NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Final Year Engineering

(E&TC/E&C)

Faculty of Engineering and Technology

COURSE OUTLINE

Semester – VII

W.E.F 2015 – 2016

E&TC

BE Semester - VII

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
Digital Signal Processing (TH)	D	3	---	---	3	20	80	---	---	100	3
Fiber Optic Communication (TH)	D	3	---	---	3	20	80	---	---	100	3
Interdisciplinary Elective	E	3	---	---	3	20	80	---	---	100	3
Elective – I	E	3	---	---	3	20	80	---	---	100	3
Computer Communication Network (TH)	D	3	--	---	3	20	80	---	---	100	3
Digital Signal Processing (LAB)	D	---	---	2	2	---	---	25	25(PR)	50	1
Fiber Optic Communication (LAB)	D	---	---	2	2	---	---	25	25(PR)	50	1
LAB#	E	---	---	2	2	---	---	25	25(PR)	50	1
Project – I	D	---	---	2	2	---	---	25	25(OR)	50	2
Seminar – II	D	---	---	2	2	---	---	25	---	25	2
Industrial Visit	D	---	---	---	---	---	---	25	---	25	1
Total		**15**	**---**	**10**	**25**	**100**	**400**	**150**	**100**	**750**	**23**

ISE: Internal Sessional Examination **ESE: End Semester Examination** **ICA: Internal Continuous Assessment**

#Lab for Elective-I

Inter Disciplinary Elective
1. **Automotive Electronics**
2. **Image Processing**

Elective I
1. **VLSI Design**
2. **Broadband Communication**
3. **Biomedical Engineering**
4. **Industrial Automation**

Note 1: For branches like Chemical Engineering and Biotech Engineering, two laboratory hours can be merged to form a four hour slot.
Note 2: Out of 3 practical ESE heads, at least 1 head should be practical.
Note 3: Interdisciplinary Elective shall be offered by the department to the students of other department. Students from one department can not register for Interdisciplinary Elective of the same department.
Note 4: At least 15 students should register for offering any elective.

BE Semester – VIII

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
Satellite & Mobile Communication (TH)	D	3	---	---	3	20	80	---	---	100	3
Radiation & Microwave Techniques (TH)	D	3	---	---	3	20	80	---	---	100	3
Elective – II	E	3	---	---	3	20	80	---	---	100	3
Elective – III	E	3	---	---	3	20	80	---	---	100	3
Satellite & Mobile Communication (LAB)	D	---	---	2	2	---	---	25	25(OR)	50	1
Radiation & Microwave Techniques (LAB)	D	---	---	2	2	---	---	25	25(PR)	50	1
LAB#	E	---	---	2	2	---	---	25	25(PR)	50	1
Industrial Lecture*	C	---	---	1*	1	---	---	50	---	50	2
Project – II	D	---	---	4	4	---	---	75	75(OR)	150	6
Total		**12**	**---**	**11**	**23**	**80**	**320**	**200**	**150**	**750**	**23**

ISE: Internal Sessional Examination **ESE: End Semester Examination** **ICA: Internal Continuous Assessment**

#Lab for Elective-II

*** Minimum 6 lectures to be delivered by experts from the industry in alternate weeks. Next week group discussion on the lecture delivered.**

Elective II

1 Embedded System
2 Digital Image Processing
3 Telematics
4 Neural Network and Fuzzy Logic

Elective III

1 Robotics
2 Nanotechnology
3 Telecomm Network Management
4 Antenna and Wave Propagation

Note 1: For branches like Chemical Engineering and Biotech Engineering, two laboratory hours can be merged to form a four hour slot.
Note 2: Out of 3 practical ESE heads, at least 1 head should be practical.
Note 3: Interdisciplinary Elective shall be offered by the department to the students of other department. Students from one department can not register for Interdisciplinary Elective of the same department.
Note 4: At least 15 students should register for offering any elective.

Digital Signal Processing

COURSE OUTLINE

Digital Signal Processing | **DSP**
Course Title | Short Title | Course Code

Course Description:

Digital Signal Processing (DSP) is concerned with the representation, transformation and manipulation of signals and Systems.

Lecture	Hours / Week	No. Of Weeks	Total Hours	Semester Credits
	03	14	42	03

Prerequisite Course(s): A significant prior knowledge of Signals, Infinite series, Complex variables and Linear Algebra.

COURSE CONTENT

Digital Signal Processing **Semester-VII**

Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week

End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: Discrete Time Signals and Systems **No of Lect. – 8, Marks: 16**

a) Basic elements of Digital Signal Processing Systems. Advantage and limitation of DSP over ASP.
b) Sampling of Analog signals, Aliasing, Sampling Theorem (Numerical only)
c) Classification of Discrete Time Signals , Classification of Discrete Time System .
d) Linear Convolution, Properties of Convolution, Causality and Stability condition in terms of the Impulse Responses
e) Correlation (Autocorrelation & Crosscorelation of two sequences).

Unit-II: DT System Analysis Using Z- Transform **No of Lect. – 8, Marks: 16**

a) Definition of Z transform, Meaning of ROC, Properties of ROC
b) Properties of Z transform.

c) Inverse Z transform, Power series method, partial fraction expansion method (Numerical only)
d) The one sided Z transform (Unilateral Z-Transform) Response of the system with nonzero initial conditions. (Numerical only)
e) Z-Transform solution of difference equations. (Numerical only)

Unit-III: Fourier Transform of DT Signals and Systems No of Lect. – 8, Marks: 16

a) DFT , IDFT ,Properties of DFT.
b) Circular Convolution (Maximum N=8)
c) The DFT as Linear Transformation, Twiddle factor.
d) FFT Algorithms: Radix2 DIT and DIF algorithms to computer DFT. (Numerical Only)

Unit-IV: Design and Realization of Digital Filters No of Lect. – 8, Marks: 16

a) IIR Filter structure : Direct form, Cascade form, Parallel form and Transposed structures.
b)IIR Filter Design: Impulse invariance, Bilinear Transformation method of design.
c) FIR Filter Structure: Direct form, cascade form, and linear phase structure.
d)FIR Filter Design: Windowing method. (Numerical on Rectangular, Hamming, Hanning only) Gibbs phenomenon .

Unit-V: Multirate DSP and Introduction to DSP processor No of Lect. – 8, Marks: 16

a) Concept of Multirate DSP, Decimation, Interpolation (Theory only)
b) Sampling Rate Conversion by Rational Factor I/D. (Theory only)
c) Application of DSP: Voice processing, Image processing. (Short notes)
d) DSP processor (TMS320C67XX) Architecture: Architectural features of DSP processors: Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSP, Multiple access memory, Multiport Memory, Pipelining, Special addressing modes, On chip Peripherals.

Reference Books:

1. John G. Proakis, Dimitris G. Manolakis, " Digital Signal Processing: Principles, algorithms and applications" Fourth edition, Pearson Prentice Hall.
2. P. Ramesh Babu "Digital Signal Processing" Fourth edition, Scitech Publications.
3. B.Venkataramani, M.Bhaskar - "Digital Signal Processor, Architecture, Programming and Applications" , TATA McGraw Hill, 2002.

Fiber Optic Communication

COURSE OUTLINE

Fiber Optic Communication **FOC**
Course Title Short Title Course Code

Lecture	Hours / Week	No. Of Weeks	Total Hours	Semester Credits
	03	14	42	03

COURSE CONTENT

Fiber Optic Communication **Semester-VII**

Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week

End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: **No of Lect. – 8, Marks: 16**

Introduction to Optical Fiber Communication System:

Block diagram of OFCS, Advantage and Disadvantage of OFCS over other communication systems. Ray theory of transmission and concept of acceptance angle and Numerical Aperture (Numericals based on this), Meridonial and skew propagation, wave theory of optical propagation : cut – off wavelength. Group velocity and Group delay, Types of fibers (According to materials, Refractive index profile, Mode of propagation)

Unit-II: **No of Lect. – 8, Marks: 16**

Light Sources and Detectors:

Sources : Factors or Characteristics for their selection in OFCS,

Light Emitting diodes: Surface emitter, LEDS, Edge emitter LEDS, LED operating Characteristics, Radiation patterns of surface and Edge emitters,

Laser diode: Laser principles, semiconductor laser diode, Hetero junction Laser, strip-gromentry lasers, laser diode operating Characteristics, Radiation patterns.

Detectors: Characteristics or factors for their Selection, P-N photo diode, P-I-N Photo diode, Avalanche photodiode,

Detector parameters: Quantum efficiency, Responsivity, speed of Response (Numericals based on this)

Unit-III: **No of Lect. – 8, Marks: 16**

Losses & Measurements in Optical System

Losses in fibers: Absorption, scattering and bending losses. Signal distortion in optical fiber: Material dispersion, waveguide dispersion, intermodal dispersion.

Noise in optical fiber: Thermal Noise, shot noise, S / N Ratio, Noise equivalent power (Numericals based on this)

Optical Fiber Measurements: Measurement of Attenuation, dispersion, refractive index.

Field Measurements: Optical time domain reflectometry. (OTDR)

Unit-IV: **No of Lect. – 8, Marks: 16**

Optical Transmission & Reception

Optical Transmitter & Receiver Circuit.

Modulation Bandwidth: 3-dB electrical bandwidth, 3-dB optical Bandwidth (Numerical based on this)

Intensity Modulation:: LED Modulation and Circuits (Analog and digital) Analog modulation formats; AM / IM Sub carrier Modulation, FM / IM Sub carrier Modulation.

Detection: (Coherent detection, Heterodyne, Homodyne detection):- Optical heterodyne receivers,

Unit-V: **No of Lect. – 8, Marks: 16**

Advanced Systems and Techniques: -

Fiber Optics System Design: Optical power budgeting, Rise-time budgeting.

Advanced Systems: Optical amplifiers(Semiconductor Amplifire, Raman Amplifier, EDFA), Optical Networks: SONET / SDH.

Advanced Techniques: Optic Frequency Division Multiplexing, Wavelength Division Multiplexing, DWDM.

Optical Sensors: Intensity modulated, Phase mosulated & Spectrally modulated sensors

Reference Books:

1. John M. Senior , “Optical Fiber Communication (principles & Practice)”,PearsonEducation

2. Govind P. Agrawal, ” Fiber Optic Communication System”, Wiley

3. Dr. Subir Kumar Sarkar,”Optical Fibres and Fiber Optic Communication System”, S.Chand

Interdisciplinary Elective

1. Automotive Electronics

COURSE OUTLINE

Automotive Electronics
Course Title | Short Title | Course Code

Course Description:

	Hours / Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	**03**	**14**	**42**	**03**

COURSE CONTENT

Automotive Electronics **Semester-VII**

Teaching Scheme
Lecture: 3 hours / week

Examination Scheme
End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: Use of Electronics In The Automobile **No of Lect. – 8, Marks: 16**

Concept of A System, Control Theory: Open Loop Control & Close loop control, Instrumentation, Signal Processing & Filtering, Electronics Fundamentals, Instrumentation application of Microcomputer

Unit-II: Electronic Engine Control **No of Lect. – 8, Marks: 16**

Motivation For Electronic Engine Control, Concept of An Electronic Engine Control System, Engine Performance Terms, Electronic Fuel Control System, Analysis of Intake Manifold Pressure, Idle speed control, Electronic Ignition

Unit-III: Sensors and Actuators **No of Lect. – 8, Marks: 16**

Automotive Control System Applications of Sensors And Actuators, Throttle Angle Sensor, Temperature Sensors, Sensors For Feedback Control: Knock Sensor, Automotive Engine Control Actuators, Electric Motor Actuator, Ignition System & Coil operation

Unit-IV: Digital Powertrain Control Systems **No of Lect. – 8, Marks: 16**

Digital Engine Control & its features, Control Modes for Fuel Control, Discrete Time Idle speed control system, EGR Control, Variable Valve Timing Control, Electronic Ignition Control : knock intensity & detection, Integrated Engine Control System, Hybrid Electric Vehicle

Unit-V: **No of Lect. – 8, Marks: 16**

Vehicle Motion Controls: Representative Cruise Control System, Cruise control Electronics, Advanced Cruise Control, Antilock Braking System, Electronic Suspension Control System, Electronic Steering Control

Automotive instrumentation System & Diagnostics: Modern Automotive & Computer Based Instrumentation System, High Speed Digital Communications & CAN, Electronic Control System Diagnostics

Reference Books:

1. William B. Ribbens – Understanding Automotive Electronics-An Engineering Perspective, Butterworth-Heinemann, An imprint Elsevier, First Indian reprint 2014, ISBN 978-93-5107-151-8

2. Al Santini- Automotive Technology, Cengage Learning, India Edition, 2011, ISBN 978-81-315-1412-2

3. K. K. Ramalingam- Automobile Engineering, Scitek Publication, Second Edition.

Interdisciplinary Elective

2. Image Processing

COURSE OUTLINE

Image Processing	**IP**	
Course Title	Short Title	Course Code

Course Description:

Lecture	**Hours / Week**	**No. Of Weeks**	**Total Hours**	**Semester Credits**
	03	**14**	**42**	**03**

COURSE CONTENT

Image Processing **Semester-VII**

Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week

End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit I

Digital Image and Video Fundamentals: **No of Lect. – 8, Marks: 16**

Introduction to Digital Image, Digital Image Processing System, Sampling and Quantization, Representation of Digital Image, Connectivity, Image File Formats : BMP, TIFF and JPEG. Colour Models (RGB, HSI, CMY) Introduction to Digital Video, Chroma Sub-sampling, CCIR standards for Digital Video.

