UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

VIII SEMESTER

APPLIED ELECTRONICS and INSTRUMENTATION ENGINEERING

SCHEME -2013

VIII SEMESTER

APPLIED ELECTRONICS and INSTRUMENTATION ENGINEERING (A)

Course No	Name of subject	Credits	Weekly load, hours			C A Marks	Exam Duration Hrs	U E Max Marks	Total Marks
			L	T	D/ P				
13.801	Robotics and Industrial Automation (A)	4	3	1	-	50	3	100	150
13.802	Non Linear and Adaptive Control (A)	4	3	1	-	50	3	100	150
13.803	Optical Instrumentation (A)	4	3	1	-	50	3	100	150
13.804	Data Networks (A)	4	3	1	-	50	3	100	150
13.805	Elective V	4	3	1	-	50	3	100	150
13.806	Elective VI	4	3	1	-	50	3	100	150
13.807	Project and Viva – Voce (AT)	5	-	-	5	200	-	100	300
	Total	**29**	**18**	**6**	**5**	**500**		**700**	**1200**

13. 805 Elective V

13.805.1	Entrepreneurship (AT)
13.805.2	Distributed Control System and Communication Protocols (A)
13.805.3	Aviation Electronics (A)
13.805.4	Wireless Sensors and Systems (A)
13.805.5	Electromagnetic Interference and Compatibility (A)
13.805.6	VLSI Devices and Process Simulation (A)

13. 806 Elective VI

13.806.1	Management Information Systems (AT)
13.806.2	Nuclear Instrumentation (A)
13.806.3	Machine Vision (A)
13.806.4	Nanosensors and Biosensors (A)
13.806.5	Robust Control System (A)
13.806.6	Parameter Estimation and System Identification (A)

13.801 ROBOTICS & INDUSTRIAL AUTOMATION (A)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

- *To learn about the concepts of robotics, automation*
- *To learn about various Transmission elements*
- *To learn about Robot programming*

Module – I

Introduction - Basic concepts, definition and origin of robotics, different types of robots, robot classification, applications, robot specifications.
Introduction to automation - Components and subsystems, basic building block of automation, manipulator arms, wrists and end-effectors.

Module – II

Transmission elements: Hydraulic, pneumatic and electric drives. Gears, sensors, materials, user interface, machine vision, implications for robot design, controllers.
Kinematics, dynamics and control - Object location, three dimensional transformation matrices, inverse transformation, kinematics and path planning, Jacobian work envelope, manipulator dynamics, dynamic stabilization, position control and force control, present industrial robot control schemes.

Module – III

Robot programming - Robot programming languages and systems, levels of programming robots, problems peculiar to robot programming, control of industrial robots using PLCs.
Automation and robots - Case studies, multiple robots, machine interface, robots in manufacturing and non-manufacturing applications, robot cell design, selection of a robot.

Module – IV

Factory automation **-** Flexible Manufacturing Systems concept – Automatic feeding lines, ASRS, transfer lines, automatic inspection – Computer Integrated Manufacture – CNC, intelligent automation, Industrial networking, bus standards.
Colour Image Processing: Colour Models, RGB, CMY, HSI – Colour Transformation – Smoothing and Sharpening, Segmentation based on colour.

References:

1. Spong and Vidyasagar, *Robot Dynamics and Control*, John Wiley & Sons, 1990.
2. Asfahl C.R, *Robots and Manufacturing Automation*, John Wiley & Sons, 1992.

3. Mikell P. Groover, *Automation Production Systems and Computer Integrated Manufacturing*, 3/e, PHI.
4. Klafter R. D., Chmielewski T.A, Negin M., *Robotic Engineering an Integrated Approach*, PHI, 2007.
5. Schilling, R. J., *Fundamental of Robotics: Analysis and Control*, PHI, 2007.
6. Fu K.S, R. C. Gonzalez and C. S. G. Lee, *Robotics, Control, Sensing, Vision and Intelligence*, McGraw-Hill, 1987.
7. Bolton W, *Mechatronics*, 3/e, Pearson Education.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will be familiarized with concepts of robotics, automation, Transmission elements and Robot programming.

13.802 NON-LINEAR AND ADAPTIVE CONTROL (A)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

- *To learn methods of stability analysis for non linear control systems.*
- *To learn about various adaptive control strategies giving emphasis to MRAS & STR.*

Module – I

Introduction -Features of linear and non-linear systems –State variable representation – Solution of state equations – Conversion of state variable models to transfer functions – Eigen values – Eigen vectors – Concepts of controllability and observability - Common physical non-linearities – Methods of linearising nonlinear systems. Phase plane analysis - Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

Module – II

Function analysis -Basic concepts, derivation of describing functions for common non-linearities – Describing function analysis of non-linear systems – Conditions for stability – Stability of oscillations. Stability analysis - Introduction – Liapunov's stability concept – Liapunov's direct method – Lure's transformation – Aizerman's and Kalman's conjecture – Popov's criterion – Circle criterion.

Module – III

Different adaptive control strategies - Gain scheduling, MRAS, STR, MRAS – adaptation law – adaptation law based on stability criterion – adaptation based on MIT rule. Design of MRAS based on MIT rule – Design of MRAS based on Lyapunov methods – simulation of MRAS systems.

Module – IV

Self-Tuning Regulators – Pole placement design – Indirect STR – continuous time STR –Direct STR simulation of STR systems - stochastic self-tuning regulators- linear quadrant STR – adaptive predictive control.

References:

1. Jean-Jacques E., *Slot line, Applied Non-linear Contro*l, Pearson Education, 1991.
2. Torkel Glad, Lennart Ljung, *Control Theory – Multi Variable and Non-linear Methods*, Taylor's & Francis Group, 2002.

