Faculty of Engineering & Technology

P. K. University Shivpuri (MP)

Department of Electronics Engineering

Evaluation Scheme & Syllabus for

B.Tech. - Electronics & Instrumentation Engineering

3rd year

(V to VI Semester)

CHOICE BASED CREDIT SYSTEM (CBCS)

[Effective from the Session: 2025-26]

P.K.University,Vill-Thanra,Teh-Karera,Distt-Shivpuri (M.P.) 473665

EVALUATION SCHEME

B.TECH –ELECTRONICS & INSTRUMENTATION ENGINEERING

5th Semester

STUDY AND EVALUATION SCHEME FOR B.TECH ELECTRONICS & INSTRUMENTATION ENGG.												
YEAR 3rd /SEMESTER-5th												
SUBJECT CODE	SUBJECTS NAME	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
UINTEEI501	Integrated Circuits	3	1	0	4	30	-	30	70	-	70	100
UMICREI502	Microprocessor & Microcontroller	3	1	0	4	30	-	30	70	-	70	100
UINDIEI503	Indian Traditions, Cultural And Society	2	0	0	2	30	-	30	70	-	70	100
UMEASEI504	Measurements & Instrumentation	3	0	0	3	30	-	30	70	-	70	100
UTRANEI505	Transducer And Sensor Measurement System	3	0	0	3	30	-	30	70	-	70	100
UELECEI506	Electrical Machines	3	0	0	3	30	-	30	70	-	70	100
UINTEEI507	Integrated Circuits Lab	0	0	2	1	-	25	25	-	25	25	50
UMICREI508	Microprocessor & Microcontroller Lab	0	0	2	1	-	25	25	-	25	25	50
UMEASEI509	Measurements &Instrumentation Lab	0	0	2	1	-	25	25	-	25	25	50
Total		17	2	6	22	180	75	255	420	75	495	750

EVALUATION SCHEME

B.TECH –ELECTRONICS & INSTRUMENTATION ENGINEERING

6th Semester

STUDY AND EVALUATION SCHEME

B.TECH (Electronics & Instrumentation Engineering) 6TH SEMESTER

SUBJECTCODE	SUBJECTSNAME	STUDY SCHEME Periods/Week			Credits	Marks In Evaluation Scheme						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
UCONSEI601	Constitution of India, Law and Engineering	3	0	0	3	30	-	30	70	-	70	100
UEMOEEI602	Embedded Systems Design	3	1	0	4	30	-	30	70	-	70	100
UCONTEI603	Control System	3	1	0	4	30	-	30	70	-	70	100
UINDUEI604	Industrial Measuring Instruments	3	1	0	4	30	-	30	70	-	70	100
UOPTOEI605	Opto-Electronics	3	0	0	3	30	-	30	70	-	70	100
UEMOEEI606	Embedded System Design Lab	0	0	2	1	--	25	25	-	25	25	50
UCONTEI607	Control Systems Lab	0	0	2	1	-	25	25	-	25	25	50
UINDUEI608	Industrial Instrumentation Lab	0	0	2	1	-	25	25	-	25	25	50
Total		15	3	6	21	150	75	225	350	75	425	650

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UINTGEI501: INTEGRATED CIRCUITS

L	T	P
3	1	0

Unit I

The 741 IC Op-Amp: General operational amplifier stages (bias circuit, the input stage, the second stage, the output stage, short circuit protection circuitry), device parameters, DC and AC analysis of input stage, second stage and output stage, gain, frequency response of 741, a simplified model, slew rate, relationship between ft
and slew rate.

Unit II

Linear Applications of IC Op-Amps: Op-Amp based V-I and I-V converters, instrumentation amplifier, generalized impedance converter, simulation of inductors.

Active Analog filters: Sallen Key second order filter, Designing of second order low pass and high pass Butterworth filter, Introduction to band pass and band stop filter, all pass active filters, KHN Filters. Introduction to design of higher order filters.

Unit III

Frequency Compensation & Nonlinearity: Frequency Compensation, Compensation of two stage Op-Amps, Slewing in two stage Op-Amp. Nonlinearity of Differential Circuits, Effect of Negative feedback on Nonlinearity.

Non-Linear Applications of IC Op-Amps: Basic Log–Anti Log amplifiers using diode and BJT, temperature compensated Log-Anti Log amplifiers using diode, peak detectors, sample and hold circuits. Op-amp as a comparator and zero crossing detector, astable multivibrator & monostable multivibrator. Generation of triangular waveforms, analog multipliers and their applications.

Unit IV

Digital Integrated Circuit Design: An overview, CMOS logic gate circuits basic structure, CMOS realization of inverters, AND, OR, NAND and NOR gates.

Latches and Flip flops: the latch, CMOS implementation of SR flip-flops, a simpler CMOS implementation of the clocked SR flip-flop, CMOS implementation of J-K flip-flops, D flip- flop circuits.

Unit V

Integrated Circuit Timer: Timer IC 555 pin and functional block diagram, Monostable and Astable multivibrator using the 555 IC. Voltage Controlled Oscillator: VCO IC 566 pin and functional block diagram and applications.

Phase Locked Loop (PLL): Basic principle of PLL, block diagram, working, Ex-
OR gates and multipliers as phase detectors, applications of PLL.