Unit II

Image Enhancement: **No of Lect. – 8, Marks: 16**

Gray Level Transformations, Zero Memory Point Operations, Histogram Processing, Neighbourhood Processing, Spatial Filtering, Smoothing and Sharpening Filters, Homomorphic Filtering.

Unit III

Image Segmentation and Representation: **No of Lect. – 8, Marks: 16**

Detection of Discontinuities, Edge Linking using Hough Transform, Thresholding, Region based

Segmentation, Split and Merge Technique, Image Representation and Description, Chain Code, Polygonal Representation, Shape Number, Moments.

Unit IV

Image Transform: **No of Lect. – 8, Marks: 16**

Introduction to Unitary Transform, Discrete Fourier Transform(DFT), Properties of DFT, Fast Fourier Transform(FFT), Discrete Hadamard Transform(DHT), Fast Hadamard Transform(FHT), Discrete Cosine Transform(DCT), Discrete Wavelet Transform(DWT).

Unit V

Image Compression: **No of Lect. – 8, Marks: 16**

Introduction, Redundancy, Fidelity Criteria, Lossless Compression Techniques : Run Length Coding, Arithmetic Coding, Huffman Coding, Differential PCM, Lossy Compression Techniques: Improved Gray Scale Quantization, Vector Quantization, JPEG, MPEG-1.

Text Books :

1. Rafel C. Gonzalez and Richard E. Woods, 'Digital Image Processing', Pearson Education Asia, Third Edition, 2009.
2. S. Jayaraman, E.Esakkirajan and T.Veerkumar, "Digital Image Processing" TataMcGraw Hill Education Private Ltd, 2009.

Reference Books:

1. Anil K. Jain, "Fundamentals and Digital Image Processing", Prentice Hall of India Private Ltd, Third Edition
2. S. Sridhar, "Digital Image Processing", Oxford University Press, Second Edition, 2012.
3. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol I, II, Addison Wesley, 1993.
4. Dwayne Phillps, "Image Processing in C", BPB Publication, 2006
5. B. Chandra and D.Dutta Majumder, "Digital Image Processing and Analysis", Prentice Hall of India Private Ltd, 2011
6. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", Prentice Hall of India Private Ltd, Third Edition
7. Fred Halshall, "Multimedia Communications: Applications, Networks Protocols and Standards,"Pearson Education 2001
8. David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach", Pearson Education, Limited, 2011.

Elective-I

1. VLSI Design

COURSE OUTLINE

VLSI Design	**VLSI**	
Course Title	Short Title	Course Code

Course Description:

This course is to teach students the way digital circuits are designed in practice today. The emphasis is on modern design methodology using CAD tools to meet desired specifications.

Lecture	**Hours / Week**	**No. Of Weeks**	**Total Hours**	**Semester Credits**
	03	**14**	**42**	**03**

Prerequisite Course(s): A background in digital logic design.

COURSE CONTENT

VLSI Design **Semester-VII**

Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week

End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: **No of Lect. – 10, Marks: 16**

Design Concept: Digital Hardware, the design process, Basic Design Loop, Introduction to CAD tools. Structure of HDL module, Operators and data types of VHDL.

Unit-II: **No of Lect. – 8, Marks: 16**

VHDL: Styles/Types of descriptions.

Data-flow Description (VHDL Programming)**:** Structure of Data-flow Description: Signal declaration and Signal assignment statements, Concurrent signal assignment statements, Constant declaration and assignment statements, Assigning a delay to the signal assignment statements. conditional signal assignment (when….else), selective signal assignment (with….select)

Unit-III: **No of Lect. – 8, Marks: 16**

Behavioral Description (VHDL Programming)**:** Structure of Behavioral Description, variable assignment statement. Sequential statements for VHDL: IF statement, Signal and variable assignment, Case statement, Loop statement, Procedures and Functions statements.
Structural Description (VHDL Programming)**:** Organization of structural design, component declaration and instantiation, binding methods. Example of a state machine.

Unit-IV: **No of Lect. – 8, Marks: 16**

Switch Level Description (VHDL Programming)**:** Single NMOS and PMOS switches: NMOS and PMOS switch description for VHDL, Serial and parallel combinations of switches. Switch level description of: Primitive gates, Combinational logics, Sequential circuits. CMOS switch.

Mixed type Description (VHDL Programming)**,** User defined data types in VHDL, implementation of Arrays.

Unit-V: **No of Lect. – 8, Marks: 16**

VHDL file processing: Concept and built-in procedures for file handling.

Programmable Logic Devices: Complex Programmable Logic Devices (CPLDs) and Field Programmable Gate Arrays, Applications of CPLD's and FPGAs.

Testing of Logic Circuits: Testing combinational logic, stuck-at-fault, Complexity of a Test set, path sensitizing, testing of sequential circuits, built in self test.

Reference Books:

1. Nazeih M. Botros - HDL programming Fundamentals VHDL and Verilog , Thomson Learning Inc.
2. Stephen Brown, Zvonko Vranesic- Fundamentals of Digital Logic with VHDL, Tata McGraw Hill Publishing Company Limited, 2nd Edition.
3. Michael John Sebastian Smith- Application Specific Integrated Circuit, Pearson Education.
4. Douglas Perry - VHDL programming, Tata MC-Graw Hill
5. Sudhakar Yalamanchil - An Introduction to VHDL from Synthesis to Simulation
6. Charles H.Roth, Lizy Kurian John – Principal of Digital System Design using VHDL, Bostan, Thomson Book.
7. Jayaram Bhasker- A VHDL Primer, P T R Prentice Hall

Elective-I

2. Broadband Communication

COURSE OUTLINE

Broadband communication	**BBC**	
Course Title	Short Title	Course Code

Course Description:

This course presents the actual concepts of Broadband Communication Networks Including ISDN and ATM networks to support multimedia applications in networking

Lecture	**Hours / Week**	**No. Of Weeks**	**Total Hours**	**Semester Credits**
	03	**14**	**42**	**03**

Prerequisite Course(s): A background in basics of computer networks.

COURSE CONTENT

Broadband communication **Semester-VII**

Teaching Scheme
Lecture: 3 hours / week

Examination Scheme
End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

UNIT I: Packet switch WAN Protocols: **Lectures 08, Marks 16**

X.25 protocol, packet Formats, sequence of events
Frame Relay:
Introduction, Frame relay protocols, architecture, comparison with X.25 protocol, frame mode call control, call control protocol.
Frame relay congestion control, Congestion, Approaches, traffic rate management, explicit congestion avoidance, implicit congestion control.

UNIT II : ISDN **Lectures 08., Marks 16**

Introduction to ISDN, IDN, Principles of ISDN, Evolution of ISDN, ISDN Standards, Architecture, Transmission structure, User network interface configuration, ISDN protocol architecture, ISDN Connection, Addressing. Inter working ISDN – ISDN, ISDN – PSTN, ISDN – CSPDN.

Unit-III: B-ISDN **Lectures 08., Marks 16**

Architecture and standards, B-ISDN Services Conversational, Messaging, Retrieval, Distribution, Business and Residential requirements.
B-ISDN protocol: User plane, Control plane, Physical layer, Line coding, Transmission structure, SONET Requirement, Signal Hierarchy, System Hierarchy, Frame format pointer adjustment

Unit-IV: ATM: **Lectures 08., Marks 16**

Overview, Virtual channels, Virtual paths, VP and VC switching, ATM cells, Header format, Generic flow control, Header error control, Transmission of ATM cells, Adaptation layer, AAL services and protocols. ATM switching building blocks, ATM cell processing in a switch, Matrix type switch, Input, Output buffering, central buffering, Performance aspects of buffering switching networks.

Unit-V: ATM Traffic and congestion Control **Lectures 08., Marks 16**

Requirements for ATM Traffic and Congestion Control, Cell-Delay Variation, ATM Service Categories, Traffic and Congestion Control Framework, Traffic Control, Congestion Control,

Reference Books:

1) Williams Stallings - ISDN and Broadband ISDN with frame Relay and ATM , PHI , 4TH Ed

2) Behrouz Forouzan. - Data Communication. and Networking, TMH

3) Balaji kumar - Broadband Communication, MGH

4) Mischa Schwartz - Broadband Internet Network, PHI

Elective-I

3. Biomedical Engineering

COURSE OUTLINE

Biomedical Engineering **BME**
Course Title Short Title Course Code

Course Description:
This course includes introduction to the Biomedical Instrumentation and Measurement. The Anatomy of Heart, Function of Heart. TheHuman Nervous and Muscular System. Human Respiratory System and Its Measurements, Imaging Techniques & telemetry system. This course is designed to introduce the students to the basic principles and applications of sensors, medical oscilloscopes, analog and digital instruments. It includes basic knowledge of heart, brain and muscular system and different types of signals. This course provides instruction in the theory and application of biomedical instruments.

	Hours/Week	**No. of Weeks**	**Total Hours**	**Semester Credits**
Lecture	03	14	42	03

Prerequisite Course(s): Digital Electronics**,** Microprocessor**,** Electronics Instrumentation.

COURSE CONTENT

Biomedical Engineering **Semester-VII**

Teaching scheme:
Lectures: 3 hrs/week

Examination scheme:
End Semester Examination (ESE): 80Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

UNIT I **Lectures 09, Marks 16**

Introduction to Human Body and Measurement on It: Basics of biomedical Instrumentation system, Anatomy and Physiology of the Human Body, Cells & Generation of potential in Body, Body potential, Transducers And Sensors. Transducers: Pressure transducers, transducer for temperature measurement, Ultrasonic Transducers, Sensors, Pulse sensors, Respiration sensors, Optical sensors, Recorders and displays. Permanent magnet moving coil instruments, PMMC writing system, X-Y Recorders, Medical oscilloscopes, Multi-beam oscilloscope, Digital storage oscilloscopes. Bedside monitor.

UNIT II **Lectures 08, Marks 16**

The Anatomy of Heart, Function of Heart: The circulatory system, Electrical conduction system of the heart, Electrocardiographs, ECG waveforms, Standard lead system, ECG measurements, ECG preamplifier, Readout device, Heart problems, Heart blocks, Pacemakers, Types of Pacemakers, Defibrillators, Ventricular Fibrillation; Heart rate measurement, Cardiotachometers, Average Heart rate meter, Electrode theory; Biopotential electrode : skin surface, Suction pasteless disspossible & air jet electrode. Unipolar & bipolar limb system, eithoven triangle,Blood pressure measurement, introduction & techniques.

