ACHARYA NAGARJUNA UNIVERSITY

A State Government University, Accredited with "A" Grade by NAAC

Nagarjuna Nagar - 522 510, Guntur, Andhra Pradesh, India.

M.Sc. ELECTRONICS & INSTRUMENTATION TECHNOLOGY

SYLLABUS

2022 - 2023 onwards

UNIVERSITY COLLEGE OF SCIENCES

PROGRAM CODE:

ANUCS08


ACHARYA NAGARJUNA UNIVERSITY
సత్యం సర్వం ప్రతిష్ఠితమ్

ABOUT UNIVERSITY

ACHARYA NAGARJUNA UNIVERSITY (ANU)

- A Brief Profile

Acharya Nagarjuna University, a State University established in 1976, has been constantly striving towards achieving progress and expansion during its existence for over four decades, in terms of introducing new courses in the University Colleges, affiliated colleges and professional colleges. Spread over 300 acres of land on the National High Way (NH-16) between Vijayawada and Guntur of Andhra Pradesh, the University is one of the front ranking and fastest expanding Universities in the state of Andhra Pradesh. The University was inaugurated on 11th September, 1976 by the then President of India, Sri Fakruddin Ali Ahmed and celebrated its Silver Jubilee in 2001. The National Assessment and Accreditation Council (NAAC) awarded "A" grade to Acharya Nagarjuna University and also has achieved 108 International ranks, 39 National ranks UI Green Metrics rankings and many more It is named after Acharya Nagarjuna – one of the most brilliant preceptors and philosophers, whose depth of thought, clarity of perception and spiritual insight were such that even after centuries, he is a source of inspiration to a vast number of people in many countries. The University is fortunate to be situated on the very soil where he was born and lived, a soil made more sacred by the aspiration for light and a state of whole someness by generations of students. With campus student strength of over 5000, the University offers instruction for higher learning in 68 UG & PG programs and guidance for the award of M.Phil. and Ph.D. in 48 disciplines spread over six campus colleges and one PG campus at Ongole. It also offers 160 UG programs in 440 affiliated colleges in the regions of Guntur and Prakasam Districts. It has a Centre for Distance Education offering 87 UG & PG programs. Characterized by its heterogeneous students and faculty hailing from different parts of the state and the country, the University provides most hospitable environment for pursuing Higher Learning and Research. Its aim is to remain connected academically at the forefront of all higher educational institutions. The University provides an excellent infrastructure and on- Campus facilities such as University Library with over one lakh books & 350 journals; Computer Centre; University Scientific Instrumentation Centre; Central Research Laboratory with Ultra-modern Equipment; Well-equipped Departmental Laboratories; Career Guidance and Placement Cell; Health Centre; Sports Facilities with Indoor & Outdoor Stadiums and Multipurpose Gym; Sports Hostel; Separate hostels for Boys, Girls, Research Scholars and International Students; Pariksha Bhavan (Examinations Building); Computers to all faculty members; Wi-Fi connectivity to all Departments and Hostels; Canteen, Student Centre & Fast-food Centre; Faculty Club; Dr. H.H. Deichmann & Dr. S.John David Auditorium cum Seminar Hall; Post office; Telecom Centre; State Bank of India; Andhra Bank; Energy Park; Silver Jubilee Park; Fish ponds; internet center; xerox center; cooperative stores; Water harvesting structures.

VISION, MISSION & OBJECTIVES OF THE UNIVERSITY

ACHARYA NAGARJUNA UNIVERSITY

VISION

To generate sources of knowledge that dispels ignorance and establish truth through teaching, learning and research.

MISSION

To promote a bank of human talent in diversified faculties – Commerce & Management Studies, Education, Engineering & Technology, Humanities, Law, Natural Sciences, Pharmacy, Physical Education & Sports Sciences, Physical Sciences and Social Sciences that would become an investment for a prosperous society.

OBJECTIVES

- To inspire and encourage all who would seek knowledge through higher education and research.
- To provide quality instruction and research for the advancement of science and technology.
- To promote teaching and research studies in disciplines of societal relevance.
- To bridge the gap between theory and practice of the principles of higher education.
- To develop human talent necessary for the industry.
- To open up avenues of higher education and research through non-formal means.
- To invite and implement collaborations with other institutes of higher learning on a continuous basis for mutual academic progress.
- To motivate and orient each academic department/centre to strive for and to sustain advanced levels of teaching and research so that the university emerges as an ideal institute of higher learning.
- To focus specially on the studies involving rural economy, justifying its existence in the rural setting.

VISION & MISSION OF THE COLLEGE

ACHARYA NAGARJUNA UNIVERSITY

UNIVERSITY COLLEGE OF SCIENCES

VISION OF THE COLLEGE:

University College of Sciences envisages to be a good team of people with scientific temperament, research bent and a flair for Teaching & Learning for the betterment of the Community, Society, State and the Country at large.

MISSION OF THE COLLEGE:

The College intends to incubate and nurture the Leaders, Mentors, Educators and researchers who can transform the country and contribute to advances in science while addressing the challenges faced by the society for the betterment of human life.

VISION & MISSION OF THE DEPARTMENT

ACHARYA NAGARJUNA UNIVERSITY
UNIVERSITY COLLEGE OF SCIENCES
DEPARTMENT OF ELECTRONICS & INSTRUMENTATION TECHNOLOGY
M.Sc. ELECTRONICS & INSTRUMENTATION TECHNOLOGY

VISION OF THE DEPARTMENT:

To become center of excellence in higher learning and research to produce creative solutions to societal needs.

MISSION OF THE DEPARTMENT:

- To make the Department of Electronics and Instrumentation Technology a preferable destination for admissions.
- To provide quality technical education using modern tools in the field of Electronics and Instrumentation Technology
- To create competent and skilled professionals who are well trained to design, implement and control electronics & instrumentation efficient systems
- To strive for continuous improvement in the quality of academics and inculcate professional ethical values among the students and the faculty members.
- To make the Department of Electronics and Instrumentation Technology learning and agile centre to nurture the spirit of innovation, creativity and entrepreneurship among the students and the faculty members.

ACHARYA NAGARJUNA UNIVERSITY
UNIVERSITY COLLEGE OF SCIENCES
DEPARTMENT OF ELECTRONICS & INSTRUMENTATION TECHNOLOGY
M.Sc. ELECTRONICS & INSTRUMENTATION TECHNOLOGY

PROGRAMME SPECIFIC OUTCOMES (PSO's):

After the completion of M.Sc., Electronics and Instrumentation Technology program, the students are expected to:	
PSO1	Design, implement and test Electronics and Communication systems using analytical knowledge and applying modern hardware and software tools
PSO2	Develop their skills to solve problems and assess social, environmental issues with ethics and manage different projects in multidisciplinary areas.
PSO3	To implant the capacity to apply the concepts of Electronics, Instrumentations, DSP, VLSI, Control systems etc., in the design, development and implementation of application oriented engineering systems.
PSO4	Ability to work in a team in sharing the knowledge learned exhibiting the effective individual talent
PSO5	Expected to develop professional ethics and demonstrate commitment to professional ethics; Ability to engage themselves in lifelong learning and teaching process

PROGRAMME OUTCOME (PO's):

PO1	To Excel in professional career and/or higher education by acquiring knowledge in measurements, transduction and instrumentation engineering principles.
PO2	To enhance knowledge to design & develop advanced instrumentation and automation systems for remote monitoring and control applications.
PO3	Analyze real life problems, design data acquisition systems with computing platforms appropriate to Electronics and Instrumentation that are economically feasible and acceptable
PO4	To acquire soft skills through teamwork, presentations, seminar and dissertation.
PO5	To serve research and development organizations to solve the problems raised in the industries and society and involve in lifelong learning.

STRUCTURE

ACHARYA NAGARJUNA UNIVERSITY

UNIVERSITY COLLEGE OF SCIENCES

DEPARTMENT OF ELECTRONICS & INSTRUMENTATION TECHNOLOGY

M.Sc. ELECTRONICS & INSTRUMENTATION TECHNOLOGY

TWO YEAR M.SC. COURSE IN ELECTRONICS AND INSTRUMENTATION TECHNOLOGY (2022-2023) COURSE STRUCTURE

SEMESTER-I

S. No.	Components of Study	Title of the Course	Title of the Paper	No. of Credits	Internal Assessment Marks	Semester end Examinations Marks	Total Marks
1.	Core-I	**E&IT 1.1 (22)**	Instrumentation Technology	4	30	70	100
2.	Core-II	**E&IT 1.2 (22)**	Advanced Analog and Digital Electronics	4	30	70	100
3.	Compulsory Foundation	**E&IT 1.3 (22)**	Sensors and Transducers	4	30	70	100
4.	Elective Foundation	**E&IT 1.4 (a) (22)**	1. Computer Programming in C	4	30	70	100
		E&IT 1.4 (b) (22)	2: Semiconductor Devices & Applications				
		E&IT 1.4 (c) (22)	3. Network Analysis				
5.	Practical-I		Analog and Digital Electronics	4	30	70	100
6.	Practical-II		Programming in "C" Language	4	30	70	100
TOTAL				**24**	**180**	**420**	**600**

Elective Foundation – Choose one paper.

Components	Weightage (%)
(Internals I& II)	30
End Semester Exams	70

SEMESTER – II

S. No.	Components of Study	Title of the Course	Title of the Paper	No. of Credits	Internal Assessment Marks	Semester end Examinations Marks	Total Marks
1.	Core-I	**E&IT 2.1(22)**	Electrical and Electronic instrumentation	4	30	70	100
2.	Core-II	**E&IT 2.2(22)**	Control Systems and Automation	4	30	70	100
3.	Compulsory Foundation	**E&IT 2.3 (22)**	Microprocessors and Microcontrollers	4	30	70	100
4.	Elective Foundation	**E&IT 2.4 (a) (22)**	Bio-Medical Instrumentation	4	30	70	100
		E&IT 2.4 (b)(22)	Computer Architecture & Organization				
		E&IT 2.4 (c) (22)	Artificial Neural Networks and Fuzzy Logics				
5.	Practical-II		Transducer & Instrumentation Laboratory	4	30	70	100
6.	Practical-IV		Microcontrollers Laboratory	4	30	70	100
TOTAL				**24**	**180**	**420**	**600**

Elective Foundation – Choose one paper

Components	Weightage (%)
(Internals I& II)	30
End Semester Exams	70

SEMESTER –III

S. No.	Components of Study	Title of the Course	Title of the Paper	No. of Credits	Internal Assessment Marks	Semester end Examinations Marks	Total Marks
1.	Core-I	**E&IT 3.1(22)**	Analytical Instrumentation	4	30	70	100
2.	Core-II	**E&IT 3.2(22)**	Embedded System	4	30	70	100
3	Compulsory foundation	**E&IT 3.3 (a) (22)**	Digital Signal Processing	4	30	70	100
		E&IT 3.3 (b) (22)	Analog Communications				
		E&IT 3.3 (c) (22)	Optical Communications				
4	Elective foundation	**E&IT 3.4 (a) (22)**	Industrial and Process Control Instrumentation	4	30	70	100
		E&IT 3.4 (b) (22)	System On Chip Design				
		E&IT 3.4 (c) (22)	Wireless Sensors & Networks				
5.	Practical-V		Advanced Instrumentation Laboratory	4	30	70	100
6.	Practical-VI		Embedded Systems Laboratory	4	30	70	100
TOTAL				**24**	**180**	**420**	**600**

Elective I – Choose one paper
Elective II – Choose one paper.

