Bachelor of Technology (Electronics & Communication Engineering) (Credit Based)
KURUKSHETRA UNIVERSITY KURUKSHETRA
Scheme of Studies/Examination(Modified)
Semester III (w.e.f. session 2019-2020)

Sr. No.	Course No.	Subject	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duratio of Exa (Hrs)
						Major Test	Minor Test	Practical	Total	
1	BS-201A	Optics & Waves	3:0:0	3	3	75	25	0	100	3
2	EC-201A	Electronic Devices	3:0:0	3	3	75	25	0	100	3
3	EC-203LA	Electronic Devices Lab	0:0:2	2	1	-	40	60	100	3
4	EC-205A	Digital Electronics	3:0:0	3	3	75	25	0	100	3
5	EC-207LA	Digital Electronics Lab	0:0:2	2	1	-	40	60	100	3
6	EC-209A	Signals & Systems	3:0:0	3	3	75	25	0	100	3
7	EC-211LA	Signals & Systems Lab	0:0:2	2	1	-	40	60	100	3
8	EC-213A	Network Theory	3:0:0	3	3	75	25	0	100	3
9	ES-219A	Essentials of Information Technology	3:0:0	3	3	75	25	0	100	3
10	*EC-215A	Industrial Training-I	2:0:0	2	-	-	100	-	100	3
11	**MC-901A	Environmental Sciences	3:0:0	3	-	75	25	0	100	3
		Total		**26**	**21**	**450**	**270**	**180**	**900**	

*EC-215A is a mandatory credit-less course in which the students will be evaluated for the industrial training undergone after 2 semester and students will be required to get passing marks to qualify.

**MC-901A is a mandatory credit-less course in which the students will be required to get passing grade.

BS – 201A	Optics and Waves						
L	**T**	**P**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3h**
Purpose	**To introduce the fundamentals of wave and optics for the applications in Engineering field.**						
Course Outcomes							
CO 1	**To make the students aware of basic terms used in light propagation.**						
CO 2	**To introduce Maxwell's equations and to study light waves incident at boundaries.**						
CO 3	**To study the interference phenomena of light and its applications.**						
CO 4	**To study diffraction phenomena of light, grating and its applications.**						
CO 5	**To study polarization of light and its applications.**						
CO 6	**To introduce basics of laser and to study various lasers.**						

Unit - I

Waves: Travelling waves, Characteristics of waves, Mathematical representation of travelling waves, General wave equation, Phase velocity, Light source emit wave packets, Wave packet and Bandwidth, Group velocity and real light waves.

Propagation of light waves: Maxwell's equations, Electromagnetic waves and constitutive relations, Wave equation for free-space, Uniform plane waves, Wave polarization, Energy density, the pointing vector and intensity, Radiation pressure and momentum, Light waves at boundaries, Wave incident normally on boundary, Wave incident obliquely on boundary: law of reflection, Snell's law and reflection coefficients.

Unit - II

Interference: Principle of Superposition, Conditions for Sustained interference, Young's double slit experiment, Division of wave-front: Fresnel's Biprism and its applications, Division of amplitude: Interference due to reflected and transmitted light, Wedge-shaped thin film, Newton's rings and its applications, Michelson Interferometer and its applications.

Unit – III

Diffraction: Types of diffraction, Fraunhofer diffraction at a single slit, Plane transmission diffraction grating: theory, secondary maxima and secondary minima, width of principal maxima, absent spectra, overlapping of spectral lines, determination of wavelength; Dispersive power and resolving power of diffraction grating.

Polarization: Polarization of transverse waves, Plane of polarization, Polarization by reflection, Double refraction, Nicol Prism, Quarter and half wave plate, Specific Rotation, Laurent ‘s half shade polarimeter, Biquartz polarimeter.

Unit – IV

Laser: Stimulated Absorption, Spontaneous and Stimulated Emission; Einstein’s Coefficients and its derivation, Population Inversion, Direct and Indirect pumping, Pumping schemes, Main components of Laser, Gas lasers (He-Ne, CO_2), Solid state lasers (Ruby, Neodymium, semiconductor), Dye laser, Characteristics of Laser, Applications of Laser.

Text/Reference Books:

1. P.K. Diwan, Applied Physics for Engineers, *Wiley India Pvt. Ltd*., *India*
2. N. Subrahmanyam, B. Lal, M.N. Avadhanulu, A Textbook of Optics, *S. Chand & Company Ltd*., *India.*
3. A. Ghatak, Optics, *McGraw Hill Education (India) Pvt. Ltd., India*.
4. E. Hecht, A.R. Ganesan, Optics, *Pearson India Education Services Pvt. Lt., India.*

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

Lecture Plan

Month	Topic /chapter covered	Academic Activity	Test /Assignment
Day 1	Travelling waves, Characteristics of waves,	Lecture	
Day 2	Mathematical representation of travelling waves, General wave equation,	Lecture	
Day 3	Phase velocity, Light source emit wave packets, Wave packet and Bandwidth,	Lecture	
Day 4	Group velocity and real light waves.	Lecture	
Day 5	Maxwell's equations, Electromagnetic waves and constitutive relations,	Lecture	
Day 6	Wave equation for free-space, Uniform plane waves, Wave polarization,	Lecture	
Day 7	Energy density, the pointing vector and intensity, Radiation pressure and momentum,	Lecture	
Day 8	Light waves at boundaries, Wave incident normally on boundary,	Lecture	
Day 9	Wave incident obliquely on boundary	Lecture	
Day 10	law of reflection, Snell's law and reflection coefficients.	Lecture	
Day 11	**Revision**		**Assignment/Test**
Day 12	Principle of Superposition,	Lecture	
Day 13	Conditions for Sustained interference, Young's double slit experiment,	Lecture	
Day 14	Division of wave-front: Fresnel's Biprism and its applications,	Lecture	
Day 15	Division of amplitude: Interference due to reflected and transmitted light,	Lecture	
Day 16	Wedge-shaped thin film,	Lecture	
Day 17	Newton's rings and its applications,	Lecture	
Day 18	Michelson Interferometer and its applications.	Lecture	
Day 19	**Revision**		**Assignment/Test**
Day 20	Types of diffraction, Fraunhofer diffraction at a single slit,	Lecture	
Day 21	Plane transmission diffraction grating: theory, secondary maxima and secondary minima,	Lecture	

Day 22	width of principal maxima, absent spectra,	Lecture	
Day 23	overlapping of spectral lines, determination of wavelength;	Lecture	
Day 24	Dispersive power and resolving power of diffraction grating.	Lecture	
Day 25	**Revision**		**Assignment/Test**
Day 26	Polarization of transverse waves, Plane of polarization, Polarization by reflection,	Lecture	
Day 27	Double refraction,	Lecture	
Day 28	Nicol Prism,	Lecture	
Day 29	Quarter and half wave plate,	Lecture	
Day 30	Specific Rotation, Laurent ‘s half shade polarimeter,	Lecture	
Day 31	Biquartz polarimeter.	Lecture	
Day 32	**Revision**		**Assignment/Test**
Day 33	Stimulated Absorption, Spontaneous and Stimulated Emission;	Lecture	
Day 34	Einstein’s Coefficients and its derivation,	Lecture	
Day 35	Population Inversion, Direct and Indirect pumping, Pumping schemes,	Lecture	
Day 36	Main components of Laser,	Lecture	
Day 37	Gas lasers (He-Ne, CO_2),	Lecture	
Day 38	Solid state lasers (Ruby, Neodymium, semiconductor)	Lecture	
Day 39	Dye laser, Characteristics of Laser,	Lecture	
Day 40	Applications of Laser	Lecture	
Day 41	**Revision**		**Assignment/Test**

Tutorial Sheet 1

1. Write notes on Phase velocity, wave packet and group velocity.
2. Write Maxwell equations in differential and integral form. Give their interpretation and derive them.
3. Derive relation of wave equation for free space. Discuss their constitutive relations.
4. Write note on Poynting vector, radiation pressure and momentum.
5. Explain when a wave incident normally and obliquely on a boundary.

Tutorial Sheet 2

1. a. Discuss analytical treatment of interference.

   b. Write conditions for sustained interference.