UNIT III **Lectures 08, Marks 16**

Human Respiratory System and Its Measurements:
Respiratory Measurements, Spirometer, Respiratory gas analyzers infra red gas analyzer, oxygen analyzer, nitrogen analyzer, 8-channel EEG system. Blood : Measurement of blood flow, Radiographic technique, Indicator Dye dilution methods, Thermal convection, Magnetic blood flow rate, Ultrasonic blood flow meter, Blood gas Pressure, Blood gas analyzer, PH measurement of blood, Oximetry, Measurement of partial pressure of CO2 in blood, Measurement of blood PaO2, In vitro Oximetry. Patient Safety, Galvanic skin resistance; Patient safety: Macro shock, Macrocurrent shock. Block diagram of visual & auditory evoked potential system.

UNIT IV **Lectures 06, Marks 16**

The Human Nervous and Muscular System: The Nervous System, The peripheral nervous system, Central nervous system, Anatomical and physiological parameter of brain, Behavior and Nervous system, Study of Brain Signals, Different waveforms of the Brain, Evoked potential, Type of electrodes, EEG Amplifier, Recording the EEG signals, Electrode, micro & needle electrode, Artifacts, Processing Artifacts, Analysis of Disease using EEG & sleep patterns, Electromyography, (EMG), How muscles work, paralysis, myograph, Nerve conduction velocity.

UNIT V **Lectures 09, Marks 16**

Imaging Techniques & telemetry system.
Imaging Techniques : X ray imaging and CT Scan : Properties of X ray Production of X ray, Application of X ray in medicine, CAT Scan, X-ray therapy; Digital radiography, ultrasound therapy units: physics, medical ultrasound, basic pulse echo system. Instruments of surgery, Principle, type of electro-surgery technique, surgical diathermy machine, electrode used for surgical diathermy, safety aspects in electro-surgical units, microwave diathermy, Telemetry, single channel telemetry, ECG telemetry, Temperature telemetry, multichannel telemetry.

References:
1) R.S.Khandpur - Bio-medical Instrumentation , TMH 2nd ed
2) Nandini K. Jog - Electronics in Medicine and Biomedical Instrumentation, PHI.
3) Cromwell - Biomedical Instrumentation and Measurements, PHI. 2nd ed/Pearson 4th ed.
4) H. S. Kalsi – Electronics Instrumentation, TMH 2

Elective-I

4. Industrial Automation

COURSE OUTLINE

Industrial Automation	**IA**	
Course Title	Short Title	Course Code

Course Description:

This course presents the actual concepts of Industrial Automation and PLC in order to meet a industrial requirement.

Lecture	**Hours / Week**	**No. Of Weeks**	**Total Hours**	**Semester Credits**
	03	**14**	**42**	**03**

Prerequisite Course(s): A background in basic plc knowledge.

COURSE CONTENT

Industrial Automation **Semester-VII**

Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week

End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: Introduction to Industrial Automation **No of Lect. – 8, Marks: 16**

Introduction to Industrial Automation, Role of automation in industries, Introduction to the types of manufacturing industries, Introduction to type of automation system, Benefits of automation. Introduction to Automation pyramid, Introduction to automation tools like PAC, PLC, SCADA, DCS, Hybrid DCS with reference to automation pyramid, Comparison of PLC, PAC, and SCADA on the basis of Performance criteria Control system audit, Performance criteria, Development of User Requirement Specifications (URS) for automation. Functional Design Specifications (FDS) for automation tools.

Unit-II: Basic concept of PLC,Pneumatic & Hydrolic: **No of Lect. – 8, Marks: 16**

Programmable Logic Controller (PLC) Continuous versus Discrete Process Control, Relay based ladder diagram using standard symbols, Limitations of relay based system. Architecture of PLC, Types of Input & Output modules (AI, DI, DO, AO), Wiring diagram, Interfacing pneumatic & Hydraulic systems to PLC, Fixed & Modular PLC (Rack, slot, grouping), PLC specifications, PLC

manufacturers, PLC Basic instructions, Timers (ON delay, OFF delay & Retentive) & Counters with timing diagrams, PLC ladder diagram, PLC programming for process applications

Pneumatic components

Pneumatic Power Supply and its components,Pneumatic relay (Bleed & Non bleed, Reverse & direct),Single acting & Double acting cylinder,Special cylinders: Cushion, Double rod, Tandem, Multiple position, Rotary,Filter Regulator Lubricator (FRL),Pneumatic valves (direction controlled valves, flow control etc),Special types of valves like relief valve, pressure reducing etc.,Time delay valve

Hydraulics

Hydraulic components ,Hydraulic supply ,Hydraulic pumps, Actuator (cylinder & motor),Hydraulic valves

Unit-III: Instrumentation Standard Protocols: **No of Lect. – 8, Marks: 16**

Definition of protocol, Introduction to Open System Interconnection (OSI) model, Communication standard (RS232, RS485), Modbus (ASCII/RTU), Introduction to third party interface, concept of OPC (Object linking and embedding for Process Control), HART Protocol: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Foundation Fieldbus H1: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Comparison of HART, Foundation Fieldbus, Devicenet, Profibus, Controlnet, Industrial Ethernet.

Unit-IV: PLC Configuration, Applications and Machine automation:
No of Lect. – 8, Marks: 16

PLC programming methods as per IEC 61131, Developing programs using Sequential Function Chart, Functional Block Diagram, Analog control using PLC (PID controller configuration), Interfacing PLC to SCADA/DCS using communication link (RS232,RS485) , Protocols (Modbus ASCII/RTU) and OPC, Development stages involved for PLC based automation systems. Introduction Computer Numerically Controlled (CNC) Machines, Basic CNC Principle, servo control, types of servo control for motion axes, Control system of CNC, Introduction to G-code.

Unit-V: Distributed Control System: **No of Lect. – 8, Marks: 16**

DCS introduction, Various function Blocks, DCS components/block diagram, DCS Architecture of different makes, comparison of these architectures with automation pyramid, DCS specification , DCS support to Enterprise Resources Planning (ERP) DCS detail Engineering, configuration and programming, functions including database management, reporting, alarm management, Historical database management, and user access management, communication, third party interfaces .

Text Books:

1. Introduction to Programmable Logic Controller, Gary Dunning, DELMAR Cengage Learning.
2. Process Control, Instrument Engineering Hand book, B.G. Liptak, Butterworth-Heinemann Ltd
3. Distributed computer control for industrial automation, Ppovik Bhatkar, Dekkar Pub.

Reference Books:

4. Industrial Electronics, Petruzella, McGraw-Hill
5. Pneumatic Instrumentation, Majumdhar, TMH
6. The management of control system: Justification and Technical Auditing, N.E. Bhttiha, ISA
7. Computer aided process control, S.K.Singh, PHI.
8. Programmable Logic Controllers: Principles and Applications, Webb &Reis, PHI.

Computer Communication Network

COURSE OUTLINE

Computer Communication Network **CCN**
Course Title Short Title Course Code:

Course Description: To understand the concept of Computer Network, architecture, protocol and its Applications.

Lecture	Hours / Week	No. Of Weeks	Total Hours	Semester Credits
	03	14	42	3

COURSE CONTENT

Computer Communication Network **Semester-VII**

Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week

End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit I: Physical Layer **No of Lect. – 8, Marks: 16**

1) Introduction to Computer Network, Network Topologies
2) ISO/OSI Reference Model
3) TCP/IP Reference Model
4) LAN,MAN,WAN
5) Guided and unguided media: Transmission media: Twisted pair, Baseband coaxial cable, Broadband coaxial cable, Fiber optics. Wireless Transmission: Radio transmission, Microwave transmission, Infrared and light wave Transmission.
6) ISDN: Narrowband ISDN: ISDN services, System architecture, Interface. Broadband ISDN
7) ATM reference model and ATM Switches.

Unit II: Data Link Layer **No of Lect. – 8, Marks: 16**

1) Design issues
2) Framing,
3) Error and Flow Control Flow control Data Link Protocols: Unrestricted Simplex Protocol, stop and wait protocol, Simplex Protocol for a Noisy Channel. Sliding Window Protocols: One bit sliding window, Using Go-Back n, Protocol using Selective Repeat

4) HDLC
5) Multiple Access Protocols: ALOHA, Carrier Sense Multiple Access, CSMA,CSMA/CD,CSMA/CA

Unit III: Network Layer **No of Lect. – 8, Marks: 16**

1) Design Issue of Network Layer
2) Comparison of Virtual circuit and Datagram subnets
3) Routing Algorithms, Shortest Path Routing, Flooding, Hierarchical Routing,
4) Broad Cast Routing, Multicast routing,
5) Congestion Control Algorithms
6) Congestion Prevention Policies
7) Choke Packets
8) Internet Protocol: Internetworking, IPV4 Datagram, IPV6 Addresses

Unit IV: Network Layer and Transport Layer **No of Lect. – 8, Marks: 16**

1) ARP,RARP
2) ICMP,IGMP
3) Transmission Control Protocol(TCP)
4) User Datagram Protocol(UDP)
5) Congestion Control of Transport Layer
6) Quality of Service(QoS)
7) Techniques to improve QoS

Unit V: Application Layer **No of Lect. – 8, Marks: 16**

1) Domain Name System(DNS)
2) SNMP
3) Network Security, Cryptography, Public key algorithms
4) Digital Signature
5) Authentication Protocols
6) Firewalls
7) Introduction to VOIP

References:

1. Andrew S Tanebaum - Computer Networks, 4th Ed. PHI/ Pearson education.
2. Behrouz A Forouzan - Data Communication and Networks, 3rd Ed. TMH.
3) Irvine Olifer - Computer Networks: Principles, Technology and Protocols, Wiley India.
4) William Stalling – Data and Computer communications, 7th Ed. PHI

Digital Signal Processing Lab

LAB COURSE OUTLINE

Digital Signal Processing Lab	**DSP LAB**	
Course Title	Short Title	Course Code

Course Description:
In this laboratory course emphasis is on the hand on design practice and implementation and testing of various circuits (discrete and IC based) in laboratory.

Laboratory	**Hours per Week**	**No. of Weeks**	**Total Hours**	**Semester Credits**
	2	**15**	**30**	**1**

Total Semester Credits: 1

Prerequisite Course(s): A background in basic electronics and circuit theory.

LAB COURSE CONTENT

(Note: Minimum EIGHT experiments to be performed)

1. Basic operations (Addition, Multiplication, Subtraction, Division and Scaling)on sequences of equal and unequal length.
2. Write a program for different waveform generation (Sin, Cos, Impulse, Unit step, delayed unit step, rising exponential, decaying exponential, Fliplr ie x(-n))
3. Sample an analog signal with different sampling frequencies and see the aliasing effect, thus verifying sampling theorem.
4. To study the circular convolution for calculation of linear convolution and aliasing effect. Take two sequences of length 4. Write a program to find 4 point circular convolution and compare the result with 8 point circular convolution to study aliasing in time domain.
5. Find DFT of a discrete sequence and also find its IDFT.
6. Solve Difference equation and find system response using Z transform.
7. To study the effect of different windows on FIR filter response.
8. Design Butterworth filter using Bilinear transformation method for LPF.
9. Design and implement two stage sampling rate converter
10. Implementation of digital filter using DSP Kit.
11. Sampling audio signal at different sampling rate using DSP kit.
12. Using ADC and DAC for signal acquisition and play back after processing.

Note: Minimum **EIGHT** practical's are to be performed. At least **TWO** on DSP Hardware Platform.

Guide lines for ESE:-

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on paper work and performance in the practical.

Fiber Optic Communication Lab

LAB COURSE OUTLINE

Fiber Optic Communication	**FOC LAB**	
Course Title	Short Title	Course Code

Course Description:
In this laboratory course emphasis is on the hand on practice of various optical circuits in laboratory.