Text Book:

1. Microelectronic Circuits, Sedra and Smith, 7th Edition, Oxford, 2017.
2. Behzad Razavi: Design of Analog CMOS Integrated Circuits, TMH

Reference Books:

1. Gayakwad: Op-Amps and Linear Integrated Circuits, 4th Edition Prentice Hall of India, 2002.
2. Franco, Analog Circuit Design: Discrete & Integrated, TMH, 1st Edition.
3. Salivahnan, Electronics Devices and Circuits, TMH, 3rd Edition, 2015
4. Millman and Halkias: Integrated Electronics, TMH, 2nd Edition, 2010

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3	1	0

UMICREI502: MICROPROCESSOR & MICROCONTROLLER

Unit I

Introduction to Microprocessor: Microprocessor architecture and its operations,/Memory, Input & output devices, The 8085 MPU- architecture, Pins and signals,Timing Diagrams, Logic devices for interfacing, Memory interfacing, Interfacing output displays, Interfacing input devices, Memory mapped I/O.

Unit II

Basic Programming concepts:, Flow chart symbols, Data Transfer operations, Arithmetic operations, Logic Operations, Branch operation, Writing assembly language programs, Programming techniques: looping, counting and indexing.Additional data transfer and 16 bit arithmetic instruction, Logic operation: rotate, compare, counter and time delays, 8085 Interrupts.

Unit III

16-bit Microprocessors (8086): Architecture, Pin Description, Physical address, segmentation, memory organization, Addressing modes.

Peripheral Devices: 8237 DMA Controller, 8255 programmable peripheral interface, 8253/8254programmable timer/counter, 8259 programmable interrupt controller, 8251 USART and RS232C.

Unit IV

8051 Microcontroller Basics: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM. 8051 Addressing Modes.

Unit V

Assembly programming and instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming. Programming 8051 Timers. Serial Port Programming, Interrupts Programming,

Interfacing: LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation.

Text Books:

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 6th Edition, Penram International Publication (India) Pvt. Ltd.,2013
2. D. V. Hall : Microprocessors Interfacing, TMH 3rd Edition,
3. Mazidi Ali Muhammad, Mazidi Gillispie Janice, and McKinlay Rolin D., "The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson, 2nd Edition,2006

Reference Books:

1. Kenneth L. Short, "Microprocessors and programmed Logic", 2nd Ed, Pearson EducationInc.,2003
2. Barry B. Brey, "The Intel Microprocessors, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, PentiumPro Processor, PentiumII, PentiumIII, Pentium IV, Architecture, Programming & Interfacing", Eighth Edition, Pearson Prentice Hall, 2009.
3. Shah Satish, "8051 Microcontrollers MCS 51 Family and its variants", Oxford,2010

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III Year V Semester

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UINDIEID503: INDIAN TRADITIONS, CULTURAL AND SOCIETY

Unit 1-

Society State and Polity in India

State in Ancient India: Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship , Council of Ministers Administration Political Ideals in Ancient India Conditions' of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Varnāshrama System, Āshrama or the Stages of Life, Marriage, Understanding Gender as a social category, The representation of Women in Historical traditions, Challenges faced by Women. Four-class Classification, Slavery.

Unit 2-

Indian Literature, Culture, Tradition, and Practices

Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali,Prakrit And Sanskrit, Kautilya's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature,Malayalam Literature ,Sangama Literature Northern Indian Languages & Literature, Persian And Urdu ,Hindi Literature

Unit 3-

Indian Religion, Philosophy, and Practices

Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19^{th} century, Modern religious practices.

Unit 4-

Science, Management and Indian Knowledge System

Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India ,Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Textile Technology in India ,Writing Technology in India Pyrotechnics in India Trade in Ancient India/,India's Dominance up to Pre-colonial Times

Unit 5-

Cultural Heritage and Performing Arts

Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Seals, coins, Pottery, Puppetry, Dance, Music, Theatre, drama, Painting, Martial Arts Traditions, Fairs and Festivals, Current developments in Arts and Cultural, Indian's Cultural Contribution to the World. Indian Cinema

- To make students aware of holistic life styles of Yogic-science and wisdom capsules in Sanskrit literature that are important in modern society with rapid technological advancements and societal disruptions.
- To acquaint students with Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

Suggested Text & Reference Books

1. V. Sivaramakrishna (Ed.), *Cultural Heritage of India-Course Material*, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. S. Baliyan, *Indian Art and Culture*, Oxford University Press, India
3. Swami Jitatmanand, *Modern Physics and Vedant*, Bharatiya Vidya Bhavan
4. Romila Thapar, *Readings In Early Indian History* Oxford University Press , India
5. Fritz of Capra, Tao of Physics
6. Fritz of Capra, The wave of Life
7. V N Jha (English Translation), *Tarkasangraha of Annam Bhatta,* Inernational Chinmay Foundation,Velliarnad,Amaku,am
8. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
9. GN Jha (Eng. Trans.) Ed. R N Jha, *Yoga-darshanam with Vyasa Bhashya*, Vidyanidhi Prakasham, Delhi,2016
10. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016
11. P R Sharma (English translation), Shodashang Hridayam
12. Basham, A.L., *The Wonder that was India* (34th impression), New Delhi, Rupa & co
13. Sharma, R.S., *Aspects of Political Ideas and Institutions in Ancient India*(fourth edition), Delhi, Motilal Banarsidass,

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III Year V Semester

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UMEASEI504: MEASUREMENTS & INSTRUMENTATION

Unit I

Electrical Measurements: Measurement system, Characteristics of instruments, Methods of measurement, Errors in Measurement & Measurement standards, Measurement error combination,
Review of indicating and integrating instruments: PMMC instrument, Galvanometer, DC ammeter, DC voltmeter, Series ohm meter.