Components	Weightage (%)
(Internals I& II)	30
End Semester Exams	70

SEMESTER –IV

S. No.	Components of Study	Title of the Course	Title of the Paper	No. of Credits	Internal Assessment Marks	Semester end Examinations Marks	Total Marks
1.	Core-I	**E&IT 4.1(22)**	PC Based Instrumentation with Lab view	4	30	70	100
2.	Core-II	**E&IT 4.2(22)**	VLSI Design	4	30	70	100
3.	Practical-VII		Virtual Instrumentation Laboratory	4	30	70	100
4.	Project Work*						300
TOTAL							

Components	Weightage (%)
(Internals I& II)	30
End Semester Exams	70

SCHEME OF EXAMINATION

TITLE OF THE PAPER	SCHEME OF EXAMINATION			
	Internal Assessment	External Assessment	No. of Credits	Total Marks
I SEMESTER				
E&IT-1.1: Instrumentation Technology	30	70	4	100
E&IT-1.2: Advanced Analog and Digital Electronics	30	70	4	100
E&IT-1.3: Sensors and Transducers	30	70	4	100
E&IT-1.4(a): Computer Programming in C	30	70	4	100
E&IT-1.4 (b) : Semiconductor Devices & Applications	30	70	4	100
E&IT-1.4 (c) : Network Analysis	30	70	4	100
Lab 1: Analog and Digital Electronics	30	70	4	100
Lab 2: Programming in "C" Language	30	70	4	100
II SEMESTER				
E&IT-2.1: Electrical and Electronic instrumentation	30	70	4	100
E&IT-2.2: Control Systems and Automation	30	70	4	100
E&IT-2.3: Microprocessors and Microcontrollers	30	70	4	100
E&IT-2.4(a): Bio-Medical Instrumentation	30	70	4	100
E&It-2.4(b) : Computer Architecture & Organization	30	70	4	100
E&IT-2.4 (c) : Artificial Neural Networks and Fuzzy Logics	30	70	4	100
MOOCS				
Lab 3: Transducer & Instrumentation Laboratory	30	70	4	100
Lab 4: Microcontrollers Laboratory	30	70	4	100
III SEMESTER				
E&IT-3.1: Analytical Instrumentation	30	70	4	100
E&IT-3.2: Embedded System	30	70	4	100
E&IT-3.3(a): Digital Signal Processing	30	70	4	100
E&IT-3.3(b): Analog Communications	30	70	4	100
E&IT-3.3(c): Optical Communications	30	70	4	100
E&IT-3.4(a): Industrial and Process Control Instrumentation	30	70	4	100
E&IT-3.4(b): System On Chip Design	30	70	4	100
E&IT-3.4(c) : Wireless Sensors & Networks	30	70	4	100
MOOCS				
Lab 5: Embedded Systems Laboratory	30	70	4	100
Lab 6: Advanced Instrumentation Laboratory	30	70	4	100
IV SEMESTER				
E&IT-4.1: PC Based Instrumentation with Labview	30	70	4	100
E&IT-4.2: VLSI Design	30	70	4	100
Lab 7: Virtual Instrumentation Laboratory	30	70	4	100
Project Work*	-	-	10	300
TOTAL FOR CORE PAPERS			**94**	
GRAND TOTAL			**94**	**2400**

FIRST SEMESTER

ACHARYA NAGARJUNA UNIVERSITY

UNIVERSITY COLLEGE OF SCIENCES

DEPARTMENT OF ELECTRONICS & INSTRUMENTATION TECHNOLOGY

M.Sc. ELECTRONICS & INSTRUMENTATION TECHNOLOGY

SEMESTER-I

S. No.	Components of Study	Title of the Course	Title of the Paper	No. of Credits	Internal Assessment Marks	Semester end Examinations Marks	Total Marks
1.	Core-I	**E&IT 1.1 (22)**	Instrumentation Technology	4	30	70	100
2.	Core-II	**E&IT 1.2 (22)**	Advanced Analog and Digital Electronics	4	30	70	100
3.	Compulsory Foundation	**E&IT 1.3 (22)**	Sensors and Transducers	4	30	70	100
4.	Elective Foundation	**E&IT 1.4 (a) (22)**	1. Computer Programming in C	4	30	70	100
		E&IT 1.4 (b) (22)	2: Semiconductor Devices & Applications				
		E&IT 1.4 (c) (22)	3. Network Analysis				
5.	Practical-I		Analog and Digital Electronics	4	30	70	100
6.	Practical-II		Programming in "C" Language	4	30	70	100
TOTAL				**24**	**180**	**420**	**600**

Elective Foundation – Choose one paper.

Components	Weightage (%)
(Internals I& II)	30
End Semester Exams	70

Theory: Course Code, Course Title	E & IT 1.1(22): INSTRUMENTATION TECHNOLOGY	Credits: 4
Unit -1	**INSTRUMENTS AND THEIR CLASSIFICATION:** Typical Applications of Instrument systems. Functional elements of Instrumentation and measuring systems. Standards and Calibrations. Introduction to errors and uncertainties in the measurement of performance parameters of instruments. Propagation of uncertainties in compound quantities. Order of instruments: Zero, First, Second and Nth order instruments. Null & Deflection, Manual & Automatic, Self generating & Power operated, Proximity& Non-proximity types, Analogue & Digital types.	**Hours* 12**
Unit -2	**INSTRUMENTS STATIC PERFORMANCE CHARACTERISTICS:** Static: Static performance parameters (characteristics) Accuracy, Precision, Resolution, Threshold, Sensitivity, Linearity, Hysteresis, Dead band, Backlash, Drift, Span. Impedance loading and Matching. Specifications of an instrument. Selection of an instrument.	**12**
Unit -3	**INSTRUMENTS DYNAMIC PERFORMANCE CHARACTERISTICS:** Dynamic: Introduction, Formulation of system equations, Dynamic Response of first order and second order instrument to periodic-Harmonic, Non-Harmonic, Transient and Random input signals, compensations.	**12**
Unit -4	**DATA PRESENTATION ELEMENTS:** Digital display modules: LED, 7-seg displays, LCD, Dot matrix and graphical display modules. Recorders -Basic recoding systems. Strip chart recorder. Galvanometer and Potentiometer type recorder. X-Y recorder (direct and null type).Servo recorder. Thermal type recorder. Data logger.	**12**
Unit -5	**CALIBRATION OF MEASURING INSTRUMENTS:** Calibration: Calibration of measuring instruments, Primary calibration, secondary calibration and field calibration. Calibration methods for different parameters (temperature, pressure, humidity, flow...etc.). Automatic Calibration mechanisms. Applications: Periodic laboratory and field calibrations of sensors (Eg: Temperature and humidity sensors, Carbon dioxide sensors, Level sensors)	**12**

TASKS AND ASSIGNMENTS:

BOOKS FOR STUDY:

1) Instrumentation measurement & analysis-Nakra/Choudhary (Unit I, II, III)
2) A Course in Mechanical Measurements & Instrumentation – A. K. Sawhney (Unit I, II, III).
3) Measurement and Instrumentation Principles - Morris, Alan S
4) Mechanical Measurements – Beckwith, Marangoni, Lienhard
5) Measurement of systems - Application and design - Earnest O. Doeblin

6) Electronic Instrumentation and Measurement Technique - Albert D Helfrick.
7) An Introduction to Error Analysis by John R. Taylor.

REFERENCE BOOKS:

1) Instrumentation devices & systems-Rangan, Mani, Sharma(Unit I,II,III)
2) Measurement of systems—Application and design—Earnest O. Doeblin
3) Electronic Instrumentation and Measurement Technique—William David Cooper & Albert D Helfrick.
4) Transducers – Neubert.
5) Mechanical Measurements – Beckwith, Marangoni, Lienhard.
6) Numerical Methods for Scientists and Engineers, S. R. Iyangar& M. K. Jain, PHI, 1999.
7) A Textbook of Computer Oriented Numerical Methods & Linear Programming, G. K. Ranganath, B. Suryanarayana, Chand Publications.

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	✈ Leaning concept of instrumentation and measuring systems ✈ To learn basic knowledge of order of instruments ✈ Learn about proximity and non proximity types	**Remember**
CO 2	✈ Students will learn the performance characteristics of instruments ✈ To learn Hysteresis ✈ Learn about specifications of instruments	**Analyze**
CO 3	✈ Leaning concept of formulation of systems ✈ To learn basic knowledge of order of instruments ✈ To learn about transient and random signals	**Understand**
CO 4	✈ Studying the working of display modules ✈ Learn about different types of recorders	**Skill**
CO 5	✈ Leaning concept of calibration methods ✈ Learning the various calibrations of sensors	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	2	2	3
CO3	2	2	2	3	2
CO4	3	3	2	3	3
CO5	2	3	2	2	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal I & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 =70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**E & IT 1.2(22): ADVANCED ANALOG AND DIGITAL ELECTRONICS**	Credits: 4
Unit -1	**POWER SUPPLIES AND REGULATION:** Electronic Transport in semiconductor, PN junction, Diode equation and diode equivalent circuit. Breakdown in diodes, Zener diodes, Tunnel diode, Semiconductor diodes. Rectifier circuits, Peak detector, voltage doublers, Shunt regulator using zener diodes. Filters - RC, LC, Π- sections. DC voltage regulation, Zener and Electronic regulation.LM-723 Regulator and three terminal regulators, Switch Mode Regulated Power Supplies (SMPS).Buck, Boost Buck Boost and Resonant Converters	**Hours* 12**
Unit -2	**ANALYSIS OF POWER AMPLIFIERS:** Concept of an amplifier, Amplifier parameters, CE, RC coupled and transformer coupled amplifier - frequency response. Classification of amplifiers, class- A power amplifier, efficiency and crossover distortion, class- B push pull amplifier, single tuned and double tuned amplifier. Classification of feedback amplifiers, Effect of negative feedback on amplifier performance.	**12**
Unit -3	**OPERATIONAL AMPLIFIERS:** Introduction to Operational Amplifiers. Characteristics of an Ideal and Practical operational amplifier. Circuit details of typical operational amplifier and equivalent circuits. Operational amplifier configurations, Current and Voltage followers, Summing, scaling and averaging amplifiers. Integrator, Differentiator, Schmitt trigger, sample and hold, Logarithmic and Anti- logarithmic amplifier, Differential amplifier, Instrumentation amplifier, I/V and V/I converters, Precision rectifiers, Peak detectors - analog multiplexers, Active Filters –LPF, HPF, BPF, Higher order and their comparison.	**12**
Unit -4	**OSCILLATORS AND TIMER** Oscillator principles, oscillator types, frequency stability, Phase shift oscillator, Wein bridge oscillator, Quadrature oscillator, Multivibrators, IC-555 Timer - Internal block diagram of 555 IC timer, Astable, Monostable multivibrators, Timer applications. Phase Locked Loops- operating principles, monolithic phase locked loops, 565 applications.	**12**
Unit -5	**DIGITAL ELECTRONICS** Number system: Binary, Decimal and Hexa-decimal number' system. Conversions to each other. Binary coded decimal (BCD - 8421) and gray code, conversion between Binary and gray code. The ASCII code (American Standard Code for information. interchange). Logic Gates TTL and CMOS logic & characteristics - Arithmetic and Logic circuits, Sequential Logic, Flip-Flops, Registers, Counters. 74193 counter - Interfacing devices- buffers, decoders, BCD-to-7 segment decoder/driver, encoders, latches, Multiplexers, De-multiplexers, Magnitude comparator and tri-state buffers. Data converters ADC and DAC.	**12**

TASKS AND ASSIGNMENTS:

BOOKS FOR STUDY:

1) Electronic Devices and Circuit Theory Nishalisky and Robert Boylestad.
2) Operational Amplifiers-Ramakant Gayakwad.
3) Digital Principles – Malvino& Leach (Unit IV)
4) Linear Integrated Circuits-D.Roy Choudhury Shail B.Jain

REFERENCE BOOKS:

1) Operational Amplifiers and Characteristic- Robert G Irvine
2) An introduction to operational Amplifiers and their Applications –S.V.Subrahmanyam, Y.Narasimha Murthy - Macmillan.

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	✦ Leaning concept of semiconductors characteristics ✦ To learn basic knowledge of voltage regulators ✦ Learn about power supplies and regulation methods	Remember
CO 2	✦ Leaning concept of amplifiers ✦ To learn basic knowledge of frequency response of amplifiers ✦ Learn about effect of feed-back on amplifier performance	Analyze
CO 3	✦ Leaning concept of ideal and practical characteristics of amplifiers ✦ To learn basic knowledge of op amp applications ✦ Learn about working of special purpose amplifiers	Understand
CO 4	✦ Leans about the basic principle of oscillators ✦ Gains the basic knowledge of PLL ✦ Learns both theory and practical applications of IC555	Skill
CO 5	✦ Gains the basic knowledge of digital electronics ✦ Will learn about logic families ✦ Learn about converters and their applications	Apply

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	2	2
CO2	3	3	2	3	3
CO3	2	2	2	3	2
CO4	2	2	3	3	3
CO5	3	2	3	2	2

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	20	20	20	20	20	100

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal 1 & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 = 70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**E & IT 1.3 (22): SENSORS AND TRANSDUCERS**	Credits: 4
Unit -1	**FUNDEMENTAL OF SENSORS AND TRANSDUCERS:** Introduction and Classifications of Sensors and Transducers - - Physical Principles of Sensing - Electric Charges, Fields, and Potentials - Capacitance - Magnetism - Induction - Resistance - Piezoelectric Effect - Pyroelectric Effect - Hall Effect –Seebeck and Peltier Effects -Sound Waves - Temperature and Thermal Properties of Materials -Heat Transfer –Light.	**Hours* 12**
Unit -2	**DISPLACEMENT, PRESSURE AND FLOW SENSORS:** Position, Displacement, and Level, Force, Strain, and Tactile Sensors, Pressure Sensors, Flow Sensors.	**12**
Unit -3	**TEMPERATURE, CHEMICAL AND FILM SENSORS:** Temperature Sensors, Chemical Sensors, Thin and Thick Film sensors And Their Processing Methods, Light Detectors.	**12**
Unit -4	**ADVANCED SENSORS:** MEMS: Introduction – Sensor Materials - Surface processing techniques - R&D on MEMS - Current and Future Technology - The NANO/MEMS Program.	**12**
Unit -5	**APPLICATIONS OF ADVANCED SENSORS:** MEMS Applications: Energy Management, Medical Industry. Automotive Applications of Microelectromechanical Systems (MEMS), Military Applications, Communication Systems.	**12**

TASKS AND ASSIGNMENTS:

BOOKS FOR STUDY:

