0	3

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Semester II

<table>
<tr><td>I</td><td>Course Code</td><td colspan="4">EE5004</td></tr>
<tr><td>II</td><td>Title of the course</td><td colspan="4">Linear Algebra in Electrical Engineering</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>Prerequisite (if any for the student)</td><td colspan="4">High School Algebra</td></tr>
<tr><td>V</td><td>Course Content</td><td colspan="4">1.Signals Spaces: vector spaces, basis and dimension, finite-dimensional vector spaces, norm and normed vector spaces, inner products. Hilbert and Banach spaces orthogonal subspaces and linear transformations, range and null space.
2.The approximation problem in Hilbert space: Orthogonality principle Gram-- Schmidt orthogonalization, matrix representations of least-squares problems minimum error in Hilbert-space approximations---least-squares filtering---LS solution of under-determined equations, signals as points: digital communication.
3.Linear Operators and Matrix Inverses: Linear operators---operator norms---adjoint operators and transposes---geometry of linear equations---four fundamental subspaces of a linear operator
4.Eigenvalues and Eigenvectors: Eigenvalues and linear systems---linear dependence of eigenvectors---diagonalization of a matrix
5.An application: Design of optimal filters via linear programming LS and eigenvalue problem
6.An introduction to wavelets through linear algebra</td></tr>
<tr><td>VI</td><td>Text/Reference Books</td><td colspan="4">Text:
Linear Algebra Done right by Sheldon Axler, 2nd Edition.
References:
1. Mathematical Methods and Algorithms for Signal Processing by Todd K. Moon and Wynn C. Stirling, 1999, Prentice Hall, Upper Saddle River, NJ
2. Optimization by Vector Space Methods by David G. Luenberger, 1969, Wiley-Interscience, New York, NY.
3. Matrix Analysis and Applied Linear Algebra by Carl D. Meyer, 2000, SIAM, Philadelphia, PA
4. Linear Operator Theory in Engineering and Science by Arch W. Naylor and George W. Sell, 1982, Springer Velag, New York, NY.
5. An introduction to wavelets through linear algebra by M. W Fraizer, Springer verlag</td></tr>
</table>

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Semester II

I	Course Code	EE5005			
II	Title of the course	Deregulated Power System			
III	Credit Structure	L	T	P	C
		3	0	0	4
IV	Prerequisite (if any for the student)	Power Systems			
V	Course Content	Deregulation of Electricity Supply Industry (ESIs): Need of deregulation, Issues associated with the restructuring of ESIs, International experiences. Economic Operation of Power Systems: Economic load dispatch, Unit commitment (UC), optimal power flow, optimal power flow in system design and operation. Electricity Markets: Models of competition, role of the independent system operator in pool versus bilateral markets, Bilateral trading, Electricity pools, Spot market, Settlement process. Power System Controls: Load frequency control, Generator voltage control. System Security and Ancillary Services (AS) Management: Balancing issues, Network issues, System restoration, AS provision, Distributed energy resources (DERs) in AS provision, Co-optimization of AS and energy. Transmission Pricing and Congestion Management: Electric power wheeling, Transmission open access, generation scheduling in deregulation, transmission pricing paradigms, Congestion management techniques, DERs in congestion management.			
VI	Text/Reference Books	Reference Books /Text Books: 1. L. L. Lai, Power System Restructuring and Deregulation: Trading, Performance and Information Technology, Wiley, (2001) 2. M. Shahidehpour and M. Alomoush, Restructured Electrical Power Systems, Operation, Trading and Volatility, Marcel Dekkar (2001). 3. O.L. Elgerd, Electric Energy Systems Theory: An Introduction, Second Edition, TMH Edition, (1996) 4. A.J. Wood and B.F. Wollenberg, Power Generation Operation and Control, Second Edition, Wiley India Edition, (2013) 5. K. Bhattacharya, M.H.J. Bollen and J.E. Daaler, "Operaiton of Restructured Power System", Kluwer Power Electronics and Power Systems Series, (2001)			

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Semester II

I	Course Code	EE5006			
II	Title of the course	Adaptive and Nonlinear Control			
III	Credit Structure	L	T	P	C
		3	0	2	4
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://www-rcf.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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Semester II