Unit II

Electronic Instruments: Transistor voltmeter circuits, AC electronic voltmeter, current measurement with electronic instruments, probes,
Digital voltmeter systems: Digital multimeter, digital frequency meter System, Oscilloscope
Instrument calibration: Comparison method, digital multimeter as standard instrument, Calibration instrument.

Unit II I

Measuring Methods: Voltmeter and Ammeter methods, Wheatstone bridge, Measurement of low, medium and high resistances, Insulation resistance measurement, AC bridges for inductance and capacitance
measurement, Q meter.

Unit IV

Electronic Measurements: Electronic instruments: Wattmeter & Energy meter. Time, Frequency and phase angle measurements using CRO; Storage oscilloscope, Spectrum & Wave analyzer, Digital counter, Frequency meter.

Unit V

Instrumentation: Transducers, classification & selection of transducers, strain gauges, Thermistors, Thermocouples, LVDT, Inductive & capacitive transducers, Piezoelectric and Hall-effect transducers, Measurement of motion, force, pressure, temperature, flow and liquid level. Concept of signal conditioning and data acquisition systems, Concept of smart sensors and virtual instrumentation.

Text Book:

1. A K Sawhney, “Electrical & Electronic Measurement & Instrument”, Dhanpat Rai& Sons, India (2015).
2. BC Nakra & K. Chaudhary, “Instrumentation, Measurement and Analysis,” TMH,
2nd Edition (2009).
3. WD Cooper, “Electronic Instrument & Measurement Technique”, Prentice Hall
International (2001).
4. E. O. Doebelin, “Measurements systems: Applications and Design”, 6th Edition,
Tata McGraw Hil 2017.

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UTRANEI505: TRANSDUCER AND SENSOR MEASUREMENT SYSTEM

Unit I

GENERALISED CONFIGURATIONS, FUNCTIONAL DISCRIPTION & PERFORMANCE CHARACTERISTICS OF MEASURING INSTRUMENTS:

Functional elements of an instrument; active & passive transducers; analog & digital modes of operation; null & deflection methods; I/O configuration of measuring instruments & instrument system – methods of correction for interfering & modifying inputs. Static characteristics; Meaning of static calibration, accuracy, precision & bias. Combination of component errors in overall system-accuracy calculation. Static sensitivity, linearity, threshold, resolution, hysteresis and dead space. Scale readability. Span. Generalized static stiffness & input impedance. Computer aided calibration &measurement, multiple regressions.

Unit II

MEASUREMENT OF DISPLACEMENT, FORCE, TORQUE & SHAFTPOWER:

Principle of measurement of displacement. Resistive potentiometers,variable inductance & variable reluctance pickups, LVDT, capacitance pickup.Principle of measurement of Force, Torque, Shaft power standards & calibration; basic methods of force measurement; characteristics of elastic force transducer-Bonded strain gauge, differential transformer, piezo electric transducer, variable reluctance/FM-oscillator, digital systems. Loading effects; Torque measurement on rotating shafts, shaft power measurement (dynamometers).

Unit III

TEMPERATURE MEASUREMENT:

Standards & calibration; thermal expansion methods- bimetallic thermometers, liquid-in-glass thermometers, pressure thermometers; thermoelectric sensor (thermocouple) – common thermocouple, special materials, configuration & techniques; electrical resistance sensors – conductive sensor (resistance thermometers), bulk semiconductor sensors (thermistors), bulk semiconductor sensors (thermistors); junction semiconductor sensors; digital thermometers. Radiation Methods – radiation fundamentals, radiation detectors, unchopped (dc) broadband radiation thermometers. Chopped (AC) selective band (photon) radiation thermometers, automatic null balance radiation thermometers (optical pyrometers). Two color radiation thermometers, Black body-tipped fibre optic radiation thermometer, IR imaging systems. Fluoroptic temperature measurement.

Unit IV

PRESSURE MEASUREMENT:

Standards & calibration; basic methods of pressure measurement; dead weight gauges & manometer, manometer dynamics; elastic transducers; high pressure measurement; low pressure (vaccum)

measurement – Mcleod gage, Knudsen gage, momentum-transfer (viscosity) gages, thermal conductivity gages, ionization gages, dual gage technique.

Unit V

FLOW MEASUREMENT:

Local flow velocity, magnitude and direction. Flow visualization. Hot wire and hot film anemometer. Hot-film shock-tube velocity sensor. Laser Doppler velocity meter; gross volume flow rate: calibration and standards. Constant-area, variable-pressure-drop meters (obstruction meters). Averaging pilot tubes. Constant pressure drop, variable area meters (rotameters), turbine meters, and positive displacement meters. Metering pumps. Electromagnetic flow meters. Drag force flow meters. Ultrasonic flow meters, vortex shedding flow meters.

LEVEL MEASUREMENT:

Capacitance probe; conductivity probes; diaphragmlevel detector, deferential pressure level detector, radiation level sensors, RADAR level gauges, level transmitter, ultrasonic level detector.