1) Handbook of Modern Sensors - Physics, Designs and Applications (3rd Edition) Search Within, Jacob © 2004 Springer – Verlag. (Units – I,II,III)
2) Sensors Handbook – SabrieSoloman, McGraw-Hill (Second ed.,)(Unit-IV)

REFERENCE BOOKS:

1) Instrumentation measurement analysis - Nakra and Choudary (Unit I)
2) Industrial Control Electronics – Michel Jacob
3) Measurement of systems—Application and design — Earnest O Doeblin
4) Hand Book of Biomedical Instrumentation –R S Khandpur (TMH)

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	⅄ Leaning concept of electric charge and potentials ⅄ To learn basic knowledge of sensors electromagnetic field effects ⅄ Learn about properties of materials	**Remember**
CO 2	⅄ Learns concept of force and strain measuring using sensors ⅄ To learn the working principle of temperature sensors	**Analyze**
CO 3	⅄ Will learn the fabrication process of thin and thick film sensors ⅄ To learn about the working principle of chemical sensors ⅄ Learn about working of light detectors	**Understand**
CO 4	⅄ Leaning concept of sensor materials and processing techniques ⅄ To learn about the applications of sensors in R&D ⅄ Learn the concept of Nano and MEMS	**Skill**
CO 5	⅄ Leaning concept of MEMS ⅄ To learn about the advanced applications of MEMS	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	2	2	3	2	2
CO3	3	2	3	3	3
CO4	3	3	2	2	2
CO5	3	2	3	3	2

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
TOTAL	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal 1 & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	6	6	6	6	6

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 = 70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**ELECTIVE FOUNDATION: E & IT 1.4. A (22): COMPUTER PROGRAMMING IN C**	Credits: 4
Unit -1	**INTRODUCTION TO COMPUTERS AND BASICS OF C LANGUAGE** Basic principle and working of computers. Need for programming languages. Machine and user oriented languages. Assemblers and compilers. Elements of computer programming. Algorithm, Flow chart, Syntax and Semantic errors. Introduction to operating systems - Windows and Linux. Overview of C: Basic Structure of C Programs , Executing a 'C' Program, Constants, Variables, and Data Types : Constants, Variables, Data Types, Declaration of Variables, Declaration of Storage Class, Assigning Values to Variables.	**Hours* 12**
Unit -2	**DATA I/O, EXPRESSIONS, BRANCHING** Input and Output Operations: Reading a Character, Writing a Character, Formatted Input, Formatted Output. Operators and Expressions : Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Some Computational Problems, Type Conversions in Expressions, Operator Precedence and Associatively, Mathematical Functions. Decision Making and Branching: Decision Making with if Statement, Simple if Statement, The if.....else Statement, Nesting of if....else Statements, The Else if Ladder, The Switch Statement, The ? : Operator, The Goto Statement. Decision Making and Looping; The While Statement, The do Statement, The for Statement, Jumps in Loops.	**12**
Unit -3	**ARRYAS, FUNCTIONS AND STRUCTURES** Arrays: One-dimensional Arrays, Declaration of One-dimensional Arrays, Initialization of One-dimensional Arrays, Two-dimensional Arrays, Initializing Two-dimensional Arrays, Multi-dimensional Arrays: Functions: Elements of User-defined Functions, Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions, Passing Arrays to Functions, The Scope, Visibility and Lifetime of Variables. Structures and Unions: Defining a Structure, Declaring Structure Variables, Accessing Structure Members, Structure Initialization, Copying and Comparing Structure Variables.	**12**
Unit -4	**POINTERS, AND APPLICATIONS OF 'C'** Pointers: Understanding , Accessing the Address of a Variable , Declaring Pointer Variables, Initialization of Pointer Variables, Accessing a Variable through its Pointer, Chain of Pointers, Pointer Expressions, Pointer Increments and Scale Factor, Pointers and Arrays, Pointers and Character Strings, Array of Pointers, Pointers as Function Arguments, Functions Returning Pointers, Pointers to Functions, Pointers and Structures.	**12**
Unit -5	**FILE MANAGEMENT USING 'C' LANGUAGE:** File Management in C: Defining and Opening a File, Closing a File, Input/ Output Operations on Files, Error Handling during I/O Operations, Random Access to Files. Accessing hardware of computer, I/O applications through printer port .C programming for the solutions of problems using numerical methods.	**12**

TASKS AND ASSIGNMENTS:

BOOKS FOR STUDY:

1) Programming in ANSI 'C' – E. Balagurusamy (Unit I, II, III & IV)
2) Let us 'C' – YeshwanthKanetkar (Unit I, II, III & IV)
3) Numerical Methods in C – J.G.Kori (Laxmi Publication Pvt.Ltd., New Delhi) (for Laboratory purpose)

REFERENCE BOOKS:

1) Numerical Methods for Scientists and Engineers, S. R. Iyangar & M. K. Jain, PHI, 1999.
2) A Textbook of Computer Oriented Numerical Methods & Linear Programing, G. K.
3) Ranganath, B. Suryanarayana, Chand Publications. Programming in C, V. Rajarama

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	✈ Leaning concept of generations and developments of computers ✈ To learn basic knowledge of data types ✈ Learn about assigning variables	Remember
CO 2	✈ Leaning concept of various operators ✈ To learn basic knowledge of loops ✈ Learn about branching	Analyze
CO 3	✈ Leaning concept of arrays and corresponding programms ✈ To learn basic knowledge of functions ✈ Learn about usage of structures in c	Understand
CO 4	✈ Leaning concept of variables ✈ To learn basic knowledge of pointers and arrays ✈ Learn about pointers and structures	Skill
CO 5	✈ Leaning concept of file handling in c ✈ To learn basic knowledge of i/o operations ✈ Learn about i/o applications	Apply

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	2
CO2	3	3	3	3	2
CO3	2	3	2	2	3
CO4	3	3	2	2	3
CO5	2	2	3	3	2

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal 1 & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 = 70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**ELECTIVE FOUNDATION:** **E & IT 1.4 B (22): SEMICONDUCTOR DEVICES & APPLICATIONS**	Credits: 4
Unit -1	**Introduction to Semiconductor Physics:** Energy Band and Charge Carriers: Energy bands in semiconductors, Types of semiconductors, Charge carriers, Intrinsic and extrinsic materials. Carrier concentration: Fermi Level, Electron and hole concentration equilibrium, Temperature dependence of carrier concentration, Compensation and charge neutrality.	**Hours* 12**
Unit -2	**Properties of Semiconductors and Mechanism:** Conductivity and mobility, Effect of temperature, Doping and high electric field, Hall Effect, Diffusion and drift of excess carriers, Recombination mechanism, Trapping, Shockley–Read–Hall theory, Continuity Equation, Diffusion Length.	**12**
Unit -3	**P-N Junction Diode:** Diffusion potential, Depletion region. Junction capacitance for an abrupt junction. Current voltage characteristics-Schottky equation. Photo-voltaic effect in Pnjunction.Zener Diode: Junction Break down, tunneling and avalanche multiplication I-V characteristics, maximum rating of a Zener diode, application of Zener diode in voltage regulation.	**12**
Unit -4	**Bipolar Junction Transistor (BJT):** Basic current-voltage characteristics, current gain, Device Modelling: Ebers-Mol model. Junction Field Effect Transistor (JFET): Basic current-voltage characteristics for uniform charge distribution, Diffusion of the linear saturation and breakdown regions in the I-V characteristics Equivalent circuit of JFET and frequency limitations.	**12**
Unit -5	**Metal semiconductor junction and MOSFET :** Metal semiconductor junction, Shottky effect; MOSFET: Different types of MOSFET: depletion and enhancement, n-channel and p-channel; Basic device characteristics, comparison of JFET and MOSFET.	**12**

TASKS AND ASSIGNMENTS:

BOOKS & REFERENCE BOOKS:

1) Streetman, B. and Banerjee, S., Solid State Electronics, Prentice Hall India, (2006).
2) Sze, S.M., Physics of Semiconductor Devices, John Wiley, (1981).
3) Solid state Electron Devices-B. G. Streetman.
4) Physics of semiconductor Devices-S. M. Sze.
5) Semiconductor Physics and Device – Neamen, McGraw Hill 3/e
6) Electronic Devices & Circuits – J. Millman and C. C. Halkias.

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	✦ Leaning concept of electrons flow in semiconductor ✦ To learn basic knowledge of temperature effect in semiconductors.	Remember
CO 2	✦ Leaning concept of diffusion and drift ✦ To learn basic knowledge of order of instruments ✦ Learn about properties of semiconductors.	Analyze
CO 3	✦ Leaning concept of semiconductor diode ✦ To learn basic knowledge of barrier breakdown in semiconductors ✦ Learn about applications of semiconductors.	Understand

CO 4	⅄ Leaning concept of FET ⅄ To learn basic knowledge of V-I characteristics of JFET.	Skill
CO 5	⅄ Leaning concept of MOSFET ⅄ To learn basic knowledge of various types of MOSFET.	Apply

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	3	3	2
CO2	3	3	2	2	3
CO3	3	2	3	2	3
CO4	2	2	3	3	2
CO5	3	3	3	2	2

EVALUATION SCHEME:

	CO1	**CO2**	**CO3**	**CO4**	**CO5**	**Total**
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal 1 & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Part – A Essay Type (Either/OR-type Question) 14 x 5 = 70 Marks	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**ELECTIVE FOUNDATION:** **E & IT 1.4 C (22): NETWORK ANALYSIS**	Credits: 4
Unit -1	**Introduction to Electrical Circuits:** Network elements classification, Electric charge and current, Electric energy and potential, Resistance parameter – series and parallel combination, Inductance parameter – series and parallel combination, Capacitance parameter – series and parallel combination. Energy sources: Ideal, Non-ideal, Independent and dependent sources, Source transformation, Kirchoff's laws, Mesh analysis and Nodal analysis problem solving with resistances only including dependent sources also.	**Hours* 12**
Unit -2	**A.C Fundamentals and Network Topology:** Definitions of terms associated with periodic functions: Time period, Angular velocity and frequency, RMS value, Average value, Form factor and peak factor- problem solving, Phase angle, Phasor representation, Addition and subtraction of phasors, mathematical representation of sinusoidal quantities, explanation with relevant theory, problem solving. Principles of Duality with examples. Network Topology: Definitions of branch, node, tree, planar, non-planar graph, incidence matrix, basic tie set schedule, basic cut set schedule.	**12**
Unit -3	**Steady State Analysis of A.C Circuits:** Response to sinusoidal excitation - pure resistance, pure inductance, pure capacitance, impedance concept, phase angle, series R-L, R-C, R-L-C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving.	**12**
Unit -4	**Network Theorems:** Thevinin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition, Max Power Transfer, Tellegens- problem solving using dependent sources also.	**12**
Unit -5	**Two-Port Networks:** Relationship of two port networks, Z-parameters, Y- parameters, Transmission line parameters, h-parameters, Inverse h- parameters, Inverse Transmission line parameters, Relationship between parameter sets, Parallel connection of two port networks, Cascading of two port networks, series connection of two port networks, problem solving including dependent sources also.	**12**

TASKS AND ASSIGNMENTS:

TEXT BOOKS:

1) Network Analysis – ME Van Valkenburg, Prentice Hall of India, 3rd Edition, 2000.
2) Network Analysis by K.Satya Prasad and S Sivanagaraju, Cengage Learning
3) Electric Circuit Analysis by Hayt and Kimmarle, TMH

REFERENCE BOOKS:

1) Network lines and Fields by John. D. Ryder 2nd edition, Asia publishing house.
2) Basic Circuit Analysis by DR Cunninghan, Jaico Publishers.
3) Network Analysis and Filter Design by Chadha, Umesh Publications.

