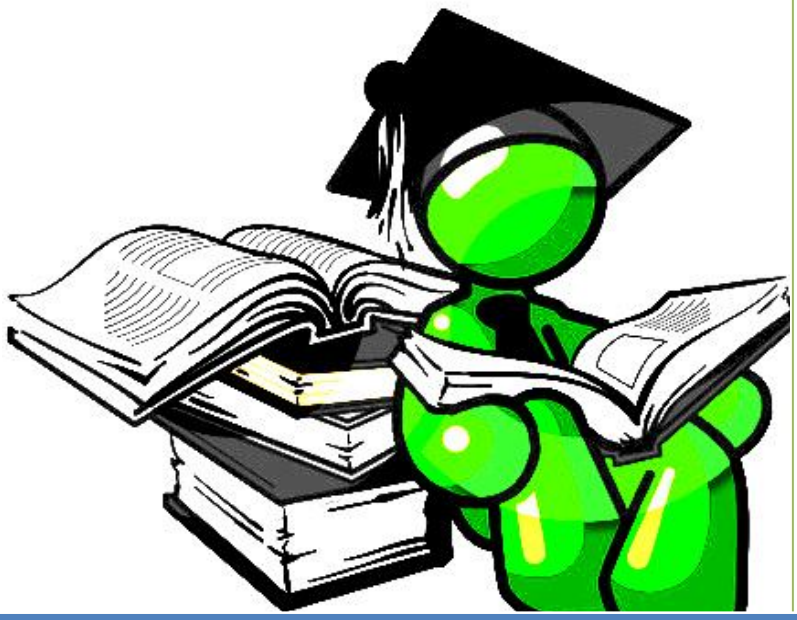
SH-2015



ACADEMIC BOOK

PADMABHUSHAN VASANTDADA PATIL PRATISHTHAN'S
COLLEGE OF ENGINEERING
SINCERITY
SACRIFICE
SYSTEM
1990
Empower The Knowledge

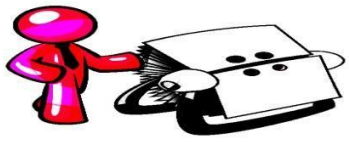
SEMESRTER V

TE-ELECTRONICS

SH-2015

ACADEMIC BOOK

INDEX



Rules and Regulations

College Timings:
The college timing is from 8:45 AM to 4:45 PM .The students must follow the college timing.

Academic calendar and Time table:
The details of academic curriculum and activities are mentioned in the academic book. The students are required to strictly follow the class Time table and academic calendar.

Attendance:
All students are hereby informed that attendance for lectures/practical/tutorials is compulsory. Mumbai University does not allow students to appear for examination if their attendance is less than 75%.But for the good academic performance of the students, the department expects 100 % attendance in theory and practical separately.

Defaulters:
Defaulters list will be displayed monthly. The defaulter students are required to bring their parents/guardians within four days after the display of defaulters list. If students remain defaulter consistently he/she has to face the consequences as laid by the Mumbai University.

Identity card:
Student must wear ID during college hours in the campus.

Mobile Phone:
Use of cell phone is strictly prohibited in the college premises.

Examination:
As per the university norms, there will be two term test i.e Mid Term test and End Term test in the semester which is an integral part of Internal Assessment for every subject. Both the examination will be based on 40 % and 70 % of theory syllabus respectively for each subject and will be conducted as per the dates mentioned in the academic calendar. Attendance for both internal examination IS COMPULSORY .As per the university norms, no retest will be conducted under any circumstances. Separate passing heads is compulsory for internal and external examination for individual subjects. If the student fails in any of the exam he/she has to reappear in the concerned subject after the declaration of the result.

Practicals/tutorials/Assignments:
The Student should compulsory bring their rough and fair journal for the concerned subject for every practical and tutorials and get it checked regularly. Failing to do so, they will not be allowed for the practical. The Assignments for every subject should be submitted on regular basis.
The student must abide by the above mentioned rules and regulations laid down by the department for their better and brighter future.

ACADEMIC CALENDER SH-2015

COMMENCEMENT OF SEMESTER

Sr. No.	Date	Activity	Responsibility
1	June 06, 2015	Mini Project Orientation Seminar for TE	TE Project Coordinators
	June 30, 2015	Display of Timetable	Time Table Committee
2	July14, 2015	Commencement of Term Address of HODs/ faculty to the student with faculty introduction. Theory and lab period as per time table. (Small orientation lecture are to be organized on first day and course content with industry relevance to be illustrated for all classes. Rules regulations to be explained too.)	HODs / CAs and faculties Distribution of Academic Book to all students Semester wise I.III,V,VII
3	July 18, 2015	Ramzan-Id	
4	July 24, 2015	Final Mini Project Group Formation(TE)	TE Project Coordinator
5	July 24, 2015	Project approval seminar and Display of approved project :Title and Name of Guide	BE Project coordinator
6	As per department's academic Calendar	Lecture Series	As per departmental Academic Time Table
7	July 31, 2015	Project Approval Seminar (TE)	Project coordinator
9	August 06, 2015	Display of approved Mini project(TE)	TE Project Coordinator
10	August 11-14, 2015	Introduction & Initial Mini Project development (TE)	TE Project Coordinator
11	August 14, 2015	**Display of defaulter's list – I**	**Class Advisors/ HODs (Reports to be generated through MIS)**
12	August 14,2015	Fresher's Party	Student's Council & SE Students
13	August 15,2015	Independence Day	Celebrated in the college as per circular
14	August 17-21, 2015	Literature Survey	TE Project Coordinator
15	August 18,2015	Parsi New Year	
16	August 17th ,18th & 19th ,2015	Students Feedback 1	Sys Admin (Online feedback in coordination with the departments)
17	**August 24-26,2015**	**Mid Term Test**	**HODs, CAs**

18		BE Project Review – I	BE Project coordinator
19	August Last week 2015	Mini Project Review	TE Project Coordinator
20	September 1-4, 2015	Practical work of Mini Project activities	TE Project Coordinator
21	September 6,2015	Gopalkala	
22	September 7 to 11th ,2015	Parent Teachers Interaction Meeting	HODs/ CAs
23	September 8-18, 2015	Implementation of Mini Project	TE Project Coordinator
24	**September 14 , 2014**	**Display of defaulter's list – 2**	**Class Advisors/ HODs (Reports to be generated through MIS)**
25	**September 14 to 18th,2015**	On line Examination	Coordinators/ Sys Administrator / Subject Teacher
26	**September 15, 2015**	Felicitation to toppers (Engineers Day)	Principal and Student's Council
27	**September 17, 2015**	Shri Ganesh Sthapana	Principal and Student's Council
28	**September 18, 2015**	Project Review – II and Submission of softcopy of synopsis	BE Project coordinator
29	**September 21,2015**	**ShriGanesh Visarjan**	Principal and Student's Council
30	September 22-25, 2015	Results & Conclusion	TE Project Coordinator
31	**September 25 ,2015**	Bakari ID (ID UL ZUHA)	
32	**September 27,2015**	Anant Chaturdashi	
33	**September 28-30 , 2015**	Students Feedback 2	Sys Admin (Online feedback in coordination with departments)
34	September Last week	Mini Project review-II	TE Project Coordinator
35	**October 2,2015**	Mahatma Gandhi Jayanti	
36	**October 5-7,2015**	**End Term Test**	**HODs, CAs**
37	October 09, 2015	Final certification and submission of synopsis	BE Project coordinator
38	October 06, 2015	Project Diary & Final report submitted to guide for approval	TE Project Coordinator
39	October 10, 2015	Final submission duly approved by guide	TE Project Coordinator
40	**October 12,2015**	**Third Defaulter List**	**Class Advisors/ HODs (Reports to be generated through MIS)**
41	**October 12-23,2015**	**Remedial Classes**	Coordinators with HODs (For weaker students)