3. Astrom K. J. and B. Wittenmark, *Adaptive Control,* Pearson Education
4. Shankar Sastry & Mare Bodson, *Adaptive Control*, IEEE press
5. Peter A. Cook, *Non-linear Dynamical Systems*, 3/e, Pearson Education.
6. Nagrath I. J. and M. Gopal, *Control System Engineering*, New Age International Publishers, 2003.
7. Ronald R. Mohler, *Non-linear Systems, Vol. – I, Dynamics & Control*, Pearson Education, 1998.
8. Hassan K. Kahalil, *Non-linear Systems*, Pearson Education, 2002.
9. Marino R. and P. Tomei, *Nonlinear control design - Geometric, Adaptive and Robust*, Prentice Hall, 1995.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will be familiarized with methods of stability analysis for non linear control systems and also they will get exposed to different adaptive control strategies.

13.803 OPTICAL INSTRUMENTATION (A)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To learn about Optical fibres and devices*
- *To learn about Laser fundamentals*
- *To learn about industrial and* medical applications of lasers

Module – I

Optical fibers and their properties - principles of light propagation through a fiber, different types of fibers and their properties, transmission characteristics of optical fiber, absorption losses, scattering losses, dispersion, optical sources and detectors – LED-PIN and APD.

Module – II

Optical fiber sensors - Intensity modulated optical fiber sensors, Reflective Evanescent wave and micro bend fiber optic sensors, Fiber optic refractometers &thermometers, distributed sensing with fiber optic sensors, interferometric optical fiber sensors, measurement of - current, pressure, temperature, liquid level, strain, current and voltage using optical fiber sensors.

Module – III

Laser fundamentals - fundamental characteristics of Lasers, three level and four level lasers, properties of laser, laser modes, resonator configuration, Q-switching and mode locking, cavity dumping, types of lasers - gas, solid, liquid and semiconductor lasers.
Industrial application of Lasers - Laser for measurement of - distance, length, velocity, acceleration, current, voltage and atmospheric effect. Laser for material processing – laser heating, welding melting and trimming of materials, removal and vaporization.

Module – IV

Medical applications of lasers - laser and tissue interaction, Laser instruments for - surgery, removal of tumors of vocal cords, brain surgery, plastic surgery, gynaecology and oncology.
Holography & Interferometry - principles of Holography, Gabor's hologram, Leith's and Upatneik's techniques in holography, Applications of holography in non-destructive testing and instrumentation.

References:

1. Senior J. M., *Optical Fiber Communication- Principles and Practice*, Prentice Hall, 1993.

2. John and Harry, *Industrial lasers and their applications*, McGraw Hill, 1974.
3. John F. Read, *Industrial Applications of Lasers*, Academic Press, 1997.
4. Gerd Keiser, *Optical Fiber Communication*, McGraw Hill, 2000.
5. Jasprit Singh, *Semiconductor Optoelectronics*, McGraw Hill, 1995.
6. Pal B. P., *Fundamentals of Fiber Optics in Telecommunication & Sensor Systems*, Wiley Eastern, 1991.
7. Govind P. Agarwal, *Optical Communications*, John Wiley, 2000.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will be familiarized with Optical fibres and devices. Also they will acquire knowledge on Industrial and medical applications of Lasers.

13.804 DATA NETWORKS (A)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *Compare and contrast the circuit and packet switching technologies. Describe the concept and the use of multiplexing technologies. Describe error control mechanisms.*
- *To describe the advantages of a layered architecture. Illustrate the roles of each layer in the OSI.*
- *To give a description of the TCP/IP protocol suite including the roles of major protocols· Configure an IP address block into a given number of subnets*

Module – I

Fundamentals of digital communications: Introduction to digital communications - Definitions of terms, Signal propagation, Signal types, Sine waves, Square waves, Signal parameters, Amplitude, Frequency, Phase, Channel effects on transmission, Attenuation, Effects of limited bandwidth, Delay distortion, Noise, Data rate limits in channels, Nyquist's theorem, Shannon's theorem.
Physical layer characterization: Transmission Media, Twisted pair cables, Co-axial cables, Fiber optic cables, Wireless media, Physical Layer Interfaces -RS 232 / EIA 232/ USB.

Module – II

Data transmission mechanisms: Communication modes -Simplex, Half-duplex, Full - duplex, Transmission modes - Serial transmission, Parallel transmission. Synchronization- Asynchronous transmission, Synchronous transmission. Introduction to packet switching, Circuit switching vs. packet switching, Types of services, Connection oriented services (Virtual circuits), Connectionless services (Datagrams). Multiplexing- Frequency division multiplexing, Synchronous time division multiplexing, Statistical time division multiplexing. Error control methods -Feedback error recovery (ARQ) (Eg: Based on parity check), Forward error correction (FEC) (Eg; CRC).

Module – III

Network architectures: Introduction to computer networks, Network topologies: Bus, Star, Ring, Types of networks- Local area networks, Wide area networks, Personal area networks, Layered network model, OSI model, TCP/ IP model.
Internet protocols: Introduction, History of the Internet protocols, Internet protocol stack, IP Addressing and Routing, Subnetting: Fixed and variable length, Unicast routing algorithms, Transport Layer protocols, TCP, UDP, IP Support Protocols, ARP, DHCP, ICMP, Application Layer Protocols, Domain Name System (DNS), Email – SMTP, POP, IMAP, FTP, HTTP, RTP and Vo IP, IP version 6.

Module – IV

Local area networks: Introduction to LANs, Conventional LAN Architectures, Access Protocols: CSMA/CD, Token Passing, Interconnecting devices: Hubs, L2 /L3 Switch, IEEE 802 MAC layer standards :802.3 , 802.11 ,802.15, Switched Ethernet variants: Fast Ethernet, Gigabit Ethernet, 10Gb Ethernet.