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	⮝ Leaning concept of network elements ⮝ To learn basic knowledge of kirchoffs laws.	Remember
CO 2	⮝ Leaning concept of network topology ⮝ To learn basic knowledge of phase representation.	Analyze
CO 3	⮝ Leaning concept of R_L_C circuits ⮝ To learn basic knowledge of R-L-c problem solving methods.	Understand
CO 4	⮝ Leaning concept of network theorems.	Skill
CO 5	⮝ Leaning concept of Network parameters ⮝ To learn basic knowledge of connections of network ports.	Apply

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	3
CO2	2	2	3	3	3
CO3	3	3	3	2	2
CO4	2	3	2	3	2
CO5	2	2	3	2	3

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
TOTAL	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal 1 & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14x 5 = 70 Marks	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

PRACTICAL-I: ADVANCED ANALOG AND DIGITAL ELECTRONICS

	Credits: 4
LIST OF EXPERIMENTS:	**HOURS**
1) IC-723 Voltage Regulator	**3**
2) Current to Voltage converter	**3**
3) Instrumentation Amplifier	**3**
4) High pass first older & second order filter	**3**
5) Low pass first older & second order filter	**3**
6) The IC-555 as Astable Multivibrator	**3**
7) Counters IC 74193	**3**
8) 7447 BCD to Seven Segment Decoder Driver	**3**
9) Wein Bridge Oscillator	**3**
10) Digital to Analog Converter DAC 0800	**3**
11) A/D Converter 0800	**3**
12) F/V converter using LM-331	
TASKS AND ASSIGNMENTS:	
1) Virtually executing the experiments	
2) Observation submission	
3) Viva-Voce	
4) Practical Examination	

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	➢ To learn basic knowledge of voltage regulators ➢ Learn about power supplies and regulation methods	**Remember**
CO 2	➢ Leaning concept of amplifiers ➢ To learn basic knowledge of frequency response of amplifiers	**Analyze**
CO 3	➢ Leaning concept of ideal and practical characteristics of amplifiers ➢ To learn basic knowledge of op amp applications	**Understand**
CO 4	➢ Leans about the basic principle of oscillators ➢ Learns both theory and practical applications of IC555	**Skill**
CO 5	➢ Gains the basic knowledge of digital electronics ➢ Learn about converters and their applications	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	3	3
CO2	3	3	2	2	2
CO3	2	2	3	3	2
CO4	3	3	3	2	2
CO5	2	2	2	1	2

PRACTICAL-II: PROGRAMMING "C" LANGUAGE

	Credits: 4
LIST OF EXPERIMENTS:	**HOURS**
1) Write a "C" program for addition of two matrices?	**3**
2) Write a "C" program to find transpose of matrices?	**3**
3) Write a "C" program to find the trace of the matrices?	**3**
4) Write a "C" program for electricity Bill taking Different readings using Nested IF Else statements?	**3**
5) Write a "C" program to find the numbers i) Prime Number or Not ii) Perfect Number or Not iii) Deficient or Not	**3** **3**
6) Write a "C" program to find numbers i) Armstrong or NOT ii) Strong or NOT	**3**
7) Write a "C" program to find the statistical parameters from an array of numbers i) Mean ii) Mode iii) Variance iv) Standard Deviation	**3**
TASKS AND ASSIGNMENTS: 1) Virtually executing the experiments 2) Observation submission 3) Viva-Voce 4) Practical Examination	

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	⮝ To learn basic knowledge of data types ⮝ Learn about assigning variables	**Remember**
CO 2	⮝ Leaning concept of various operators ⮝ To learn basic knowledge of loops	**Analyze**
CO 3	⮝ Leaning concept of arrays and corresponding programms ⮝ To learn basic knowledge of functions	**Understand**
CO 4	⮝ Leaning concept of variables ⮝ To learn basic knowledge of pointers and arrays	**Skill**
CO 5	⮝ Leaning concept of file handling in c ⮝ To learn basic knowledge of i/o operations	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	2	2	2	2	2
CO3	3	3	2	2	3
CO4	2	3	2	3	2
CO5	3	2	3	3	2

SECOND SEMESTER

M.Sc. ELECTRONICS & INSTRUMENTATION TECHNOLOGY

SEMESTER – II

S. No.	Components of Study	Title of the Course	Title of the Paper	No. of Credits	Internal Assessment Marks	Semester end Examinations Marks	Total Marks
1.	Core-I	**E&IT 2.1(22)**	Electrical and Electronic instrumentation	4	30	70	100
2.	Core-II	**E&IT 2.2(22)**	Control Systems and Automation	4	30	70	100
3.	Compulsory Foundation	**E&IT 2.3 (22)**	Microprocessors and Microcontrollers	4	30	70	100
4.	Elective Foundation	**E&IT 2.4 (a) (22)**	Bio-Medical Instrumentation	4	30	70	100
		E&IT 2.4 (b)(22)	Computer Architecture & Organization				
		E&IT 2.4 (c) (22)	Artificial Neural Networks and Fuzzy Logics				
5.	Practical-II		Transducer & Instrumentation Laboratory	4	30	70	100
6.	Practical-IV		Microcontrollers Laboratory	4	30	70	100
TOTAL				**24**	**180**	**420**	**600**

Elective Foundation – Choose one paper

Components	Weightage (%)
(Internals I& II)	30
End Semester Exams	70

Theory: Course Code, Course Title	**E & IT 2.1 (22): ELECTRICAL AND ELECTRONIC INSTRUMENTATION**	Credits: 4
Unit -1	**ANALOG INSTRUMENTS:** Principle, Operation and constructional details of PMMC moving coil galvanometer, Moving Iron galvanometer, DC Ammeters, DC voltmeters. Ohmmeters: Series type, shunt type meters. Extension of ranges of meters. AC meters – Electrodynamometers, Rectifier type and Thermal type Errors and their compensation. Design and constructional details of multimeters.	**Hours* 12**
Unit -2	**POWER & ENERGY METERS AND INSTRUMENT TRANSFORMERS:** Electrodynamometer type (power) watt meters-methods of connection, errors and their compensation. Principle, Operation, Constructional details of Hall-effect and thermal type watt meters. Principle and construction of electro-dynamometers, watthour meters, power factor meter, Instrument transformers – Phaser diagram, expression for ratio and phase angle, applications of CTs and PTs.	**12**
Unit -3	**MEASURING INSTRUMENTS:** Introduction, Output power meters, Field strength meters, Stroboscope, Phase Meter,Vector Impedance Meter (Direct Reading) Q-Meter, LCR Bridge, RX meters, Automatic Bridges, Transistor Tester, Megger, Analog pH meter.	**12**
Unit -4	**PRECISION ANALOG MEASURING INSTRUMENTS:** Electronic voltmeter (Transistor and FET versions).DC and AC Milli/Micro voltmeters, Nano-ammeter. Analog frequency meter. Analog phase meter. Cathode Ray Oscilloscope- Signal beam, Dual trace, Dual beam.	**12**
Unit -5	**DIGITAL MEASURING INSTRUMENTS & WAVEFORM GENERATORS:** Digital voltmeter, Digital multimeter, Introduction to ICL 7106/7107 DVM I.C, Digital frequency meter, Digital phase meter, Storage Oscilloscope, Digital Storage Oscilloscope and Sampling Oscilloscopes. Sine/Square Wave Generator.R.F. Signal Generator.Standard Signal Generator. Function Generator.	**12**

TASKS AND ASSIGNMENTS:

BOOKS FOR STUDY:

1) Electronic Instrumentation and Measuring Techniques- Cooper (Unit I, II)
2) A course in Electrical and Electronic Measurements and Instrumentation-A K Sawhney (Unit I, II, & III)
3) Electronic Instrumentation - H S Kalsi (Unit III,IV)

REFERENCE BOOKS:

1) Electronic Measurements and Instrumentation – Oliver & Cage
2) Instrumentation Devices and Systems- Rangan, Mani and Sharma
3) Experiments in Electronics- Subramanyam
4) Electrical Measurements and Measuring Instruments- Goldings & Widdis

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	✦ Leaning concept of moving coil instrument working ✦ To learn basic knowledge of ac and dc meters ✦ Learn about multimeters	Remember
CO 2	✦ Leaning concept of meters methods of connection ✦ To learn basic knowledge of Hall Effect ✦ Learn about CT's and PT's usage in Electrical	Analyze
CO 3	✦ Students should be able to understand different meters working principle ✦ To understand working principle of bridges	Understand
CO 4	✦ Leaning concept of meters to measure both ac and dc values ✦ To learn basic knowledge of CRO ✦ Learn about applications of oscillators	Skill
CO 5	✦ Understands the universal counter working principle ✦ To know how to generate different wave forms using wave form generators. ✦ Learn about signal generators	Apply

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	2	2
CO2	3	3	2	3	3
CO3	2	2	2	3	2
CO4	2	2	3	3	3
CO5	3	2	3	2	2

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	20	20	20	20	20	100

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal 1 & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal 1 & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 = 70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**E & IT 2.2. (22): CONTROL SYSTEMS AND AUTOMATION**	Credits: 4
Unit -1	**INTRODUCTION TO CONTROL SYSTEMS** Basic elements in control systems, Open-loop, closed-loop control systems. Types of control systems linear and non-linear, Time-invariant and Time-varying, continuous and sampled data and digital control, Effects of Feedback on-Overall Gain, Stability, Sensitivity, Bandwidth and Noise. Transfer function-AC and DC servomotors. Block Diagram Algebra, Block diagram reduction techniques – Signal flow graphs.	**Hours* 12**
Unit -2	**TIME RESPONSE :** Time response: – Time domain specifications, Standard Test Signals, Time Response of First and second order system. Design Specifications of Second Order System. Performance Indices. Static error coefficients, Generalized error series – Steady state errors, Effects of P, PI, PID modes of feedback control –Time response analysis.	**12**
Unit -3	**STABILITY CRITERION:** Concept of Stability, Necessary condition for Stability. Hurwitz stability Criterion. Routh stability criterion. Relative stability Analysis. Roots-Locus concepts. Construction of root-loci. Rules for constructing Root-loci. Root-locus Analysis of control System. Determination of roots from root locus, root contours	**12**
Unit -4	**FREQUENCY RESPONSE ANALYSIS:** Introduction, correlation between time and frequency responses. Polar plots, Bode plots. All pass and minimum phase systems, Experimental determination of transfer functions. Bode plots. Introduction to mathematical preliminaries. Nyquist stability Criterion. Assessment of relative stability. Stability Analysis Gain Margin (GM) and Phase Margin (PM) Closed-loop Frequency response. Constant M and N circles. Nicholas Chart.	**12**
Unit -5	**STATE VARIABLE ANALYSIS AND DESIGN:** Concept of state, State variables and state model. State models for Linear continuous and Time-varying system. Diagonalization. State transition matrix. Solutions of state equations. Concepts of Controllability and observability. State variables and linear discrete time system.	**12**

TASKS AND ASSIGNMENTS:

BOOKS FOR STUDY:

1) Control Systems Engineering – Nagrath. I. J. &Gopal. M (Unit I, II, & III)
2) Automatic Control Systems- Benjamin C. Kuo (Unit II & III)
3) Modern Control System Engineering – K. Ogata (Unit IV)

REFERENCE BOOKS:

1) Feedback Control System Analysis & Design – D Azz, J.J and Houpis C.H
2) Control System Design – Savant C. J.
3) 3. Basic Automatic Control Theory – Murphy G.J.

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	✦ To study the control system elements ✦ To learn basic knowledge open and closed loop systems ✦ Learn about advanced techniques of control system	**Remember**
CO 2	✦ Students will learn the time response of control systems ✦ Learning the order of system and types of PID controllers	**Analyze**
CO 3	✦ To study the concept of stability ✦ Learn about analysis of Root locus	**Understand**
CO 4	✦ To study the frequency response of the system ✦ To learn basic knowledge of Bode plots ✦ Learn about control system mathematical preliminaries	**Skill**
CO 5	✦ Learn about state and state transition ✦ To learn basic knowledge of controllability and observability	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	2	2	3
CO3	2	2	2	3	2
CO4	3	3	2	3	3
CO5	2	3	2	2	2

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal I & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 =70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**E & IT 2.3. (22): MICRO PROCESSORS AND MICRO CONTROLLERS**	Credits: 4
Unit -1	**MCS-51 MICROCONTROLLER SYSTEMS:** Introduction to Microcontroller Systems - Block diagram of 8051 Mc - functional units - memory organization - ports, interrupts, timers - Addressing modes, instruction set - I/O Ports, Interrupts, Timer/Counter, Serial Communication.	**Hours* 12**
Unit -2	**PIC MICROCONTROLLER PIC 16C6X/7X ARCHITECTURE:** PIC Microcontrollers- Overview and features, PIC 16C6X/7X, PIC reset actions, Oscillator connection, Memory organization, PIC 16C6X/7X instructions, Addressing modes, I/O ports, Interrupts, PIC 16C61/71 timer and A/D converter.	**12**
Unit -3	**PIC MICROCONTROLLER 16F8XX ARCHITECTURE:** PIC 16F8XX Flash Microcontrollers- Pin diagram of 16F8XX, STATUS Register, OPTION_REG Register, Power Control Register, PIC 16F8XX program memory, data memory, Data EEPROM and Flash Program EEPROM, Interrupts in 16F877, I/O ports and Timers.	**12**
Unit -4	**INTERFACING WITH 8051 AND PIC MICROCONTROLLERS :** Interfacing of LED, 7-segment Display, Multiplexed7-segment Display, LCD, Keyboard, Stepper motor, ADC and DAC and their applications. Measurement of Frequency and Pulse width - Generation of PWM waveforms.	**12**
Unit -5	**ADVANCED APPLICATIONS USING PIC MICROCONTROLLER:** Application on Graphical LCD - SD Card - 1^2C, USB Bus - CAN Bus-SPI Interface– Ethernet Interface – ZigBee Interface- RFID & Bluetooth, GSM&GPRS.	**12**

TASKS AND ASSIGNMENTS:

BOOKS FOR STUDY:

1) The 8051 microcontroller and embedded systems - Muhammad Ali Mazidi& J G Mazidi (Unit I&III).
2) PIC Microcontrollers by Ajay V Deshmukh
3) Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F series/Dogan Ibrahim - (Newnes publications)
4) Design with PIC Microcontrollers – John B. Peatman (Unit III and IV)

REFERENCE BOOKS:

1) Embedded microcontroller's data book- Intel Corporation.
2) Embedded microcontroller's application- Intel Corporation.
3) PICs in practice - F P Volpe & S Volpe, Elector Electronics
4) Embedded Control Handbook - MICROCHIP (Vol. 1 & 2)
5) The 8051 Microcontroller: Architecture, Programming and Applications -Kenneth J Ayala.