2. Explain how fringes are obtained from Fresenel's biprism. Discuss its application also

3. How circular rings are observed in reflected system in Newton's ring experiment.

4. Discuss Michelson interferometer alongwith its two applications.

Tutorial Sheet 3

1. Discuss diffraction grating.

2. Write note on Width of principal maxima and resolving power of grating.

3. What is double refraction? Discuss in detail. Also discuss Nicol prism.

4. What is specific rotation? Discuss biquartz polarimeter.

5. Explain (i) absent spectra in grating (ii) quarter and half wave plate

Tutorial Sheet 4

1. Explain following: Stimulated absorption, Spontaneous emission and stimulated emission

2. Discuss Einstein's coefficients.

3. What are characteristics of laser? Explain

4. Discuss He-Ne and Ruby laser. Write their application also.

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OPTICS AND WAVES

BS-201A

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Section.

Section I

1. (a) Derive the equations of electromagnetic waves propagation through free space. Further deduce important properties of EM wave propagation in free space. 8

   (b) What is Ampere's circuital rule ? What is the drawback of this rule and how it was accounted for by Maxwell ? 7

2. (a) Explain the significance and normalization of wave functions. 8

   (b) Derive the expression of time-dependent Schrödinger wave equation for a given wave function. 7

Section II

3. (a) Explain in detail the principle of superposition and highlight it with an example. 8

   (b) With the help of an application explain Fresnel's Biprism and give its application. 7

4. (a) Explain in detail the formation of Newton's ring and give its application. 8

   (b) Explain in detail Michelson Interferometer and give its applications. 7

Section III

5. (a) Define Electronic Polarization and obtain the relevant mathematical expressions for Electronic Polarization in terms of the radius of the atoms. 7

   (b) A paramagnetic materials has a magnetic field intensity of 10^4 A/m. If the susceptibility of the material at room temperature is 3.7×10^{-3}, calculate the magnetization and flux density of the material. 8

6. (a) Explain the Fraunhoffer diffraction due to single slit. Obtain the conditions for maxima and minima. 8

(b) In the diffraction grating, what is effect of total number of lines and width of grating on the spectrum. 7

Section IV

7. (a) Explain the construction and working of CO_2 laser. 8

(b) Obtain expression for energy density in terms of Enstein's A and B coefficient. 7

8. Explain the following in detail :

(a) Dye Laser 8

(b) Semiconductor Laser. 7

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EC-201A	Electronic Devices						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**To understand the concept of carrier transport phenomena in semiconductors and diodes such as p-n junction diode and tunnel diode.**						
CO2	**To understand the detailed operation of BJT and calculation of its parameters using transistor models.**						
CO3	**To understand the operation, characteristics & parameters of FET and MOSFET.**						

CO4	**To understand the concept of different types of regulated power supplies and Op-Amp based voltage regulators**

UNIT-I

Charge Carriers Transport : Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Continuity equation, PN Junction: Basic Structure, small signal equivalent circuit of p-n diode, derivation of barrier potential and diode current equation, Simple diode circuits: clipping, clamping and rectifiers, Zener diode and its application as voltage regulator.

UNIT-II

Bipolar Junction Transistor: Basic principle of operation, Current gains : derivation of α,β,Υ and their relationship. Various modes of operation of BJT, Base Width Modulation, Transistor hybrid model, h-parameter equivalent circuit of transistor, Analysis of transistor amplifier using h-parameters, calculation of input impedance, output impedance and voltage gain.

UNIT-III

Field Effect Devices: JFET : basic Operation and characteristics, drain and transfer characteristics, pinch off voltage, parameters of JFET: Transconductance (g_m), ac drain resistance (r_d), amplification factor(μ) ,Small Signal Model & Frequency Limitations. MOSFET: basic operation, depletion and enhancement type, pinch-off voltage, Shockley equation and Small Signal Model of MOSFET, MOS capacitor.

UNIT-IV

Regulated Power Supplies: Voltage Regulation, block diagram of DC regulated power supply, Zener diode voltage regulators: transistor series voltage regulator, Transistor shunt voltage regulator, Controlled Transistor Voltage Regulator, Op-Amp Series and shunt voltage regulator.

Text Books:

1. Millman & Halkias: Integrated Electronics, TMH.
2. Boylestad & Nashelsky: Electronic Devices & Circuit Theory, PHI.

Reference Books:

1. B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi, 1995.
2. E S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988.
3. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991.
4. S Salivahanan and N Naresh Kumar, Electronics devices and circuits, McGraw Hill,1998.

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

Lecture Plan

Lecture No	**Topics**
L-1	**Unit 1:** Introduction
L-2	Energy bands in intrinsic and extrinsic silicon
L-3	Carrier transport: diffusion current, drift current
L-4	Mobility and resistivity
L-5	PN Junction
L-6	Continuity equation,:
L-7	Small signal equivalent circuit of p-n diode,
L-8	Derivation of barrier potential
L-9	Diode current equation
L-10	Simple diode circuits: clipping, clamping
L-11	Rectifiers,.
L-12	Zener diode and its application as voltage regulator
L-13	**Unit 2:Bipolar Junction Transistor: Introduction**
L-14	Basic principle of operation
L-15	Current gains
L-16	derivation of α, β, Υ and their relationship
L-17	Numericals
L-18	Various modes of operation of BJT,

L-19	Cont..
L-20	Base Width Modulation,
L-21	Transistor hybrid model
L-22	h-parameter equivalent circuit of transistor,
L-23	Cont..
L-24	Analysis of transistor amplifier using h-parameters
L-25	Cont..
L-26	Calculation of input impedance
L-27	Output impedance
L-28	Voltage gain.
L-29	Unit3: **Field Effect Devices**: Basic Operation and characteristics
L-30	Drain and transfer characteristics, pinch off voltage, parameters of JFET:
L-31	Transconductance (g_m), ac drain resistance (r_d), amplification factor(μ)
L-32	Small Signal Model & Frequency Limitations. MOSFETs:basic operation, depletion and enhancement type,
L-33	Pinch-off voltage, Shockley equation
L-34	Small Signal Model of MOSFET, MOS capacitor
L-35	**Unit4: Regulated Power Supplies**: Voltage Regulation
L-36	Block diagram of DC regulated power supply, Zener diode voltage regulators
L-37	Transistor shunt voltage regulator, Controlled Transistor Voltage Regulator,
L-38	Op-Amp Series and shunt voltage regulator. transistor series voltage regulator,

Tutorial Sheet-1

Unit 1

1. Derive the current equation and barrier potential for a P-N diode.
2. Find the static and dynamic resistance of a PN junction germanium diode if temperature is 27^{o}C and saturation current is 1µA for an applied forward voltage of .2V.
3. The saturation current density of a PN junction Ge diode is 250 mA/m^2 at 300K. Find the voltage that would have to be applied across junction to cause forward current density of 10^5 amp./m^2.
4. Find the forward current for germanium diode at room temperature 22^{o}C when voltage across it is 0.3V and compare this current when temperature rises to 72^{o}C. express answer in terms of I_0
5. If the current of a Si diode with V_T =26mV doubles, find the increase in forward voltage drop.
6. Determine a.c resistance of a semiconductor diode having a forward bias of 200mV and a reverse saturation current of 1µA at room temperature

Tutorial Sheet-2

1. What are the various limitations for BJT to operate at higher frequencies? How these can be eliminated.
2. A transistor is operating in CE configuration, in which Vcc=8V and voltage drop across resistance Rc connected in collector circuit is 0.5V. The value of Rc = 800ohms. If a=0.96 determine (i) collector emitter voltage (ii) base current.
3. Discuss in brief h-parameter model of transistor.
4. Explain hetro junction bipolar transistors

Tutorial Sheet-3

1. Compare JFET and BJT

2. Discuss the small signal equivalent model of MOSFET

3. Explain the basic operation region of MOSFET

Tutorial Sheet-4

1. Explain SMPS
2. Draw and explain the circuit of a series voltage regulator and compare it with shunt voltage regulator.
3. What is the dB gain of an amplifier for an increase in power level from 12 W to 24W.
4. Explain op-amp based series and shunt regulator

4. Explain the working of MOSFET is enhancement mode and depletion mode

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ELECTRONIC DEVICES

EC-201

Time : Three Hours] [Maximum Marks : 75

Note : All questions in Part A and Part B are compulsory. Attempt any *four* questions from Part C selecting at least *one* from each Unit.