Text Books:

1. Transducers and Instrumentation – D. V. S. Murty, 2nd Edition, PHI, 2009
2. Instrumentation Measurement and Analysis- B. C. Nakra and K. K. Choudhry,
3rd Edition, McGraw Hill Education (India) Pvt. Ltd. 2009
3. Measurement systems application and design, ERNEST DOEBELIN, IV Edn.
4. Introduction to Measurements and Instrumentation – A. K. Ghosh, 2nd Edition, PHI, 2007.

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III Year V Semester

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UELECEI506: ELECTRICAL MACHINES

Unit I

Basic concept of rotating machines: Introduction, Review of magnetic system, Energy in Magnetic system, Introduction to Elementary machines – synchronous machines, dc machine, Asynchronous machines: concept of Rotating magnetic field, generated emf, torque in round rotor machines, matching characteristics of electric machines and load.

Unit II

DC Machine: Introduction, emf equation, torque equation, power balance, linear magnetization, circuit model, generating mode, motoring mode, armature reaction, compensating winding, commutation, method of excitation, characteristics of dc shunt, series and compound motors and generators. Starting of dc motor, speed control of dc motor, breaking of dc motor.

Unit III

Synchronous machines: Introduction of basic synchronous machine model, circuit model of synchronous machine, determination of armature reaction ampere turn and leakage reactance of synchronous machine, synchronizing to infinite bus bar, operating characteristics, power flow equations, parallel operation of synchronous generators, hunting in synchronous machines.

Unit IV

Induction Motor: Introduction, construction, flux and mmf phasor in induction motors, slip and frequency of rotor currents, rotor emf, power, induction motor phasor diagram, torque slip characteristics, determination of equivalent circuit parameters, circle diagram, starting of induction motor, speed control.

Unit V

Single Phase Motors: Introduction, types of single-phase motor, single phase induction motor, split phase motors, single phase commutator motor, single phase synchronous motor, stepper motor.

Text Book:

1. DP Kothari & I J Nagrath, "Electric Machines", Tata McGraw Hill Publication.
2. G.C. Garg, Electrical Machines – I, II, Khanna Publishing House, Delhi.

Reference Book:

1. Fitzgerald, C. Kingsley and S.Umans , "Electric Machinery", Tata McGraw Hill Publication.
2. P.S. Bimbhra, Electrical Machines, Khanna Book Publishing Co. (P) Ltd., Delhi..

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III Year V Semester

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UINTEEI507:INTEGRATED CIRCUITS LAB

LIST OF EXPERIMENTS:

1. Design the following using Op-Amp: ***(Through Virtual Lab Link 1)***
a) A unity gain amplifier.
b) An inverting amplifier with a gain of "A".
c) A non-inverting amplifier with a gain of "A"
2. Study and design Log and antilog amplifiers.
3. Voltage to current and current to voltage convertors.
4. Second order filters using operational amplifier for: ***(Through Virtual Lab Link 1)***
a) Low pass filter of cutoff frequency 1 KHz.
b) High pass filter of frequency 12 KHz.
5. Realization of Band pass filter with unit gain of pass band from 1 KHz to 12 KHz.
6. Study and design voltage comparator and zero crossing detectors.
7. Function generator using operational amplifier (sine, triangular & square wave).
8. Design and construct astable multivibrator using IC 555 and
a) Plot the output waveform
b) Measure the frequency of oscillation ***(Through Virtual Lab Link 2)***
9. Design and construct a monostable multivibrator using IC 555 and
a) Plot the output waveform
b) Measure the time delay ***(Through Virtual Lab Link 2)***
10. Implement Schmitt Trigger Circuit using IC 555. ***(Through Virtual Lab Link 2)***
11. Implement voltage-controlled oscillator using IC566 and plot the waveform.
(Through Virtual Lab Link 2)
12. Study and design ramp generator using IC 566.

Virtual Lab Link:
1. http://vlabs.iitkgp.ernet.in/be/exp17/index.html
2. http://hecoep.vlabs.ac.in/Experiment8/Theory.html?domain=ElectronicsandCommunications&lab=Hybrid%20Electronics%20Lab

Available on: **http://www.vlab.co.in/broad-area-electronics-and-communications**

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L	T	P
0	0	2

UMICREI508: MICROPROCESSOR & MICROCONTROLLER LAB

LIST OF EXPERIMENTS:

1. Write a program using 8085 Microprocessor for Decimal, Hexadecimal addition and subtraction of two Numbers. ***(Through Virtual Lab Link)***
2. Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers. ***(Through Virtual Lab Link)***
3. To perform multiplication and division of two 8 bit numbers using 8085. ***(Through Virtual LabLink)***
4. To find the largest and smallest number in an array of data using 8085 instruction set.
5. To write a program using 8086 to arrange an array of data in ascending and descending order. ***(Through Virtual Lab Link)***
6. To convert given Hexadecimal number into its equivalent ASCII number and vice versa using 8086 instruction set.
7. To convert given Hexadecimal number into its equivalent BCD number and vice versa using 8086 instruction set.
8. To interface 8253 programmable interval timer and verify the operation of 8253 in six different modes.
9. To write a program to initiate 8251 and to check the transmission and reception of character.
10. Serial communication between two 8085 through RS-232 C port.
11. Write a program of Flashing LED connected to port 1 of the 8051 Micro Controller
12. Write a program to generate 10 kHz square wave using 8051.
13. Write a program to show the use of INT0 and INT1 of 8051.
14. Write a program for temperature & to display on intelligent LCD display.