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	✦ Leaning concept of functional units of microcontroller ✦ Learn about timer and counter applications	**Remember**
CO 2	✦ Leaning concept of PIC ✦ To learn basic knowledge of memory organization ✦ Learn about A/D converters	**Analyze**

CO 3	✦ To learn basic knowledge of pin configurations of PIC ✦ Learn about types of memory	**Understand**
CO 4	✦ Leaning concept of interfacing devises ✦ To learn basic knowledge of ADC and DAC ✦ Learn about wave form generation	**Skill**
CO 5	✦ Learning about SD card ✦ Leaning concept CAN bus ✦ Understand about interfacing	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	2	2
CO2	3	3	2	3	3
CO3	2	2	2	3	2
CO4	2	2	3	3	3
CO5	3	2	3	2	2

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	20	20	20	20	20	100

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal 1 & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 = 70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**E & IT 2.4. (A) (22): BIO-MEDICAL INSTRUMENTATION**	Credits: 4
Unit -1	**BIOMEDICAL ELECTRODES AND TRANSDUCERS:** Bio-electrical signal, recording electrode for ECG, EEG, EMG. Monopolar, Bipolar and nonpolar electrode. Biochemical sensors, pulse and respiration sensors. Bio electric amplifiers.Bio potential amplifiers.	**Hours* 12**
Unit -2	**CARDIO-VASCULAR SYSTEM & RELATED INSTRUMENTATION:** Physiology of heart and cardiovascular systems, electrocardiography, pace makers, defibrillators, measurement of blood pressure, temperature and pulse recorders.	**12**
Unit -3	**RESPIRATORY SYSTEM AND RELATED INSTRUMENTATION:** Physiology of respiratory system – mechanism of breath, pulmonary function analysers, respiratory gas analysers, artificial heart, lung mechanisms .	**12**
Unit -4	**NERVOUS & SENSOR SYSTEMS , RELATED INSTRUMENTATION:** Physiology of nervous system, neuronal communication, organization of brain, electro-encephalograph and reflex of the brain, experimental study of the behavior and physiological measurement. Instruments for testing of motor responses and sensory measurements .	**12**
Unit -5	**MODERN IMAGING SYSTEMS:** X-ray, computer aided tomography and applications, NMR imaging techniques and Applications. Medical Ultra sound, Pulse echo transmitter and receiver, A- scan, Echo-Opthamoscope, Echo-Cardiogram and B-scan, Biological effects of Ultra sound. Heomodialysismachine. Applications of Ar, Ruby AND Diode lasers in biomedical field	**12**

TASKS AND ASSIGNMENTS:

BOOKS FOR STUDY:

1) Hand book of Biomedical Instrumentation -R S Khandpur (Unit I, II).
2) Biomedical Instrumentation and Measurements- Leslie, Cromwel, Fred Wailbell, Erich, Pfeiffer (Unit I, II, III & IV)
3) Biomedical Instrumentation – Arumugam (Unit I, II)
4) Biomedical Equipment and Technology – Joseph Brown (Unit I, III, IV)

REFERENCE BOOKS:

1) Biomedical Instrumentation and Measurements, allied- Harry E Thomas.
2) Hand book of Biomedical Engineering –Jacob Kline Transducers for Biomedical Measurements – Richard S C Cobold
3) Biomedical Electronics- Joseph Dubovy
4) Biomedical Instruments, Theory and Design-Welkowitz and Dentsch

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	⅄ Leaning concept of recording electrodes ⅄ To learn basic knowledge of biochemical sensors	**Remember**
CO 2	⅄ Leaning concept of electrocardiography ⅄ To learn basic knowledge of blood pressure ⅄ Learn about pulse recorders	**Analyze**
CO 3	⅄ Leaning concept of pulmonary function analyzers ⅄ To learn basic knowledge of heart and lung mechanisms	**Understand**

CO 4	⮝ To understand the concept of nervous system ⮝ To learn basic knowledge of electro encephalograph ⮝ Learn about sensory measurements	**Skill**
CO 5	⮝ Leaning concept of X-ray and NMR imaging techniques ⮝ To learn basic knowledge of A-Scan, Echo, B-Scan ⮝ Learn about lasers applications in biomedical	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	2	2
CO2	3	3	2	3	3
CO3	2	2	2	3	2
CO4	2	2	3	3	3
CO5	3	2	3	2	2

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	20	20	20	20	20	100

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal 1 & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 = 70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**E & IT 2.4. (B) (22): BIO- COMPUTER ARCHITECTURE & ORGANIZATION**	Credits: 4
Unit -1	**BASIC STRUCTURE OF COMPUTERS:** Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers. Data types, Complements, Data Representation. Fixed Point Representation. Floating – Point Representation. Error Detection codes. COMPUTERARITHMETIC: Addition and subtraction ,multiplication Algorithms, Division Algorithms, Floating point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.	**Hours* 12**
Unit -2	**REGISTERTRANSFERLANGUAGEANDMICRO-OPERATIONS:** Register Transfer language. Register Transfer, Bus and memory transfer, Arithmetic Micro-operations, logic micro operations, shift micro-operations, Arithmetic logic shift unit. Instruction codes. Computer Registers Computer instructions –Instruction cycle. Memory Reference Instructions. CENTRAL PROCESSING UNIT - Stack organization. Instruction formats. Addressing modes. DATA Transfer and manipulation. Program control. Reduced Instruction set computer.	**12**
Unit -3	**MICRO PROGRAMMED CONTROL:** Control memory, Address sequencing,microprogramexample,Designofcontrolunit-Hardwired control. Micro programmed control.THE MEMORY SYSTEM: Memory Hierarchy, Main memory, Auxiliary memory, Associative memory, Cache memory, Virtual memory, Memory management hardware.	**12**
Unit -4	**INPUT-OUTPUT ORGANIZATION:** Peripheral Devices, Input-Output Interface, Asynchronous data transfer Modes of Transfer, Priority Interrupt, Direct memory Access, Input – Output Processor (IOP), Serialcommunication;	**12**
Unit -5	**PIPELINE AND VECTOR PROCESSING:** Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline Vector Processing, Array Processors. Multi processors: Characteristics of Multiprocessors, Interconnection Structures, Interprocessor Arbitration. Interprocessor Communication and Synchronization, Cache Coherence.	**12**

TASKS AND ASSIGNMENTS:

TEXT BOOKS:

1) Computer System Architecture–M. MorisMano ,IIIrdEdition,PHI/ Pearson, 2006.
2) ComputerOrganization–CarHamacher,ZvonksVranesic,SafwatZaky, V Edition, McGraw Hill, 2002.

REFERENCE BOOKS:

1) Computer Organization and Architecture–William Stallings Seventh Edition, PHI/Pearson, 2006.
2) Computer Architecture and Organization–JohnP.Hayes,McGraw Hill International editions, 1998.

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	✦ Leaning concept of functional units of computer ✦ To learn basic knowledge of arithmetic operations	**Remember**
CO 2	✦ Leaning concept of bus and memory transfer ✦ To learn basic knowledge of instruction cycle ✦ Learn about stack organization	**Analyze**

CO 3	✈ Leaning concept of hardwired control ✈ To learn basic knowledge of memory system ✈ Learn about memory management hardware	**Understand**
CO 4	✈ Leaning concept of input output interface ✈ To learn basic knowledge of modes of data transfer ✈ Learn about serial communication	**Skill**
CO 5	✈ Leaning about instruction pipeline ✈ To understand the characteristics of multiprocessors ✈ Learn about interprocessor	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	2	2
CO2	3	3	2	3	3
CO3	2	2	2	3	2
CO4	2	2	3	3	3
CO5	3	2	3	2	2

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	20	20	20	20	20	100

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal 1 & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 = 70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**E & IT 2.4. (C). (22): BIO- ARTIFICIAL NEURAL NETWORKS AND FUZZY LOGICS**	**Credits: 4**
Unit -1	**Introduction to Neural Networks:** Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Potential Applications of ANN.	**Hours* 12**
Unit -2	**Essentials of Artificial Neural Networks:** Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN- Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.	**12**
Unit -3	**Feed Forward Neural Networks:** Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications. Multilayer Feed Forward Neural Networks, Credit Assignment Problem, Generalized Delta Rule, Derivation of Back- propagation(BP) Training, Summary of Back-propagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements	**12**
Unit -4	**Associative Memories of Fuzzy logics:** Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory Associative Matrix, Association Rules,HammingDistance,TheLinearAssociator,MatrixMemories,Content Addressable Memory, Bidirectional Associative Memory (BAM) Architecture ,BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem. Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.	**12**
Unit -5	**Classical & Fuzzy sets Fuzzy Logic System Components& Applications:** Introduction to classical sets – properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, Properties, fuzzy relations, cardinalities, membership functions. Fuzzification, Membership Value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods. Neural network applications: Process identification, Fraction Approximation, Control and Process Monitoring, Fault diagnosis and Load forecasting Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.	**12**

TASKS AND ASSIGNMENTS:

TEXT BOOKS:

1) Neural Netwroks, Fuzylogic, Gnenetic algorithms: synthesis and applications by Rajasekharan and Rai- PHI Publication.
2) Introduction to Artificial Neural Systems- Jacek M.Zurada, Jaico Publishing House, 1997.

REFERENCE BOOKS:

1) Neural and Fuzzy Systems: Foundation, Architectures and Applications, - N. Yadaiah and S. BapiRaju, Pearson Education
2) Neural Netwroks – James A Freeman and Davis Skapura, Pearson, 2002
3) Neural Netwroks – Simon Hykins, Pearson Education.
4) Neural Engineering by C. Eliasmith and CH. Anderson, PHI.
5) Neural Netwroks and Fuzzy Logic System by BrokKosko, PHI Publications.

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	⮝ Leaning concept of biological neurons ⮝ To learn basic knowledge of different neuron models ⮝ Learn about applications of ANN	**Remember**
CO 2	⮝ Leaning the concept of artificial neuron ⮝ To learn basic knowledge of Neural dynamics	**Analyze**
CO 3	⮝ Leaning concept of feed forward neural networks ⮝ To learn basic knowledge of delta rule ⮝ Understand the back propagation algorithm	**Understand**
CO 4	⮝ Leaning concept of fuzzy memory organization ⮝ To learn basic knowledge of BAM ⮝ To understand BAM functions	**Skill**
CO 5	⮝ Leaning concept of fuzzy sets ⮝ To learn basic knowledge of defuzzification ⮝ Learn about fuzzy logic applications	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	2	2	3
CO3	2	2	2	3	2
CO4	3	3	2	3	3
CO5	2	3	2	2	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal I & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 =70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Practical: Course Title:	LABORATORY-III /PRACTICAL TRANSDUCERS & INSTRUMENTATION LAB	Credits: 4

List of Experiments:	HOURS
1) Characteristics of LM35 and measurement of Temperature	3
2) Characteristics of Thermistor, Pt100 and measurement of Temperature	3
3) Characteristics of Thermocouple and measurement of Temperature	3
4) Measurement of weight using Strain gauge	3
5) Measurement of Torque using Strain gauge	3
6) Measurement of Pressure using Strain gauge	3
7) Characteristics of RTO (PT100) and measurement of Temperature	3
8) Characteristics of LVDT and measurement of Displacement	3

TASKS AND ASSIGNMENTS:

1) Virtually executing the experiments
2) Observation submission
3) Viva-Voce
4) Practical Examination

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	Leaning concept of instrumentation and measuring systems	Remember
CO 2	Students will learn the performance characteristics of instruments	Analyze
CO 3	Leaning concept of formulation of systems	Understand
CO 4	Studying the working of display modules	Skill
CO 5	Leaning concept of temperature sensors	Apply

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	2	3
CO2	3	2	3	2	3
CO3	3	3	3	2	3
CO4	2	3	3	3	2
CO5	3	2	3	3	3

PRACTICAL: MICROCONTROLLER LAB	Credits: 4
LIST OF EXPERIMENTS:	**HOURS**
1) Write an 8051 c Program to send values from 00 to FF to the port P1 with time delay 1000m.s.	**3**
2) Write an 8051 c Program to toggle all the bits of PI continuously with time delay 500 m.s.	**3**
3) Write an 8051 c Program to send values from0X0F and 0x0F to PI continuously with some time delay.	**3**
4) Write an 8051 c Program to implement stack case wiring, two switches are connected to PI.0 &PI.I and lamp is connected to PI.7.	**3**
5) Write an 8051 c Program to rotate a bit starting from PI.0 to PI.7 continuously with some delay b/w them (PI is output port).	**3**
6) Write an 8051 c Program to transfer the letter 'A' serially at baud rate 9600bps continuously 8-bit data and 1 start & 1 stop bit.	**3**
7) Write an 8051 c Program to send "Dept. of E&IT" to 2x16 milford serial LCD serially at baud rate 2400 bps continuously using 8-bit data.	**3**
8) Interfacing Stepper Motor	**3**
9) Interfacing Hex key board	**3**
10) Interfacing of LCD & LED	**3**
11) Interfacing of Seven Segment Display	**3**
12) Interfacing of ADC	**3**
13) Test Basic Application Using ARM S32440A a) Led Testing b) PWM Buzzer ADC c) Key Board Interfacing	
TASKS AND ASSIGNMENTS: 1) Virtually executing the experiments 2) Observation submission 3) Viva-Voce 4) Practical Examination	