	Hours per Week	**No. of Weeks**	**Total Hours**	**Semester Credits**
Laboratory	**2**	**14**	**28**	**1**

Total Semester Credits: 1

Prerequisite Course(s): A background in basic electronics and optical theory.

LAB COURSE CONTENT

(Note: Minimum eight experiments to be perform)

1. **Electrical Characteristics of (Different type LED).**
   - **a)** To plot the VI characteristics of LED.
2. **Electrical Characteristics of Laser Diode.**
3. **Photometric characteristics of LED/LD(Polar plot/Intensity Measurement)**
   - a) To plot the Photometric characteristics of LED/LD of different wavelengths.
4. **NA Measurement for Single/Multi mode, GI/SI, Fiber**
   - a) To measure Numerical Aperture of SM-GI/SI fiber
   - b) To measure Numerical Aperture of MM-GI/SI fiber.
5. **Attenuation Measurement of optical fiber.**
   - a) To measure attenuation due to angular misalignment.
   - b) To measure attenuation due to longitudinal misalignment.
   - c) To measure attenuation due to axial/lateral misalignment.
6. **Study of different fiber losses.**
   - a) To measure propagation loss of given fiber.
   - b) To measure bending loss of given fiber.
7. **Spectral characteristics of LED/LD.**
   - a) To study spectral characteristics of LED/LD.
8. **Fiber optic Analog transmitter/Receiver parameter measurement**.
   - a) To set up analog link and measure the various parameters.

9. **Fiber optic Digital transmitter/Receiver parameter measurement**.
    a) To set up digital link and measure the various parameters.
10. **Study of fiber optical connectors.**
11. **Parameter measurement of opto isolator.**
12. **Study of OTDR**.

Guide lines for ESE:-

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on paper work and performance in the practical.

Elective-I Lab

1. VLSI Design Lab

LAB COURSE OUTLINE

VLSI Design Lab	**VLSI LAB**	
Course Title	Short Title	Course Code

Course Description:
In this laboratory course emphasis is on the hand on design practice and implementation and testing of various circuits (discrete and IC based) in laboratory.

	Hours per Week	**No. of Weeks**	**Total Hours**	**Semester Credits**
Laboratory	**2**	**14**	**28**	**1**

Total Semester Credits: 1

Prerequisite Course(s): A background in digital electronics.

LAB COURSE CONTENT

(Note: Group A is compulsory minimum three experiments to be performed from each group B and C)

List of Practical:
Practical consists of writing VHDL code, simulation, synthesis and implementation on CPLD / FPGA devices.

Group A

Realization of a full adder circuit using dataflow, behavioral, structural and mixed type of description.

Group B
1. Realization of all 2 input and 3 input Logic Gates.
2. Realization of 2 to 4 decoder/3 to 8 decoder.
3. Realization of 4 to 1 multiplexer/ 8 to 1 multiplexer.
4. Realization of 4 bit binary to Gray converter/ BCD to seven segment decoder .

Group C
5. Realization of JK and T flip-flop .
6. Realization of 4 bit binary up down counter with Asynchronous reset.
7. Realization of 4 bit BCD counter with Synchronous reset.
8. Realization of 4 Bit Left / Right Shift Reg

Elective-I Lab

2. Broadband Communication Lab

LAB COURSE OUTLINE

Broadband Communication Lab	**BBC LAB**	
Course Title	Short Title	Course Code

Course Description:
In this laboratory course emphasis is on the study and analysis of varius concepts in Switching ,ISDN

	Hours per Week	**No. of Weeks**	**Total Hours**	**Semester Credits**
Laboratory	**2**	**10**	**20**	**1**

Total Semester Credits: 3

Prerequisite Course(s): A background in basic of networking concepts

LAB COURSE CONTENT

(Note: Minimum eight experiments to be perform)

1. Introduction to Electronic Private Automatic Branch Switching Exchanges
   Study of working of a Manual and Automatic matrix switching Network,
2. Learning Broadband communication and its various protocol and connection using simtel Netsys software.
3. Study of different types of ISDN interfaces
4. To set basic configuration of ISDN system using Emulator, ISDN Telephones, terminal Adapter and Analog Telephones
5. To analyze simple Trace using Protocol Analyzer after establishing, voice communication between two ISDN telephones.
6. Study of Different types of Numbering in ISDN System.
7. Study of point to point/multipoint connections in ISDN System
8 Study of filtering in ISDN analyzer
9. Study of ISDN Telephone Features
10. Study of Euro-/SDN ETSI standards with Fault Finding

Elective-I Lab

3. Biomedical Engineering Lab

LAB COURSE OUTLINE

Biomedical Engineering Lab	**BME Lab**	
Course Title	Short Title	Course Code

Course Description:
In this laboratory course emphasis is on the understanding of Biomedical electronics components & system application.

Laboratory	**Hours per Week**	**No. of Weeks**	**Total Hours**	**Semester Credits**
	2	**14**	**28**	**1**

LAB COURSE CONTENT

(Note: Minimum EIGHT Experiments from below list.)

1. Study of blood pressure measurement.
a. Measurement of systolic & diastolic pressure

2. Study of ECG amplifier to measure amplitude and frequency components.
a. Measurement of ECG Waveform & amplitude

3. Measurement of pulse Rate.
a. Measurement of pulse rate.

4. Study of measurement of temperature of human body direct and indirect method.
a. Measurement of body temperature.

5. Study of pace maker unit to compare the operation of heart with the normal functioning of heart.
a. Demonstration of pace maker working & modes of pacemaker.

6. Study of blood cell counter to measure cell counts.
a. Measure cell count

7. Study of spectrophotometer.

a. Analysis of chemical composition of body fluids.

8. Use of ultrasound in medical electronics.

a. Measurement of Blood Flow using ultrasound Blood flow meter.

9. Study of temperature telemetry system to measure the received data.

a. Observe sending & receiving data

10.Study of Different Biomedical Electrodes.

a. Observe and Mount diff. Skin surface Electrodes.

b. Study and Observe Micro electrodes and Needle electrodes.

Guidelines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked to perform any one practical out of 8. Evaluation will be based on paper work and performance in the practical.

Elective-I Lab

4. Industrial Automation Lab

LAB COURSE OUTLINE

Industrial Automation Lab	**IA LAB**	
Course Title	Short Title	Course Code

Course Description:

In this laboratory course emphasis is on the hand on design practice and implementation and testing of various circuits (discrete and IC based) in laboratory.

Laboratory	**Hours per Week**	**No. of Weeks**	**Total Hours**	**Semester Credits**
	2	**15**	**30**	**1**

Total Semester Credits: 1

Prerequisite Course(s): A background in basic electronics and circuit theory.

LAB COURSE CONTENT

(Note: Minimum eight experiments to be performed)

1. Study of relay and contactor logic for load control
2. Study of fully automatic DOL & star-delta starters
3. Study of temperature controller
4. Study and verification of PID functions using controller.
5. Study and verification of counter functions
6. Study of AC drives and verification of start, stop, jog and direction control features
7. Study of types, functioning and symbols of various hydraulic components
8. Study of types, functioning and symbols of various pneumatic components.
9. Development of timer and counter functions using PLC.
10. Development of interface of I/O devices using PLC.
11. Communication, downloading / uploading of PLC programs
12. Basic Analog Inputs (AI) and Analog Output (AO) programming techniques using scaling functions.

13. Understanding GUI features of HMI (WinCC flexible / other compatible)

14. System graphic designing using SCADA (WinCC / other compatible)

15. Mini-hardware project: Integration of 1DI, 1DO & 1AI with PLC

Guide lines for ESE:-

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on paper work and performance in the practical.

Project-I

Project-I
Course Title Short Title Course Code

Course Description:
The course explores the knowledge of design, experiment and analysis of data. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	**2**	**15**	**30**	**2**

COURSE CONTENT

Project-I **Semester-VII**

Lab:2 Hrs/week **Examination Scheme**

Total Semester Credits: 02
Internal Continuous Assessment (ICA): 25 Marks
End Semester Examination(ESE)-Oral:25 Marks
Total: 50Marks

1. It is expected that the broad area of Project-I shall be finalized by the student in the beginning of the VII semester / extension of Minor project undertaken may be Project-I.
2. A group of Minimum 3 and Maximum 5 students shall be allotted for Project-I and same project group for Project-II.
3. Exhaustive survey of literature based on a clear definition of the scope and focus of the topic should be carried out by the students. The **Synopsis/Abstract** on the selected topic, after detail literature survey should be submitted to the Project coordinator appointed by Head of the department.
4. Project-I may involve literature survey, problem identification, work methodology preparing specification and material procurement, collection of data , conduction of experiments and analysis. The project work shall involve sufficient work so that students get acquainted with different aspects of fabrication, design or analysis.
5. Approximately more than 50% work should be completed by the end of VII semester.
6. Each student group is required to maintain log book for documenting various activities of Project-I and submit group project report in the form of thermal bound at the end of semester –VII. Submit the progress report in following format:
    a. *Title*
    b. *Abstract*
    c. *Introduction*
    d. *Problem identification and project objectives*
    e. *Literature survey*
    f. *Case study/Analysis/Design Methodology*

g. *Work to be completed (Progress status)*
h. *Expected result and conclusion*
i. *References.*

7. Evaluation Committee comprising of the Guide, Project Coordinator and Expert appointed by the Head of the department will award the marks based on the work completed by the end of semester and the presentation based on the project work.

Guide lines for ICA : The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Assessment of the project-I for award of ICA marks shall be done jointly by the guide and departmental committee as per the guidelines given in **Table-A.**

Guide lines for ESE: The End Semester Examination for Project shall consist of demonstration if any, presentation and oral examinations based on the project report**.**

Assessment of Project-I

Name of the Project: _____

Name of the Guide: _____

Table-A

SN	Name of Student	Problem Identification and project objectives	Literature Survey	Project Methodology/ Design/PCB/ hardware/ simulation/ programming	Progress Status	Present ation	Total
		5	5	5	5	5	25

Seminar-II

COURSE CONTENT

Seminar-II

Course Title | Short Title | Course Code

Course Description: The course explores the knowledge of presentation and effective communication. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	**2**	**15**	**30**	**2**

COURSE CONTENT

Seminar-II **Semester-VII**

Examination Scheme

Practical : 2 Hrs/Week **Total Semester Credits: 02**

Internal Continuous Assessment (ICA): 25 Marks

1. Each Student shall select a topic for seminar which is not covered in curriculum. Seminar topic should not be repeated and registration of the same shall be done on first come first serve basis.
2. Topic of Seminar shall be registered within a three weeks from commencement of VII Semester and shall be approved by the committee.
3. The three-member committee appointed by Head of the department shall be constituted for finalizing the topics of Seminar-II. Seminar shall be related state of the art topic of his choice approved by the committee.
4. Each student should deliver a seminar in scheduled period (Specified in time table or time framed by department) and submit the seminar report (paper bound copy/Thermal bound)in following format:
    a. *Title*
    b. *Abstract*
    c. *Introduction*
    d. *Literature survey*
    e. *Concept*
    f. *Functional and Technical Details*
    g. *Applications*
    h. Comparison with similar topics / methods
    i. *Future scope*
    j. *References*

ASSESSMENT OF SEMINAR-II

Guide lines for ICA: ICA shall be based on topic selection , presentation and Seminar-II report submitted by the student in the form of thermal bound. Assessment of the Seminar-II for award of ICA marks shall be done jointly by the guide and a departmental committee, as per the guidelines given in **Table- B**

Name of Guide: _____

Table-B

SN	Name of Student	Seminar Topic	Topic Selection	Literature survey	Report writing	Depth of under-standing	Presentation	Total
			5	5	5	5	5	25

Industrial Visit

Industrial Visit
Course Title | Short Title | Course Code

Course Description: The course explores the knowledge industry organization, new trends in manufacturing, maintenance and safety. The industrial visit provide the practical visualization of theoretical study of various engineering subject.