Practical aspects of networking: Structured cabling and specifications: Standards CAT5, 5E, etc. Network security, Firewalls and NAT, VLANs, VPNs, Proxy server, Wireless security, User access technologies, Wired: xDSL, FTTH, Cellular wireless: GPRS, EDGE, HSPDA, Broadband wireless: 802.16.

References:

1. Tanenbaum Andrew S., *Computer Networks*, 4/e (2nd Impression), 2006.
2. William Stallings, *Data and Computer Communications*, 7/e (3rd Impression), 2007.
3. Larry L. Peterson, Bruce S. Davie, *Computer Networks: A Systems Approach*, 4/e.
4. Halsall Fred, *Data Communications, Computer Networks and OSI*, 4/e (10th Indian reprint), 2005.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will be able to, Identify the different components and their respective roles in a communication system, Propose efficient, cost effective, reliable and appropriate technology to establish communication links, Design an enterprise network employing the common LAN technologies and be able to evaluate the advantages and disadvantages, Configure a PC to work as a host in a TCP/IP network and to use the IP based commands to facilitate the trouble shooting process.

13.805.1 ENTREPRENEURSHIP (AT) (Elective V)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits:** 4

Course Objectives:

- *To develop and strengthen entrepreneurial quality and motivation*
- *To impart basic entrepreneurial skills*
- *To run a business efficiently and effectively.*

Module – I

Entrepreneurship: definition, requirements to be an entrepreneur, entrepreneur and intrapreneur, entrepreneur and manager, growth of entrepreneurship in India, women entrepreneurship, rural and urban entrepreneurship.

Entrepreneurial Motivation, motivating factors, motivation theories-Maslow's Need Hierarchy Theory, McClelland' s Acquired Need Theory, government's policy actions towards entrepreneurial motivation, entrepreneurship development programmes.

Module – II

Types of Enterprises and Ownership Structure: small scale, medium scale and large scale enterprises, role of small enterprises in economic development; proprietorship, partnership, Ltd. companies and co-operatives: their formation, capital structure and source of finance.

Institutional Support and Policies: institutional support towards the development of entrepreneurship in India, technical consultancy organizations, government policies for small scale enterprises.

Module – III

Projects: identification and selection of projects; project report: contents and formulation, concept of project evaluation, methods of project evaluation: internal rate of return method and net present value method.

Module – IV

Management of Enterprises, objectives and functions of management, general and strategic management, introduction to human resource management, planning, job analysis, training, recruitment and selection, marketing and organizational dimension of enterprises, enterprise financing ,raising and managing capital, shares, debentures and bonds, cost of capital, break- even analysis, balance sheet analysis.

References:

1. Ram Chandran, *Entrepreneurial Development*, Tata McGraw Hill, New Delhi, 2009.

2. Saini J. S., *Entrepreneurial Development Programmes and Practices*, Deep & Deep, 2003.
3. Khanka, S. S., *Entrepreneurial Development*, S Chand, 2013.
4. Badhai B., *Entrepreneurial Development*, Dhanpat Rai, 2001.
5. Desai Vasant, *Project Management and Entrepreneurship*, Himalayan Publishing, 2002.
6. Gupta and Srinivasan, *Entrepreneurial Development*, S Chand, 2012.
7. Kuratko and Rao, *Entrepreneurship*, Cengage Learning, 2012.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the Completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.

13.805.2 DISTRIBUTED CONTROL SYSTEMS AND COMMUNICATION PROTOCOLS (A) (Elective V)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

- *To Learn about SCADA and PLC*
- *To Learn about various DCS based aspects like packages and control*
- *To Learn about instrumentation standard protocols*

Module – I

Review of computers in process control: Data loggers, Data Acquisition Systems (DAS), Direct Digital Control (DDC). Supervisory Control and Data Acquisition Systems (SCADA), sampling considerations. Functional block diagram of computer control systems.

Programmable logic controller (PLC) basics: Definition, overview of PLC systems, input/output modules, power supplies and isolators. General PLC programming procedures, programming on-off inputs/ outputs. Auxiliary commands and functions, PLC Basic Functions, register basics, timer functions, counter functions. PLC functions: Arithmetic functions, comparison functions, Skip and MCR functions, data move systems. PLC Advanced intermediate functions: Utilizing digital bits, sequencer functions, matrix functions.

Module – II

PLC Advanced functions: Alternate programming languages, analog PLC operation, networking of PLC, PLC-PID functions, PLC installation, troubleshooting and maintenance. Design of interlocks and alarms using PLC.

DCS- Basic Packages Introduction, analog control, direct digital control, distributed process control, DCS configuration with associated accessories, control console equipment, control unit (Relay Rack mounted equipments), local control units, attributes of DCS & DCS Flow sheet symbols. DCS System Integration I/O hardware stations, Set-point station control, Supervisory Computer Tasks & configurations, system integration with PLCs and computers.

Module – III

Instrumentation Standard Protocols: HART Protocol, frame structure, programming, implementation examples, Benefits, Introduction, Advantages and Limitations of Fieldbus, FDS configuration, Comparison with other fieldbus standards including Device net, Profibus, Controlnet, CAN, Industrial Ethernet, MAP and TOP.

Module – IV

Industrial applications of PLC, SCADA, DCS and open systems for following plants: Cement plant, Thermal power plant, Steel Plant, Glass manufacturing plant, Paper and Pulp plant.