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	⅄ Learn about timer and counter applications	**Remember**
CO 2	⅄ Leaning concept of PIC ⅄ Learn about A/D converters	**Analyze**
CO 3	⅄ To learn basic knowledge of pin configurations of PI	**Understand**
CO 4	⅄ Leaning concept of interfacing devises ⅄ To learn basic knowledge of ADC and DAC	**Skill**
CO 5	⅄ Understand about interfacing	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	2	2
CO2	3	3	3	3	2
CO3	2	3	2	2	3
CO4	3	3	2	2	3
CO5	2	2	3	3	2

THIRD SEMESTER

M.Sc. ELECTRONICS & INSTRUMENTATION TECHNOLOGY

SEMESTER –III

S. No.	Components of Study	Title of the Course	Title of the Paper	No. of Credits	Internal Assessment Marks	Semester end Examinations Marks	Total Marks
1.	Core-I	**E&IT 3.1 (22)**	Analytical Instrumentation	4	30	70	100
2.	Core-II	**E&IT 3.2 (22)**	Embedded System	4	30	70	100
3	Compulsory foundation	**E&IT 3.3 (a) (22)**	Digital Signal Processing	4	30	70	100
		E&IT 3.3 (b) (22)	Analog Communications				
		E&IT 3.3 (c) (22)	Optical Communications				
4	Elective foundation	**E&IT 3.4 (a) (22)**	Industrial and Process Control Instrumentation	4	30	70	100
		E&IT 3.4 (b) (22)	System On Chip Design				
		E&IT 3.4 (c) (22)	Wireless Sensors & Networks				
5.	Practical-V		Advanced Instrumentation Laboratory	4	30	70	100
6.	Practical-VI		Embedded Systems Laboratory	4	30	70	100
TOTAL				**24**	**180**	**420**	**600**

Elective I – Choose one paper
Elective II – Choose one paper.

Components	Weightage (%)
(Internals I& II)	30
End Semester Exams	70

Theory: Course Code, Course Title	E & IT 3.1. (22): ANALYTICAL INSTRUMENTATION	Credits: 4
Unit -1	**COLORIMETERS AND SPECTROPHOTOMETERS** Principle and working with a Block diagram. Salient features of individual blocks. Specifications of a colorimeter. Applications of colorimeters. Spectrophotometers-Principle and working with block diagram. Salient features of individual blocks. Specification and operation of Spectrophotometer. Types of spectrophotometers –Ultraviolet, Visible and Infrared.- AAS - Applications of Spectrophotometers to chemical analysis.	**Hours** **12**
Unit -2	**CONDUTIVITY, pH METERS AND POLAROGRAPHS** Conductivity Bridge- Principle and working of a conductivity bridge with a block diagram. Salient features of individual blocks. Applications of conductivity bridges. pH meters- Principle and working with a block diagram. Salient features of individual blocks. Types of pH meters. Applications of pH meters in chemical and industrial fields. Polorograph-principle and working with a block diagram. Salient features of individual blocks. Characteristics of dropping mercury electrode. Polorogram. Applications of polorograph in chemical and industrial fields.	**12**
Unit -3	Nuclear Magnetic Resonance Spectrometers- Principle and working with suitable schematic/block diagrams. Experimental arrangement. Salient features of individual blocks. Applications of NMR spectrometer. Electron Spin Resonance- Principle and working with suitable schematic/block diagrams. Experimental arrangement. Salient features of individual blocks. Applications of ESR spectrometer. Mass Spectrometer- Principle and working. Description of individual blocks of experimental arrangement. Application of Mass Spectrometers	**12**
Unit -4	**ELECTRON MICROSCOPES TECHNIQUES AND APPLICATIONS** Transmission Electron Microscope- Principle and working with a block diagram. Salient features of individual blocks. Scanning Electron Microscope- Principle and working with a block diagram. Description of individual blocks. Applications of Electron Microscopes. Atomic Force Microscopy (AFM): Principle and working with a block diagram. Description of individual blocks. Applications of Atomic Force Microscopy (AFM)	**12**
Unit-5	**THERMAL ANALYSIS &CHROMATOGRAPHS AND APPLICATIONS** Thermo gravimetric and Differential Thermal Analysis-Principle and working with a Schematic diagram. Description of individual blocks. Applications. Chromatographs- Gas and Liquid Chromatographs- Principle and working with a block diagrams. Applications. Supercritical fluid chromatography (SFC)- Principle and working with a block diagrams. Applications.	**12**

TASKS AND ASSIGNMENTS:

REFERENCE BOOKS:

1) Hand Book of Analytical Instruments- R. S. Khandpur (Unit IV
2) Principles of Instrumental Analysis- Skoog (Unit IV)
3) Instrumental methods of Analysis- Chatwal and Anand (Unit I, II, III)
4) Instrumental methods of Chemical Analysis- B. K. Sharma. (Unit IV)

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	✈ Leaning working principle of colorimeters ✈ To learn basic knowledge of spectrophotometer ✈ Learn about applications of spectrophotometer	**Remember**
CO 2	✈ Understanding the working principle of conductivity and pH meters ✈ To learn basic knowledge of polorograph ✈ Learn about polorograph industrial applications	**Understand**
CO 3	✈ Understanding the concept of resonance ✈ To learn basic knowledge of electron spin resonance ✈ Understand about Mass spectrometer	**Apply**
CO4	✈ Leaning concept of TEM and SEM ✈ To learn basic knowledge of AFM	**Analyze**
CO5	✈ Leaning concept of TEM and SEM ✈ To learn basic knowledge of AFM	**Skill**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	2	2	3
CO3	2	2	2	3	2
CO4	3	3	2	3	3
CO5	2	3	2	2	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal I & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 =70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	E & IT 3.2. (22): EMBEDDED SYSTEMS	Credits: 4
Unit -1	**EMBEDDED SYSTEMS AND ARCHITECTURE** Embedded System Architecture - Introduction - hardware and software components - Classification –Embedded Systems on a Chip (SoC). I/O Devices - Device I/O Types and Examples, Applications of Embedded Systems, Tools For Development of embedded systems.	**Hours** **12**
Unit -2	**'C' PROGRAMMING FUNDAMENTALS** Review of C Programming - Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Arrays-Structures and Unions – Data Structures - Linked Lists.	**12**
Unit -3	**OS FOR EMBEDDED SYSTEMS** Basic Features of an Operating System - Kernel Features: Real-time Kernels, Polled Loops System, Co-routines, Interrupt-driven System, Multi-rate System - Processes and Threads - Inter-process Communication – Signals, Shared Memory Communication, Message-Based Communication.	**12**
Unit -4	**SCHEDULING AND MEMORY MANAGEMENT** Scheduling - Rate-Monotonic Scheduling, Earliest-Deadline First Scheduling, Task Assignment, Fault-Tolerant Scheduling - Real-time Memory Management - Process Stack Management, Dynamic Allocation - I/O- Synchronous and Asynchronous I/O, Interrupt Handling, Device Drivers, Real-time Transactions and Files - Example Real-time OS – VxWorks, RT-Linux, Psos	**12**
Unit-5	**NETWORK BASED EMBEDDED APPLICATIONS** Network Fundamentals - Layers and Protocols - Network Architectures, Network Components: Bridges, Routers, Switches - Distributed Embedded Architectures -Elements of Protocol Design Network Based Design - Internet-Enabled Systems - Protocols for industrial and control applications, Internetworking Protocols - Wireless Applications, Blue-tooth	**12**

TASKS AND ASSIGNMENTS:

REFERENCE BOOKS:

1) Embedded Systems Architecture, Programming and Design - Rajkamal, TATA McGraw-Hill, First reprint Oct. 2003.
2) Real-Time Concepts for Embedded Systems - Qing Li and Carolyn Yao, CMP Books 2003. (Unit I, II, III)
3) Steve Heath, Embedded Systems Design, Second Edition-2003, Newnes,
4) David E. Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.
5) Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design – Harcourt India, Morgan Kaufman Publishers, First Indian Reprint 2001.

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	⮚ Understanding the hardware and software components ⮚ To learn basic knowledge of I/O devices ⮚ Learn about embedded tools	**Remember**

CO 2	⮚ Leaning concept of c program elements ⮚ To learn basic knowledge of function calls ⮚ Learn about arrays, structures and unions	**Understand**
CO 3	⮚ Leaning concept of c program elements ⮚ To learn basic knowledge of function calls ⮚ Learn about arrays, structures and unions	**Apply**
CO4	⮚ To learn basic knowledge of dynamic allocation ⮚ Learn about real time OS	**Analyze**
CO5	⮚ Leaning concept of network fundamentals ⮚ To learn basic knowledge of protocol design ⮚ Learn about proximity and non proximity types	**Skill**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	2	2
CO2	3	3	2	3	3
CO3	2	2	2	3	2
CO4	2	2	3	3	3
CO5	3	2	3	2	2

EVALUATION SCHEME:

	CO1	**CO2**	**CO3**	**CO4**	**CO5**	**Total**
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	20	20	20	20	20	100

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal 1 & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Part – A Essay Type (Either/OR-type Question) 14 x 5 = 70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**E & IT 3.3.(A) (22): DIGITAL SIGNAL PROCESSING**	**Credits: 4**
Unit -1	**Discrete Time (DT) Sequences and Systems:** a. Introduction: Elements of Continuous Time and Digital Signal Processing Systems. Advantages of DSP Systems over Analog Processing System. b. Sampling and Reconstruction: Graphics and analytical proof of sampling theorem. Reconstruction of signal from its samples. Effect of under sampling-Aliasing. c. DT Sequences: Representation of DT sequences, Classification of discrete time sequences and manipulation of DT sequences. d. DT systems: Input-out-put description of Systems, Classification of DT Systems: Linearity, static, Time-Invariant, Causality and Stability of systems. Convolution and its properties. e. DTFT: Magnitude and phase spectrum, properties,	**Hours* 12**
Unit -2	**Fourier Transformation of Discrete Time Sequences Transforms and its properties.** Applications of Z. Transforms: System Function, Impulse Response, Causality and Stability of LTI systems in terms of System Function Solutions of Linear Constant Coefficient Difference Equations. DFT and FFT: Magnitude and phase spectrum, properties.	**12**
Unit -3	**Design and Realization of Digital Filters IIR Design** Digital Filter-IIR Design: Introduction, Normalized Butterworth functions. Design fo Digital filters using Bilinear Transformation, Impulse invariance and Step Invariance Transformation Methods, Frequency Transformation in Analog and Digital Domains. Realization of IIR System structures: Realization of Direct form structures, Cascade form Structures and Parallel form structures.	**12**
Unit -4	**Design and Realization of Digital Filters IIR Design** Digital Filter- FIR Design: Introduction, Characteristics of Linear Phase FIR filters, Designing FIR filters using Windowing Methods. Frequency Sampling Method, Comparison of IIR & FIR Filters. Realization of FIR system structures: Realization of Direct Form, Transposed Direct Form, Direct form for Linear-Phase FIR systems and Cascade Form structures.	**12**
Unit -5	**Digital Signal Processors and Applications:** a. Introduction to programmable DSPs: Multiplier and Multiplier Accumulator (MAC), multiple access memory, multiport memory, VLSI Architecture, pipelining. Architecture of TMS 320C5X-Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Registrar, Index Register, Auxiliary Register Compare Register, Block Move Address Register, Memory mapped registers, program controller, same flags in the status registers, On – Chip Registers, On-Chip peripherals. Concept of assembly language. b. Applications of Digital Signal Processing: Introduction, Speech Processing, Speech Analysis, Speech coding, Sub-band Coding, Channel Vocoder, Homomorphic Vocoder, Digital Processing of Audio Signals, Radar Signal Processing.	**12**

TASKS AND ASSIGNMENTS:

BOOKS FOR STUDY:

1) Digital Signal Processing : Principles, Algorithms, and Applications 4 Edition (English, Paperback, Dimitris G Manolakis, John G. Proakis)

2) Discrete-Time Signal Processing, - Alan V. Oppenheim, Ronald W. Shafer and John R. Buck, 2/e, Pearson Education, Inc., 2000. (UNIT- I,II,III)
3) Digital Signal Processors: Architecture, Programming and Applications - B. Venkataramani and M. Bhaskar TMH, 2002. (UNIT IV)

REFERENCE BOOKS:

1) Sanjit K. Mitra, "Digital Signal Processing: A Computer Based Approach", TMH, 1998.
2) Johnny R. Johnson, "Introduction to Digital Signal Processing", PHI, 2000.
3) Boaz Porat, "A Course in Digital Signal Processing", John Wiley & Sons (Asia) Pte. Ltd., 1997.
4) Texas Instruments TMS 320C5X User's Guide, 1997.