Part A

1. Explain the following in brief : 5×3=15
   (i) Drift current and barrier potential
   (ii) Transistor Hybrid Model
   (iii) MOS Capacitor
   (iv) Voltage Regulation
   (v) Clamping

Part B

Unit I

2. Sketch an energy band diagram and explain conduction band valence band and forbidden gap in details. 5

Unit II

3. Give comparison of CB, CC, CE configurations. 5

Unit III

4. What is MOSFET ? Explain the construction and characteristics of N channel MOSFET with suitable diagram. 5

Unit IV

5. What do you understand by voltage regulation ? With neat sketch explain the working of Zener diode shunt voltage regulator. http://www.kuonline.in

Part C

Unit I

6. Describe the negative and positive shunt clipping circuits and explain the operation of each circuit. 10

7. Explain the current flow in a forward biased PN junction with relevant expression for minority carrier concentration and diagram to illustrate the carrier density close to depletion layer. 10

Unit II

8. Draw and explain the practical transistor CE amplifier. Also explain the function of each component. 10

EC-203LA	Electronic Devices Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**To teach the students how to experimentally plot the VI characteristics of various diodes such as p-n diode, zener diode etc. find the threshold voltage and zener breakdown voltage from the VI curve.**						
CO2	**To teach the students how to experimentally find the values of various parameters of Transistor such as voltage gain, current gain etc.**						
CO3	**To teach the students how to plot the input and output characteristics of FET and MOSFET by experimental method.**						
CO4	**To experimentally teach the students the concept of different configurations of regulated power supplies using Zener diodes and Op-Amp.**						

List of experiments:

1. To study the VI characteristics of p-n diode in forward and reverse bias and find the threshold voltage from the VI curve.
2. To study the operation of Zener diode as a voltage regulator.
3. To study the operation of half-wave and full wave rectifiers and calculate their ripple factor values.
4. To study the operation of series and parallel Clippers using P-N junction diodes.
5. To study the operation of clampers using P-N junction diodes.
6. To experimentally plot the input and output characteristics of a given BJT transistor in CE configuration and calculate its various parameters.
7. To experimentally plot the input and output characteristics of a given BJT transistor in CB configuration and calculate its various parameters.
8. To study the transfer and drain characteristics of JFET and calculate its various parameters.
9. To study the transfer and drain characteristics of MOSFET and calculate its various parameters.
10. To study the different types of negative feedback in two stage amplifier and to observe its effects upon the amplifier parameters.
11. To study the Zener diode as a transistor series voltage regulator.
12. To study the Zener diode as a transistor shunt voltage regulator.

Reference Books:

1. Millman & Halkias: Integrated Electronics, TMH.
2. Boylestad & Nashelsky: Electronic Devices & Circuit Theory, PHI.

Note: Atleast ten (10) experiments from the above list are mandatory to perform for the students.

EC-205A	Digital Electronics						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**Students will be able to understand the basic logic gates and will be able to apply minimization techniques for reducing a function upto six variables.**						
CO2	**Students will be able to design combinational circuits and applications related to them.**						
CO3	**Students will be able to write the truth table, excitation table, characteristic equations of various flip flops and to design the sequential circuits using Flip flops.**						
CO4	**Students will be able to familiarize with varied memory types and various A/D, D/A Converters and their characteristics.**						

UNIT-I

Fundamentals of Digital Systems and Techniques: Digital signals, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, number systems: binary, signed binary, octal, hexadecimal number, binary arithmetic,one's and two's complements arithmetic, Codes:BCD codes, Excess-3, Gray codes, Error detecting and correcting codes: parity check codes and Hamming code

Minimization Techniques: Basic postulates and fundamental theorems of Boolean algebra: Standard representation of logic functions: SOP and POS forms, Simplification of switching functions using K-map and Quine-McCluskey tabular methods,Don't care conditions, Digital logic families: TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-statelogic.

UNIT-II

Combinational Digital Circuits:Design procedure: Half adder, Full Adder, Half subtractor, Full subtractor , Parallel binary adder, parallel binary Subtractor, Carry Look Ahead adder, Serial Adder/Subtractor, BCD adder, Binary Multiplier, Binary Divider, Multiplexer/ De-multiplexer, decoder, encoder, parity checker, parity generators, code converters, Magnitude Comparator.

UNIT-III

Sequential circuits: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K, T and D types flip flops, applications of flip flops: shift registers, serial to parallel converter, parallel to serial converter, Synchronous and Asynchronous mod counter,FSM, sequence generator and detector.

UNIT-IV

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder D/Aconverter, specifications for D/A converters, analog to digital converters: quantization and encoding, parallel comparator A/Dconverter, successive approximation A/D converter, specifications for A/D converters

Semiconductor Memories and Programmable Logic Devices: Characteristics of memories, read only memory (ROM), read and write memory (RAM), Programmable logic array, Programmable array logic, Introduction to Field Programmable Gate Array (FPGA)

Text Books:

1. M. M. Mano, "Digital design", Pearson Education India, 2016.
2. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003.
3. Taub Schilling, Digital Integrated Electronics, TMH

Reference Books:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. A.K. Maini, Digital Electronics, Wiley India
3. R P Jain, Modern digital electronics, TMH

LECTURE PLAN

L1	**Fundamentals of Digital Systems and Techniques**: Digital signals
L2	AND, OR, NOT, NAND, NOR and Exclusive-OR operations
L3	Boolean algebra
L4	Number systems: binary, octal, hexadecimal number
L5	Signed binary representation
L6	Binary Arithmetic
L7	One's and two's complements arithmetic
L8	Codes: BCD codes, Excess-3, Gray codes
L9	Error detecting and correcting codes: parity check codes, Hamming code
L10	**Minimization Techniques:** Basic postulates, Fundamental theorems of Boolean algebra
L11	Standard representation of logic functions: SOP and POS forms
L12	Simplification of switching functions using K-map
L13	Quine-McCluskey tabular methods Don't care conditions
L14	Digital logic families: TTL, Schottky TTL
L15	CMOS logic, Tri-state logic, Interfacing CMOS and TTL
L16	**Combinational Digital Circuits**: Design procedure: Half adder, Full Adder
L17	Half subtractor, Full subtractor
L18	Parallel binary adder, Parallel binary Subtractor
L19	Carry Look Ahead adder, Serial Adder/Subtractor
L20	BCD adder

L21	Binary Multiplier, Binary Divider
L22	Multiplexer/ De-multiplexer
L23	Decoder, Encoder
L24	Parity Checker, Parity Generators
L25	Code converters, Magnitude Comparator.
L26	**Sequential circuits**: A 1-bit memory, the circuit properties of Bistable latch
L27	The clocked SR flip flop
L28	J- K flip flop
L29	T and D types flip flops
L30	Applications of flip flops: shift registers
L31	Serial to parallel converter, parallel to serial converter
L32	Synchronous mod counters
L33	Asynchronous mod counters
L34	FSM, Sequence generator and detector.
L35	**A/D and D/A Converters**: Digital to Analog converters: weighted resistor/converter, R-2R Ladder D/A Converter
L36	Specifications for D/A converters
L37	Analog to digital converters: quantization and encoding
L38	Parallel comparator A/D converter
L39	Successive approximation A/D converter
L40	Specifications for A/D converters
L41	**Semiconductor Memories and Programmable Logic Devices**: Characteristics of memories
L42	Read only memory (ROM), Read and write memory (RAM)
L43	Programmable logic array, Programmable array logic
L44	Introduction to Field Programmable Gate Array (FPGA)

Tutorial Sheet 1

Ques 1. Why NAND and NOR gates are known as universal gates? Obtain following operations using NAND and NOR gate.

i. OR
ii. AND
iii. EXOR

Ques 2. What do you mean by

i. Bubbled AND gate
ii. Bubbled OR gate

Ques 3. Which logic gate is called

i. Coincidence gate
ii. Anti-Coincidence gate

Ques 4. Draw logic gate to realize following expression using 2 input gates only

i. $Y = A \oplus B \oplus C$
ii. $Y = A \odot B \odot C$
iii. $Y = (AB)(\overline{A + B}) + \overline{EF}$
iv. $Y = \overline{A.B.C}$
v. $Y = \overline{A + B + C}$

Ques 5. Two square waves, A of 1KHz and B of 2KHz frequency, are applied as input to the following logic gates. Draw the output waveform in each case.

i. AND
ii. OR
iii. NAND
iv. NOR
v. X-OR
vi. X-NOR

Ques 6. Prove the following using De Morgan's theorem.

i. $AB + CD = \overline{\overline{AB}.\overline{CD}}$
ii. $(A + B).(C + D) = \overline{\overline{A + B} + \overline{C + D}}$

Ques 7. Prove the following using Boolean algebraic theorem.

i. $\bar{A}BC + A\bar{B}C + AB\bar{C} + ABC = AB + BC + CA$
ii. $A + \bar{A}B + A\bar{B} = A + B$
iii. $\overline{\overline{AB} + \bar{A} + AB} = 0$
iv. $AB + \overline{A\bar{C}} + A\bar{B}C(AB + C) = 1$

Ques 8. Convert the following

i. Binary to decimal
    a. $(11111011)_2$
    b. $(1001.0101)_2$
ii. Decimal to binary

a. 255
b. 102A
c. 10.625
d. 0.6875

iii. Binary to octal
a. $(101110111)_2$
b. $(011011.001)_2$

iv. Octal to binary
a. $(371)_8$.
b. $(237)_8$

v. Octal to hexadecimal
a. $(237)_8$
b. $(543)_8$

vi. Hexadecimal to octal
i. $(F25)_{16}$
ii. $(A3A)_{16}$

Ques 9. Express the following decimal numbers in BCD, Excess 3 and Grey codes

i. 97
ii. 653
iii. 19

Ques 10. Name 2 alphanumeric codes.