References:

1. Popovic and Bhatkar, *Distributed computer control for Industrial Automation*, Mareeet Dekkar, New York.
2. Krishna Kant, *Computer based Industrial Control*, Prentice Hall, New Delhi.
3. Lukcas M. P., *Distributed Control Systems*, Van Nostrand Reinhold Co., New York.
4. Curtis D. Johnson, *Process Control Instrumentation Technology*, 7/e, PHI.
5. John. W. Webb, Ronald A Reis, *Programmable Logic Controllers - Principles and Applications*, 4/e, Prentice Hall Inc.
6. Frank D. Petruzella, *Programmable Logic Controllers*, Second edition, McGraw Hill, New York.
7. Deshpande P. B. and R. H. Ash, *Elements of Process Control Applications*, ISA Press, New York.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will be familiarized with SCADA and PLC and also they will acquire knowledge about various instrumentation standard protocols and applications of PLC, SCADA and DCS in working of various industrial plants.

13.805.3 AVIATION ELECTRONICS (A) (Elective V)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

- *To familiarize terminology used in Avionics*
- *To give an understanding of basic principles, theory and operation of modern avionics systems and their implementation*
- *To enable students to effectively use the principles covered in analyzing and testing the performance of avionics*

Module – I

Atmospheric flight mechanics, Aerostatics, Bernoulli's equation, Air data instruments-Pitot and static systems, Altimeter and its types, Airspeed indicator, Mach meter, Vertical speed indicator. Gyroscopic instruments and compasses. Static stability and control - Longitudinal control, Stick forces, Directional stability and control, Roll stability and control.

Module – II

Aircraft equations of motion –Rigid body equations of motion, Orientation and position of the Airplane, Gravitational and thrust forces, small disturbance theory, Aerodynamic force and moment representation. Longitudinal motion - Pure pitching motion, Stick fixed longitudinal motion and approximations, Flying qualities, Flight simulation.

Module – III

Lateral motion - Pure rolling and yawing motion, Lateral directional equations of motion, Lateral flying qualities, Inertial coupling. Aircraft response to control - Equation of motion in a non-uniform atmosphere, Pure vertical motion, Atmospheric turbulence and models, Wind shear.

Module – IV

Application of classical control theory to aircraft autopilot design - Aircraft transfer functions, Control surface actuator, Displacement autopilot, Stability augmentation, Instrument landing. Application of modern control theory to aircraft autopilot design - Stability augmentation, Autopilot design, State observer, Optimal control.

References:-

1. Robert C. Nelson, *Flight Stability and Automatic Control*, 2/e, TMH.
2. David Harris, *Flight Instruments & Automatic flight control systems*, 6/e, Wiley India.
3. Myron Kayton, Walker R. Fried, *Avionics Navigation Systems*, John Wiley and Sons Inc, 1997.

4. Underdown R. B. and Tony Palmer, *Ground studies for pilots Navigation*,6/e, Wiley India.
5. Albert Helfrick, *Principles of Avionics*, Avionics publication, 2002.
6. Collinson R. P. G., *Introduction to Avionics*, Kluwer Academic publications

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will be familiarized with major components of aircraft navigation systems and their functions.

13.805.4 WIRELESS SENSORS AND SYSTEMS (A) (Elective V)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits:** 4

Course Objectives:

- *To familiarize with Sensor, actuator and transducer*
- *To familiarize with* Smart Sensor Technologies
- *To learn about Sensor Networking and Computing*

Module – I

Review: Sensor, actuator and transducer- Classification of sensors on the basis of energy source and type of output signals. Signal conditioning. Meaning and types of smart sensors.

MEMS Sensors: Concept and methods of making MEMS devices, Sensors and Actuators, Examples.

Module – II

Smart Sensor Technologies: Thick-film, thin-film and monolithic IC technologies and their use in making smart sensors. Bulk and surface micromachining technologies, Wafer bonding, LIGA process, Plasma etching, and their use in making smart sensors.

Module – III

Intelligent and Network Sensors: Concept and architecture of intelligent sensors, Concept and architecture of network sensors.

Sensor Networking: 7-Layer OSI model of communication system, device-level networks, introduction to protocols and technologies for wired and wireless LANs. Ethernet, RS-485 and Foundation Fieldbus protocols. Wi-Fi. Zigbee and Bluetooth protocols. Concept of adhoc networks. Smart Transducer Interface Standard IEEE 1451.

Module – IV

Introduction to Sensor network computing: Applications, Constraints/Challenges, Wireless and wired networking issues for sensor nets. Networking for sensor nets- Directed diffusion, Aggregation, Network discovery/initialization, Location/Time service, Routing, Large-scale analysis, Power-aware computing and Communication.

References:

1. Fraden J., *Handbook of Modern Sensors: Physics, Design and Applications*, AIP press, 2003.
2. Feng Z. and Leonidas G., *Wireless Sensor Networks*, Elsevier Eastern Limited, 2007.

3. Anna Hac, *Wireless Sensor Network Design*, John Wiley & Sons, Ltd, 2004.
4. Frank R., *Understanding Smart Sensors*, Artech House Publishers. 2000.
5. Yamasaki H., *Intelligent Sensors*, Elsevier Eastern Limited. 1996.
6. Ramon P. A. and Webster J. G., *Sensors and Signal Conditioning*, 2/e, John Wiley and Sons.
7. Elena Gaura, Robert Newman, *Smart MEMS and Sensor systems*, Imperial College Press, 2006.
8. Mohammad Ilyas, *Sensor Network Applications, Architecture and Design*, CRC.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will be familiarized with Sensor Networking and Computing.

13.805.5 ELECTROMAGNETIC INTERFERENCE AND COMPATABILITY (A) (Elective V)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits:** 4

Course Objectives:

- *To learn about Electromagnetic Interference*
- *To learn different EMI control techniques.*

Module – I

EMI Environment – Sources of EMI, conducted and radiated EMI, Transient EMI, EMI-EMC definitions, units, parameters. EMI coupling principles - Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near field cable to cable coupling. Power mains and power supply coupling.