COURSE CONTENT

Semester-VII **Examination Scheme**
Total Semester Credits: 01
Internal Continuous Assessment (ICA): 25 Marks

1. Industry visits to minimum two industries shall be carried out by each student preferably/college shall arrange the industrial visit during the vacation period otherwise during the regular VII semester.
2. The student should obtain appropriate certificates of visit from the concerned organizations just after the visits.
3. Every Student should submit Industrial Visit report individually at the end of Semester-VII(First Term of Final Year)
4. The report(Thermal Bound) should contain information about the following points:
   a. *The organization - activities of organization and administrative setup technical personnel and their main duties.*
   b. *The project / industry brief description with sketches and salient technical information.*
   c. *The work / processes observed with specification of materials, products, equipments etc. and role of engineers in that organization.*
   d. *Suggestions (if any) for improvement in the working of those organizations.*
5. The evaluation of the report of technical visits will be made by panel of three teachers appointed by Head of the department based on following points:

Guide lines for ICA : ICA shall be based on knowledge gain by student and Industrial Visit Report submitted by the student in the form of Thermal bound. Assessment of the Industrial Visit for award of ICA marks shall be done jointly by industrial visit coordinators departmental committee based on viva -voce as per the guidelines given in **Table- C**

Table-C

SN	Name of Student	Name of Industry	Report writing	Depth of Under-standing	Total
			15	**10**	**25**

NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Final Year Engineering

(E&TC/E&C)

Faculty of Engineering and Technology

COURSE OUTLINE

Semester – VIII

W.E.F 2015 – 2016

Satellite & Mobile Communication

COURSE OUTLINE

Satellite & Mobile Communication	S&MC	
Course Title	Short Title	Course Code

Course Description:

This course describes the basics of Satellite and Mobile communication to the undergraduate students. Mobile communications provide terrestrial coverage in densely populated areas, while satellite communications enable wireless communication in regions where mobile networking is not cost-effective. The program gives you an in-depth understanding of the engineering aspects of these important current and future technologies.

Lecture	Hours / Week	No. Of Weeks	Total Hours	Semester Credits
	03	13	39	03

Prerequisite Course(s): Communication System-I, Communication System-II.

COURSE CONTENT

Satellite & Mobile Communication **Semester -VIII**

Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week

End Semester Examination (ESE): 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: Overview of Satellite Systems, Orbits and Launching Methods

No of Lect. –7, Marks: 16

a. Introduction – Frequency Allocations for Satellite Services
b. Intelsat, Polar Orbiting Satellites
c. Kepler's First , Second and Third Law
d. Definitions of Terms for Earth orbiting Satellites – Orbital Elements – Apogee and Perigee Heights
e. Orbital Perturbations, and sun-synchronous orbit

Unit-II: Geostationary orbit, Wave Propagation and Polarization

No of Lect. – 8, Marks: 16

a. Antenna look angles, antenna mount, limits of visibility,
b. Earth eclipse of satellite, sun transit outage, launching of geostationary satellites
c. Atmospheric losses, ionospheric effects, rain attenuation

d. Antenna polarization,
e. polarization of satellite signals,
f. cross polarization discrimination, Ionospheric depolarization rain depolarization, ice depolarization

Unit-III: Satellite Antenna and Link Design **No of Lect. –12, Marks: 16**

a. Antenna basics, aperture antennas. Parabolic reflectors,
b. Offset feed, double reflector antenna
c. Introduction, equivalent isotropic radiated power, Transmission losses
d. The link power budget equation, System noise, carrier to noise ratio
e. The uplink
f. The downlink
g. Effects of rain, combined Uplink and Downlink C/N ratio

Unit-IV: Introduction to Wireless Communications and Modern Wireless Communications system **No of Lect. – 4, Marks: 16**

a) Evolution of Mobile radio communication
b) Mobile Radio systems around the world
c) wireless communication system
d) Trends in cellular radio and personal communications
e) Second generation(2G) cellular networks
f) Third generation(3G) wireless networks
g) wireless local loop(WLL) and wireless Local Area Networks(WLANs)

Unit-V: Cellular Concept and System Design Fundamentals, Wireless systems and Standards **No of Lect. – 9, Marks: 16**

a) Introduction, Frequency reuse, channel assignment strategies
b) Handoff strategies, Interference and system capacity, Trucking and grade of service
c) Improving coverage and capacity in cellular systems
d) Global System for Mobile (GSM)

Reference Books:

1. D. Roddy, “Satellite Communications”, Tata McGraw-Hill, 4th Edition, ISBN-0-07-007785-1.
2. T. Rappaport, “Wireless Communications-Principles and Practice, 2nd Edition, ISBN-978-81-317-3186-4.

Radiation and Microwave Techniques

COURSE OUTLINE

Radiation and Microwave Techniques **RMT**
Course Title Short Title Course Code

Course Description:

This course will help students to understand the essentials of microwave engineering, active and passive microwave devices, microwave tubes and applications of microwave.

	Hours / Week	No. of Weeks	Total Hours	Semester Credits
Lecture	**03**	**14**	**42**	**03**

Prerequisite Course(s): A background of Electromagnetic field theory and communication system.

COURSE CONTENT

Radiation and Microwave Techniques **Semester-VIII**

Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week

End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: Microwave Transmission Lines **No of Lect. – 8, Marks: 16**

Transmission Line equivalent circuit, Transmission line parameter, Transmission line equation, Transmission coefficient, reflection coefficient, Impedance matching, quarter wave transmission line, single stub, double stub matching, Solution of single stub by using smith chart. Application of smith chart

Unit-II: Microwave waveguides and components **No of Lect. – 8, Marks: 16**

Wave guide Theory: Waveguide types rectangular and circular. Wave propagation through rectangular waveguide, Solution of wave equation in rectangular waveguide, Rectangular wave guide modes, Waveguide characteristics for TE and TM modes (for rectangular waveguide), equation for cut off wavelength, guided wavelength, guided velocity, group velocity
Microwave components: S parameters**,** S matrix, E-plane, H-plane, Magic Tee, Directional couplers, Ferrite devices – Isolator, Circulator. Waveguide Terminations, short circuit plunger, Waveguide corners, bends & twists, Attenuators.

Unit-III: Microwave Tubes and Solid State Devices **No of Lect. – 9, Marks: 16**

Microwave Tubes: Limitations of conventional Tubes, Klystron tubes, Two cavity Klystron, Multi cavity Klystron, Reflex klystron, Travelling Wave Tube (TWT), Magnetron.

Solid state Devices: PIN diode, GUNN diode, IMPATT diode, Microwave strip lines, and Monolithic Microwave Integrated circuits.

Unit-IV: Microwave Measurement and antennas **No of Lect. – 8, Marks: 16**

Microwave Measurements: Power, Frequency, VSWR, attenuation, Impedance measurement.
Microwave Antennas: Fundamental parameters of antennas**,** Horn antenna, Parabolic reflector with all types of feeding methods, slotted antenna, Lens antenna, Microwave strip line antennas.

Unit-V: Application of Microwaves - RADAR **No of Lect. – 8, Marks: 16**

RADAR: Principle of Radar System, Radar range equation, Pulse radar, Doppler Effect, Blind Speed, MTI Radar, CW Doppler Radar, FMCW Doppler Radar.

Industrial Applications of Microwaves- Microwave heating, microwave oven, Thickness measurement, Medical applications of microwaves.

Reference Books:

1. Samuel Liao, Microwave Devices and Circuits, Pearson Education, 3/e,
2. Annapurna Das, Sisir Das, Microwave Engineering, TMH, 2/e
3. David M. Pozar, Microwave Engineering, Wiley India, 4/e
4. Sisodia, Gupta, Microwaves : Introduction to Circuits, Devices and Antennas, New Age, 1/e
5. Manojit Mitra, Microwave Engineering, Dhanpat Rai, 3/e
6. Robert E Collin, Foundations for Microwave Engineering, Wiley India, 2/e
7. Simon Ramo, Fields and Waves in Communication Electronics, Wiley India, 3/e
8. K K Sharma, Fundamentals of Microwave and Radar Engineering, S Chand. 1/e

Elective-II

1. Embedded System

COURSE OUTLINE

Embedded System	**ES**	
Course Title	Short Title	Course Code

Course Description:

This course presents the fundamentals of embedded system hardware and firmware design. Issues such as embedded processor selection, firmware debugging will be discussed. A very popular microcontroller LPC 2148 and Real time operating system concept will be studied to meet the real time system requirement.

Lecture	**Hours / Week**	**No. Of Weeks**	**Total Hours**	**Semester Credits**
	03	**14**	**42**	**03**

Prerequisite Course(s): Knowledge of microprocessor and microcontroller architecture, digital design, and the C programming language.

COURSE CONTENT

Embedded System **Semester-VIII**

Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week

End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: Embedded System Introduction **No of Lect. – 8, Marks: 16**

Introduction to Embedded System, History, Design challenges, optimizing design metrics, time to market, applications of embedded systems and recent trends in embedded systems, embedded design concepts and definitions, hardware and software design and testing, communication protocols like CAN, bluetooth and Zig-bee.

Unit-II: ARM Embedded System **No of Lect. – 8, Marks: 16**

RISC Design Philosophy, comparision between CISC and RISC, ARM Design Philosophy, Embedded System hardware, Embedded System software.

ARM Processsor fundamentals - ARM core architecture, data flow model, Register, Current Program Status Register, Pipeline, Exceptions, Interrupts and Vector Table, Core Extensions, ARM Processor families.

Unit-III: ARM Processor **No of Lect. – 8, Marks: 16**

ARM-7 processor LPC 2148 Block diagram and pin diagram, operating modes: ARM mode & Thumb mode, study of on-chip peripherals like I / O ports, timers, counters, interrupts, on-chip ADC, DAC, RTC modules, WDT, PLL, PWM and USB.

Unit-IV: Programming & Interfacing for LPC2148 **No of Lect. – 8, Marks: 16**

Hardware interfacing of LPC2148 using Embedded C language: LED, Switches, LCD Display & stepper motor. On chip programming: UART, Timer, Real Time Clock & ADC.

Unit-V: Real Time Operating System Concept **No of Lect. – 8, Marks: 16**

Architecture of kernel, task and task scheduler, ISR, Mutex, Semaphores, mailbox, message queues, pipes, events, timers, Priority inversion problem, priority Inheritance, RTOS services in contrast with traditional OS.

Introduction to Ucos II RTOS and it's features, study of kernel structure of Ucos II.

Case study of digital camera and automatic chocolate vending machine (without codes)

Reference Books:

1. Rajkamal - Embedded Systems, TMH, Second edition
2. Andrew sloss " Arm System Developer guide"
3. Data sheet and User manual of LPC2148.
4. Dr.K.V.K.K. Prasad - Embedded / real time system, Dreamtech.
5. Steve Furber - ARM System-on-Chip Architecture, Pearson
6. Jean J Labrose - MicroC / OS-II, Indian Low Price Edition

Elective-II

2. Digital Image Processing

COURSE OUTLINE

Digital Image Processing **DIP**
Course Title Short Title Course Code

Course Description:

This course presents the fundamentals and mathematical models in digital image processing, develop time and frequency domain techniques for image enhancement, expose the students to current technologies and issues and develop image processing applications in practice.

Lecture	Hours / Week	No. Of Weeks	Total Hours	Semester Credits
	03	14	42	03

Prerequisite Course(s): A background in basics of digital signal processing.

COURSE CONTENT

Digital Image Processing **Semester-VIII**
Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week **End Semester Examination(ESE) :80 Marks**
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: Image Fundamentals **No of Lect. – 8, Marks: 16**

a) Introduction and Examples of Fields that use Digital Image Processing,
b) Fundamental Steps and components in Digital Image Processing,
c) Image Sensing ,Acquisition, Sampling and Quantization,
d)Spatial and Gray level Resolution, Basic pixel relationship,
e) Distance Measures, Statistical Properties

Unit-II: Image Enhancement: **No of Lect. – 8, Marks: 16**

Enhancement in Spatial Domain:
a) Basic Gray Level Transformations
b) Histogram Processing
c) Enhancements using arithmetic and logical operations
d) Smoothening and sharpening Spatial filters

Enhancement in Frequency Domain:
a)Smoothening and Sharpening frequency Domain Filters.