42	October 22,2015	Dasara	
43	October 19-23 ,2015	Final Certification and submission	HOD (As per University schedule)
44	October 24,2015	Moharam	
45	October 26,2015	Final defaulter list	HODs
46	October 26,2015	Term End	HODs (As per University Schedule)
47	October 26 to November 7,2015	Conduction of Oral and Practical Examinations	Faculties (As per University Schedule)
48	November 11,2015	Laxmi Pujan	
49	November 12, 2015	Balipratiprada	
50	After Term End	Vacation for faculties 1st Slot	Exam In –Charge (As per University Schedule)
51	November 25, 2015	Gurunanak Jayanti	
52	18th Nov.2015 to 19th Dec. 2015	Non Vacation Slot	(As per University schedule)
53	18th November,2015 onwards	University Theory Examination for all Semesters	Exam In-Charge (As per University schedule)
54	20th December-3rd Jan. 2016	Vacation for faculties 2nd Slot	Exam In –Charge (As per University Schedule)
55	24th December,2015	ID-E-MILAD	
56	25th December,2015	CHRISTMAS	
57	January 04,2016	Commencement of FH-2016	

Summary:

1) Total Working Weeks : 15
2) Total Working days (excluding Saturdays, Sundays & examination) : 86
3) Total Working Days for teaching : 73
4) Available Periods for teaching :

Perweek	@
3	42
4	56
5	70

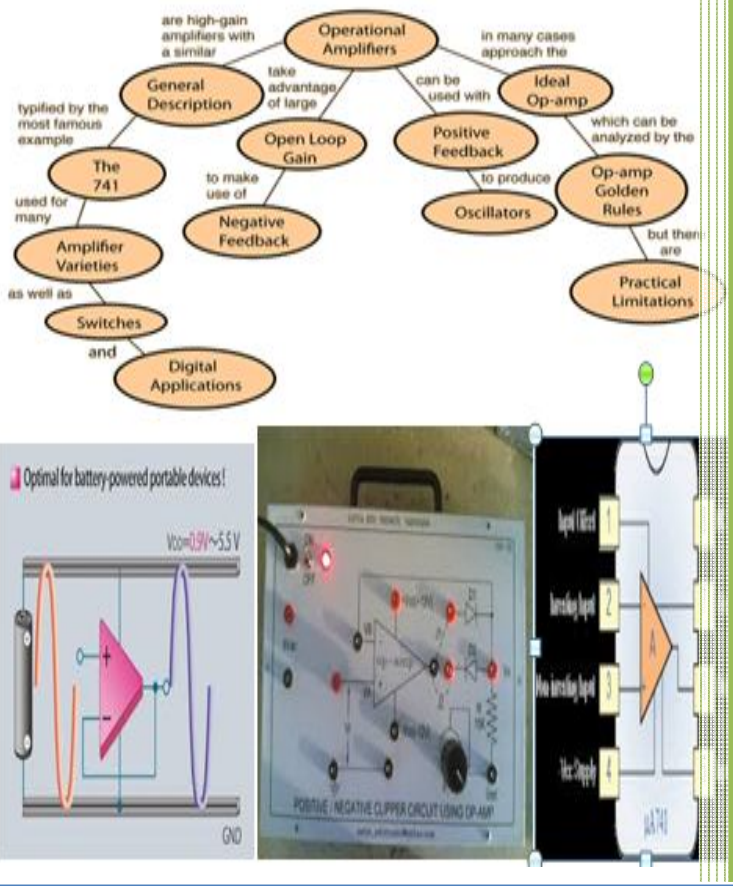
5) Tests :

Mid Term, End Term for (FE/SE/TE/BE)	Online Test for (FE/SE/TE/BE)
02 Written test	01

Note:

a. Attendance is compulsory from first day onwards
b. Those students who will remain absent on first day of academic semester, are compulsorily required to bring letter along with parents and meet the Principal/ HOD for permission to attend the college.
c. In case of absence (even for a day or hour), students are required to submit letters from parents at the time of attending the college.

Dr.Rajendra R.Sawant
Principal



SH-2015

DESIGN WITH LINEAR INTEGRATED CIRCUITS

PADMABHUSHAN VASANTDADA PATIL PRATISHTHAN'S
COLLEGE OF ENGINEERING
SINCERITY
SACRIFICE
SYSTEM
1990
Empower The Knowledge

Mrs.Deepali Bhosale

Subject Plan

GROUP NAME	**: Integrated Circuits**
COURSE TITLE	**: Design with Linear Integrated Circuits**
COURSE CODE	**: EXC 502**
SEM	**: V (SH 2015)**
PRE-REQUISITE	**:** Electronic Devices, Digital Circuits and Design, Discrete Electronic Circuits.

RATIONALE

Linear Integrated Circuits hold an important unique place in the field of electronics. This subject is classified under Integrated circuits group with a focus on imparting concepts, principles and applications of Linear/Analog integrated circuits in the field of Electronics. The prerequisite for this subject is knowledge of basic electronic devices and circuits.

OBJECTIVES :

1. To teach fundamental principles of standard linear integrated circuits.
2. To develop a overall approach for students from selection of integrated circuit, study its specification, the functionality, design and practical applications.

OUTCOME :

1. Demonstrate an understanding of fundamentals of integrated circuits.
2. Analyze the various applications and circuits based on particular linear and non linear integrated circuit.
3. Explore performance parameters of Data converters.
4. Select and use an appropriate integrated circuit to build a given application.
5. Design and use of different types of Voltage Regulators.

LEARNING RESOURCES: -

RECOMMENDED BOOKS: -

1. Sergio Franco, “Design with operational amplifiers and analog integrated circuit”, 3rd edition, Tata Mc Graw Hill.
2. William D. Stanley, “Operational Amplifiers with Linear Integrated Circuits”, New Age International Publishers, 4th Edition.

3. D. Roy Choudhari and S. B. Jain, “Linear Integrated circuit”, New age International Publishers, 4th Edition.
4. David A. Bell, “Operational Amplifiers and Linear Integrated Circuits”, Oxford University Press, Indian Edition.
5. Ramakant A Gayakwad, “Op-Amps and linear Integrated Circuit”, Pearson Prentice Hall, 4th Edition.
6. R. P. Jain, “Modern Digital Electronics,” Tata McGraw Hill, 3rd Edition.
7. J. Millman and A. Grabel, “Microelectronics”, Tata McGraw Hill, 2nd Edition.