Module – II

EMI specifications, standards, limits - units of specifications, Civilian and Military standards. EMI measurements – EMI test instruments, systems, EMI test, EMI shielded chamber, Open area test site.

Module – III

TEM cell Antennas, conductors, sensors, injectors, couplers, Military test methods and procedures, calibration procedures. Crosstalk -Three-conductor transmission lines, shielded wires, twisted wires, shielding.

Module – IV

EMI control techniques – shielding, filtering, grounding, bonding, Transient suppressors, Isolation transformer, Cable routing, signal control, component selection and mounting. EMC design of PCB – PCB traces cross talk, impedance control, power distribution decoupling, zoning, motherboard designs.

References:

1. Bernhard Keiser, *Principles of Electromagnetic Compatibility,* Artech house, 3/e, 1986.
2. Henry W. Ott, *Noise reduction Techniques in Electronics Systems,* John Wiley & Sons, 1988.
3. Paul, C.R., *Introduction to Electromagnetic Compatibility*, Wiley Interscience, 2006.
4. Kaiser, K. L., *Electromagnetic Compatibility Handbook*, CRC Press, 2004
5. Kodali, V. P., *Engineering Electromagnetic Compatibility: Principles, Measurement and Technologies*, IEEE Press, 2001.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will be familiarized with Electromagnetic Interference. They will also be familiarized with different EMI control techniques

13.805.6 VLSI DEVICE AND PROCESS SIMULATION (A) (Elective V)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits:** 4

Course Objectives:

- *To learn about VLSI Design methodologies*
- *To learn about Layout Compaction, Partition, Placement, Routing and Sequential Logic Optimization & Cell Binding in VLSI Design.*

Module – I

Introduction to VLSI Design methodologies - Review of Data structures and algorithms, Review of VLSI Design automation tools, Algorithmic Graph Theory and Computational Complexity. Tractable and Intractable problems. General purpose methods for combinatorial optimization.

Layout Compaction - Design rules, problem formulation, algorithms for constraint graph compaction.

Module – II

Partition- Kernigham-Lin's algorithm, Fiduccia Mattheyes algorithm, Krishnamurty extension, hMETIS algorithm, multilevel partition techniques.

Floor-Planning- Hierarchical design, wire length estimation, slicing and non-slicing floor plan, polargraph representation, operator concept, Stockmeyer algorithm for floor planning, mixed integer linear program.

Module – III

Placement- Design types, ASICs, SoC, microprocessor RLM, Placement techniques, Simulated annealing, partition-based, analytical, and Hall's quadratic, Timing and congestion considerations.

Module – IV

Routing- Detailed, global and specialized routing, channel ordering, channel routing problems and constraint graphs, routing algorithms, Yoshimura and Kuh's method, zone scanning and net merging, boundary terminal problem, minimum density spanning forest problem, topological routing, cluster graph representation.

Sequential Logic Optimization and Cell Binding- State based optimization, state minimization, algorithms- Library binding and its algorithms.

References:

1. Sarrafzadeh, M. and Wong, C.K., *An Introduction to VLSI Physical Design*, 4/e, McGraw-Hill.
2. N.A. Sherwani, *Algorithms for VLSI Physical Design Automation*, 3/e, BSP, India.

3. Gerez S.H., *Algorithms for VLSI Design Automation*, John Wiley & Sons,2002.
4. Lim, S.K., *Practical Problems in VLSI Physical Design Automation*, Springer.2008
5. Wolf, W., *Modern VLSI Design System on Silicon*, 2/e, Pearson Education. 2000
6. Sait, S.M. and Youssef, H., *VLSI Physical Design Automation: Theory and Practice*, World Scientific.1999
7. Dreschler, R., *Evolutionary Algorithms for VLSI CAD*, 3/e, Springer. 2002
8. Hill, D., D. Shugard, J. Fishburn and K. Keutzer, *Algorithms and Techniques for VLSI Layout Synthesis*, Kluwer Academic Publishers, 1989.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will be familiarized with VLSI Design methodologies. They will also be familiarized with Layout Compaction, Partition, Placement, Routing and Sequential Logic Optimization & Cell Binding in VLSI Design.

13.806.1 MANAGEMENT INFORMATION SYSTEMS (AT) (Elective VI)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits:** 4

Course Objectives:

- *To equip students with skills to analysis information requirements for managerial decision making.*

Module – I

Data and Information, MIS- need and concepts, factors influencing MIS, characteristics of MIS. Technology of MIS. Structure of MIS. Decision Making and role of MIS. Data communication, Channel features and concept of Distributed Data bases, Decision Support System: Overview, components and classification, steps in constructing a DSS, role in business, group decision support system.

Module – II

Information system for strategic advantage, strategic role for information system, breaking business barriers, business process reengineering, improving business qualities.

Module – III

Planning for MIS; System Development Methodologies; Conceptual and detailed designs of MIS. Information system analysis and design, information SDLC, hardware and software acquisition, system testing, documentation and its tools, conversion methods.

Module – IV

System implementation Strategies and process; System Evaluation and Maintenance. Applications – cross –functional MIWS; ERP; CRM; SCM; Transaction Processing; Artificial Intelligence technologies in business: neural network, fuzzy logic, virtual reality; Executive information system.

References:

1 Jawadekar, *Management Information Systems*, McGraw Hill, 2008.
2 Brien, James, *Management Information System*, McGraw Hill, 2008.
3 Stair, *Principles of Management System*, Thomson Learning, 2012.
4 Kanter, J., *Management Information System*, PHI, 2005.
5 Oz, *Management Information Systems*, Cengage, 2009.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the successful completion of the course the student will be able to equip students with skills to analysis information requirements for managerial decision making.