Unit-III: Image Coding and Compression: **No of Lect. – 8, Marks: 16**

a)Image Coding Fundamentals, Image Compression Model
b) Error Free Compression
c) Lossless Predictive Coding
d) Lossy-Compression, Lossy Predictive Coding, Transform Coding,
e) Image Compression Standards, JPEG Baseline Coder Decoder.

Unit-IV: Image Restoration and Color Image Processing: **No of Lect. – 9, Marks: 16**

a) Image Degradation Model, Noise Models,
b) Restoration in Presence of Noise in spatial Domain
c) Linear Filtering
d) Inverse Filter, Wiener Filter
e)Constrained Least Square Restoration, Geometrical Transformation
f) Spatial Transformation, and Grey Level Transformation.
g) Color Image Processing
h) Color models, RGB to HIS and vice versa
i) Color Transforms, Smoothing and Sharpening

Unit-V: Image Analysis and Image Processing Applications **No of Lect. – 8, Marks: 16**

a) Edge detection
b) Boundary representation by chain codes and B splines,
c) Morphological Image Processing: Dilation, Erosion, Opening, Closing on Binary Images,
d) Segmentation: Point, line. Edge detection, Boundary detection and Thresholding.
e) Applications: Character Recognition, Fingerprint Recognition, Remote Sensing.
f) Medical imaging, electron microscopy

Reference Books:

1) Gonzalez and Woods, "Digital Image Processing", Pearson Education,
2) A. K. Jain, "Fundamentals of Digital Image Processing"; Pearson Education
3) Pratt William, "Digital Image Processing", John Wiley & Sons
4) Arthur Weeks Jr., "Fundamentals of Digital Intake Processing", PHI.

Elective-II

3. Telematics

COURSE OUTLINE

Telematics	**Telematics**	
Course Title	Short Title	Course Code

Course Description:

This course presents the actual concepts of wired, wireless communication system and mobile communication system.

Lecture	**Hours / Week**	**No. Of Weeks**	**Total Hours**	**Semester Credits**
	03	**14**	**42**	**03**

Prerequisite Course(s): A background in basic communication system.

COURSE CONTENT

Telematics **Semester-VIII**

Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week

End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: Telephone switching and Traffic Engineering **No of Lect. – 8, Marks: 16**

a) Evolution of telecommunication, simple telephone communication, basics of switching systems
b) Dialing mechanism, electronics switching, digital switching system,
c) SPC configuration, Architecture features, centralized and distributed SPC, enhanced services.
d) Traffic Engineering, Introduction, Traffic usages, traffic measurement unit, traffic distribution, Grade of service, Blocking probability

Unit-II: Introduction to Wireless Communication System **No of Lect. – 8, Marks: 16**

a) History and evolution of mobile radio systems,
b) Examples of wireless communication systems, Paging, Cordless Telephone systems,
c) Cellular Telephone systems, Trends in cellular radio and Personal communications,
d) Wireless local loop and LMDS, Wireless Local Area Networks, Bluetooth and Personal Area Networks, IEEE 802.15, IEEE-802.16

Unit-III: Mobile cellular Telephony **No of Lect. – 8, Marks: 16**

a) Limitations of conventional mobile Telephone system, Frequency band allocation, Basic cellular system components,
b) Operations of a cellular system, Calculation of maximum number of calls per hour per cell, frequency channels per cell, concept of frequency reuse, cell splitting,
c) Hand off mechanism, Delayed hand off, Forced hand off. Mobile assisted hand off. Cell site hand off, Inter system hand off, co-channel Interference reduction factor, fading. Multi-user communication. TDMA, FDMA and CDMA.

Unit-IV: Digital cellular systems **No of Lect. – 8, Marks: 16**

a) GSM, radio aspects, features of GSM. Architecture details channel structure, security aspects, Authentication and ciphering key.
b) Different call flow sequences in GSM, North American CDMA cellular standard,
c) Radio aspect, forward link and Reverse link structure, key features of standard.

Unit-V: IP telephony **No of Lect. – 8, Marks: 16**

a) Introduction to VOIP, low level protocols, - RTP / RTCP / UDP,
b) Voice activity detection and discontinuous transmissions. IP telephony protocols: - H.323 standard, session Initiation protocol (SIP),
c) Gateway location protocol, QOS requirements, RSVP Architecture, message format, reservation merging.

Reference Books:

1. Vishwanathan - Telecommunication switching systems, PHI
2. William C.Y. LEE - Wireless and cellular Telecommunications, MGH , 3rd Ed, 4th Ed
3. Raj Pandya - Mobile and personal communication systems , PHI
4. Rappaport - Wireless communication, PHI
5. Andrew S Tanenbaum- Computer Networks, 4th ED, PHI/ Pearson Education
6. Alberto Leon Garcia - Communication network, TMH
7. Andreas F. Molisch - Wireless communication, Wiley

Elective-II

4. Neural Network and Fuzzy Logic

COURSE OUTLINE

Neural Network and Fuzzy Logic	NNFL	
Course Title	Short Title	Course Code

Course Description:
This course gives introduction to the artificial neural network and fuzzy logic which is basic requirement for intelligent system.

Lecture	Hours / Week	No. Of Weeks	Total Hours	Semester Credits
	03	14	42	03

Prerequisite Course(s): A background in basic mathematics & set theory is required.

COURSE CONTENT

Neural Network and Fuzzy Logic **Semester-VIII**

Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week

End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) :03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: Fundamentals of Neural Networks **No of Lect. – 8, Marks: 16**

a) Fundamental Concept: Artificial Neural Network, Biological Neural Network.
b) Evolution of Neural Networks.
c) Basic Models of ANN: Types based on Connections, Learning & Activation functions. Terminologies of ANN.
d) McCulloch-Pitts Neuron**:** Theory & Architecture.Linear & Non-Linear Separability.
e) Hebb Network: Thery, Training Algorithm.
f) Perceptron: Theory, Architecture.
g) Numericals.

Unit-II: Supervised Learning Networks **No of Lect. – 8, Marks: 16**

a) Perceptron Networks: Theory, Architecture, Perceptron learning rule, Flow Chart for Training Algorithm, Training algothms for single output classes & multiple output classes, Testing Algorithms.

b) Adaptive Linear Neuron (Adaline): Theory, Architecture, Delta rule for learning, Flowchart for training, Training Algorithm, Testing Algorithm.
c) Multiple adaptive Linear Neurons (Medaline): Theory, Architecture, Rule for learning, Flowchart for training, Training Algorithm, Testing Algorithm.
d) Back-Propagation Network: Theory, Architecture, Flowchart for Training Process, Training Algorithm,Learning Factors of BPN, Testing Algorithm.
e) Associative Memory Networks: Training algorithms for Pattern Association, Hebb Rule, Outer Product Rule.
f) Autoassociative Memory Network: Theory, Architecture, Flowchart for Training Process, Training Algorithm, Testing Algorithm.
g) Hetero Associative Memory Network: Theory, Architecture, Flowchart for Training Process, Training Algorithm, Testing Algorithm.
h) Bidirectional Associative Memory (BAM): Theory, Architectures.

Unit-III: Fundamentals of Fuzzy Logic **No of Lect. – 8, Marks: 16**

a) Fundamental Concept: Introduction to Fuzzy Logic. Applications.
b) Introduction to Classical Sets & Fuzzy Sets: **Classical Stes**- Operations, Properties, Function Mapping, **Fuzzy Sets**- Operations, Properties.
c) Classical Relations & Fuzzy Relations: **Classical Relations** – Cardinality, Operations, Properties, Composition of Classical Relations. **Fuzzy Relations** - Cardinality, Operations, Properties, Composition of Fuzzy Relations
d) Membership Functions: Features of membership function, Fuzzification, Various methods of membership value assignments.
e) Defuzzification: Lambda-Cuts on Fuzzy Sets, Lambda-Cuts on Fuzzy Relations, Various Defuzzification methods.

Unit-IV: Fuzzy Arithmetic, Measure & Rule Base Approximate Reasoning No of Lect. – 8, Marks: 16

a) Fuzzy Arithmetic: Interval Analysis, Fuzzy Numbers, Fuzzy Ordering, Fuzzy Vectors
b) Extension Principle
c) Fuzzy Measures: Belief & Plausibility Measures, Probability Measures, Possibility & Neccessity Measures.
d) Fuzzy Rule base & Approximate Reasoning: Truth Values & Tables in Fuzzy Logic, Fuzzy Propositions, Formation of Rules
e) Decomposition of Rules, Aggregation of Fuzzy Rules.
f) Fuzzy Inference System.

Unit-V: Applications & Advanced Systems **No of Lect. – 8, Marks: 16**

a) **Applications of Neural Networks:** Character Recognition Networks, Control System, Robot Kinematics, Expert Systems for Medical Diagnosis.
b) **Applications of Fuzzy Logic:** Pattern Recognition, Control System.

Reference Books:

1) Principles of Soft Computing by S. N. Sivanandam & S. N. Deepa, Wiley India, Edition
2) Fuzzy Logic with Engineering Applications by Timuthi J. Ross, Wiely.
3) Introduction to Artificial Neural Systems by Jacek M. Zurada, West Publishing Company

Elective-III

1. Robotics

COURSE OUTLINE

Robotics
Course Title Short Title Course Code

Course Description:

Lecture	Hours / Week	No. Of Weeks	Total Hours	Semester Credits
	03	14	42	03

COURSE CONTENT

Robotics **Semester-VIII**

Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week

End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: Introduction **No of Lect. – 8, Marks: 16**

Automation and Robotics, Definition, Laws of robotics, Basic Structure of Robots, Classification of Robots based on co-ordinate system, Present trends and future trends in robotics, Overview of robot subsystems, Components of Robot system-Manipulator, Controller, Power conversion unit etc, Specifications of robot, programming robots.

Unit-II: Dynamics & Kinematics **No of Lect. – 8, Marks: 16**

Dynamic constraints, velocity & acceleration of moving frames, Robotic Mass Distribution & Inertia, Tension, Newton's equation, Euler equations, Dynamic Modeling of Robotic Manipulators. Homogeneous co-ordinate vector operations, matrix operations, co-ordinate reference frames, Homogeneous transformation and manipulator orientation relative points reference frames, forward Kinematics - Link co-ordinate frames, D-H matrix, Inverse or back solutions- problem of obtaining inverse solution, techniques of using direct & geometric approach.

Unit-III: End Effectors and Actuators **No of Lect. – 8, Marks: 16**

Different types of grippers, vacuum & other methods of gripping, overview of actuators, Internal & External sensors, position, relocking and acceleration sensors, proximity sensors, force sensors, touch slip sensor, laser range finder, camera.

Unit-IV: Motion Planning and Controllers **No of Lect. – 8, Marks: 16**

On-off trajectory, relocking and acceleration profile, Cartesian motion of manipulator, joint interpolated control, Jacobian in terms of D-H matrix, Obstacle avoidance, Basic control system, control loops of robotic system, Fuzzy controllers.

Unit-V: Robot Vision **No of Lect. – 8, Marks: 16**

Machine Vision system, (description, sensing, Digitizing, Image Processing and Analysis), architecture of robotic vision system, and Application of Machine Vision System, Robotic assembly sensors & Intelligent Sensors.