COURSE MATERIALS MADE AVAILABLE

1. Course instructional objectives & outcomes
2. Syllabus
3. Chapterwise Question Bank

Evaluation :

Theory Exam	80 M
Internal assessment:-. The average marks of Mid-term test (20 M) & End-term test (20 M) will be considered as final IA marks	20 M
Practical and Oral	25 M
Term Work	25 M
Total	150 M

List of Experiments

Expt. No.	Name of the Experiments
1	To verify the frequency response for Inverting Amplifier using Op-Amp IC 741
2	To verify the frequency response for Inverting Amplifier using Op-Amp IC 741
3	To design a practical integrator circuit to properly process the input sinusoidal waveform upto 1KHz
4	To design a differentiator to differentiate input signal that varies with frequency from 10 Hz to about 1KHz
5	To design an astable multivibrator of frequency 1KHz and duty cycle 60% using IC555.
6	To construct the circuit for precision half wave rectifier
7	To design and simulate Low Pass Filter .
8	To design and simulate Schmitt trigger.
9	To design and simulate Triangular wave generator.
10	To design and simulate Full wave Precision Rectifier

Chapterwise Plan

Subject Title: Design with Linear Integrated Circuits

Chapter No. : 1

Chapter Name : Fundamentals of Operational Amplifier

Approximate Time Needed : 06 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Orientation.
2	Basic Fundamentals of Op-Amp.
3	High frequency effects on op-amp gain & phase, Slew Rate.
4	Open loop configuration of op-amp.
5	Closed loop configuration of op-amp.
6	Inverting and Non-inverting amplifier.

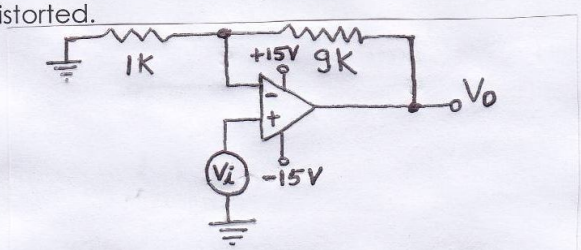
Objectives:

1. Op-amp basic fundamentals.
2. Static and dynamic characteristics of op-amp.
3. Configurations of Op-amp

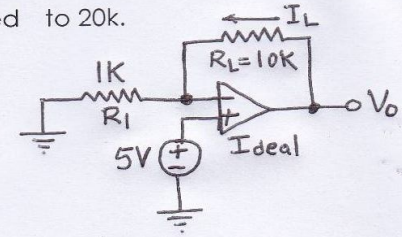
Model Questions:

Model Questions :

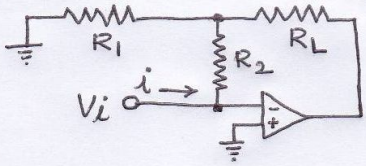
Q.1 For the circuit shown in figure, find the range of input voltage to be applied at input terminals such that output remains undistorted.



Q.2 For the circuit shown in figure find current I_L. Also find I_L when R_L is changed to 20k.

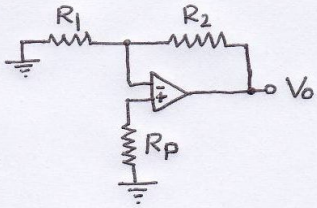


Q.3 Consider the circuit with R_1= 2k Ω, and R_2= 8kΩ for i_1=0.6 mA and R_L = 1kΩ, verify linear operation. Determine I_L .



Q.4 For the circuit shown in figure, derive the expression for output voltage caused by input bias current I_B and input offset current I_{io}. Also calculate V_0 in case of :-

1) R_1 = 22k, R_2 = 2.2 MΩ
   I_B = 80 ηA, I_{io} = 20 nA with Rp= 0.
2) R_1 = 22k, R_2 = 2.2 MΩ, I_B = 80 nA
   I i_o = 20nA with Rp = R1 // R2



Q.5 Explain why most of the applications of op-amp is in inverting mode.

Q.6 Explain the terms input bias current, input offset voltage. Give their typical values and explain its effect on output voltage.

Q.7 Define and state significance of following terms regarding op-amp.
1) CMRR 2) Open Loop gain 3) Virtual ground

Q.8 Draw & Explain simplified op-amp circuit diagram

Q.9 Define and state significance of slew rate of op-amp.

Q.10 The slew rate of an op-amp is 6V/μs when the closed loop again is unity. If the output signals V0 = Vm. Cost wt, find the limiting frequency which will distort the output signal by the rate limit if:
1) Vm = 1V
2) Vm = 10V

Q.11 A 741Cop-amp is used as an inverting amplifier with a gain of 50. The voltage gain Vs frequency curve of 741C is flat up to 20 KHz. What maximum peak to peak input signal can be applied without distorting the output? Slew rate for 741C is 0.5V/μs.

Q.12 Prove with proper expression that, what produces more offset voltage at the output; input offset current or input bias current? Discuss various compensating techniques for input offset voltage.

Q.13 With the help of op-amp model explains the slew rate limitation? Also explain various method of increasing slew rate?

Q.14 (i) For this non-inverting amplifier R_1 = 1kΩ and R_f = 10 kΩ. Calculate the maximum output offset voltage due to Vos and l_B' The op-amp is LM307 with Vos = 10 mv and I_B = 300nA, los = 50nA.

(ii) Calculate the value of R_{comp} to reduce the effect of l_B'

(iii) Calculate maximum output offset voltage if R_{comp} calculated in (ii) is connected in the circuit.

Q.15 Explain in brief input offset error compensation.

Q.16 Write the 741 specification rating's.

Q.17 Draw the buffer circuit using IC 741.

Q.18 Compare inverting and non inverting amplifier.

Q.19 What is SR. What are causes of SR.

(i) If an op-amp has SR of 2V/μsec. What is the max. frequency of an output sinusoid of 5V peak value at which distortion set in due to the SR limitation?

(ii) If the sinusoid of 10V peak is specified what is the full power BW?

Q.20 Draw simplified op-amp circuit diagram and explain the following stages along with the working of this circuit:-

(i) Input stage
(ii) Second stage
(iii) Output stage.

DEC 2014

Q.1 Design Inverting op-amp circuit for voltage gain 10. What care should be taken to operate it linearly

Q.2 Define following

- CMRR
- Slew rate
- Input offset voltage
- Output offset voltage
- PSRR

JUNE 2015

Q.1 What is the need of Input Offset voltage compensation and how it can be achieved Q.2 Derive closed loop parameters for Inverting opamp.

Chapterwise Plan

Subject Title: Design with Linear Integrated Circuits

Chapter No. : 2

Chapter Name : Applications of Operational Amplifier

Approximate Time Needed : 12 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
07	Adder, Subtractor, Current, Difference amplifier.
08	Integrator, Differentiator.
09	Instrumentation amplifier.
10	Instrumentation amplifier applications
11	DC biasing technique for amplifier.
12	Current to Voltage convertor.
13	Voltage to Current convertor.
14	First order active filter.
15	Second order active filter.
16	Low pass, High pass, Band pass and Band reject filters.
17	RC phase shift oscillator, Wien bridge oscillator.
18	Quadrature oscillator.