13.806.2 NUCLEAR INSTRUMENTATION (A) (Elective VI)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits:** 4

Course Objectives:

- *To learn about the Properties of Nuclear Systems & Radiation*
- *To familiarize terminology used in Nuclear Systems & Radiation*
- *To learn about its Application in industrial system*

Module – I

General: Introduction to Properties of Nuclear Systems & Radiation, Interaction of radiation with matter, Radioactive sources – choice of isotopes, Radiation detectors – Ionization chamber, Geiger Muller counters, Scintillation counters, Semiconductor devices, Neutron detectors based on recoil measuring circuits including modulators; converters & stabilizers, Synchronous detectors.

Module – II

Counting statistics, correlation sets, standard deviation of ratio meters, error propagation, effect of background, statistical distribution of pulse height distribution, detector efficiency. Nuclear reactor instrumentation: Diffusion, moderation, absorption and delay processes, neutral flux, control rod calibration, nuclear fuel inspection and testing including poisoning, radiation energy measurement, remote control instrumentation, nuclear instrument maintenance.

Module – III

Application of industrial system: Radioactive tracer technique-gas & liquid flow measurement, leak detector, residence time & its distribution, application to blending corrosion & wear studies. Thickness & density measurement by beta rays, gamma rays absorption technique, measurement of thickness of surface material by back scattering. Level detection by radioactive devices, interface detection by neutron moderation technique. Measurement of gas pressure and gas analyzers, spectroscopy and frequency methods.

Module – IV

Void detection idity meter, moisture meter, smoke detection, ozoniser, radio chromatography and interferometer. Portable instruments, source activity for dynamic properties of instruments. Safety: Hazards of ionization radiation, physiological effect of radiation, dose and risk radiological protection (alpha, beta and gamma, X, neutron) shielding material and effectiveness. Operational safety instrument, emergency schemes, effluent disposal, application to medical diagnosis and treatment.

References:

1. Vashtell C.C and S. G. Hewit, *Nucleonic instrumentation*, Newnes, 1965.
2. Sherry A., et.al (Editors): *Modern Power Station Practice*, Volume 6, Pergamon Press 1971.
3. EL Wakil M. M., *Power Plant Technology*, McGraw Hill, 1985.
4. Balasubramanian J. and R. K. Jain, *Modern Power Plant Engineering*, Khanna Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, problems based on MATLAB / any other software packages covering the syllabus etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer two full question out of the three from each module. Each question carries 10 marks.

Note: *Question paper should contain minimum 60% Numerical Problems/ derivations/proofs.*

Course Outcome:

After successful completion of the course, students will be familiarized with Nuclear Systems & Radiation and its industrial application.

13.806.3 MACHINE VISION (A) (Elective VI)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits:** 4

Course Objectives:

- *To acquire knowledge about various concepts in image processing and multi resolution analysis*
- *To learn about Motion analysis and estimation.*

Module – I

Introduction- The Marr paradigm and scene reconstruction, Other paradigms for image analysis. Image Formation- Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems, Image Digitization. Binary Image Analysis and Segmentation- Properties, Digital geometry, Segmentation.

Module – II

Image Processing for Feature Detection and Image Synthesis- Image representations in continuous and discrete form, Edge detection, corner detection, Line and curve detection.

Module – III

SIFT operator, Image based modeling and rendering, Mosaics, snakes, Fourier and wavelet descriptors, Multiresolution analysis. Shape from X - Shape from shading, Photometric stereo, Texture, Occluding contour detection.

Module – IV

Motion Analysis- Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion. Object Recognition- Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition.

References:

1. David. A. Forsyth and J. Ponce, *Computer Vision: A Modern Approach*, Prentice Hall, 2003.
2. Horn B. K. P., *Robot Vision*, MIT Press, 1986.
3. Linda Shapiro and George Stockman, *Computer Vision*, Prentice Hall, 2001
4. Jain R., R. Kasturi and B. Schunk, *Machine Vision*, McGraw Hill, 1995
5. Trucco E. and A. Verri, *Introductory Techniques for 3D Computer Vision*, Prentice Hall.
6. Adrian Low, *Introductory Computer Vision, Imaging Techniques and Solutions*, 2/e, BSP, India.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will be familiarized with various concepts in image and motion analysis with emphasis on multi resolution analysis.

13.806.4 NANOSENSORS AND BIOSENSORS (A) (Elective VI)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

- *To learn about various physical effects utilized in nano and biosensors*
- *To learn about organic and in organic bio sensors*
- *To learn about applications of nano and biosensors*

Module – I

Sensor Characteristics And Physical Effects**:** Active and Passive sensors – Static characteristic - Accuracy, offset and linearity – Dynamic characteristics - First and second order sensors – Physical effects involved in signal transduction- Photoelectric effect – Photo dielectric effect – Photoluminescence effect – Electroluminescence effect – Hal effect – Thermoelectric effect – Peizoresistive effect – Piezoelectric effect – Pyroelectric effect –Magneto-mechanical effect (magnetostriction) – Magneto resistive effect.

Nano Based Inorganic Sensors: Density of states (DOS) – DOS of 3D, 2D, 1D and 0D materials – one dimensional gas sensors: - gas sensing with nanostructured thin films – absorption on surfaces – metal oxide modifications by additives – surface modifications – nano optical sensors – nano mechanical sensors – plasmon resonance sensors with nano particles – AMR, Giant and colossal magneto resistors – magnetic tunneling junctions.