<table>
<tr><td>I</td><td>Course Code</td><td colspan="4">EE5007</td></tr>
<tr><td>II</td><td>Title of the course</td><td colspan="4">Artificial Intelligence</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>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">Introduction to AI, history of AI, course logistics, Intelligent agents, uninformed search, Heuristic search, greedy search, A* algorithm, stochastic search,Adversarial search, game playing Machine Learning: basic concepts, linear models, K nearest neighbors, overfitting, Machine Learning: perceptrons, neural networks, naive Bayes, decision trees, ensemble, logistic regression, and unsupervised learning, Constraint satisfaction problems, Markov decision processes, reinforcement learning.
Logical agents, propositional logic and first order logic AI applications to natural language processing (NLP) AI applications to vision/robotics</td></tr>
<tr><td>VI</td><td>Text/Reference Books</td><td colspan="4">Stuart J. Russel, Peter Norvig, Artificial Intelligence: A Modern Approach
E. Rich and K.Knight, Artificial Intelligence, Pearson

Other references:

1. Rich and Knight, Artificial Intelligence 3ed. TMH
2. Deepak Khemani, A Frist course in Artificial Intelligence, McGraw Hill
3. Malik Ghallab, Dana Nau, Paolo Traverso, Automated
4. Planning: Theory & Practice, The Morgan Kaufmann Series in Artificial Intelligence, 2004.
5. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
6. Mark Stefik, Introduction to Knowledge Systems, Morgan Kaufmann, 1995.</td></tr>
</table>

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Semester II

<table>
<tr><td>I</td><td></td><td>Course Code</td><td colspan="4">EE5008</td></tr>
<tr><td>II</td><td></td><td>Title of the course</td><td colspan="4">Department Elective – II(Satellite Communication)</td></tr>
<tr><td rowspan="2">III</td><td></td><td rowspan="2">Credit Structure</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td></td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>IV</td><td></td><td>Prerequisite (if any for the student)</td><td colspan="4">NO</td></tr>
<tr><td>V</td><td></td><td>Course Content</td><td colspan="4">SATELLITE ORBITS
Kepler’s Laws, Newton’s law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility –eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

SPACE SEGMENT AND SATELLITE LINK DESIGN
Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry,
Tracking and command. Satellite uplink and downlink Analysis and Design, link budget, E/N calculation- performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System
reliability and design lifetime.

SATELLITE ACCESS:
Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Brocast, multiple access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression – encryption, Transponder and their Access.

EARTH SEGMENT
Earth Station Technology-- Terrestrial Interface, Transmitter and Receiver, Antenna Systems TVRO, MATV, CATV, Test Equipment Measurements on G/T, C/No, EIRP, Antenna Gain.

SATELLITE APPLICATIONS
INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH), Digital audio broadcast (DAB)- Worldspace services, Business TV(BTV), GRAMSAT, Specialized services – E –mail, Video conferencing, Internet, Tracking Telemetry.</td></tr>
<tr><td>VI</td><td></td><td>Text/Reference Books</td><td colspan="4">1. Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communication, John Wiley International 2006.</td></tr>
</table>

			2. Dennis Roddy, Satellite Communications, McGraw Hill 2014.

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I	Course Code	EE5009			
II	Title of the course	**Special Electrical Machines**			
III	Credit Structure	L	T	P	C
		3	0	0	4
IV	Prerequisite (if any for the student)				
V	Course Content	Permanent Magnet Brushless D.C. Motors - Fundamental equations; EMF and Torque equations; Torque speed characteristics; Rotor position sensing; Sensorless motors; Motion control. Permanent Magnet Synchronous Motors – Construction; Principle of operation; EMF and torque equations; Starting; Rotor configurations; Dynamic model. Synchronous Reluctance Motors - Constructional features; axial and radial flux motors; operating principle; characteristics Switched Reluctance Motors - Constructional features; principle of operation; torque production; characteristics; power controllers Stepping Motors – Features; fundamental equations; PM stepping motors; Reluctance stepping motors; Hybrid stepping motors; Torque and voltage equations; characteristics			
VI	Text/Reference Books	**Text book** K. Venkataratnam, "Special Electrical Machines", Universities Press **References** [1] J. R. Hendershot and T. J. E. Miller, "Design of Brushless Permanent-Magnet Machines", Motor Design Books LLC [2] R. Krishnan, "Switched Reluctance Motor Drives", CRC Press [3] T. J. E. Miller, "Brushless Permanent Magnet and Reluctance Motor Drives", Oxford Science Publications [4] T. Kenjo, and A. Sugawara, "Stepping Motors and their Microprocessor Controls", Oxford Science Publications			