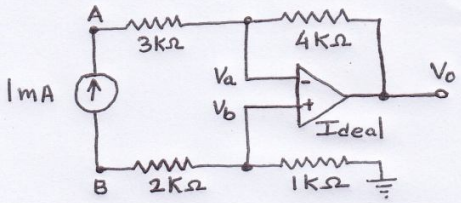
Objectives:

1. Various linear applications of operational amplifier.
2. Active filters using operational amplifier.
3. Low frequency oscillators using operational amplifier

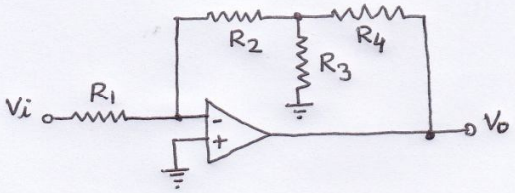
Model Questions:

Model Questions :

Q.1 For circuit shown in figure, find Va, Vb & Vo. Repeat the same with 5k resistance connected between A and B.



Q.2 Determine Vo/Vi for the circuit shown in the figure.



Q.3 In the circuit shown in the figure let R1 = R3 = 10k and R2 = R4= 100k assuming perfectly matched resistor. Find Vo for each of the following input voltages pairs.

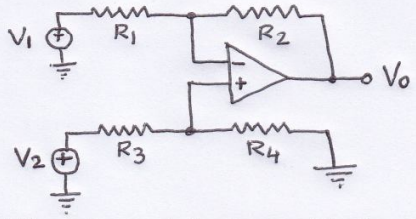
(V1 V1) = (-0.1V, + 0.1V)

= (4.9 V, 5.1 V)

and = (9.9v,10.1V)

then repeat a part with resistors mismatched as follows:

R1 = 10k, R2 = 98k, R3 = 9.9k, R4 = 103k comment.



Q.4 Give different specializations of instrumentations amplifier. Draw instrumentation amplifier using three op-amps. Derive expression for output voltage. Explain output offset technique in such amplifiers.

Q.5 Draw the circuit diagram of two-op-amp instrumentation amplifier. Derive expression for the output.

Q.6 Design a linear combination circuit op-amp to combine three signals

$Vo = -2V_1 - 8V_2 - V_3$

The following specifications are imposed:

1) $R_{in} \geq 20k\Omega$ at all points.
2) All resistance values $\leq 200k$

Q.7 In an inverting op-amp adder if 3 voltages $V_1 = 1V$, $V_2 = 3V$ & $V_3 = 2V$ with $R_1 = R_2 = R_3 = 2\ k\Omega$ & $R_F = 10k\Omega$, find the output voltage.

Q.8 Explain an integrator circuit using op-amp If RC Time Constant is 1msec and input to the integrator is a square ware of frequency 1kHz, $V_{pp} = 2V$, draw the output waveform. Assume Vo at t= 0 as 0V.

Q.9 What is an Instrumentation Amplifier? Derive the output gain of IA using three op-Amp. State its characteristics.

Q.10 Write a short note on Integrator and summing amplifier using op-amp.

Q.11 Design a differentiated to differentiate input signal that varies in frequency from 10 Hz to about 1 kHz.

Q.12 Compare the trans conductance and trans resistance amplifier circuit.

Q.13 Draw the block diagram of Instrumentation amplifier. Design digitally programmable IA having an overall gain of 1V/V, 10V/V and 100V/V. Also state its applications.

Q.14 Derive an expression for basic integrator circuit. If $R_1C_f = 1sec$ and input is 2Vdc then draw the output voltage wave form by considering an op-amp is initially nulled. What is the necessity of lossy integrator circuit?

Q.15 Draw basic differentiator circuit and derive an expression for output voltage. Explain why this circuit is sensitive to high frequency noise.

Q.16 Design a practical integrator circuit with a dc gain of 10 to integrate a square wave Of 10 kHz.

Q.17 Explain in detail about instrumentation amplifier.

Q.18 Write a short note on I-V converter.

Q.19 What are the advantage of active filter over passive filter.

Q.20 Draw circuit diagram of low pass KRC filter. Derive expression for gain frequency & Q. Find values of k,w_0 & Q design the same using equal component design using f_0 = 1kHz and Q = 5. What is its dc gain.

Q.21 Draw the circuit diagram for 2^{nd} order high pass KRC filter. Derive expression for gain frequency.

Q.22 Design a High pass second order filter for the cut off frequency of 1kHz. Pass band gain Af = 2.

Q.23 What is roll of rate of first order filter?

Q.24 Design a second order low pass filter at a high cut off frequency of 1kHz. Draw frequency response of the network.

Q.25 Design unity gain KRC low pass filter with f_0 = 10kHz and Q = 2.

Q.26 Explain with design about First Order Low Pass filter.

Q.27 Design Wein bridge and RC phase shift oscillator to generate 10KHZ frequency of oscillation.

Q.28 For an RC phase shift oscillator the component value are R = 8.2 K, C = 0.01 μF, R_1 = 1.22kΩ, R_f = 39kΩ.

1) Determine whether we can get sustained oscillations.
2) What will be the frequency of oscillation?

Q.29 Design a phase shift oscillator to oscillate with frequency of oscillations fo = 1500 Hz. How to adjust the peak to peak voltage of the wave form.

Q.30 Write a short note on RC phase shift oscillator.

Q.31 Explain in detail about Wien bridge oscillator.

DEC 2014

Q.1 Design a differentiated to differentiate input signal that varies in frequency from 10 Hz to about 1 kHz.
Q.2 Draw neat diagram of Instrumentation amplifier using op-amp and hence derive the equation of output voltage
Q.3 Give design procedure of first order HPF ?
Q.4 Design RC phase shift oscillator to produce a sinusoidal frequency output of 5KHz

JUNE 2015

Q.1 Calculate output voltage for the given amplifier Q.4(a) DLIC May2015
Q.2 Design RC phase shift oscillator to produce a sinusoidal frequency output of 5KHz
Q.3 Design a second order KRC low pass filter at a cut off frequency of 2kHz and Q=5 .
Q.4 Prove that opamp can be used as current to voltage converter.

Chapterwise Plan

Subject Title: Design with Linear Integrated Circuits

Chapter No. : 3

Chapter Name : Non-Linear Applications of Operational Amplifier.

Approximate Time Needed : 12 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
19	Inverting Comparators, Non-inverting Comparator.
20	Window detector, Level detector.
21	Inverting Schmitt Trigger.
22	Non-inverting Schmitt Trigger.
23	Square wave generator.
24	Triangular wave generator.
25	Half wave precision rectifier.
26	Full wave precision rectifier.
27	Peak detectors, sample and hold circuit.
28	Voltage to frequency convertor.
29	Frequency to Voltage convertor.
30	Logarithmic and antilog convertor.