Organic / Biosensors**:** Structure of Protein – role of protein in nanotechnology – using protein in nano devices – antibodies in sensing – antibody in nano particle conjugates – enzymes in sensing – enzyme nanoparticle hybrid sensors – Motor proteins in sensing – transmembrane sensors – Nanosensors based on Nucleotides and DNA – Structure of DNA – DNA decoders and microarrays – DNA protein conjugate based sensors – Bioelectronic sensors – DNA sequencing with nano pores – sensors based on molecules with dendritic architectures – bio magnetic sensors.

Module – II

Nano Sensors: Temperature Sensors, Smoke Sensors, Sensors for aerospace and defense: Accelerometer, Pressure Sensor, Night Vision System, Nano tweezers, nano-cutting tools, Integration of sensor with actuators and electronic circuitry Biosensors.

Applications: Cantilever array sensors - Cantilever sensors for diagnosis of diabetes mellitus - Cantilever sensors for cancer diagnosis - Nanotube based sensors - Nanotube based sensors for DNA detection - Nanotube based sensors for capnography - Nanowire based sensors - Nanowire based electrical detection of single viruses - Nanowire based electrical detection of biomolecules.

Detectors and Applications: Bio receptors –Bio detectors - Nano array based detector - Nano Particle based detector - Ultra-sensitive detection of pathogenic biomarkers - Ultra-sensitive detection of single bacteria.

Module – III

Overview about technologies for detection of biochemical species: applications DNA chips, molecular recognition, lab-on a chip, etc. TFTs: operation, compact models, electrical characterization, equivalent circuits, TFTs with nanoparticles, TFTs as sensors. Basic concepts about impedance: Impedance measurements, Instruments, artefacts (Ultra-low frequency). frequency response of MIS capacitors and MISFET devices. Frequency response in electrolyte environment (electrical double layer). Equivalent circuit analysis. Dielectric properness of cells and Tissues: Electrical equivalent networks, electrical double layers, interaction with living cells. TFTs to measure living cells.

Module – IV

Optical sensors: Photometric sensors, waveguides basics, waveguide analyses and examples, Optical fibres, optical spectroscopic techniques for biosensors. Mass Sensitive Transducers: MEMS acoustic wave devices, piezoelectric effect, Electrostatic Transduction. Capacitive Sensing, Comb---drives, micro machined mechanical sensors, Quartz Crystal Microbalance (QCM) Biosensors, surface acoustic wave, modes of operation, mass sensitivities of acoustic wave devices, capacitive ultrasonic transducers, MEMS cantilevers, Cantilever operation, deflection detection, MEMS acoustic wave devices, cantilever---based biosensors, piezo resistive deflection sensor cantilever sensors. Connecting biosensors to wireless networks.

References:-

1. Kourosh Kalantar – Zadeh, Benjamin Fry, *Nanotechnology- Enabled Sensors*, Springer.
2. Vijay K. Varadan, Linfeng Chen, Sivathanupillai, *Nanotechnology Engineering in Nano and Biomedicine*, John Wiley & Sons, 2010.
3. Ajit Sadana, Engineering *Biosensors: Kinetics and Design Applications*, 2001, Academic Press.
4. Eggins B., *Biosensors: an Introduction*, 1996, John Wiley & Sons.
5. Rosemary Taylor H., *Data acquisition for sensor systems*, Chapman & Hall, 1997.
6. Jerome Schultz, Milan Mrksich, Sangeeta N. Bhatia, David J. Brady, Antonio J. Ricco, David Walt R., Charles L. Wilkins, *Biosensing: International Research and Development*, Springer,
7. Ramon Pallas-Areny, John G. Webster, *Sensors and signal conditioning* John Wiley & Sons, 2001.
8. Willner and E. Katz (eds.), *Bioelectronics: From Theory to Applications*, Wiley---VCH, 2005.
9. Bilitewski, U. and Turner, A.P.F. 2000. *Biosensors for Environmental Monitoring*. Harwood, Academic Publishers, The Netherlands.
10. Donald G. Buerk, *Biosensors: Theory and Applications*, 1995, CRC.
11. Gass E. G., Jon Cooper, *Biosensors: A practical Approach*, 2/e, 2004, Oxford University Press, USA.

12. Robert S. Marks, Christopher R. Lowe, David C. Cullen, et al*., Handbook of Biosensors and Biochips*, Wiley, 2008.
13. Ligler F. S. and C. A. Rowe Tail (editors), *Optical Biosensors: Present and Future*, 2002, Elsevier Science

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will acquire knowledge about physical effects utilized in various nano and bio sensors and also they will be able to choose or design the most appropriate sensor for specific applications.

13.806.5 ROBUST CONTROL SYSTEM (A) (Elective VI)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

- *To learn about Essentials of Robust Control*
- *To learn different methods used in Robust Control System*

Module – I

Introduction - Some common robust control problems. Linear system tools - Jordan and Real Jordancanonical forms, structural decomposition.

Structural mapping of Bilinear Transformations - Mapping of continuous time to discrete time andvice a versa, existence condition of H **-** sub optimal controllers, continuous time system and discrete time system.

Module – II

Solution to Discrete time Riccati Equations - Solutions to general DARE and H - DARE.

Information in continuous time and discrete time H **-** optimization - Full information feedback case, output feedback case, plants with imaginary axis zeros/unit circle zeros.

Module – III

Solutions to continuous time and discrete time H - problems - Full state feedback, full order output feedback, reduced order output feedback.

Module – IV

Robust and perfect tracking of continuous time and discrete time systems, solvability conditions andSolutions - solutions to measurement feedback case.