Ques 11. Reduce the following Boolean expression using K-map.

i. $A\bar{B}C + B + B\bar{D} + AB\bar{D} + \bar{A}C$
ii. $(A + B).(A + \bar{B} + C)(A + \bar{C})$
iii. $AB\bar{C} + AB + C + B\bar{C} + D\bar{B}$
iv. $Y = \sum m(0,1,2,3, L1, L2, L4, L5)$

Ques 12. Minimize the following logic function & realize using NAND / NOR gates.

i. $f_1(A, B, C, D) = \sum m(1, 3, 5, 8, 9, 11, 15) + \alpha(2, 13)$
ii. $f_2(A, B, C, D) = \prod M(1, 2, 3, 8, 9, 10, 11, 14) + \alpha(7, 15)$

TUTORIAL SHEET 2

Ques 1. Describe the following arithmetic circuits.

i. 2-bit comparator

ii. Full adder

iii. Full subtractor

Ques 2. What is a parity bit generator? Explain even & odd parity generator.

Ques 3. List the application of multiplexers & demultiplexers.

Ques 4. Realize using 16:1, 18:1 mux& MSI gates.

$$\sum m(2,3,5,8,11,13)$$

A	B	C	D	Y
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

TUTORIAL SHEET 3

Ques 1. Distinguish between combinational and sequential circuit.

Ques 2. What do you mean by

i. A latch

ii. Active high latch

iii. Active low latch

Ques 3. Distinguish between synchronous and asynchronous latches.

Ques 4. Differentiate between level triggered and Edge triggered flip flop.

Ques 5. Define following

i. Clock skew

ii. Race around condition

iii. Propagation delay

Ques 6. What is the basic difference between counter and a shift register?

Ques 7. What is universal shift register?

Ques 8. Design following ripple counters using flip flop.

i. Divide by 5

ii. Mod 7

Ques 9. Design a Mod-10 synchronous counter.

Ques 10. What is meant by 'modulus' of a counter?

Tutorial Sheet 4

Ques 1. Define following parameter of DACs.

i. Resolution

ii. Accuracy

iii. Setting time

iv. Conversion time

v. Step size

Ques 2. Why voltage DAC are slower than current DACs?

Ques 3. What is advantage of smaller resolution?

Ques 4. Which is the fastest ADC and why?

Ques 5. Determine the resolution of

i. 6-bit DAC

ii. 12-bit DAC in terms of percentage

Ques 6. Design a combination circuit using a ROM. The circuit accepts a 3 bit number and output a binary no. equal to the square of the input no.

Ques 7. Design a combinational logic circuit using PAL.

Important Question

Ques 1. What is meant ‘base’ or ‘radix’ of number system?

Ques 2. Explain the following term

i. Bit
ii. Byte
iii. Nibble
iv. Word

Ques 3. Find one’s and two’s complement of the following number

i. 10100111
ii. 01100100
iii. 10010010
iv. 01100111

Ques 4. Represent the following decimal number in 1’s and 2’s complement format

i. -4
ii. -25
iii. +11
iv. +9
v. -14
vi. -6

Ques 5. Subtract using 1’s and 2’s compliment method

i. 01000 – 01001
ii. 01100 – 00101

Ques 6. Add the binary numbers.

i. 1011+1001
ii. 1011.101+101+01

Ques 7. Minimize the following using K-map.

$$f_3(A, B, C, D) = \sum m(8,9,10,111,13,15,16,18,21,24,25,26,27,30,31)$$

Q ues 8. Minimize using QM method

$$f_4(A, B, C, D) = \sum m(0,1,2,8,9,15,17,21,24,25,27,31)$$

Roll No. ..... Total Pages : 04

BT-3/D-19 33133

DIGITAL ELECTRONICS
ES-207A

Time : Three Hours] [Maximum Marks : 75

Note : All questions in Part A and Part B are compulsory. Attempt any *four* questions from Part C, selecting *one* question from each Unit.

Part A

1. Answer the following questions : 5×3=15
   (i) Explain the conversion of AND operation into OR operation with the help of deMorgan theorem.
   (ii) Explain conversion of standard form into canonical form.
   (iii) Explain designing and working of half adder.
   (iv) State the difference between positive edge triggering, negative edge triggering and level triggering of flip-flops.
   (v) List the specifications of D/A converters.

Part B

Note : Attempt all questions.

2. Perform the following operations : 5
   (i) $(27)_7 + (53)_2$
   (ii) $(34\text{-}48)_2$ using 2's compliment.
   Simplify (A+B)(A'+C) to minimum number of literals.

3. Explain the different properties of logic families. Explain the working of TTL NAND gate. 5

4. Explain the working of JK flip-flop. What is race around condition in JK flip-flop ? How it can be solved by master slave flip-flop ? 5

5. Draw the basic circuit of a ROM cell. Explain its working. 5

Part C

Note : Attempt *one* question from each Unit.

Unit I

6. Using Q-M method, obtain the minimal expression for F = $\sum$m(6, 7, 8, 9, 13, 15) + d(10, 11, 12, 14). Also realize the expression using NAND gate only. 10

7. Reduce the following expression using K-Map : **10**

   (a) $F = \Pi M(1, 2, 5, 6, 8, 9, 10)$

   (b) $f = \sum(0, 1, 4, 7, 13, 14) + d(5, 8, 15)$

   Realise the obtained expression using NAND/NOR logic.

Unit II

8. (a) State and explain the working of BCD adder with its logic diagram. **6**

   (b) Design a 3 to 8 decoder. **4**

9. What do you mean by multiplexer ? Explain the working of n:1 mux. Design a multiplexer tree f 32:1 mux using 8:1 and 2:1 mux. **10**

Unit III

10. (a) Draw a diagram for 5 bit ring counter using JK flip-flop. Explain its working with the help of timing diagram. **10**

    (b) Design a synchronous mode-6 counter. Use JK flip-flop for designing the counter. **10**

11. (a) What do you mean by Register ? Draw and explain the logic diagram of serial in serial out shift right register. **10**

    (b) Explain how JK flip-flop can be converted into D flip-flop. **10**

Unit IV

12. What are the different types of memories ? Explain them. **10**

13. What do you mean by PLD ? Discuss different types of PLD. Implement the following Boolean functions using PLA : **10**

    $F1(A,B,C) = \sum m(1, 2, 4, 6)$, $f2\ (A, B, C) = \sum m(0, 1, 5, 7)$, $f3\ (A, B, C) = \sum m(1, 2, 3, 5, 7)$

EC-207LA	Digital Electronics Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical**	**Minor Test**	**Total**	**Time**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	**Students will be able to verify truth tables of basic logic gates and design various gates using universal gates.**						
CO2	**Students will be able to design various combinational circuits and verify their operation.**						
CO3	**Students will be able to design different sequential circuits by using flip flops and verify their operation.**						
CO4	**Students will be to study and design various encoders and decoders.**						

List of experiments:

1. Familiarization with Digital Trainer Kit and associated equipment.

2. Study of TTL gates AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.

3. Design and realize a given function using K-Maps and verify its performance.

4. To verify the operation of Multiplexer and De-multiplexer.

5. To verify the operation of Comparator.

6. To verify the truth table of S-R, J-K, T, D Flip-flops.

7. To verify the operation of Bi-directional shift register.

8. To design and verify the operation of 3-bit asynchronous counter.

9. To design and verify the operation of asynchronous Up/down counter.

10. To design and verify the operation of asynchronous Decade counter.

11. Study of Encoder and Decoder.

12. Study of BCD to 7 segment Decoder

Text Books:

1. M. M. Mano, "Digital design", Pearson Education India, 2016.
2. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003.

Note: Atleast ten (10) experiments from the above list are mandatory to perform for the students.