Objectives:

1. The nonlinear behavior stems either the lack of feedback (voltage Comparators) of the presence of positive feedback or using nonlinear elements such as switches (precision rectifiers, peak detector).
2. Square and Triangular wave generator.
3. Non-linear convertor and its applications.

Model Questions:

Q.1 Explain concept of precision rectifier. Draw neat circuit diagram of full wave precision rectifier. Explain its working with appropriate sketches and derive expression for output voltage.

Q.2 Draw the circuit diagram to achieve hysteresis of 4V with UTP = 7V ,LTP = 3V, VCC = 12V and VEE = -12V.

Q.3 Design a Schmitt trigger circuit with following requirements :

UTP = 6V

LTP = 1V

Assume op-amp is powered with $\pm$12 Volts and reference voltage to beaded is V_{REF} = 8V.

Q.4 Write a short note on Precision Rectifiers.

Q.5 Draw circuit diagrams to generate square & triangular wave using op-amp. Derive expression for frequency.

Q.6 Explain the peak detector. Also explain voltage drop, sag back and speed limitations of peak detector.

Q.7 Design an inverting Schmitt trigger to achieve hysteresis of 7V.

Q.8 Draw the circuit to achieve hysteresis of variable limits between 3V to 7V. Assume Vcc = 12V and V_{EE} = -12V. Consider the hysterics of 4 volts

Q.9 Design the Schmitt trigger circuit, (Draw the circuit) V_{in} =1V_{pp}, V_{ut} = 25mV, V_{lt} = -25mV, Voltage swing = ±14Volt, Calculate R_1, R_2 and R_{om}.

Q.10 Draw the characteristics of an ideal comparator. Explain about zero crossing detectors.

Q.11 A Schmitt trigger is with the upper threshold level Vut=0V and hysteresis width Vh=0.2V. Convert a 1kHz sine wave of amplitude 4Vpp into a square wave. Calculate the time duration of the negative and positive portion of the output Waveform.

Q.12 What is comparator? Draw the characteristics of an ideal comparator and that of a commercially available comparator. What is the difference between a basic comparator and the Schmitt trigger?

Q.13 Write a short note on Regenerative Comparator (Schmitt trigger) and Saw-tooth Waveform generator.

Q.14 What is comparator ? Explain in detail about schmitt trigger.

Q.15 Advantages of precision rectifier.

Q.16 Write the list of application for voltage comparator.

Q.17 Write a short note on sample and Hold circuit.

Q.18 Write a short note on V-F converter using op-amp.

Q.19 Explain in detail V-I converter.

Q.20 Explain log and antilog amplifier using op-amp.

DEC 2014

Q.1 Comapare zero crossing detector with Schmitt trigger circuit
Q.2 Give complete procedure to design Schmitt trigger circuit and hence design it for UTP = 0.5 V and LTP= 0.5V
Q.3 Design triangular waveform generator for frequency of 5 KHz and Vopp= 6V using Opamp.

JUNE 2015

Q.1 Design Schmitt trigger circuit to achieve upper and lower threshold voltage as 1.5V
Q.2 Design triangular waveform generator to get the output frequency of 1.5 KHz and Vopp= 7.5V using Opamp.
Q.3 Compare normalrectifier with precision rectifier
Q.4 Explain different comparators , state different applications and suggest modification. for practical comparator

Chapterwise Plan

Subject Title: Design with Linear Integrated Circuits

Chapter No. : 4

Chapter Name : Data Convertors.

Approximate Time Needed : 06 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
31	Ramp ADC, ADC using DAC.
32	Successive approximation ADC, Flash ADC
33	ADC0808/0809 and its interfacing.
34	Binary weighted register DAC.
35	R/2R ladder DAC.
36	DAC0808 and its interfacing.

Objectives:

1. Data Converter specification and various applications with multiplying DAC.
2. IC used for data convertor and its applications.

Model Questions:

Q.1 Draw functional block diagram of Dual-Slope ADC. Explain its working with neat sketches.
Q.2 Write a short note on DAC Based AD conversion.
Q.3 Which is the fastest type of A/D converter?
Explain working for 2 bit A/D converter along with neat circuit diagram. State limitations of this method.
Q.4 Draw circuit diagram of 3 bit Flash (parallel comparators) type A/D converter. State clearly advantages and limitations of this method.
Q.5 Write short note on : Multiplying ADC applications.
Q.6 List out the specifications of Digital of Analog converter and explain with circuit diagram any one technique of D to A conversion.
Q.7 Explain 4 bit A to D convertor successive approximation method with tree.

Q.8 Compare different types of ADCs based on their working principle. Explain working of any one type of ADC.
Q.9 Explain R-2R ladder DAC and counter type ADC.
Q.10 Why is an inverted R-2R ladder network DAC better than R-2R ladder DAC.
Q.11 State the important specifications of ADC. Explain the logic diagram of dual slope ADC in detail.

DEC 2014

Q.1 What are the specification of DAC
Q.2 Explain 4-bit successive approximation type ADC
Q.3 What is basic performance parameter of sample and hold amplifier circuit?

JUNE 2015

Q.1 Explain Resolution, Accuracy and settling time with respect to DAC
Q.2 Explain counter type ADC with neat diagram

Chapterwise Plan

Subject Title: Design with Linear Integrated Circuits

Chapter No. : 5

Chapter Name : Special Purpose Integrated Circuits.

Approximate Time Needed : 08 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
37	Specifications, Functional block diagram of Timer 555IC.
38	Monostable Multivibrator.
39	Astable Multivibrator.
40	Applications of Timer IC555.
41	Functional block diagram of PLL565.
42	Applications of PLL IC.
43	Multiplier 534IC.
44	Waveform generator XR2206, Power amplifier LM380.

Objectives:

1. Functional block diagram of special purpose IC's.
2. Its specifications, the functionality and practical applications.

Model Questions:

Q.1 Draw the circuit of mono stable multi vibrator using IC 555 to generate pulse of 100µsec. Give component value used.

Q.2 Design one shot multi vibrator using IC 555 for pulse width of 10ms. What voltage must be applied to the CONTROL pin to stretch pulse width.

1) From 10 µs to 20 µs
2) From 10µs to 5 µs.

Q.3 Design a circuit to make 'RED' and GREEN LED to glow alternately for 1sec.
Assume C = 1μF.

Q.4 Explain how a missing pulse can be detected using IC 555

Q.5 Design a stable multi vibrator using IC 555 for 50% duty cycle without using diode.
Take case that the pin 7 of IC 555 should not get connected directly to Vcc which may damage the internal transistor.

Q.6 Write a short note on monolithic PLL

Q.7 Explain any one application of PLL

Q.8 With neat functional block diagram explain the working of PLL IC 565 and explain
i) Free running frequency ii) Capture range
ii) Lock range.

Q.9 In astable m/v using IC555, R_A=2.2kΩ, R_B=6.9kΩ and C=0.01μF . Calculate t_{high}, t_{low}, free running frequency and duty cycle. Derive the relation used.

Q.10 What is PLL? Explain about monolithic PLL.