Text Books:

1. Fundamentals of Robotics: Analysis and Control – Robert J Schilling,PHI, NewDelhi
2. Robotic Engineering – Klafter, Thomas, Negin,PHI, New Delhi
3. Robotics and Control- R. K. Mittal, I. J. Nagrath, TMH, NewDelhi

Reference Books:

1.Robotics for Engineers – Yoram Koren,McGraw Hill, New York
2.Fundamentals of Robotics– T.C. Manjunath, Nandu Publishers, Mumbai
3.MEMS and Microsystems Design and Manufacture- HSU, TMH , NewDelhi

Elective-III

2. Nanotechnology

COURSE OUTLINE

Nanotechnology	**Nanotech**	
Course Title	Short Title	Course Code

Course Description:

This course presents the actual concepts of nanoelectronics, Nano CMOS devices and nano material in order to meet a given system specification.

Lecture	**Hours / Week**	**No. Of Weeks**	**Total Hours**	**Semester Credits**
	03	**14**	**42**	**03**

Prerequisite Course(s): A background in electronic circuits and VLSI .

COURSE CONTENT

Nanotechnology **Semester-VIII**

Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week

End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) :03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: Introduction to Nanotechnology **No of Lect. – 8, Marks: 16**

a) Introduction: Evolution of science and technology, Introduction to Nanotechnology.

b) Nanotechnology–Definition–Difference between Nanoscience and Nanotechnology.

c) Feynman Predictions on Nanotechnology.

d) Role of Bottom up and top down approaches in nanotechnology, challenges in Nanotechnology.

Unit-II: Physical Chemistry of Solid Surfaces **No of Lect. – 8, Marks: 16**

a) Introduction, Surface Energy
b) Chemical potential as function of surface curvature.
c)Electrostatic Stabilization .
d) Steric Stabilization.

Unit-III: Nano particles and Nanotubes **No of Lect. – 8, Marks: 16**

a) Properties of Nano particles: Metal nanostructures and semiconducting nanoparticles.
b) Carbon nanostructure: carbon molecules, cluster, Nanotubes.
c) Properties of Nanotubes strength and elasticity.
d) Applications of Carbon Nanotubes.

Unit-IV: Special Nanomaterial **No of Lect. – 8, Marks: 16**

a) Characterization and tool: carbon nano tubes, nano composites, carbon fullerenes.
b) Micro and mesoporous material, core shell structure. Organic-Inorganic Hybrid
c) Intercalation Compounds, Nanocomposite & Nanograined material.
d) Inverse opals,Bio induced nanomaterial.

Unit-V: Nanotechnology in Electronics **No of Lect. – 8, Marks: 16**

a) Nanomachines and nano devices, NEMS and MEMS and their fabrication.
b) Use of nanotechnology in electronics, Application of nano structure in electronics, sensor, optics, energy capture, transformation and storage.
c) Applications of nanotechnology in biomedical electronics. Drug & Drug Delivery
d) Photodynamic therapy, Molecular motors, Neuroelectronic interface

Reference Books:

1) Mark Ratner and Daniel Ratner," Nanotechnology: A Gentle introduction to next big Idea". Pearson Education.
2) Introduction to Nanotechnology-by Charles P. Poole Jr. Frank J. Owens-John Wiley & Sons.
3) Nano structure & Nano material by Guozhong cao, Imperial College Press.

Elective-III

3. Telecomm Network Management

COURSE OUTLINE

Telecomm Network Management **TNM**
Course Title Short Title Course Code

Course Description: To understand the concept of Telecom Network Management, architecture, protocol and its Applications**.**

Lecture	Hours / Week	No. Of Weeks	Total Hours	Semester Credits
	03	14	42	03

Prerequisite Course(s): A background basic in Network Management system.

COURSE CONTENT

Telecomm Network Management
Semester-VIII
Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week
End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: Foundations and TMN architecture: **No of Lect. – 8, Marks: 16**

a) Network management standards, network management model,
b) organization model, information model,
c) abstract syntax notation 1 (ASN. 1),
d) encoding structure, macros, functional model. Terminology, functional TMN architecture, Information architecture,
e) physical architecture, TNN tube
f) TMN and OSI

UNIT II : Network managements: **No of Lect. – 8, Marks: 16**

a)Configuration management, fault management.
b) Performance management.
c) Error correlation technology.
d) Security management.
e) Accounting management, service level management,
f) Management service.

UNIT III : TMN modeling & service **No of Lect. – 8, Marks: 16**

a) CMISE model, service definitions,
b) Errors, scooping and filtering features,
c) Synchronization, functional units, association services,
d) Common management information protocol specification.
e) Rationale for information modeling, management information model, object oriented modeling paradigm,
f) Management information base (MIB)

UNIT IV: SNMP **No of Lect. – 8, Marks: 16**

a) SNMPv1: managed networks, SNMP models, organization model, information model b)

b)**SNMPv2:** communication model, functional model, major changes in SNMPv2, structure of management information (SMI), MIB.

c) SNMPv2 protocol compatibility with SNMPv1.

d) **SNMPv3:** architecture, applications, MIB security.

e) Remote monitoring SM and MIB, RMON1 and RMON2.

UNIT V: Network management and tools **No of Lect. – 8, Marks: 16**

a) ATM integrated local management interface, ATM, MIB M1, M 2, M 3, M 4 interfaces,
b) ATM digital exchange interface management,
c) Digital subscriber loop (DSL) and asymmetric DSL technologies,
d) Network statistics management.
e) Management platform case studies: OPENVIEW, ALMAP

Reference Books:

1. Mani Subramaniam, ―Network Management Principles and Practise", Addison Wisely, New York, 2000.
2. Lakshmi G. Raman, ― Fundamental of Telecommunications Network Management" Eastern Economy Edition, IEEE Press New Delhi.
3. Salh Aiidarons, Thomas Plevoyak ―Telecommunications Network Technologies and implementations" Eastern Economy Edition, IEEE press New Delhi-1998.
4. Telecommunication Network Management - Haojin Wang Mc-Graw Hill Professional Publication.

Elective-III

4. Antenna and Wave Propagation

COURSE OUTLINE

Course Title	Short Title	Course Code
Antenna and Wave Propagation	**A&WP**	

Course Description:

The objective of this course is to provide an in- depth understanding of modern antenna concepts, and practical antenna design for various applications. The course will explain the theory of different types of antennas used in communication systems

Lecture	Hours / Week	No. Of Weeks	Total Hours	Semester Credits
	03	14	42	03

Prerequisite Course(s): The course requires knowledge about fundamental antenna theory and advanced electromagnetic field theory. The following experience is useful: understating vector calculus, some knowledge of Maxwell's equations, electrical engineering principles.

COURSE CONTENT

Antenna and Wave Propagation **Semester-VIII**

Teaching Scheme **Examination Scheme**

Lecture: 3 hours / week

End Semester Examination (ESE) : 80 Marks
Paper Duration (ESE) : 03 Hours
Internal Sessional Exam (ISE) : 20 Marks

Unit-I: Antenna Fundamental Concepts: **No of Lect. – 8, Marks: 16**

Definitions – Radiation intensity – Directive gain – Directivity – Power gain – Beam width – Band width – Gain and radiation resistance of current element – Half-wave dipole and folded dipole – Reciprocity principle – Effective length and effective area, Relation between gain, effective length and radiation resistance. Physical concept of radiation, Radiation pattern, near- and far-field regions, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

Unit-II:Antenna Arrays, Radiation from Wires and Loops: **No of Lect. – 8, Marks: 16**

Antenna array concept, Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays.

Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.

Unit-III: Aperture Antennas: **No of Lect. – 8, Marks: 16**

Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts.

Broadband Antennas: Broadband concept, Log-periodic antennas, frequency independent antennas.

Unit-IV: Microstrip Antennas: **No of Lect. – 8, Marks: 16**

Concept, Advantages and disadvantages, Basic characteristics of microstrip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

Unit-V: Wave Propagation **No of Lect. – 8, Marks: 16**

The three basic types of propagation: Ground wave, space wave and sky wave propagation.

Sky Wave Propagation: Structure of the ionosphere – Effective dielectric constant of ionized region – Mechanism of refraction – Refractive index – Critical frequency – Skip distance – Effect of earth's magnetic field – Energy loss in the ionosphere due to collisions – Maximum usable frequency – Fading and diversity reception.

Space Wave Propagation: Reflection from ground for vertically and horizontally polarized waves – Reflection characteristics of earth – Resultant of direct and reflectedray at the receiver – Duct propagation.

Ground Wave Propagation: Attenuation characteristics for ground wave propagation – Calculation of field strength at a distance.

Reference Books:

1. C. A. Balanis, "Antenna Theory and Design", 3rd Ed., John Wiley & Sons., 2005.
2. Antennas And Wave Propagation by: K.D.PRASAD
3. Harish A. R., Antenna and wave propagation, Oxford University Press.

Satellite & Mobile Communication Lab

LAB COURSE OUTLINE

Satellite & Mobile Communication Lab	**SMC LAB**	
Course Title	Short Title	Course Code

Course Description:

This course describes the basics of Satellite and Mobile communication to the undergraduate students. Mobile communications provide terrestrial coverage in densely populated areas, while satellite communications enable wireless communication in regions where mobile networking is not cost-effective. The program gives you an in-depth understanding of the engineering aspects of these important current and future technologies.

	Hours per Week	**No. of Weeks**	**Total Hours**	**Semester Credits**
Laboratory	2	15	30	1

Total Semester Credits: 3

Prerequisite Course(s): Communication System-I, Communication System-II.

LAB COURSE CONTENT

(Note: Minimum FOUR Experiments from each group.)

Group A

1. To set up Direct link
2. To set up Active Satellite link
3. To Study Satellite transponder
4. To set up Satellite communication link
5. To transmit and receive function generator waveforms through Satellite link.
6. To understand the shape of Earth. Measurement of latitude and longitude.
7. To understand the principle of PRN code in GPS.

Group B

8. To establish PC-to-PC Communication using Satellite Communication link.
9. To establish the link between GPS Satellite and GPS Trainer.
10. Mobile Transmitter and Receiver (Trainer Kit)
11. To study GSM architecture
12. To Study cordless Telephone system
13. To study CDMA
14. To study VOIP
15. To study RSVP Architecture.
16. Study of GSM AT commands.

Guide lines for ESE:-

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked to perform any one practical out of Group A and Group B. Evaluation will be based on paper work and performance in the practical.

References:

1. D. Roddy, “Satellite Communications”, Tata McGraw-Hill, 4th Edition, ISBN-0-07-007785-1.
2. T. Rappaport, “Wireless Communications-Principles and Practice, 2nd Edition, ISBN-978-81-317-3186-4.

Radiation & Microwave Techniques Lab

LAB COURSE OUTLINE

Radiation and Microwave Techniques	**RMT LAB**	
Course Title	Short Title	Course Code

Course Description:
The objective of this lab is to familiarize the students with microwave communication techniques, different sources, passive devices and antennas used in microwave communication.

	Hours per Week	**No. of Weeks**	**Total Hours**	**Semester Credits**
Laboratory	**2**	**14**	**28**	**1**

Total Semester Credits: 1

Prerequisite Course(s): A background of Electromagnetic field theory, and communication system.

LAB COURSE CONTENT

(Note: Minimum Eight experiments to be perform)

SN	**Experiment Title**
1	Plot and study V-I Characteristics of GUNN Diode
2	Plot and study Reflex Klystron Characteristics
3	Measurement of Attenuation (Fixed and Variable)
4	Microwave Junction: Power splitting Characteristics (E / H/ EH plane tee)
5	Measurement of coupling factor, insertion loss, directivity and isolation of Directional coupler
6	Study of Circulators (Y or T Type) and Isolators (measurement of isolation)
7	Measurement of VSWR (using V_{max} / V_{min} method)
8	Plot radiation pattern of horn antenna.
9	Plot radiation pattern of parabolic antenna.
10	Measurement of unknown impedance using smith chart
11	Study of MIC components.

Guide lines for ESE:- ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on paper work and performance in the practical.

Elective-II Lab

1. Embedded System Lab

LAB COURSE OUTLINE

Embedded System Lab
Course Title | Short Title | Course Code

Course Description:
The objective of this lab is to familiarize the students with LPC 2148 and the real time operating system concepts.