Signals and Systems(EC-209A)

Course Outcomes:	
CO1	Analyze different types of signals.
CO2	Represent continuous and discrete systems in time and frequency domain using different transforms.
CO3	Understand sampling theorem and its implications.

UNIT-I

Introduction to Signals: Continuous and discrete time signals, deterministic and stochastic signals, periodic and a periodic signals, even and odd signals, energy and power signals, exponential and sinusoidal signals and singular functions. Signal representation in terms of singular functions, orthogonal functions and their use in signal representation

Introduction to Systems: Linear and non-linear systems, time invariant and time varying systems, lumped and distributed systems, deterministic and stochastic systems, casual and non-causal systems, analog and discrete/digital memory and memory less systems.

UNIT-II

Random Variables: Introduction to Random Variables, pdf, cdf, moments, distributions, correlation functions.

Linear Time Invariant Systems: Introduction to linear time invariant (LTI) systems, properties of LTI systems, convolution integral, convolution sum, causal LTI systems described by differential and difference equations, Concept of impulse response.

UNIT-III

Discretization of Analog Signals: Introduction to sampling, sampling theorem and its proof, effect of undersampling, reconstruction of a signal from sampled signal.

Fourier Series : Continuous time Fourier series (CTFS), Properties of CTFS, Convergence of Fourier series, Discrete time Fourier Series (DTFS), Properties of DTFS **,** Fourier series and LTI system, Filtering.

UNIT-IV

Fourier Transform: Continuous Time Fourier Transform (CTFT), Properties of CTFT, Systems characterized by linear constant- coefficient differential equations, Discrete time fourier transform (DTFT), Properties of DTFT, Duality, Systems characterized by Linear constant coefficient difference equations.

Laplace Transform: Introduction to Laplace transform, Region of convergence for laplace transform, Inverse laplace transform, Properties of laplace transform, Analysis and characterization of LTI systems using laplace transform, System function algebra and block diagram representations,Unilateral laplace transform.

Text Books:

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, Signals and Systems, Prentice Hall
India, 2nd Edition, 2009

Reference Books:

1. Simon Haykins – "Signal & Systems", Wiley Eastern
2. Tarun Kumar Rawat , Signals and Systems , Oxford University Press.
3. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.

4. M. J. Robert “Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.
5. B. P. Lathi, “Linear Systems and Signals”, Oxford University Press, 2009.

Lecture Schedule:

L.No.	***Topic***
L1	Introduction to Signals and Systems
L2	Continuous time signals (CT signals), discrete time signals (DT signals)
L3	Elementary signals – Step, Ramp, Pulse, Impulse, Sinusoidal, Exponential
L4	Elementary signals – Step, Ramp, Pulse, Impulse, Sinusoidal, Exponential
L5	MATHEMATICAL PROBLEMS
L6	Classification of CT and DT signals - Periodic & Aperiodic signals, Even & Odd signals
L7	Classification of CT and DT signals-Deterministic & Random signals, Energy & Power signals
L8	MATHEMATICAL PROBLEMS
L9	CT and DT systems
L10	Classification of Systems – Linear and Non-Linear, Time Variant and Time Invariant
L11	Classification of Systems – Causal and Non-causal, Stable and Unstable, Static and Dynamic.
L12	Introduction to Random Variables
L13	Probability Density Function
L14	Cumulative distribution function
L15	Moments, distributions, correlation functions
L16	Introduction to sampling
L17	Sampling theorem and its proof
L18	Effects of Under-sampling

L19	Reconstruction of a signal from sampled signal
L20	Continuous time Fourier series (CTFS),
L21	Properties of CTFS,
L22	Convergence of Fourier series,
L23	Discrete time Fourier Series (DTFS),
L24	Properties of DTFS
L25	Fourier series and LTI
L26	System Filtering
L27	Problems on Fourier series
L28	Continuous Time Fourier Transform (CTFT)
L29	Properties of CTFT
L30	Systems characterized by linear constant- coefficient differential equations
L31	Discrete time Fourier transform (DTFT)
L32	Properties of DTFT
L33	Duality
L34	Systems characterized by Linear constant coefficient difference equations
L35	Problems on DTFT
L36	Problems on Fourier Transform
L37	Introduction to Laplace transform,
L38	Region of convergence for laplace transform
L39	Inverse laplace transform
L40	Properties of laplace transform
L41	Analysis and characterization of LTI systems using laplace transform
L42	System function algebra and block diagram representations

L43	Unilateral laplace transform
L44	Laplace Transform – ROC
L45	Problems on Laplace transform
L46	Discussion on Old University Question papers

Tutorial Sheet - 01

1. Define the basic form of the discrete time impulse and step signals and sketch the signals.
2. Calculate the power and energy of the following continuous and discrete time signals: $x(t) = e^{-4t}u(t)$ and $x[n] = (1/4)^n u[n]$
3. Are the following continuous and discrete time signal periodic, if so determine their period (and fundamental frequency for the continuous time signal): $x(t) = je^{j5t}$, $x[n] = e^{j7\pi n}$.
4. Describe what system linearity means in terms of a system's response to individual signals. Is the following system linear: $y[n] = 5*x[n] + 2$?
5. Describe what system stability means. Are the following systems stable $y[n] = x[n]$, $y(t) = t^2*x(t)$, $y[n] = 2y[n-1]+x[n]$?
6. Describe what system causality means. Are the following discrete time systems causal $y[n] = x[n+1]$, $y[n] = x[n-1]$?

Tutorial Sheet – 02

1. Describe how the sifting property can be used to represent a discrete time signal in terms of impulse basis signals.
2. Describe how the superposition and sifting properties allows the response of a discrete time, linear time invariant system to be determined by $y[n] = \sum_{k=-\infty}^{\infty} x[k]h[n-k]$, where $h[n]$ is the system's impulse response.
3. Calculate, using convolution, the system's response to the following input signals and system with impulse response pairs
    1. $x[n] = (1/3)^n u[n]$, $h[n] = u[n]$
    2. $x[n] = (1/3)^n u[n]$, $h[n] = u[n-2]$
    3. $x[n] = u[n]-u[n-3]$, $h[n] = u[n-2]$

   In all cases, sketch the input signal, the impulse response and the system's response.
4. Calculate, using convolution, the system's response to the following input signal and system impulse response pairs:
    1. $x(t) = e^{-4t}u(t)$, $h(t) = u(t)$
    2. $x(t) = e^{-4t}u(t)$, $h(t) = u(t-2)$
    3. $x(t) = u(t)-u(t-3)$, $h(t) = u(t-2)$

   In all cases, sketch the input signal, the impulse response and the system's response.

5. Describe what system stability means in terms of the system's impulse response. Is the following discrete time system stable $h[n]$ = n*$u[n]$?
6. Describe what system causality means in terms of the system's impulse response. Is the following system causal $h(t) = e^{-t}$

Tutorial Sheet – 03

1. If $x(t)$ is a periodic signal, describe the form of the basis functions that occur in the Fourier series representation of the time domain signal.
2. Calculate the Fourier series (coefficients) of the following periodic signals
    - $x(t) = \cos(t)$
    - $x(t) = 2+\cos((2\pi/3)t)+4\sin((5\pi/3)t)$
    - $x(t) = 1$ (where $0<=t<1$) and -1 (where $1<=t<2$), which is period 2.
3. For each of the signals in question 2, sketch the time domain signals and the magnitude/phase of the Fourier series coefficients
4. Does the Fourier transform of the following continuous time signals exist: $x(t) = e^{-5t}$, $x(t) = e^{t}$,
5. Calculate the Fourier transforms of the following continuous time signals:
    - $x(t) = e^{-5t}$
    - $x(t) = 1$ (where $|t|<1$) and 0 otherwise
    - $x(t) = \delta(t)$
    - $x(t) = \sin(t)$
    - $x(t) = 2+\cos((2\pi/3)t)+4\sin((5\pi/3)t)$

    In each case, explicitly state whether the Fourier transforms exist, and sketch the time domain signals and magnitude of the Fourier transforms
6. Using the inverse Fourier transform formula, calculate and sketch the time domain signal corresponding to the frequency domain signal
    - $X(jw) = 1$ (where $|w|<5$) and 0 otherwise
7. Show that the Fourier transform of dx/dt is $jwX(jw)$
8. Using convolution in the frequency domain, calculate the system's response when the input signal is $x(t) = e^{-2t}u(t)$ and the impulse response is $h(t) = e^{-t}u(t)$.