Q.11 Draw and explain the astable m/v circuit using functional block diagram of SE555 And design the same for a frequency of 1kHz and duty cycle of 70% using pin diagram. Use C=0.1μF.

Q.12 Draw circuit diagram of Schmitt trigger using 555 timer and explain its operation.

Q.13 Explain how a missing pulse can be detected using IC555.

Q.14 Design a monostable 555 timer circuit to produce an output pulse 10sec. wide.
Draw the circuit diagram.

Q.15 Write the 555IC specification rating's.

Q.16 Design the 15 kHz generator with IC 555
Capacitor C = 47 μF, duty cycle = 60%

Calculate R_A and R_B
Draw waveforms.

Explain if above circuit diagram- (i) Duty cycle only adjusted 40%- What modification required? (ii) If duty cycle 50%- What is modification required.

Q.17 Write a short note on IC555 internal block diagram.

DEC 2014

Q.1 Design a circuit tokeep LED 'ON' for 20seconds once circuit is triggered.
Q.2 Explain in detail about frequency multiplier and application of PLL
Q.3Draw functional block diagram of IC 8038

JUNE 2015

Q.1 Define different parameters of PLL
Q.2 Explain function of each block of PLL

Chapterwise Plan

Subject Title: Design with Linear Integrated Circuits

Chapter No. : 6

Chapter Name : Voltage Regulators.

Approximate Time Needed : 08 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
45	Three terminal fixed voltage regulators IC78XX & IC79XX.
46	Three terminal adjustable voltage regulators LM317 & LM337.
47	Pin diagram, functional block diagram & specifications of IC 723.
48	Design of LVLC & LVHC voltage regulator using IC723.
49	Design of HVLC & HVHC voltage regulator using IC723.
50	Current limit & Current fold-back protection in IC723.
51	Switching regulator.
52	Functional block diagram & working of LT1070 switching regulator.

Objectives:

1. Functional block diagram of various voltage regulator IC's.
2. Its specifications, the functionality and applications.

Model Questions:

Q.1 Explain difference between linear regulator and switching regulator.

Q.2 Design the voltage regulator for the following specification:

$V_o = 18 \pm 3$ Volts.

$I_L = 50$mA.

Q.3 State any four significant characteristics of linear voltage regulator (LM 723) IC.
Q.4 Write a short note on Switching Voltage regulator.

Q.5 Using a MA 7805-5 volt regulator and 0.25 W resistances, design a 1 Amp current source.
Q.6 Design a voltage regulator using IC 723 to regulator the output voltage between 4V to 20V and output current of 500mA.
Q.7 Draw the power supply diagram, (Input 230V,50Hz and o/p 5V dc supply).
Q.8 Draw the power supply diagram for o/p -5V dc supply.
Q.9 Write a short note on (i) IC723 internal block diagram,
(ii) IC LM-317 internal block diagram.
Q.10 Explain current boosting achieved in IC723.
Q.11 Explain in brief about fixed voltage series regulator. What is current limit protection ?
Q.12 Design a current source using IC 7805 that will deliver a 0.25A current to the 48Ω, 10 W load.
Q.13 State the important features and applications of LM723.
Q.14 Design a 0.5A current source using IC 7805. Assume R_L = 10Ω.

Q.15 Write the 78xx IC specification rating's

DEC 2014

Q.1 Compare normal regulator with SMPS, explain any one circuit of SMPS
Q.2 Design voltage regulator using IC723 to give Vo=5V and output current=2A

JUNE 2015

Q.1 What are different possible IC723 based voltage regulators. Design voltage Regulator to achieve Vo=12V and Io=1Amp.
Q.2 Design voltage regulator using IC LM317 for the given specifications Vo=12 +_3 Volts and IL=100mA

Assignments

ASSIGNMENT 1 (DATE :14th August 2015)

Q.1 What is the need of Input Offset voltage compensation and how it can be achieved
Q.2 Define and state significance of

- CMRR
- Slew rate
- Input offset voltage
- Output offset voltage
- PSRR

Q.3 Compare inverting and non inverting amplifier.

Q.4 Design Inverting op-amp circuit for voltage gain 10. What care should be taken to operate it linearly

Q.5 Calculate output voltage for the given amplifier Q.4(a) DLIC May2015

Q.4 Draw neat diagram of Instrumentation amplifier using op-amp and hence derive the equation of output voltage

Q.5 Give design procedure of first order HPF and LPF?

Q.6 Design a second order KRC low pass filter at a cut off frequency of 2kHz and Q=5 .

Q.7 Design a differentiated to differentiate input signal that varies in frequency from 10 Hz to about 1 kHz.

ASSIGNMENT 2 (DATE : 1st October 2015)

Q.1 Design an inverting Schmitt trigger to achieve hysteresis of 7V.

Q.2 Design Wein bridge and RC phase shift oscillator to generate 10khz frequency of oscillation.

Q.3 Write a short note on (i) Precision Rectifier,
(ii) Peak Detector

Q.4 Write the 555IC specification ratings.

Q.5 Draw circuit diagram of 3 bit Flash (parallel comparators) type A/D converter.

State clearly advantages and limitations of this method.

Q.6 Design the 15 kHz generator with IC 555. Capacitor C = 47 μF, duty cycle = 60% Calculate R_A and R_B. Draw waveforms.
Explain if above circuit diagram- (i) Duty cycle only adjusted 40%- What modification required? (ii) If duty cycle 50%- What is modification required.

Q.7 Explain R-2R ladder DAC and counter type ADC.

Q.8 Design a 0.5A current source using IC 7805. Assume R_L = 10Ω.

Q.9 Explain current boosting achieved in IC723.

Q.10 Write a short note on-
(i) IC 565 PLL internal block diagram,
(ii) IC 555 internal block diagram,
(iii) IC723 internal block diagram.

T.E. ETRX Sem V (CBGS). 24/11/14

DLIC

QP Code :14855

(3 Hours) [Total Marks : 80

N.B. : (1) **Question** No. **one** is **compulsory.**
(2) **Solve** any **three** questions from remaning.
(3) **Assume** suitable data if **necessary.**
(4) **Figures** to the **right** indicate marks.

1. (a) Design Inverting op-amp circuit for voltage gain 10. what care should be taken to operate it linearly. **4**
(b) Design a differentiator to differentiate the input signal that varies in frequency from 10 Hz to 1 kHz. **4**
(c) Compare zero crossing detector with schmitt trigger circuit. **4**
(d) What are the specifications of DAC ? **4**
(e) Design a circuit to keep LED 'ON' for 20 seconds once circuit is triggered. **4**

2. (a) Define the following . **10**
(i) Slew rate
(ii) CMRR
(iii) Input offset voltage
(iv) Output offset voltage
(v) PSRR

2. (b) Draw neat diagram of Instrumentation Amplifier using op-amp and hence derive the equation of output voltage. **10**

3. (a) Give complete procedure to design schmit trigger circuit and hence design it for UTP = 0.5 V and LTP = -0.5 V. **10**
(b) Explain 4-bit successive approximation type ADC. **10**

4. (a) (i) Give design proecedure of first order HPF. **3**
(ii) Draw functional block diagram of IC 8038. **3**
(iii) What is the basic and performance parameter of sample and hold amplifier circuit ? **4**

4. (b) Design RC phase shift oscillator to produce a sinusoidal frequency output of 5 kHz. **10**

5. (a) Design triangular waveform generator for frequency of 5 kHz and Vopp = 6 V using op-amp. **10**

5. (b) Compare normal regulator with SMPS, explain any one circuit of SMPS. **10**

6. (a) Design voltage regulator using IC 723 to give V_0=5V and output current = 2A **10**
(b) Explain in detail about frequency multiplier and application of PLL. **10**

GN-Con.:7737-14.