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	✦ Leaning concept of time and digital signal processing ✦ To learn basic knowledge of DT syste ✦ Learn about DIFT	**Remember**
CO 2	✦ Leaning concept of Z-transforms and LTI systems ✦ To learn basic knowledge of DFT and FFT	**Analyze**
CO 3	✦ Leaning concept of Z-transforms and LTI systems ✦ To learn basic knowledge of DFT and FFT	**Understand**
CO 4	✦ Leaning concept of Z-transforms and LTI systems ✦ To learn basic knowledge of DFT and FFT	**Skill**
CO 5	✦ Leaning concept of MAC ✦ To learn basic knowledge of TMS 320c5X ✦ Learn about Radar signal processing	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	2	2	3
CO3	2	2	2	3	2
CO4	3	3	2	3	3
CO5	2	3	2	2	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal I & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 =70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**E & IT 3.3.(B) (22): ADVANCED COMPUTER ARCHITECTURE**	Credits: 4
Unit-1	**Fundamentals of Computer Design:** Fundamentals of Computer design, Changing faces of computing and task of computer designer, Technology trends, Cost price and their trends, Measuring and reporting performance, Quantitative principles of computer design, Amdahl's law. Instruction set principles and examples- Introduction, Classifying instruction set- Memory addressing- type and size of operands, Operations in the instruction set.	**Hours 12**
Unit-2	**Pipelines:** Introduction, Basic RISC instruction set, Simple implementation of RISC instruction set, Classic five stage pipe lined RISC processor, Basic performance issues in pipelining, Pipeline hazards, Reducing pipeline branch penalties. Memory Hierarchy Design: Introduction, Review of ABC of cache, Cache performance, Reducing cache miss penalty, Virtual memory.	**12**
Unit-3	**Instruction Level Parallelism the Hardware Approach:** Instruction-Level parallelism, Dynamic scheduling, Dynamic scheduling using Tomasulo's approach, Branch prediction, high performance instruction delivery- hardware based speculation.	**12**
Unit-4	**ILP Software Approach:** Basic compiler level techniques, Static branch prediction, VLIW approach, Exploiting ILP, Parallelism at compile time, Cross cutting issues -Hardware verses Software.	**12**
Unit-5	**Multi Processors and Thread Level Parallelism:** Multi Processors and Thread level Parallelism- Introduction, Characteristics of application domain, Systematic shared memory architecture, Distributed shared – memory architecture, Synchronization.	**12**

TASKS AND ASSIGNMENTS:

REFERENCE BOOKS:

1) JohnP.ShenandMiikkoH.Lipasti-ModernProcessorDesign: Fundamentals of Super Scalar Processors
2) ComputerArchitectureandParallelProcessing-KaiHwang,FayeA.Brigs., MC Graw Hill.
3) AdvancedComputerArchitecture-ADesignSpaceApproach- DezsoSima, Terence Fountain, Peter Kacsuk , Pearson Ed.

COURSE OUTCOMES:

	Course Outcome	Level
CO1	⅄ Understand the computer design ⅄ To learn basic knowledge of classifying instruction set ⅄ Learn about instruction set	**Remember**
CO2	⅄ Understanding the basic RISC instruction set ⅄ To learn basic knowledge of memory organization	**Understand**
CO3	⅄ Leaning concept of instruction level parallelism ⅄ To learn basic knowledge of branch prediction ⅄ Learn about hardware based speculation	**Apply**

CO4	➢ Understand the compiler level techniques ➢ To learn basic knowledge of VLIW approach	**Analyze**
CO5	➢ Leaning concept of multi processors ➢ To understand characteristics of applications of multi processor	**Skill**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	2	2	3
CO3	2	2	2	3	2
CO4	3	3	2	3	3
CO5	2	3	2	2	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal I & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A **Essay Type (Either/OR-type Question) 14 x 5 =70**	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**E & IT 3.4.(A) (22): INDUSTRIAL AND PROCESS CONTROL INSTRUMENTATION**	Credits: 4
Unit -1	**INDUSTRIAL COMPONENTS AND CONTROL SYSTEMS** Elements of process Instrumentation: Switches, Relays, Actuators & Valves, Transmitters. Basic control actions - Proportional (P), Proportional + Integral (PI), Proportional + Derivative (PD), Proportional + Integral + Derivative (PID) Hydraulic, Pneumatic and Electronic Controllers. Digital PID Controllers, Cascade and Feed Forward Control Systems, Direct Digital Control Systems, Supervisory Control Systems, Distributed Control Systems (DCS).	**Hours* 12**
Unit -2	**PLC & SCADA CONTROLLERS AND APPLICATIONS** PLC block diagram, PLC Hardware, PLC Operations, Instructions of PLC, Programming the PLC, Ladder diagram programming, Applications of PLC. SCADA fundamentals, Overview of SCADA software	**12**
Unit -3	**INSTRUMENTATION IN IRON AND STEEL INDUSTRIES** Description of the process, Measurement hardware, valves, Controllers and displays, Computer Applications and Typical control systems as applied to the iron and steel industries.	**12**
Unit -4	**INSTRUMENTATION IN INDUSTRIES** Control of Distillation Towers, Refrigeration units, System boilers, Furnaces, Crystallizers, Heat exchanges, Pumps, Compressors and Evaporators as applied to the petrochemical industry, Paper and Pharmaceutical Industries.	**12**
Unit -5	**INSTRUMENTATION FOR INDUSTRIAL SAFETY** Intrinsic safety: Definition - conservation and emergency vents - flame, fire and smoke detectors - leak detectors - metal detectors. safety instrument system (sis): need, features, components, difference between basic process control system and sis. Safety Integrity Levels (SIL), Determination method : as -low as reasonably practical (alarp), evaluating risk: risk matrix, risk graph, layers of protection analysis (lopa) – issues related to system size and complexity –issues related to field device safety.	**12**

TASKS AND ASSIGNMENTS:

1) Chemical Process Industries – R.Norris Shreve, Joseph A.Brink
2) Modern Control Technology – Christopher T. Killian (Unit I)
3) Industrial Control Electronics – Michael Jacob (Unit I)
4) Process/Industrial Instrumentation – D. M. Considine (Unit I, II)

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	⅄ Leaning concept of industrial elements ⅄ To learn basic knowledge of PID controller ⅄ Learn about different controllers applications in industries	**Remember**
CO 2	⅄ Understanding the working of PLC controller ⅄ To learn basic knowledge of PLC logic ⅄ Learn about SCADA applications	**Analyze**

CO 3	⮚ Understanding the working of PLC controller ⮚ To learn basic knowledge of PLC logic ⮚ Learn about SCADA applications	**Understand**
CO 4	⮚ Understand the different control devices in petrochemical industry ⮚ To learn basic knowledge of paper and pharmaceutical industries	**Skill**
CO 5	⮚ Understand the different control devices in petrochemical industry ⮚ To learn basic knowledge of paper and pharmaceutical industries	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	2	2	3
CO3	2	2	2	3	2
CO4	3	3	2	3	3
CO5	2	3	2	2	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal I & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A **Essay Type (Either/OR-type Question) 14 x 5 =70**	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	E & IT 3.4.(B) (22): SYSTEM ON CHIP DESIGN	Credits: 4
Unit -1	**Introduction to the System Approach:** System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, an approach for SOC Design, System Architecture and Complexity.	**Hours* 12**
Unit -2	**Processors & Architectures:** Introduction , Processor Selection for SOC, Basic concepts in Processor Architecture, Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.	**12**
Unit -3	**Memory Design for SOC:** Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation , SOC Memory System, Models of Simple Processor – memory interaction.	**12**
Unit -4	**Inter connect Customization and Configuration:** Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor.	**12**
Unit -5	**Interconnect Configuration:** Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance- Specific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism.	**12**

TASKS AND ASSIGNMENTS:

TEXT BOOKS:

1) Computer System Design System-on-Chip-Michael J.Flynnand Wayne Luk, Wiely India Pvt. Ltd.
2) Design of System on a Chip: Devices and Components–Ricardo Reis, 1st Ed., 2004, Springer

REFERENCE BOOKS:

1) ARM System on Chip Architecture – Steve Furber –2nd Ed., 2000, Addison Wesley Professional.
2) System on Chip Verification – Methodologies and Techniques – Prakash Rashinkar, Peter PatersonandLeenaSinghL, 2001, Kluwer Academic Publishers.

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	✦ Leaning concept of system architecture ✦ To learn basic knowledge of SOC design ✦ Learn about system architecture	**Remember**
CO 2	✦ Leaning about selection for SOC ✦ To learn basic knowledge of VLIW processors	**Analyze**
CO 3	✦ Leaning concept SOC external memory ✦ To learn about types of cache ✦ Learn about memory interaction	**Understand**
CO 4	✦ Leaning concept of SOC standard buses ✦ To learn basic knowledge of bus transactions	**Skill**

CO 5	➢ Leaning concept of reconfiguration technologies ➢ To learn basic knowledge of customizable soft processor	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	2	2	3
CO3	2	2	2	3	2
CO4	3	3	2	3	3
CO5	2	3	2	2	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal I & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A **Essay Type (Either/OR-type Question) 14 x 5 =70**	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**E & IT 3.4.(C) (22): DIGITAL SYSTEM DESIGN & DIGITAL IC APPLICATIONS**	Credits: 4
Unit -1	**Digital Design Using HDL:** Design flow, program structure, History of VHDL, VHDL requirements, Levels of Abstraction, Elements of VHDL, Concurrent and Sequential Statements, Packages, Libraries and Bindings, Objects and Classes, Subprograms, Comparison of VHDL and Verilog HDL. VHDL Modeling: Simulation, Logic Synthesis, Inside a logic Synthesizer, Constraints, Technology Libraries, VHDL and Logic Synthesis, Functional Gate-Level verification, Place and Route, Post Layout Timing Simulation, Static Timing, Major Netlist formats for design representation, VHDL Synthesis-Programming Approach.	**Hours* 12**
Unit -2	**: Programmable Logic Devices (PLDs) & Memories:** Programmable Read Only Memory, Programmable Logic Array, Programmable Array Logic Devices, ROM: Internal structure, 2D-Decoding, Commercial ROM types, timing and applications,. Static RAM: Internal structure, SRAM timing, standard, synchronous SRAMS, Dynamic RAM: Internal structure, timing, synchronous DRAMs. Design considerations of PLDs with relevant Digital ICs.	**12**
Unit -3	**Digital Logic Families and Interfacing:** Introduction to logic families, CMOS logic, CMOS steady state and dynamic electrical behavior, CMOS logic families. Bipolar logic, transistor-transistor logic, TTL families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing, Emitter coupled logic.	**12**
Unit -4	**Combinational Logic Design:** Adders & Subtractors, Ripple Adder, Look Ahead Carry Generator, Binary Parallel Adder, Binary Adder-Subtractor, ALU, Decoders, encoders, three state devices, multiplexers and demultiplexers, Code Converters, parity circuits, comparators, multipliers, Barrel Shifter, Simple Floating-Point Encoder, Cascading Comparators, Dual Priority Encoder, Design considerations with relevant Digital ICs, modeling of Circuits by using VHDL.	**12**
Unit -5	**Sequential Logic Design:** SSI Latches and Flip-Flops, Counters, Design of Counters using Digital ICs, Ring Counter, Johnson Counter, Modulus N Synchronous Counters, MSI Registers, Shift Registers, Modes of Operation of Shift Registers, Universal Shift Registers, MSI Shift Registers, Design considerations with relevant Digital ICs, modeling of circuits by using VHDL.	**12**

TASKS AND ASSIGNMENTS:

TEXT BOOKS:

1) Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3rd Edition, 2005.
2) Designing with TTL Integrated Circuits: Robert L. / John R. Morris & Miller.

REFERENCE BOOKS:

1) "Fundamentals of Digital logic design with VHDL". Stephen Brown &Zvonko Vranesic, Tata McGraw Hill, 2nd edition.
2) VHDL Primer – J. Bhasker, Pearson Education/ PHI, 3rd Edition.
3) PrakashRashinkar, Peter Paterson and Leena SinghL, 2001, Kluwer Academic Publishers.