Tutorial Sheet - 04

1. Describe how the Laplace and the Fourier transform are related and what are the conditions are they the same.
2. Calculate the Laplace transform and the associated regions of convergence for the following signals:
    - $x(t) = \cos(5t)u(t)$
    - $x(t) = e^{-3t}u(t)$
    - $x(t) = u(t-2)$
    - $x(t) = 2e^{-3(t-1)}u(t-1) - e^{-3(t-2)}u(t-2)$

3. For each of the Laplace transforms in question (2) state the corresponding poles and zeros of the Laplace transfer function and draw them in the complex *s*-plane along with the corresponding regions of convergence.
4. Show that the Laplace transform of dx/dt is $sX(s)$
5. Using convolution in the *s*-domain, calculate the system's response when the input signals and impulse responses are:
    - $x(t) = e^{-2t}u(t)$, $h(t) = e^{-t}u(t)$.
    - $x(t) = e^{-4t}u(t)$, $h(t) = u(t-2)$.
    - $x(t) = u(t)$, $h(t) = e^{-t}u(t)+e^{-2t}u(t)$.

    In each case, sketch the input signal, the impulse response and the calculated system response.

Tutorial Sheet – 05

1. Find the frequency response of an LTI-CT system described by
2. If and LTI-CT systems frequency response is H (j ?) = a-j ? / a+j?. Find |h(j?)|, H(j?) and impulse response.
3. State time convolution property of Fourier transform.
4. Given the transform pair L [x (t)] = 2s/s2 –2. Determine the Laplace transform of x (2t).
5. Find the impulse response of H (s) = s+2/s2 + 5s + 4.
6. Find the transfer function of a ideal integrator.
7. State frequency shifting property of laplace transform.
8. Plot pole – zero diagram of the following transfer functions.
    1) s+2 / s2 +2s +2 2) S + 3 / s (s2+4) (s+2) (s+1)
9. What is meant by state of a system?
10. What is need of transforms in signal analysis?
11. Represent an inductor in s-domain with zero initial conditions.

Question paper

Roll No. ..... Total Pages : 03

BT-3/D-19 33139

SIGNALS AND SYSTEMS

EC-209A/EEN-209A

Time : Three Hours] [Maximum Marks : 75

Note : All questions in Part-A and Part-B are compulsory. Attempt any *four* questions from Part-C selecting at least one question from each Unit.

PART-A (15 Marks)

1. Answer the following questions carrying 3 marks each : **5×3=15**

(i) Explain the properties of periodic signals.

(ii) Explain time invariance property of systems.

(iii) Describe the properties of Probability Density Function.

(iv) State and prove periodic convolution property for continuous time Fourier series.

(v) Explain region of convergence.

PART-B (20 Marks)

Answer the following questions, one from each unit and all questions carrying equal marks. **5×4=20**

Unit-I

2. Determine whether signal $x(t) = e^{j(2t + \pi/4)}$ is energy or power signal. **(5)**

Unit-II

3. Derive the expression for standard deviation of random variable X. **(5)**

Unit-III

4. Determine the exponential Fourier series for periodic signal $x(t) = (5/\pi)t$ for $0 < t < 2\pi$. The fundamental time period of the signal is 2π. **(5)**

Unit-IV.

5. Find the Fourier transform for $x(t) = e^{-a|t|}$. **(5)**

PART-C (40 Marks)

Students are required to attempt *four* question, by selecting *one* question from each unit and all questions carrying equal marks. **10×4=40**

Unit-I

6. (a) Explain orthogonal functions. (4)

   (b) Check the periodicity for $x[n] = u[n] + u[-n]$ (6)

7. Determine whether the system with output $y(t) = \sin(x(t))$ is : (10)

   (a) Static (b) Causal (c) Linearity
   (d) Time invariant (e) Stable.

Unit-II

8. (a) Explain convolution integral and derive its expression for $y(t)$. (5)

   (b) Determine causality and stability for LTI system with impulse response $h(t) = e^{-6t}\, u(3-0)$. (5)

9. (a) Explain and derive the expression for unit step response of LTI systems. http://www.kuonline.in (5)

   (b) Determine the variance of X if $f_x(x) = (1 - x^2)$ for $0 \le x \le 2$. (5)

Unit-III

10. Explain reconstruction of a signal from its samples. (10)

11. Find the exponential Fourier series for $x(t) = e^{-t/2}$, $0 < t < \pi$. (10)

Unit-IV

12. Consider the causal LTI system with frequency $H(\omega) = \frac{1}{3 + j\omega}$. For a particular input $x(t)$, this system is observed to produce the output $y(t) = e^{-3t}\, u(t) - e^{-4t}\, u(t)$. Determine $x(t)$.

13. Determine the Laplace transform for (10)

    $x(t) = \sin(\omega_0 t)\, u(t)$ and ROC for $x(t)$.

Signals & System Lab	
CO1	To understand the basic concepts of software.
CO2	To explore properties of various types of signals and systems.
CO3	To explore different properties of signals and systems.
CO4	To understand the concept of sampling in time and frequency domain.

List of experiments:

1. Introduction of the MATLAB/SciLab/Octave software.
2. To demonstrate some simple signal.
3. To explore the effect of transformation of signal parameters (amplitude-scaling, time-scaling and time- shifting).
4. To visualize the complex exponential signal and real sinusoids.
5. To identify a given system as linear or non-linear.
6. To explore the time variance and time invariance property of a given system.

7. To explore causality and non-causality property of a system.
8. To determine Fourier transform of a signal.
9. To determine Laplace transform of a signal.
10. To demonstrate the time domain sampling of bandlimited signals (Nyquist theorem).
11. To demonstrate the sampling in frequency domain (Discrete Fourier Transform).
12. To demonstrate the convolution and correlation of two continuous-time signals.
13. To demonstrate the convolution and correlation of two discrete-time signals.

Reference Books:

1. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.
2. Signals and Systems using Scilab, www.scilab.in.
3.Signals and Systems using Octave, www.octave.org

EC-213A	**Network Theory**						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	To understand the concept of network topologies and the network analysis in the time domain for solving simple and complex circuits.						
CO2	Describe the circuit element models, network analysis using Laplace transform and time domain behavior from the pole-zero plots.						
CO3	Describe the characteristics & parameters of two port networks.						

CO4	To understand the concept of filters and synthesis of one port networks.

UNIT I

INTRODUCTION: - Principles of network topology, graph matrices, Network Analysis (Time-Domain): Singularity Functions, Source-Free RC, RL, Series RLC, Parallel RLC circuits, Initial & Final Conditions, Impulse & Step Response of RC, RL, Series RLC, Parallel RLC circuits.

UNIT 2

NETWORK ANALYSIS (using Laplace Transform): - Circuit Element Models, Transient Response of RC, RL, RLC Circuits to various excitation signals such as step, ramp, impulse and sinusoidal excitations using Laplace transform.

NETWORK FUNCTIONS: - Terminal pairs or Ports, Network functions for one-port and two-port networks, poles and zeros of Network functions, Restrictions on pole and zero Locations for driving point functions and transfer functions.

UNIT 3

CHARACTERISTICS AND PARAMETERS OF TWO PORT NETWORKS: - Relationship of two-port variables, short-circuit admittance parameters, open circuit impedance parameters, transmission parameters, hybrid parameters, relationships between parameter sets, Inter-connection of two port networks.

UNIT 4

TYPES OF FILTERS AND THEIR CHARACTERISTICS: - Filter fundamentals, constant-k and m-derived low-pass and high-pass filters.

NETWORK SYNTHESIS: - Causality & Stability, Hurwitz Polynomials, Positive real functions, Synthesis of one port networks with two kind of elements.

TEXT BOOKS:

- Fundamentals of Electric Circuits: Charles K. Alexander, Matthew N. O. Sadiku, McGraw Hill Education
- Network Analysis: M.E. Van Valkenburg, PHI

REFERENCE BOOKS:

- Network Analysis & Synthesis: F. F. Kuo, John Wiley.
- Circuits & Networks: Sukhija & Nagsarkar, Oxford Higher Education.
- Basic Circuit Theory: DasoerKuh, McGraw Hill Education.
- Circuit Analysis: G.K. Mithal, Khanna Publication.