T.E. Sem V (CBGS) · ETRX 19/5/15

OLIC

QP Code : 3306

(3 Hours) **[Total Marks : 80**

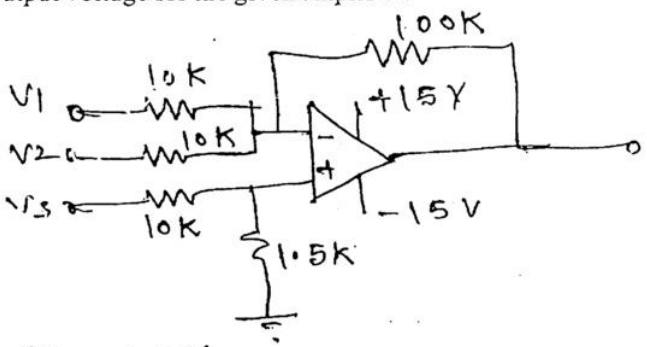
N.B. (1) Question No. **1** is **compulsory**.
(2) Solve any **three** questions from **remaining** questions.
(3) Assume **suitable** data if **necessary**.

1. Solve any **four** :–
   (a) What is the need of Input offset voltage compensation and how it can be achieved. 5
   (b) Design RC phase shift oscillator to produce sinusoidal output of 5KHz. 5
   (c) Design schmitt strigger circuit to achiev upper and lower threshold voltage as 1·5 volts. 5
   (d) Explain Resolution, Accuracy and settling time with respect to DAC. 5
   (e) Design a Flasher circuit using IC 555, in which lamp should remain on for 4 sec and off for 2 sec. 5

2. (a) Derive closed loop parameters for Inverting opamp. 10
   (b) Design a second order KRC low pass filter with a cut off frequency fo = 2KHz and Q = 5. 10

3. (a) Design a triangular wave generator to get the ouput frequency of 1·5 KHz and $V_{o(p-p)}$ = 7·5V using IC 741. 10
   (b) Explain counter type ADC with neat diagram. 10

4. (a) Calculate output voltage for the given amplifier. 10



$V_1 = 1.5V$
$V_2 = 3V$
$V_3 = 4V$

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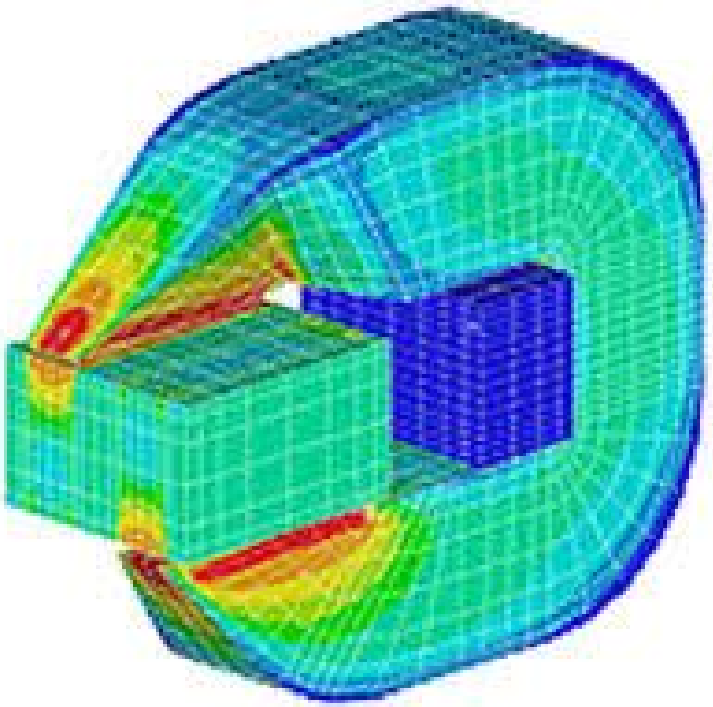


SH 2015

ELECTROMAGNETIC ENGINEERING

PADMABHUSHAN VASANTDADA PATIL PRATISHTHAN'S
COLLEGE OF ENGINEERING
SINCERITY SACRIFICE
SYSTEM 1990
Empower The Knowledge

Mrs S.N. Despande

Subject Plan

GROUP NAME : COMMUNICATION	
COURSE TITLE : Electromagnetic Engineering **COURSE CODE : -EXE 503** **SEM : VIII (FH 2015)**	
1. PRE-REQUISITE : Knowledge of vector calculus, cylindrical and spherical coordinate systems.	

RATIONALE

This course in communication group prepares the student in basics or transmission.

COURSE OBJECTIVES:

1. To study relationship between electrostatics, steady magnetic field and time varying fields using Maxwell's equations for different media
2. To understand the propagation of wave in different media like dielectric and conducting media by solving wave equation
6. To study radiation from a current element and find parameters of media
3. To calculate energy transported by means of electromagnetic waves from one point to another and to study polarization of waves
4. To solve electromagnetic problems using different numerical methods
5. To extend students' understanding about wave propagation by different techniques such as ground waves and space waves

COURE OUTCOME:

1. Ability to find nature of electric or magnetic fields produced due to different charge distributions
2. Ability to understand working of different equipment based on electromagnetic effects used in day to day life
3. Knowledge of behavior of EM waves and travelling of waves in free space as well as media
4. Ability to identify and solve problems related to the propagation of waves
5. Ability to understand the basics of wave propagation required for the study of antennas

LEARNING RESOURCES: -

RECOMMENDED BOOKS: -

1. W.H. Hayt, and J.A. Buck, "*Engineering Electromagnetics*", McGraw Hill Publications, 7th Edition, 2006
2. R.K. Shevgaonkar, "*Electromagnetic Waves*", TATA McGraw Hill Companies, 3rd Edition, 2009
3. Edward C. Jordan and Keth G. Balmin, "*Electromagnetic Waves and Radiating Systems*", Pearson Publications, 2nd Edition, 2006
4. Matthew N.D. Sadiku, "*Principles of Electromagnetics*", Oxford International Student 4th Edition, 2007
5. J.D. Kraus, R.J. Marhefka, and A.S. Khan, "*Antennas & Wave Propagation*", McGraw Hill Publications, 4th Edition, 2011

COURSE MATERIALS MADE AVAILABLE

4. Course instructional objectives & outcomes
5. Syllabus
6. Chapter wise Question Bank

Evaluation :