Virtual Lab Link: http://vlabs.iitb.ac.in/vlabs-dev/labs_local/microprocessor/labs/explist.php

Available on: http://www.vlab.co.in/broad-area-electronics-and-communications

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0	0	2

UMEASEI509: MEASUREMENTS &INSTRUMENTATION LAB

LIST OF EXPERIMENTS:

1. Study of semiconductor diode voltmeter and its use as DC average responding AC Voltmeter.
2. Study of L.C.R. Bridge and determination of the value of the given components.
3. Characteristics of Thermocouples and RTD.
4. Study of the following transducer - (i) PT-100 Transducer
   (ii) J-Type Transducer
   (iii) K Type Transducer
   (iv) Pressure Transducer
5. Measurement of phase difference and frequency using CRO (Lissajous Figure)
6. Characteristics of LDR, Photo Diode, and Phototransistor:
   (i) Variable Illumination.
   (ii) Linear Displacement
7. Characteristics of LVDT.
8. Study of the transistor tester and determination of the parameters of the given transistors
9. Design and Test a signal conditioning circuit for any transducer.
10. Implementation of Color Sensor for differentiating frequencies

Through Virtual Lab:

11. Measurement of low resistance Kelvin's double bridge.
12. To measure unknown capacitance of small capacitors by using Schering's bridge.
13. To measure unknown Inductance using Hay's bridge.
14. Measurement of capacitance by De Sauty Bridge.

Virtual Lab Link: http://vlabs.iitkgp.ernet.in/asnm/#

Available on: http://www.vlab.co.in/broad-area-electronics-and-communications

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UCONSEI601: CONSTITUTION OF INDIA, LAW AND ENGINEERING

Module 1--Introduction and Basic Information about Indian Constitution:

Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947,Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India.

Module 2-Union Executive and State Executive:

Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, Lok Ayukta, The Lokpal and Lok ayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts.

Module 3- Introduction and Basic Information about Legal System:

The Legal System: Sources of Law and the Court Structure: Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law, Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court). Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplace.

Module 4- Intellectual Property Laws and Regulation to Information:

Intellectual Property Laws: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement, Regulation to Information-Introduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act.

Module 5 -Business Organizations and E-Governance:

Sole Traders, Partnerships: Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up.

E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development.

Suggested Readings:

- Brij Kishore Sharma: *Introduction to the Indian Constitution*, 8th Edition, PHI Learning Pvt. Ltd.
- Granville Austin: *The Indian Constitution: Cornerstone of a Nation (Classic Reissue)*, Oxford University Press.
- S.G Subramanian: *Indian Constitution and Indian Polity*, 2nd Edition, Pearson Education 2020.
- Subhash C. Kashyap: *Our Constitution: An Introduction to India's Constitution and constitutional Law*, NBT, 2018.
- Madhav Khosla: *The Indian Constitution*, Oxford University Press.
- PM Bakshi: *The Constitution of India*, Latest Edition, Universal Law Publishing.
- V.K. Ahuja: *Law Relating to Intellectual Property Rights* (2007)
- Suresh T. Viswanathan: *The Indian Cyber Laws, Bharat Law House*, New Delhi-88
- P. Narayan: Intellectual Property Law, Eastern Law House, New Delhi
- Prabudh Ganguli: *Gearing up for Patents: The Indian Scenario*, Orient Longman.
- BL Wadehra: Patents, Trademarks, *Designs and Geological Indications Universal Law* Publishing - LexisNexis.
- *Intellectual Property Rights: Law and Practice, Module III* by ICSI (only relevant sections)
- Executive programme study material Company Law, Module II, by ICSI (The Institute of Companies Secretaries of India) (Only relevant sections i.e., Study 1, 4 and 36).https://www.icsi.edu/media/webmodules/publications/Company%20Law.pdf
- Handbook on e-Governance Project Lifecycle, Department of Electronics & Information Technology, Government of India, https://www.meity.gov.in/writereaddata/files/e-Governance_Project_Lifecycle_Participant_Handbook-5Day_CourseV1_20412.pdf
- Companies Act, 2013 Key highlights and analysis by PWC. https://www.pwc.in/assets/pdfs/publications/2013/companies-act-2013-key-highlights-and-analysis.pdf

Referred Case Studies:

- Keshavanand Bharati V. State of Kerala, AIR 1973 SC 1461.
- Maneka Gandhi V. Union of India AIR, 1978 SC 597.
- S.R. Bammai V. Union of India, AIR 1994 SC 1918.
- Kuldip Nayyar V. Union of India, AIR 2006 SC312.
- A.D.M. Jabalpur V. ShivkantShakla, AIR 1976 SC1207.
- Remshwar Prasad V. Union of India, AIR 2006 SC980.
- Keshav Singh in re, AIR 1965 SC 745.
- Union of India V. Talsiram, AIR 1985 SC 1416.
- Atiabari Tea Estate Co.V. State of Assam, AIR 1961SC232.
- SBP & Co. Vs. Patel Engg. Ltd. 2005 (8) SCC 618.
- Krishna Bhagya Jala Nigam Ltd. Vs. G. Arischandra Reddy (2007) 2 SCC 720.
- Oil & Natural Gas Corporation Vs. Saw Pipes Ltd. 2003 (4) SCALE 92 – 185.