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

Lesson Plan		
Week	**Lecture Day**	**Theory** **Topic (Including Assignment/Test)**
1	1.	Introduction to Network Theory
	2.	Revision of basic theorms
	3.	Use of matrix for solving equations
2	4.	Kirchoff's voltage law and numericals
	5.	Kirchoff's Current law and numericals
	6.	Thevinin's theorm and numericals based on this
3	7.	Norton's theorm
	8.	Mesh analysis
	9.	Nodal analysis
4	10.	Inter conversion between rectangular and polar coordinate system
	11.	Introduction to 02 port N/w , Z and Y parameters
	12.	Hybrid and inverse hybrid parameters

5	13.	Transmission and inverse transmission parameters
	14.	Conversion between different parameters
	15.	Terminated 02 port n/w parameters
6	16.	Interconnection of 02 port network
	17.	Introduction to Network functions
	18.	Transfer functions
7	19.	Poles and zeroes of network function
	20.	Time domain analysis of network functions
	21.	Restriction on poles and zeroes
8	22.	Introduction to network synthesis
	23.	Causality and stability
	24.	Hurwitz polynomial
9	25.	Positive real functions
	26.	Routh Hurwitz criteria for stability
	27.	Synthesis using LC
10	28.	Synthesis using RC & RL
	29.	Filter fundamental and constant K filter
	30.	m derived filters
11	31.	Introduction to graph theory
	32.	Cutset matrix
	33.	Tie set matrix
12	34.	Singularity functions , source free RC and RL circuits
	35.	Source free series and parallel RLC circuits

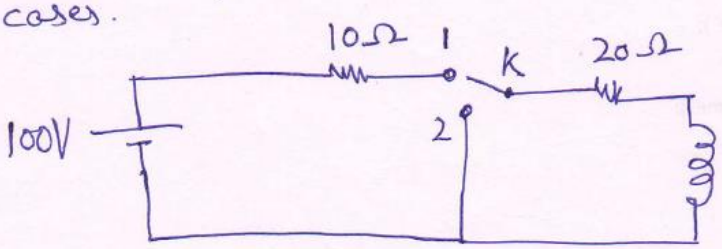
13	36.	Series & parallel RLC circuits
	37.	Initial and final conditions
	38.	Impulse and step response of RC , RL circuits
	39.	Circuit element models
14	40.	Transient response of RC and RL circuits
	41.	Step and ramp response of RC and RL circuits
	42.	Step and ramp response of RLC circuits
15	43.	Impulse response of RC , RL
	44.	Impulse response of RLC circuits
	45.	Revision

Tutorial Sheet 1

Q1 Explain Cutset & Tieset matrise

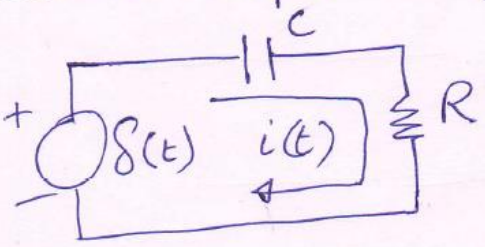
Q2. Derive an expression for transient response in RLC circuit

Q3. The switch K is kept first at position 1 and steady state condition is reached. At $t=0$ switch is moved to position 2. Find current in both the cases.



Q4. In a RC series circuit $R = 1\Omega$ and $C = 0.5F$ An exponential voltage $v = 10e^{-t}$ is suddenly applied at $t=0$. Obtain $i(t)$. Assume no initial charge.

Q5 Calculate impulse response of $i(t)$



Tutorial Sheet 2

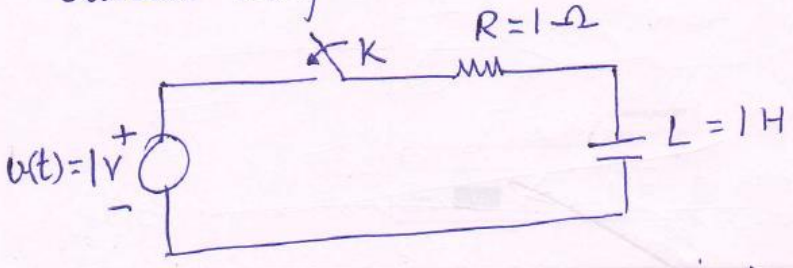
Q1 What are the restrictions on poles and zeroes of transfer function.

Q2 Obtain time domain response of :-

$$I(s) = \frac{2s}{(s+1)(s^2+2s+4)}$$

Q3 Derive an expression for step response of RL series circuit.

Q4. RL circuit is energised by DC voltage of 1V by switching at $t=0$. Find the expression of current using convolutional integral.

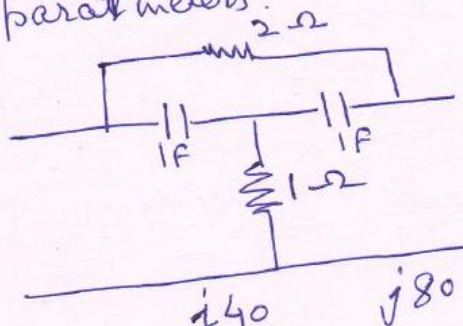


Q5 Derive an expression for impulse response of RC series network.

Tutorial Sheet 3

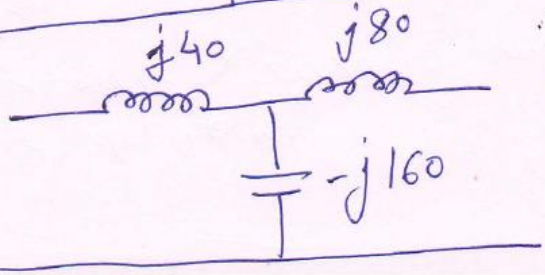
Q1 Find Y parameters in terms of transmission parameters.

Q2

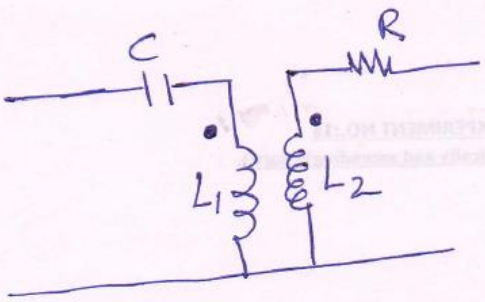


Find Y parameters

Q3



Find Z parameters.

Q4. 

Find Z parameters

Q5 In a 02 port n/w $Z_{11} = 2\Omega$,
$Z_{12} = Z_{21}$; $Z_{22} = 1\Omega$
Find transmission parameters

Tutorial Sheet 4

Q1. Design a constant K-LPF having cut off frequency 2.5 KHz & design resistance $R_0 = 400\ \Omega$.

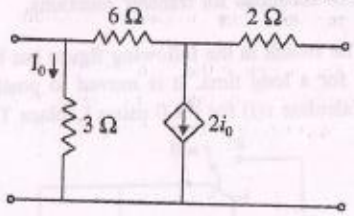
Q2. Design T & π section of m derived HPF having $R_0 = 600\ \Omega$ and cut off frequency 4 KHz and infinite attenuation of 3.6 KHz.

Q3. Find the range of values of m in P(s so that P(s) is Hurwitz
$$P(s) = 2s^4 + s^3 + ms^2 + s + 2$$

Q4. Synthesize the network in Cauer 1 form
$$Z(s) = \frac{s^5 + 5s^3 + 3s}{s^4 + 3s^2 + 1}$$

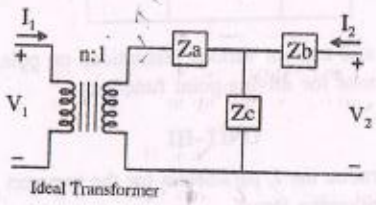
Q5 Explain Causality and Stability of a network.

(b) Determine the Y parameters of the two-port network.



7

6. Find the Z parameters of the circuit shown in the following figure : 15



UNIT–IV

7. (a) Design m-derived T-sections LPFs for $R_0 = 500$ ohms, $f_c = 3600$ Hz and $f_\infty = 4000$ Hz. 8

(b) Define Positive real functions and its properties. 7

8. (a) An impedance is given by $Y(s) = \frac{3s^2 + 18s + 24}{s^2 + 3s}$.

Realize the network in Foster-II form. 8

(b) List and explain the synthesis properties of LC impedance or admittance functions. 7

Roll No. ..... Total Pages : 4

BT-3/D-18 **33088**

NETWORK ANALYSIS AND SYNTHESIS

Paper : ECE-205(N)

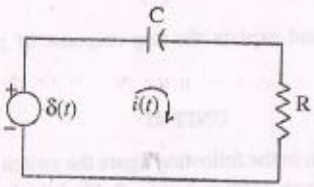
Opt. (1)

Time : Three Hours] [Maximum Marks : 75

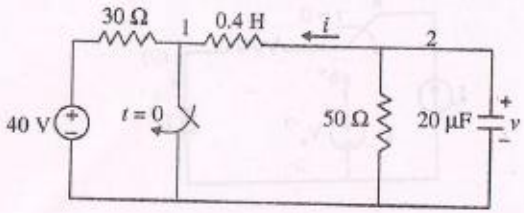
Note : Attempt *five* questions in all, selecting at least *one* question from each unit.