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	➢ Leaning concept of VHDL ➢ To learn basic knowledge of Verilog HDL ➢ Learn about VHDL synthesis	**Remember**
CO 2	➢ Leaning concept of PLDs ➢ To learn basic knowledge of commercial ROM types ➢ Learn about SRAM and DRAMs	**Analyze**
CO 3	➢ Understanding the CMOS logic ➢ To learn basic knowledge of CMOS interfacing	**Understand**
CO 4	➢ Leaning concept of adders ➢ To learn basic knowledge of decoders and encoers ➢ Learn about VHDL	**Skill**
CO 5	➢ Leaning concept of sequential logic design ➢ To learn basic knowledge of MSI registers ➢ Learn about VHDL	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	2	2	3
CO3	2	2	2	3	2
CO4	3	3	2	3	3
CO5	2	3	2	2	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal I & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 =70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

PRACTICAL - EMBEDDED SYSTEMS LABORATORY-5	Credits: 4
	HOURS
1) Blinking LED with Arduino Board.	3
2) Fading LED with Arduino Board.	3
3) Interfacing of Push Button with Arduino Board.	3
4) Controlling the brightness LED using Potentiometer with Arduino Board.	3
5) Generation of Pulse Width Modulation with Arduino Board.	3
6) Interfacing of Temperature Sensor with Arduino Board.	3
7) Interfacing LDR with Arduino Board.	3
8) DC Motor Speed Controller with Arduino Board.	3
9) Stepper Motor Control with Arduino Board.	3
10) Measurement of Temperature on LCD Display.	3
11) Playing Music with Arduino Board.	3
12) RFID Interface with Arduino Board.	3
13) GPS Interface with Arduino Board.	3
14) Piezo Vibration Sensor with Arduino Board.	3
15) Earth Moisture Sensor with Arduino Board.	3
16) Light Intensity Meter with Arduino Board.	3

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	✦ Leaning concept of instrumentation and measuring systems ✦ To learn basic knowledge of order of instruments ✦ Learn about proximity and non proximity types	**Remember**
CO 2	✦ Students will learn the performance characteristics of instruments ✦ To learn Hysteresis ✦ Learn about specifications of instruments	**Analyze**
CO 3	✦ Leaning concept of formulation of systems ✦ To learn basic knowledge of order of instruments ✦ To learn about transient and random signals	**Understand**
CO 4	✦ Studying the working of display modules ✦ Learn about different types of recorders	**Skill**
CO 5	✦ Leaning concept of calibration methods ✦ Learning the various calibrations of sensors	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**2**	**2**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**
CO3	**2**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

PRACTICAL: ANALYTICAL INSTRUMENTATION-6	Credits: 4
1) PH electric Characteristics	HOURS
2) Conductivity Probe characteristics.	3
3) Spectral Response of LED ,Filter & Detector	3
4) Spectral Response of Colour Filters.	3
5) Spectral Response of LDR & Solar Cell.	3
	3

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	✈ Leaning concept of instrumentation and measuring systems ✈ To learn basic knowledge of order of instruments ✈ Learn about proximity and non proximity types	**Remember**
CO 2	✈ Students will learn the performance characteristics of instruments ✈ To learn Hysteresis ✈ Learn about specifications of instruments	**Analyze**
CO 3	✈ Leaning concept of formulation of systems ✈ To learn basic knowledge of order of instruments ✈ To learn about transient and random signals	**Understand**
CO 4	✈ Studying the working of display modules ✈ Learn about different types of recorders	**Skill**
CO 5	✈ Leaning concept of calibration methods ✈ Learning the various calibrations of sensors	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**2**	**2**	**3**	**3**
CO2	**3**	**3**	**2**	**2**	**3**
CO3	**2**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**2**
CO5	**3**	**3**	**3**	**3**	**3**

FOURTH SEMESTER

M.Sc. ELECTRONICS & INSTRUMENTATION TECHNOLOGY

SEMESTER-IV

S. No.	Components of Study	Title of the Course	Title of the Paper	No. of Credits	Internal Assessment Marks	Semester end Examinations Marks	Total Marks
1.	Core-I	**E&IT 4.1(22)**	PC Based Instrumentation with Lab view	4	30	70	100
2.	Core-II	**E&IT 4.2(22)**	VLSI Design	4	30	70	100
3.	Practical-VII		Virtual Instrumentation Laboratory	4	30	70	100
4.	Project Work*						300
TOTAL							

Components	Weightage (%)
(Internals I& II)	30
End Semester Exams	70

Theory: Course Code, Course Title	**E & IT 4.1. (22): PC BASED INSTRUMENTATION**	Credits: 4
Unit -1	**INTRODUCTION TO PERSONAL COMPUTER (PC) AND PERIPHERALS** Computer organization and architecture – Computer components and interconnections – Memory management – I/O devices - PC extension slots (ISA, EISA & PCI).Serial, parallel and USB ports and their applications. IEEE 488 and GPIB bus standard.	**Hours* 12**
Unit -2	**V.I. PROGRAMMING TECHNIQUES** Virtual Instrumentation- Definition, flexibility- Block diagram and Architecture of Virtual Instruments- Data flow techniques- graphical programming in dataflow. VI, sub VI, loops and charts, arrays, clusters and graphs, case and sequence structures, forma nodes , local and global variables, string and file Input/output, Instrument drivers	**12**
Unit -3	**DATA ACQUISITION IN VI** Introduction to data Acquisition-signal conditioning –classes of signal conditioning-field wiring and signal measurement-ground loops-A/D,D/A converters. Design and interface of digital input/output and timer (DIOT) cards. Plug-in DAQ boards- Data acquisition modules with parallel and serial communication.	**12**
Unit -4	**PC FOR MEASUREMENT AND CONTROL IN INSTRUMENTATION** Role of PC in instrumentation. Application of PC for measurement of Temperature, Pressure, Torque, Load, Displacement and P^H. Waveform generation- data visualization at multiple locations.	**12**
Unit -5	**PC FOR MEASUREMENT AND CONTROL IN REAL TIME APPLICATIONS** Real time control and applications: design of ON/OFF controller, PID controller, PC based digital storage oscilloscope. PC based UV - Visible spectrophotometers.	**12**

TASKS AND ASSIGNMENTS:

BOOKS FOR STUDY:

1) Microprocessor and Interfacing: Programming and Hardware – Douglas V. Hall
2) S.Gupta and J.P.Gupta, "PC interfacing for data acquisition and process control", Second Edition, Instrument Society of America,1994.
3) LabVIEW based Advanced Instrumentation Systems - S. Sumathi and P. Surekha ISBN-10 3-540-48500-7 Springer Berlin Heidelberg New York.
4) John Park and Steve Mackay, Practical Data Acquisition for Instrumentation and control Systems, Elsevier Publications.

REFERENCE BOOKS:

1) The 80X86 IBM Pc and compatable computers Vol 1, 2. - Muhammad Ali Mazidi & J G Mazidi
2) The IBM PC Connection – James F. Caffron
3) Computer based Industrial Control – Krishna Kant
4) Computer Controlled Systems – K.J. Astram&B.Wittenmark.
5) 5. IBM PC and Clones Hardware, Troubleshooting and Maintenance – B. Govindarajalu (Unit I, II)

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	➢ Leaning concept of computer organization ➢ To learn basic knowledge of PC extension slots ➢ Learn about USB ports and their applications	**Remember**
CO 2	➢ Understand the virtural instrumentation and the architecture of VI ➢ To learn basic knowledge of VI programming	**Analyze**
CO 3	➢ Understanding the data acquisition and signal conditioning ➢ To learn basic knowledge of A/D and D/A converters ➢ Learn about DAQ boards	**Understand**
CO 4	➢ Leaning concept of role of pc in instrumentation ➢ Understanding the concept of measuring parameters using VI	**Skill**
CO 5	➢ Leaning concept of real time control and applications ➢ To learn basic knowledge of PID controller ➢ Learn about spectrophotometers	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	2	2	3
CO3	2	2	2	3	2
CO4	3	3	2	3	3
CO5	2	3	2	2	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal I & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 =70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

Theory: Course Code, Course Title	**E & IT 4.2. (22): VLSI DESIGN**	Credits: 4
Unit -1	**AN OVERVIEW OF VLSI AND LOGIC DESIGN WITH MOSFETS** Complexity and Design, Basic concepts, Ideal switches and Boolean operations, MOSFETs as switches, Basic logics gates in CMOS, Complex logic gates in CMOS, Transmission Gate circuits, Clocking and data flow control.	**Hours* 12**
Unit -2	**PHYSICAL STRUCTURE AND FABRICATION OF CMOS ICs**Integrated Circuit layers, MOSFETs, CMOS layers, Designing FET arrays, Overview of silicon processing, Material growth and deposition, Lithography, The CMOS process flow, Design rules.	**12**
Unit -3	**ELEMENTS OF PHYSICAL DESIGN** Basic concepts, Layout of basic structures, Cell concepts, FET sizing and the unit transistor, Physical design of logic gates, Design hierarchies.	**12**
Unit -4	**ELECTRICAL CHARACTERISTICS OF MOSFETs** MOS physics, nFET current-voltage equations, FET RC model, pFET characteristics, Modeling of small MOSFETs.	**12**
Unit -5	**ELECTRONIC ANALYSIS & DESIGNING OF CMOS LOGIC GATES** DCcharacteristics of the CMOS inverter, Inverter switching characteristics, Power dissipation, DC characteristics: NAND and NOR gates, NAND and NOR transient response, Analysis of complex logic gates, Gate design for transient performance, Transmission gates and pass transistors.	**12**

TASKS AND ASSIGNMENTS:

1) John P. Uyemura, "Introduction to VLSI circuits and Systems", John Wiley & Sons (Asia) Pte. Ltd., 2003.

REFERENCE BOOKS:

1) S.K. Ghandhi, "VLSI Fabrication principles", 2/e, John Wiley & Sons (Asia) Pte. Ltd., 2003.
2) S.M. Sze, "VLSI Technology", 2/e, McGraw-Hill, 1988.

COURSE OUTCOMES:

	Course Outcome	Level
CO 1	➢ Leaning concept of Boolean operations ➢ To learn basic knowledge of MOSFET switches ➢ Learn about clocking and data flow control	**Remember**
CO 2	➢ Leaning concept of MOSFETs ➢ To learn basic knowledge of FET arrays ➢ Learn about CMOS process flow	**Analyze**
CO 3	➢ Leaning concept of Cell concepts ➢ To learn basic knowledge of FET sizing ➢ Learn about design of logic gates	**Understand**
CO 4	➢ Leaning concept of nFET ➢ To understand the FET RC model ➢ Learn about Modeling of MOSFETs	**Skill**
CO 5	➢ Leaning concept of CMOS inverter ➢ To learn basic knowledge of NAND and NOR transient response ➢ Learn about Gate design	**Apply**

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	2	3	2	2	3
CO3	2	2	2	3	2
CO4	3	3	2	3	3
CO5	2	3	2	2	2

(If the correlation between mission statement and program specific outcome is high 3 is assigned, for moderate 2, for low 1, and for 0 are assigned)

EVALUATION SCHEME:

	CO1	CO2	CO3	CO4	CO5	Total
Internal	6	6	6	6	6	30
External	14	14	14	14	14	70
Total	**20**	**20**	**20**	**20**	**20**	**100**

MAPPING COURSE OUTCOME WITH INTERNAL ASSESSMENT (30 MARKS):

	CO1	CO2	CO3	CO4	CO5
Assignments	1	1	1	1	1
Seminar	1	1	1	1	1
Test (Internal I & Internal II)	2	2	2	2	2
Attendance	2	2	2	2	2
TOTAL	**6**	**6**	**6**	**6**	**6**

MAPPING COURSE OUTCOME WITH EXTERNAL ASSESSMENT:

Category	CO1	CO2	CO3	CO4	CO5
Part – A Essay Type (Either/OR-type Question) 14 x 5 =70	14	14	14	14	14
TOTAL	**14**	**14**	**14**	**14**	**14**

LBA-7: LAB VIEW	Credits:2
1) Write a Lab VIEW program to compute the following Expressions: (a.) (a+b+c) – c/d+ab (b.) abc + b/a +log a	HOURS 3
2) Write a Lab VIEW program to compute the following Expressions: (a.) (a+b)/ca + ac/bc+abc (b.) (a+b) (b+c) (a+c)	3
3) Design a Virtual Instrumentation to verify whether a given number is Odd or Even.	3
4) Design a Virtual Instrumentation to design and verify the following simple logic operations (a.) Half Adder (b.) Full Adder	3 3
5) Design a VI to convert 4-bit Binary number to Decimal number	3
6) Write a Lab VIEW program to generate sine wave form using Simulate signal and Sine waveform Generator	3
7) Write a Lab VIEW program to obtain frequency domain representation of Sine signal.	3
8) Write a LABVIEW program to find the factorial of the number by using feedback node and shift register?	3
9) Write a LABVIEW program to find sum of the natural numbers by using feedback node and shift register?	3

TASKS AND ASSIGNMENTS:

1) Virtually executing the experiments
2) Observation submission
3) Viva-Voce
4) Practical Examination

COURSE OUTCOMES:

	Course Outcome	Level
CO1	Students can understand the Lab VIEW software tools	Understand
CO2	Students can execute those experiments	Virtual
CO3	Students can utilize the technology to do the experiments	Utilizing
CO4	Understand the virtural instrumentation	Experimental
CO5	Learn basic knowledge of VI programming	Research

MAPPING OF PROGRAM OUTCOMES WITH COURSE OUTCOMES:

	PO1	PO2	PO3	PO4	PO5
CO1	1	2	1	1	1
CO2	1	1	3	1	1
CO3	3	3	2	3	1
CO4	3	2	3	3	1
CO5	2	2	2	2	1

PROJECT WORK

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