** **Prescribed Legislations:**

1. Information Technology Act, 2000 with latest amendments.
2. RTI Act 2005 with latest amendments.
3. Information Technology Rules, 2000
4. Cyber Regulation Appellate Tribunal Rules, 2000

Suggested aid for Students and Pedagogic purpose

- RSTV debates on corporate law, IPR and patent issues
- NPTEL lectures on IPR and patent rights

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UEMBEEI602: EMBEDDED SYSTEMS DESIGN

Unit I

Advanced concepts in 8051 architecture:

Review of 8051 architecture, concept of synchronous serial communication, SPI and I2C communication protocols, study of SPI port on 89LP 51RD2, study of SAR ADC/DAC MCP3304 / MCP 33, interfacing concepts for SPI based ADC/DAC, study of watchdog timer, study of PCA timer in different modes like capture mode, PWM generation mode, High speed output toggle mode Embedded 'C' programming for the above peripherals.

Unit II

MSP430x5x Microcontroller:

series block diagram, address space, on-chip peripherals (analog and digital), and Register sets. Instruction set, instruction formats, and various addressing modes of 16-bit microcontroller; Sample embedded system on MSP430 microcontroller. Memory Mapped Peripherals, programming System registers, I/O pin multiplexing, pull up/down registers, GPIO control. Interrupts and interrupt programming.

Unit III

Introduction to Embedded Systems:

Describe what an embedded system is and its main components, Outline the different options available for building embedded systems,Explain the benefits, functions, and attributes of embedded systems, Examine the constraints specific to embedded systems and their impact

Introduction to the Arm Cortex-M4 Processor

Architecture, Identify key features of Arm architectures and processors, Explain the features and layout of the Arm Cortex-M4 processor. Explain the structure and purpose of specific registers in the Arm Cortex-M4 processor

Introduction to Arm Cortex-M4 Programming,

Compare the C and Assembly programming languages, Explain program-generation flow, including compilation and program images , Describe and compare different data formats and how they are stored in memory, Explain how mixed assembly and C programming can be performed, Introduction to the Mbed Platform and CMSIS.

Unit IV

Digital Input and Output (IO): Explain the relationship between electrical voltages and logic values , Describe the key features of GPIOs (General Purpose I/O pins) and how they can be used to control peripherals, Explain the key elements of GPIO design in relation to microcontrollers. Compare register-level

GPIO programming to GPIO programming with the Mbed API. Interrupts and Low Power Features: Interrupts and Low Power Features, Serial Communication

Introduction to the Internet of Things (IoT):

Describe the concepts of IoT and understand the key elements of an IoT device, Outline the evolution of IoT, Describe the main technologies that enable IoT, Identify the key challenges facing IoT systems, and Evaluate the opportunities and risks that emerge with IoT adoption.

Unit V

Hardware Platforms for IoT: Identify the concepts of hardware platform and the factors influencing its design,Differentiate between various types of memory, Explain the principles of sensors and the role of I/O

IoT Connectivity: Identify the concept of Bluetooth technology,Identify key features of the Bluetooth and Bluetooth Low Energy protocols,Explain how a Bluetooth connection is secured,Outline the new features that are introduced in the Bluetooth 5 specification, Explain the architecture and protocol stack used in

ZigBee

Text Books:

1. Mazidi Ali Muhammad, Mazidi Gillispie Janice, and Mc Kinlay Rolin D "The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson Publication,2006

2. John H Davies, "MSP430 Microcontroller Basics" Newnes Publication,2008.

3. Embedded Systems Fundamentals on Arm Cortex-M based Microcontrollers: A Practical Approach by Alexander G. Dean https://www.arm.com/resources/education/textbooks/efficientembedded-systems

Reference Books:

1. TI MSP430x5xx and MSP430x6xx Family User's Guide , Revised 2018.

2. The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors, Third Edition by Joseph Yiu

3. Cortex-A Series Programmer's Guide for ARMv7-A by Arm from http://infocenter. arm.com/ help/topic/com.arm.doc.den0013d/index.html

4. White Paper: Cortex-M for Beginners - An overview of the Arm Cortex-M processor family and comparison:https://community.arm.com/developer/ip-products/processors/b/processors-ipblog/ posts/white-paper-cortex-m-for-beginners-an-overview-of-the-arm-cortex-m-processor-familyand-**comparison.**

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UCONTEI603: CONTROL SYSTEM

Unit I- Introduction to Control Systems:

Basic Components of a control system, Feedback and its effect, types of feedback control systems. Block diagrams Reduction and signal flow graphs, Modeling of Physical systems: electrical networks, mechanical systems elements, free body diagram, analogous Systems, sensors and encoders in control systems, modeling of armature controlled and field controlled DC servomotor.

Unit II- State-Variable Analysis:

Introduction, vector matrix representation of state equation, state transition matrix, state-transition equation, relationship between state equations and high order differential equations, relationship between state equations and transfer functions, Decomposition of transfer functions, Controllability and observability, Eigen Value and Eigen Vector, Diagonalization.

Unit III- Time domain Analysis of Control Systems:

Time response of continuous data systems, typical test signals for the time response of control systems, unit step response and timedomain specifications, time response of a first order system, transient response of a prototype second order system, Steady-State error, Static and dynamic error coefficients, error analysis for different types of systems.