References:-

1. Ben M. Chen, *Robust and H Control*, Springer Verlag, 2000.
2. Zhon K. and John C. Doyle, *Essentials of Robust Control*, Prentice Hall, 1998
3. Bhattacharya S. P. and H. Chapellat. *Robust Control - The Parametric Approach*, Prentice Hall, 1995.
4. Petros A. Ioannou, Jing Sun, *Robust Adaptive Control*, Prentice Hall.1995.
5. Morari M. and E. Zafiriou, *Robust Process Control*, Prentice Hall, 1989.
6. Doyle J. C., B. A. Francis and A. R. Tannenbaum, *Feedback Control Theory*, Macmillan, 1992.
7. *Optimal Controller, A General Robust Control in Control System Toolbox: Robust Analysis, Robust Model Reduction:* MATLAB, Mathwork Inc. 1992.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will be familiarized with Essentials of Robust Control.

13.806.6 PARAMETER ESTIMATION AND SYSTEM IDENTIFICATION (A) (Elective VI)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

- *To learn in detail about frequently used parameter and state estimation techniques and algorithms that are widely used in many fields.*
- *To learn about performance analyses of the major estimation algorithms and their applications*

Module – I

Introduction, Coverage and Philosophy/ The Linear Model, Least-Squares Estimation: Batch Processing, Least-Squares Estimation: Recursive Processing, Small Sample Properties of Estimators, Large Sample Properties of Estimators.

Module – II

Elements of Multivariate Gaussian Random Variables, Mean-Squared Estimation of Random Parameters, Elements of Discrete-Time Gauss-Markov Random Processes, State Estimation: Prediction, State Estimation: Filtering, Linearization and Discretization of Nonlinear Systems.

Module – III

Iterated Least Squares and Extended Kalman Filtering, Unscented Kalman Filtering–1, Unscented Kalman Filtering–2, Singular Value Decomposition and Computation of LSE's, Properties of Least-Squares Estimators, Best Linear Unbiased Estimation, Likelihood, Maximum-Likelihood Estimation, Maximum A Posteriori Estimation of Random Parameters.

Module – IV

State Estimation: Filtering Examples, State Estimation: Steady-State Kalman Filter and its Relationship to a Digital Wiener Filter, State Estimation: Smoothing, State Estimation: Smoothing (General Results), State Estimation for the Not-So-Basic State-Variable Model, Maximum Likelihood State and Parameter Estimation, Higher-Order Statistics: An Overview.

References:-

1. Mendel J. M., *Lessons in Estimation Theory for Signal Processing, Communications and Control*, Prentice-Hall, New Jersey, 1995.
2. Julier S. J. and K. J. Uhlmann, *Unscented Filtering and Nonlinear Estimation*, IEEE Proc., vol.92, pp. 401-422, March 2004.
3. Wan E. A. and R. van der Merwe, *The Unscented Kalman Filter*, in *Kalman Filtering and Neural Networks*, S. Haykin (Ed.), pp. 221-280, John Wiley, 2001.
4. Julier S. J. and K. J. Uhlmann, *A General Method for Approximating Nonlinear Transformations of Probability Distributions*, Tech. Report RRG, Dept. of Engineering Science, Univ. of Oxford, Nov. 1996.

5. Teixeira B. O. S., M. A. Santillo, R. S. Erwin and D. S. Bernstein, *Spacecraft tracking using sample-data Kalman filters*, IEEE Control System Magazine, August 2008, pp. 78-94.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course, students will be familiarized with different parameter and state estimation techniques used and also they will get exposed to estimation algorithms and their applications.

13.807 PROJECT AND VIVA – VOCE (AT)

Teaching Scheme: 0(L) - 0(T) - 5(P) **Credits**: 5

Course Objective

- *To simulate real life situations related to Electronics and Communication Engineering and impart adequate training so that confidence to face and tackle any problem in the field is developed in the college itself.*
- *To culminate in gaining of major design experience in the related area of specialization.*
- *To realize constraints like that related to economic, environmental, social, political, ethical, health & safety, manufacturability and sustainability.*

Internal Continuous Assessment (Maximum Marks-200)

Each student shall complete the project work assigned to him/her and submit the project report by the end of the semester. This report (consisting of problem statement, design, implementation, results and analysis) shall be of a hard bound type. The report shall be endorsed by the Guide, Project co-ordinator and the Professor/HOD. Evaluation of report, results, presentation and viva will be conducted by a committee consisting of the **Project co-ordinator, Guide and a senior faculty.** The number of students in a project batch shall be limited to a **maximum of four**.

Marks shall be awarded as follows:

1. Mid semester evaluation by the committee - 50 Marks.
2. End semester evaluation & Viva by the committee - 50 Marks.
3. Evaluation of the report and results by Guide - 100 Marks.

University Examination (Maximum Marks-100)

Examiners shall be faculty members having minimum of five years teaching experience. Viva-Voce examination shall be based only on the subjects studied in the B. Tech course. Students shall submit the following while attending the viva-voce

1. Seminar Report (Certified during 7th Semester)
2. Project Design Report (Certified during 7th Semester)
3. Project Report (Certified during 8th Semester)

External Examiner shall endorse all the Reports. Marks shall be awarded as follows:

1. Questions based on subjects in the B. Tech course : 70 Marks
2. Questions based on Project : 20 Marks
3. Questions based on Seminar : 10 Marks

Note: Students shall not be permitted to attend the Viva-Voce examination if he/she does not submit the certified Project reports and Seminar report to the External Examiner for endorsing

Course Outcome:

After the successful completion of the course the student will be able to

- *acquire better communication skills and improve their leadership quality as well as the ability to work in groups, and thus aid them in building a successful career as an engineer*
- *simulate real life situations related to Electronics and Communication Engineering and impart adequate training so that confidence to face and tackle any problem in the field is developed in the college itself.*
- *gain major design experience in the related area of specialization.*
- *realize constraints like that related to economic, environmental, social, political, ethical, health & safety, manufacturability and sustainability.*