UNIT–I

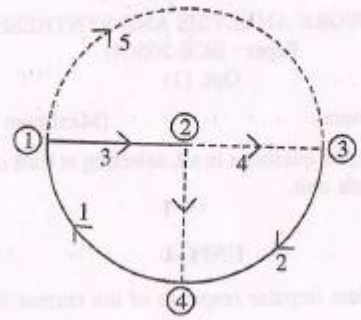
1. (a) Calculate impulse response of the current $i(t)$. 8



(b) Find $v(t)$ for $t > 0$ in the RLC circuit given below : 7



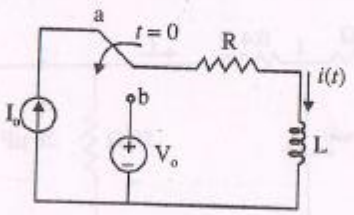
2. (a) For the tree shown, develop the fundamental cut-set matrix : 8



(b) Derive and explain the step response of parallel RLC circuit. 7

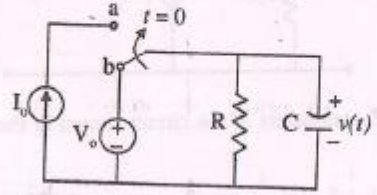
UNIT–II

3. (a) As shown in the following figure the switch moves from position a to position b at $t = 0$. Find $i(t)$ for $t > 0$ using Laplace Transform : 8



(b) List and explain the various restrictions on pole and zero locations for transfer functions. 7

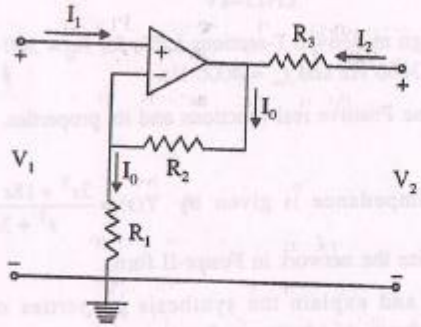
4. (a) The switch in the following figure has been in position b for a long time. It is moved to position a at $t = 0$. Calculate $v(t)$ for $t > 0$ using Laplace Transform. 8



(b) List and explain various restrictions on pole and zero locations for driving-point functions. 7

UNIT–III

5. (a) Determine the Z parameters for the two-port shown in the following figure. 8



ES-219A	Essentials of Information Technology						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs.
Course Outcomes (CO)							
CO1	Develop basic computational thinking. Learn how to reason with variables, state transitions, conditionals, and iteration						
CO2	Understand the notion of data types, and higher order data structures such as lists, tuples, and dictionaries.						
CO3	Develop a basic understanding of computer systems -architecture, OS, mobile and cloud computing.						
CO4	Learn basic SQL programming						

UNIT-I

Python Programming: Familiarization with the basics of Python programming, process of writing a program, running it, and print statements; simple data-types: integer, float, string. The notion of a variable, and methods to manipulate it, Knowledge of data types and operators: accepting input from the console, assignment statement, expressions, operators and their precedence. Conditional statements: if, if-else, if-elsif-else; Notion of iterative computation and control flow: for, while, flowcharts, decision trees and pseudo code

UNIT-II

Idea of debugging: errors and exceptions; debugging: pdb, break points. Sequence datatype: Lists, tuples and dictionary, Introduce the notion of accessing elements in a collection using numbers and names. Sorting algorithm: bubble and insertion sort; count the number of operations while sorting. Strings: Strings in Python : compare, concat, substring. **Data visualization using Pyplot:** line chart, pie chart, and bar chart.

UNIT-III

Computer Systems and Organisation: description of a computer system and mobile system, CPU, memory, hard disk, I/O, battery, power. Types of software:Types of Software – System Software, Utility Software and Application Software, how an operating system runs a program, operating system as a resource manager. **Cloud Computing**: Concept of cloud computers, cloud storage (public/private),and brief introduction to parallel computing.

UNIT-IV

Relational databases: idea of a database and the need for it, relations, keys, primary key, foreign key; use SQL commands to create a table, foreign keys; insert/delete an entry, delete a table. SQL commands: select, project, and join; indexes. Basics of NoSQL databases: Mongo DB

Text Books:

1. Python Programming: A modular approach by Sheetal Taneja and Naveen Kumar Pearson

Reference Books:

1. Python Programming - Using Problem Solving Approach by Reema Thareja Oxford Publication.

2. Database Management System a Practical Approach by Rajiv Chopra by S. Chand

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

Lesson Plan

Lecture	Topic/Chapter Covered
L1	Python Programming: Familiarization with the basics of Python programming, process of writing a program, running it, and print statements
L2	simple data-types: integer, float, string. The notion of a variable
L3	Methods to manipulate it, Knowledge of data types and operators
L4	accepting input from the console, assignment statement,
L5	expressions, operators and their precedence
L6	Conditional statements: if, if-else, if-elsif-else;
L7	; Notion of iterative computation and control flow: for, while
L8	flowcharts, decision trees and pseudo code
L9	Idea of debugging: errors and exceptions; debugging: pdb, break points
L10	datatype: Lists, tuples and dictionary
L11	, Introduce the notion of accessing elements in a collection using numbers and names
L12	Sorting algorithm: bubble
L13	insertion sort

L 14	Strings in Python : compare, concat, substring
L 15	Data visualization using Pyplot
L 16	line chart, pie chart, and bar chart.
L 17	Computer Systems and Organisation: description of a computer system
L 18	mobile system
L 19	CPU, memory
L20	hard disk, I/O, battery, power
L 21	Systemsoftware
L 22	Utility Software ,Application Software
L23	how an operating system runs a program
L 24	operating system as a resource manager
L 25	Cloud Computing
L26	Concept of cloud computers
L 27	cloud storage (public/private)
L 28	brief introduction to parallel computing
L29	Relational databases: idea of a database and the need for it, relations
L30	Relational databases:relations
L 31	keys, primary key, foreign key
L 32	SQL commands to create a table
L33	foreign keys; insert/delete an entry
L34	delete a table, select
L35	join; indexes
L 36	Basics of NoSQL databases
L 37	Mongo DB

Tutorial Sheet

Unit-1

1. What is a variable?
2. What are the primitive built-in types in Python?
3. When should we use “”” (tripe quotes) to define strings?
4. Assuming (name = “John Smith”), what does name[1] return?
5. What about name[-2]?
6. Explain operators and their precedence.
7. What are decision control statements. Explain with an example.

Unit-2

1. Explain datatype: Lists, tuples and dictionary with an example.
2. Explain types of error .how to debug also explain exception handling in python.
3. Explain bubble sort
4. Expalin string and also explain all the functions applied on string.

Unit-3

1. Explain in detail about System Software, Utility Software and Application Software
2. Explain operating system and how an operating system runs a program.
3. Explain concept of Cloud Computing

Unit -4

1. Explain Relational databases and the need for it
2. Explain relations, keys, primary key, foreign key
3. Command used in SQL to create a table, foreign keys; insert/delete an entry, delete a table.
4. Explain Basics of NoSQL databases and Mongo DB

Roll No. ..... Total Pages : 03

BT-3/D-19 **33141**

ESSENTIALS OF INFORMATION TECHNOLOGY

ES-219A

Time : Three Hours] [Maximum Marks : 75

Note : All questions in Part A and B are compulsory. Attempt any *four* questions from Part C selecting at least *one* from each Unit.

Part A 15

1. Answer the following questions :
   (i) Make a flowchart for any suitable example.
   (ii) What are main components of C.P.U. ?
   (iii) How input is accepted from console in python ?
   (iv) Define Strings.
   (v) Write a SQL command to delete an entry from a table. 5×3=15

Part B 20

Unit I

2. What is process of writing a program in python ? 5

Unit II

3. Discuss bar chart with an example. 5

Unit III

4. Write short note on parallel computing. 5

Unit IV

5. Why primary key can't be NULL ? 5

Part C 40

Unit I

6. Illustrate the use of conditional statements with an example. 10

7. Write a simple program in python using while loop. 10

Unit II

8. What are different sequence data types ? Explain functions of each with example. 10

9. Describe insertion sort with its complexity and with an example. 10