Unit IV- Stability of Linear Control Systems:

Bounded-input bounded-output stability continuous data systems, zero-input and asymptotic stability of continuous data systems, Routh Hurwitz criterion, Root-Locus Technique: Introduction, Properties of the Root Loci, Design aspects of the Root Loci.

Unit V- Frequency Domain Analysis:

Resonant peak and Resonant frequency, Bandwidth of the prototype Second order system, effects of adding a zero to the forward path, effects of adding a pole to the forward path, polar plot, Nyquist stability criterion, stability analysis with the Bode plot, relative stability: gain margin and phase margin.

Text Book:

1. I. J. Nagrath & M. Gopal, “Control System Engineering”, 6th Ed. New Age International Publishers, 2018
2. B.C. Kuo & Farid Golnaraghi, “Automatic Control Systems”, 9th Edition, John Wiley India,2008

Reference Books:

1. (Schaums Outlines Series) Joseph J. Distefano III, Allen R. Stubberud, Ivan J. Williams, “Control Systems”, 3rd Edition, TMH, Special Indian Edition, 2010.
2. A. Anand Kumar, “Control Systems”, Second Edition, PHI Learning private limited, 2014.
3. William A. Wolovich, “Automatic Control Systems”, Oxford University Press, 2011.

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UINDUEI604: INDUSTRIAL MEASURING INSTRUMENTS

Unit I- I Generalized configurations, functional descriptions and performance characteristics of measuring instruments:
General concepts and terminology of measurement systems, transducer classification, general input-output configuration, static and dynamic characteristics of a measurement system, Statistical analysis of measurement data. Standards and Calibration.
Displacement measurement: Resistive potentiometers, Digital displacement transducers, Mechanical fly ball angular velocity sensor, Mechanical revolution counters and timers, stroboscopic method

Unit II- Force and Pressure Measurement:
Standards & calibration; basic methods of force measurement; Characteristics of elastic force transducer- Bonded strain gauge, differential transformer, Piezo electric transducer. Units of pressure; dead weight gauges & manometer and its types, Bellows and force balance type sensors, Bourden guage, Piezoelectric, Capacitive and Inductive Pressure pickups.

Unit III- Flow measurement:
Differential pressure flowmeters: Bernoulli's theorem: pitot tube, orifice, venturi, flow nozzle, Hot wire and hot film anemometers, variable area meters (rotameter), meters, Electromagnetic flowmeters, Ultrasonic flowmeters, Drag force flow meter, Vortex shedding flow meters. Measurement of level, Float type gauge, purge method, differential pressure method, conductive and capacitive method; electromechanical method.

Unit IV-Temperature measurements:
Standards and calibration, thermal expansion methods, bimetallic thermometer, thermocouple, reference junction considerations, special materials, configuration & techniques, Measurement of thermocouple output, Electrical resistance sensors and thermistors, Radiation thermometers.

Unit V-Miscellaneous Measurements: Viscosity, Density and Vacuum:
Measurement of Viscosity: Definitions, units, Newtonian and Newtonian behaviour, measurement of viscosity using laboratory viscometers, industrial viscometers. Viscometer selection and application.
Measurement of Density: Definitions, units, liquid density measurement, gas densitometers, its application and selection,
Measurement of Vacuum: Mcleod gauge, Pirani gauge, Knudsen gauge and Ionization gauge

Text Books:
1. E. O. Doebelin, "Measurements systems: Applications and Design", 4th Edition, Tata McGraw Hill.
2. B. C. Nakra and K. K. Chaudhry, "Instrumentation: Measurements & Analysis" Tata McGraw Hill
3. J.G. Joshi, Electronics Measurement and Instrumentation, Khanna Publishing House, Delhi.
Reference Books:
1. A.K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation" Dhanpat Rai Publications., 19th Edition.
2. Bela G. Liptak, "Process Measurement and Analysis, Vol. 1", CRC Press

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UOPTOEI605: OPTO-ELECTRONICS

Unit I- Introduction to optical waveguide, Photo sources and detectors:
Optical wave guide modes-Theory of Dielectrics lab waveguides- Symmetric and Asymmetric Slab waveguide, Channel waveguide Light emitting diode (LED), materials, constructions, Drive circuitry, Fundamentals of lasers and its applications

Unit II- Electro Optic Effects:
Birefringence phenomenon EO Retardation, EO Amplitude and Phase Modulator, Electro optic Intensity Modulators, Beam deflection, Acousto-optics, A-O Modulators, Integrated optic spectrum analyzer.

Unit III- Optical Fiber Sensors:
Multi mode fiber Sensors-Displacement, pressure, stress, strain. Intensity modulated sensors, Active multimode FO sensors, Micro-bend optical fiber sensor, Current sensors, Magnetic sensors, Single mode FO sensors, Phase modulated, Polarization modulated, Fibre Optic Gyroscope

Unit IV- Optical detection principles:
Absorption Quantum efficiency Responsivity, Long wavelength cutoff, Photon detectors: Photodiodes, PIN photodiode, APD, photomultipliers, Thermal detector: Bolometers and thermisters, Pyroelectric detector

Unit V- Optical Computing:
Analog arithmetic operation- addition/subtraction, multiplication, division, averaging, differentiation and integration. Digital logic: modified signed digit number system, residue number system, logarithmic number system. Arithmetic operations: MSD, residue, signed logarithmic arithmetic, threshold logic, threshold devices, spatial light modulators.