Laboratory	Hours per Week	No. of Weeks	Total Hours	Semester Credits
	2	**12**	**24**	**1**

Total Semester Credits: 1

LAB COURSE CONTENT

1. Study of IDE (integrated development environment)
2. C-Program to explore timers / counter.
3. C-programs for interrupts.
4. Program to interface LED and switch.
5. Program to interface LCD.
6. Program to interface Keyboard and display key pressed on LCD.
7. Program to interface stepper motor.
8. Writing basic C-programs for I / O operations.
9. Implementation of USB protocol and transferring data to PC.
10. Implementation of algorithm /program for the microcontroller for low power modes.
11. Program to demonstrate RF communication.
12. Writing a scheduler / working with using RTOS for 4 tasks with priority. The tasks may be keyboard, LCD, LED etc. and porting it on microcontroller/ microprocessor

Note: Lab file should consist of minimum eight experiments.

Guide lines for ESE:-

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on paper work and performance in the practical.

Elective-II Lab

2. Digital Image Processing Lab

LAB COURSE OUTLINE

Digital Image Processing	**DIP LAB**	
Course Title	Short Title	Course Code

Course Description:
In this laboratory course Image processing has grown considerably due to fast computational systems. Many important real life applications indiverse fields are therefore possible.

Laboratory	**Hours per Week**	**No. of Weeks**	**Total Hours**	**Semester Credits**
	2	**14**	**28**	**1**

Total Semester Credits: 1

Prerequisite Course(s): A background in basic Digital signal processing.

LAB COURSE CONTENT

(Note: Minimum Eight experiments to be perform)

1. **Study of different file formats e.g. BMP, TIFF and extraction of attributes of BMP.**
   a. BMP.
   b. TIFF and extraction of attributes of BMP.

2. **Study of statistical properties- mean, standard deviation, profile, variance and Histogram plotting.**
   a. Study of statistical properties-mean, standard deviation and profile.
   b. Study of statistical properties- variance and Histogram plotting.

3. **Histogram equalization and modification of the image.**
   a. Histogram equalization of the image.
   b. modification of the image.

4. **Gray level transformations such as contrast stretching, negative, power law transformation.**
   a. Contrast Stretching, negative.
   b. Power Law Transformation.

5. Spatial Domain filtering- smoothing and sharpening filters.

a. Spatial Domain filtering- smoothing filters.

b. Spatial Domain filtering- sharpening filters.

6. DCT / IDCT of given image.

a. DCT of given image.

b. IDCT of given image.

7. Edge detection using Sobel, Prewitt and Roberts operators.

a.Edge detection using Sobel,Prewitt operators.

b.Edge detection using Roberts operators.

8. Capturing image through grabber card from camera and Process it.

9. Application Development

a**.** Biometric Authentication such as Face / Finger Print / Signature Recognition.

b.Human Expression Detection.

10. Creating noisy image and filtering using MATLAB.

11. Study of morphological processing in digital image.

12. Converting color image to B / W image and vice versa.

Note: Lab file should consist of minimum Eight experiments.

All experiments must performed using MATLAB or Scilab only.

Guide lines for ESE:-

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on paper work and performance in the practical.

Elective-II Lab

3. Telematics Lab

Telematics
Course Title | Short Title | Course Code

Course Description: In this laboratory course emphasis is the study and testing of various trainer kit in laboratory

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	**2**	**15**	**30**	**1**

Total Semester Credits: 1

Prerequisite Course(s): A background in basic communication system.

LAB COURSE CONTENT

(Note: Minimum eight experiments to be perform)

1. To Study Electronic Telephone exchange (C-Dot. OR E-10B)

a. CDOT MAX-XL switching network on PSTN platform
b. Trunk group setup and call flow analysis on CDOT MAX-XL switching system
c. Subscribers Management and features in CDOT MAX-XL switching system
d. SS7 signaling setup in CDOT MAX-XL switching system

2. Traffic Measurement calculations

a. Study of different traffic parameters and calculations

3. To Study Digital cordless Telephone system

a. Study the functional block diagram and operation of all sections of Digital Cordless Telephone system - Base unit
b. Study the Polarity protection block
c. Study the functional block diagram and operation of all sections of Handset unit
d. Study the charging circuit (with Base unit as well as with adaptor)

4. To Study Telephone Trainer Kit

a. Understanding of Telephone
b. Study of Telephone features

c. Study of Speech Circuits, ringers, tone dialing, pulse dialing and switching mechanism between subscribers: incoming and outgoing calls.

5. Study of Mobile Transmitter and receiver

a. Study and observe Transmitted/Received RF signals
b. Study and observe Tx IQ/ Rx IQ signals
c. Study and observe signal constellation of GMSK signal (Tx I/Q) & (Rx I/Q)
d. Study and measure Battery voltages the Battery charging phenomena
e. Study and analyze Different sections & fault finding

6. Study of DTMF signaling including DTMF decoder

a. Study of the Telephone by Line Connection
b. Study of the Polarity Protection Block
c. Study of the Working of Voltage Dropper Circuit in Telephone

7. To study GSM architecture

a. GSM Theory & Standards
b. Understanding of GSM technology, its network, GSM capability & data services

8. Study of GSM AT commands

a. Understanding RF environment & study of GSM network by actually connecting to the GSM environment by any service provider.
b. Command Level Study
c. Real Time study of GSM 07.05 & 07.07 commands

9. To study CDMA

a. To study theory of CDMA DSSS Modulation & 4 Demodulation
b. To generate CDMA-DSSS signal
c. To demodulate CDMA-DSSS signal using BPSK
d. To study pseudo random bit sequence generation.

10. To study of VOIP

a. To Study the Block Diagram and Working principle of VOIP

11. To study of RSVP architecture

a. To study the RSVP as part of the integrated services approach that provide QOS to individual application

Reference Books:

1. Vishwanathan - Telecommunication switching systems, PHI
2. William C.Y. LEE - Wireless and cellular Telecommunications, MGH , 3rd Ed, 4th Ed
3. Raj Pandya - Mobile and personal communication systems , PHI
4. Rappaport - Wireless communication, PHI
5. Andrew S Tanenbaum- Computer Networks, 4th ED, PHI/ Pearson Education
6. Alberto Leon Garcia - Communication network, TMH
7. Andreas F. Molisch - Wireless communication, Wiley

Elective-II Lab

4. Neural Network and Fuzzy Logic Lab

LAB COURSE OUTLINE

Neural Network and Fuzzy Logic	**NNFL LAB**	
Course Title	Short Title	Course Code

Course Description:
In this laboratory course emphasis is on the hand on practice of various Neural network & Fuzzy logic techniques in laboratory.

Laboratory	**Hours per Week**	**No. of Weeks**	**Total Hours**	**Semester Credits**
	2	**14**	**28**	**1**

Total Semester Credits: 1

Prerequisite Course(s): A background in NNFL theory.

LAB COURSE CONTENT

(Note: Minimum eight experiments to be perform)

1. To study and implement AND, OR, NAND etc logic function using perceptron.
2. To study and implement EX—OR logic function using perceptron
3. To study and implement MEDALINE network.
4. To study and implement back propagation network.
5. To study and implement BAM algorithm.
6. To study and implement fuzzy compositions of given examples.
7. To study and implement fuzzification methods.
8. To study and implement defuzzification methods.
9. To study and implement fuzzy rule base system.
10. To study fuzzy inference system.
11. To study and implement neural system for Character Recognition/ Control System/ Expert Systems for Medical Diagnosis.
12. To study and implement Fuzzy Logic system for Pattern Recognition/Control system.

Note: All the experiments should be performed by using Scilab/Matlab only.

Guide lines for ESE:-

ESE will be based on practical assignment submitted by the student in the form of journal. Evaluation will be based on paper work and performance in the practical.

Industrial Lecture

COURSE CONTENT

Industrial Lecture
Course Title | Short Title | Course Code

Course Description:
The gap between industry's needs and the academic community's aspirations appears to be considerably large. There exists a strong feeling, at least in the academic circles, that unless technology driven initiatives find a surer place in the industrial sector in this country, the academia-industry interaction is likely to remain confined to developmental activities with limited exploratory or research-based content As institutes committed primarily to creation and growth of technological knowledge, technical institutes have an important role to play in the industrial sector of the country's economy. This fact by way of encouraging mechanisms to foster interaction between the academia and industry. Typically, academic interest in the multidimensionality of a problem leads to a tendency to explore a variety of options to arrive at a solution. This industrial lecture develops ability of student for expectations of the industrialists from the fresh engineers.

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	**1**	**15**	**15**	**2**

COURSE CONTENT

Semester-VIII

Examination Scheme
Total Semester Credits: 02
Internal Continuous Assessment (ICA): 50 Marks

1. There is a need to create avenues for a close academia and industry interaction through all the phases of technology development, starting from conceptualization down to commercialization.
2. List of renowned persons from industry shall be prepared by the committee appointed by Head of the department. After approval from the Principal, Minimum five Industrial lectures in alternate week shall be arranged, which shall be delivered by the experts/Officials from Industries/Govt. organizations/ Private Sectors/Public Sectors / R&D Labs covering the various aspects.
3. Topics of Industrial Lectures shall be Technical in nature and should not be the specific contents from the curriculum.
4. Students shall submit the report based on minimum five lectures giving summary of the lecture delivered.
5. The summary should contain brief resume of the expert, brief information of his organization and brief summary of the lecture in bullet point form.

Guide lines for ICA : Assessment of the Industrial Lecture for award of ICA marks shall be done jointly by departmental committee as per attendance in industrial lecture, report submitted by student and overall performance in semester as per the guidelines given in **Table- D**

Table-D

SN	Name of Student	Attendance (05 Marks per Lecture)	Dept of Understanding (03 Marks per Lecture)	Report Writing	Total
		25	**15**	**10**	**50**

Project-II

Project-II
Course Title Short Title Course Code

Course Description:
The course explores the knowledge of design, experiment and analysis of data. The course develops ability to work on multidisciplinary teams, Identify, formulate, and solve engineering problems in view of economic, environmental and societal context.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	**4**	**15**	**60**	**6**

COURSE CONTENT

Semester-VIII

Examination Scheme
Total Semester Credits: 06
Internal Continuous Assessment (ICA): 75 Marks
End Semester Examination (ESE):75 Marks
Total:150Marks

1. Project-I work decided in VII semester shall be continued as Project-II
2. Students should complete implementation of ideas given in synopsis/Abstract, so that project work should be completed before end of semester.
3. Project-II may involve fabrication, design , experimentation , data analysis within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability. The stage also includes testing , possible results and report writing
4. Each students project group is required to maintain log book for documenting various activities of Project-II and submit group project report at the end of Semester-VIII in the form of Hard bound.
    a. *Title*
    b. *Abstract*
    c.Introduction
    d. *Problem identification and project objectives*
    e. *Literature survey*
    f. Case study/Analysis/Design Methodology
    g. *Project design and implementation details*
    h. *Result and conclusion*
    i. Future scope
    j. references.

Guide lines for ICA : ICA shall be based on continuous evaluation of students performance throughout semester in project-II and report submitted by the students project group in the form Hard bound. Assessment of the project-II for award of ICA marks shall be done jointly by the guide and departmental committee as per the guidelines given in **Table-D.**

Guide lines for ESE:-

In ESE the student may be asked for demonstration and questions on Project. Evaluation will be based on answers given by students in oral examination.

Assessment of Project-II

Name of the Project: _____

Name of the Guide: _____

Table-D

		Assessment by Guide (50 Marks)				Assessment by Committee (25 Marks)		
SN	**Name of Student**	**Attendance , Participa-tion and team work**	**Material procurement / assembling/Designing/Programming**	**Case study/ Execution**	**Project Report**	**Dept of Understan-ding**	**Presentation**	**Total**
Marks		**10**	**15**	**15**	**10**	**10**	**15**	**75**