Text Books:
1. J.Wilson and J.Hawkes,"Optoelectronics-AnIntroduction",PHI. (2002)
2. M.A.Karim,"OpticalComputing–Anintroduction",WileyIndia. (1997)
3. Optical fiber communications: principles and practice, John. M. Senior (2005)
Reference Books:
1. A.Yariv, P.Yeh,"Photonics",6th Ed.,OxfordUniversityPress. 2011
2. Emmanuel Rosencher and BorgeVinter, "Optoelectronics", Cambridge University Press. 2012

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UEMBEEI606: EMBEDDED SYSTEM DESIGN LAB

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LIST OF EXPERIMENTS:

Part A: Based on ARM Process:

1. To develop and verify the interfacing ADC and DAC with LPC 2148 Arm Micro Controller.
2. Interfacing of LED and PWM with Micro Controller. (ARM-) using embedded C program.
3. Interfacing of serial port with Am processor using embedded C-program.
4. Interfacing of key board and LCD with Arm processor using embedded C-Program.
5. To develop and verify Embedded C program mailbox using ARM.
6. To implement zigbee protocol with ARM program.
7. Implement the lighting and winking LEDs of the ARM I/O port via programming.
8. ARM programming in C language using KEIL IDE.
9. Demonstrate the TIMING concept of real time application using RTOS on ARM microcontroller kit.
10. Demonstrate the Multi-Tasking concept of real time application using RTOs on ARM microcontroller.
11. Demonstrate the RS 232 serial communication using RTOS on ARM microcontroller kit.
12. ISR (Interrupt Service Routine) programming in ARM based system with I/O port.

Part B: Based on MSP 430

1. Write a program for temperature & to display on intelligent LCD display.
2. Write a program to generate a Ram waveform using DAC with micro controller.
3. Write a program to Interface GPIO port in C using MSP430 (blinking LEDs, push buttons)
4. Write a program Interface potentiometer with GPIO.
5. Write a program of PWM based Speed Controller of Motor controlled by potentiometer connected to GPIO.
6. Write a program of PWM generation using Timer on MSP430 GPIO.
7. Write a program to Interface an accelerometer.
8. Write a program using USB (Sending data back and forth across a bulk transfer-mode USB connection.)

Part C: Virtual Lab Platform

https://www.soe.uoguelph.ca/webfiles/engg4420/EmbeddedSystemsAndLabsForARM-V1.1.pdf

https://profile.iiita.ac.in/bibhas.ghoshal/IEMB_2018/Lectures/ES_basics.pdf

https://nptel.ac.in/courses/108/102/108102045/

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UCONTEI607: CONTROL SYSTEMS LAB

LIST OF EXPERIMENTS:

1. Introduction to MATLAB Control System Toolbox.
2. Determine transpose, inverse values of given matrix.
3. Plot the pole-zero configuration in s-plane for the given transfer function.
4. Determine the transfer function for given closed loop system in block diagram representation.
5. Create the state space model of a linear continuous system.
6. Determine the State Space representations of the given transfer function.
7. Determine the time response of the given system subjected to any arbitrary input.
8. Plot unit step response of given transfer function and find delay time, rise time, peak time, peak overshoot and settling time.
9. Determine the steady state errors of a given transfer function.
10. Plot root locus of given transfer function, locate closed loop poles for different values of k.
11. Plot bode plot of given transfer function. Also determine gain and phase margins.
12. Plot Nyquist plot for given transfer function. Also determine the relative stability by measuring gain and phase margin.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Classify different tools in MATLAB along with the basic matrix operations used in MATLAB.
2. Evaluate the poles and zeros on s-plane along with transfer function of a given system.
3. Construct state space model of a linear continuous system.
4. Evaluate the various specifications of time domain response of a given system.
5. Appraise the steady state error of a given transfer function.
6. Examine the relative stability of a given transfer function using various methods such as

root locus, Bode plot and Nyquist plot.

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UINDIEI608: INDUSTRIAL INSTRUMENTATION LAB

LIST OF EXPERIMENTS:

1. Instrumentation Amplifier: Design for specific gain and verification of CMRR.
2. Realization of PCM signal using ADC and reconstruction using DAC using 4-bit/8bit systems. Observe the Quantization noise in each case.
3. Study of low noise and low frequency amplifier for biomedical application.
4. Design of temperature transmitter using RTD.
5. Design of cold junction compensation circuit.
6. Design of Linearization circuit for thermistor.
7. Design of pressure transmitter.
8. Performance evaluation of pressure gauges using Dead weight tester.
9. Measurement of level using capacitance probe, differential pressure transmitter.
10. Measurement of flow using orifice, electromagnetic and positive displacement flowmeters.
11. Study of PID controllers in flow measurement.
12. Measurement of solar energy using sensor.
13. Experiment using PLC Trainer Kits
14. Simulate and analyze the frequency domain measurement of electrical signals using spectrum analyzer.
15. Range finding and object detection using detection sensor.
16. Measurement using various sensors and analyzing the output using Virtual Instrumentation Lab-VIEW software.

Course Outcomes: At the end of this course students will demonstrate the ability:

1. To design instrumentation amplifier.
2. To execute PCM technique and demonstrate the concept.
3. To design equipments related to temperature measurement.
4. To analyze the performance of various pressure gauges.
5. **To conceptualize the principle of flow meters using various flow measurement instruments.**