Theory Exam	80M
Internal assessment:-. The average marks of Mid-term test (20 M) & End-term test (20 M) will be considered as final IA marks.	20 M
Oral	--
Term Work	--
Total	100 M

Chapterwise Plan

Subject Title : ELECTROMAGNETIC ENGINEERING

Chapter No. : 1

Chapter Name : Basic Laws of Electromagnetic and Maxwell's Equations

Approximate Time Needed : 10 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Coulomb's law, Gauss's law.
2	Bio-Savart's law, Ampere's law.
3	Poisson's and Laplace equation.
4	Boundary conditions for static electric and magnetic fields
5	Boundary conditions for static electric and magnetic fields.
6	**Maxwell's Equations:** Integral and differential form for static and time varying fields
7	**Maxwell's Equations:** Integral and differential form for static and time varying fields
8	**Maxwell's Equations:** Integral and differential form for static and time varying fields
9	**Maxwell's Equations:** Integral and differential form for static and time varying fields
10	**Maxwell's Equations:** Integral and differential form for static and time varying fields

Objectives:

1. To provide an overview of the subject.
2. To define laws of Electromagnetism.
3. To give an idea of the principal areas in which it is applied.

Model Questions:

1. Explain coordinate systems (10)

2. Write short notes on the following:

(a) **Poisson & Laplace's Equations (10)**

(b) **Ampere's Law,(5)**

3. Derive Maxwell's equations in Integral form(10)
4. **Write short notes on-i.displacement current ,ii.poison's equation**

iii. **Gausses** Law

5. Derive Ampere's Circuital law in point form for circuits that include capacitors (10)

DEC 2014

1. Derive Lapas's and Poison's equation [4]
2. State and explain Maxwell's equations in Integral and differential form for static fields.[8]

Chapterwise Plan

Subject Title: ELECTROMAGNETIC ENGINEERING

Chapter No. : 2

Chapter Name : Uniform Plane Wave Equation and Power Balance

Approximate Time Needed : 10 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
11	**Wave equation:** Derivation and its solution in Cartesian co-ordinates
12	**Wave equation:** Derivation and its solution in Cartesian co-ordinates
13	**Solution of wave equations:** Partially conducting media, perfect dielectrics and good conductors, concept of skin depth
14	**Solution of wave equations:** Partially conducting media, perfect dielectrics and good conductors, concept of skin depth
15	**Electromagnetic Power:** Poynting Vector and power flow in free space and in dielectric, conducting media
16	**Electromagnetic Power:** Poynting Vector and power flow in free space and in dielectric, conducting media
17	**Polarization of wave:** Linear, Circular and Elliptical
18	**Polarization of wave:** Linear, Circular and Elliptical
19	**Propagation in different media:** Behavior of waves for normal and oblique incidence in dielectrics and conducting media, propagation in dispersive media
20	**Propagation in different media:** Behavior of waves for normal and oblique incidence in dielectrics and conducting media, propagation in dispersive media

Objectives:

1. To understand the concept of Wave, Uniform Plane Wave.
2. To understand and derive the propagation characteristics.
3. To understand the concept of Polarization.
4. To understand Poynting's Theorem, and its significance.

Model Questions:

1. Write short notes on the following : I.**Poynting's Theorem, ii.Poynting Vector,iii. Intrinsic Impedance (10)**
2. For an e.m. Wave travelling between a pair of parallel perfectly conducting infinite planes, analyze TE mode. (10)
3. An electromagnetic wave propagates downward from an aircraft and into water at frequency of 10 GHz. Assume water has no loss and a relative permittivity of 81.Negleting interface effects, calculate i.the wave no. in air ii.the wave no. in water (10)
4. For free space ,show that the intrinsic impedance is equal to 377
5. Explain the significance of the propagation constant and arrive at expression for its real and imaginary parts for a uniform plane wave.(10)
6. State Poynting theorem and derive the expression for Instantaneous Poynting Vector (10)
7. Derive boundary conditions for field vectors **E,D,B,H.** (10)
8. **Derive expressions for the reflection and transmission coefficients of a perfect dielectric when a plane e. m. wave is incident normally on it(10)**
9. **Derive expressions for the reflection and transmission coefficients of a perfect dielectric when a plane e. m. wave is incident obliquely on it (10)**
10. Write short notes on the following: i. **pulse broadening in dispersive media. ii. wave reflections from multiple interfaces.(10)**

DEC 2014

1. **Derive wave equation for time harmonic fields. [4]**
2. **What do you understand by conservative fields? [4]**
3. **A 10 GHz plane wave travelling in free space has an amplitude of E_x=10V/m**
   Find 1. The phase constant
   2. Intrinsic impedance and
   3. Amplitude and direction of H [8]

4. Find the transmission and reflection coefficient at the boundary of normal incidence. Given that for region 1 μ_{r1}=1 and ϵ_{r1} = 9 and region 2 is free space. Consider perpendicular polarization. [8]

5. Derive an expression for vector magnetic potential wave equation. [8]

6. Explain the physical significance of the terms α, β, γ related to wave propagation in lossy dielectric. [4]

7. Determine the Pointing vector theorem and explain the power flow terms due to time varying fields. [8]

8. Write short note on
   1. Boundary condition for static E and M field. [5]
   2. Polarization of waves [5]

Chapterwise Plan

Subject Title: ELECTROMAGNETIC ENGINEERING

Chapter No. : 3

Chapter Name: Radiation Field and Computation

Approximate Time Needed : 09 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
21	Concept of vector potential, fields associated with Hertzian dipole
22	Concept of vector potential, fields associated with Hertzian dipole
23	Radiation resistance of elementary dipole with linear current distribution, radiation from half-wave dipole and quarter-wave monopole
24	Radiation resistance of elementary dipole with linear current distribution, radiation from half-wave dipole and quarter-wave monopole
25	**Finite Difference Method (FDM):** Neumann type and mixed boundary conditions, Iterative solution of finite difference equations, solutions using band matrix method
26	**Finite Difference Method (FDM):** Neumann type and mixed boundary conditions, Iterative solution of finite difference equations, solutions using band matrix method
27	**Finite Difference Method (FDM):** Neumann type and mixed boundary conditions, Iterative solution of finite difference equations, solutions using band matrix method
28	**Finite Element Method (FEM**): triangular mesh

		configuration, finite element discretization, element governing equations, assembling all equations and solving resulting equations	
	29	**Finite Element Method (FEM**): triangular mesh configuration, finite element discretization, element governing equations, assembling all equations and solving resulting equations	
	30	**Finite Element Method (FEM**): triangular mesh configuration, finite element discretization, element governing equations, assembling all equations and solving resulting equations	
	31	**Method of Moment (MOM):**Field calculations of conducting wire, parallel conducting wires	
	32	**Method of Moment (MOM):**Field calculations of conducting wire, parallel conducting wires	

Objectives:

4. To understand concept of vector potential, hertzian dipole, radiation resistance.
5. To understand concept of FDM, FEM, MOM.

Model Questions:

1. **Derive the expression for the power radiated by a dipole. (20)**
2. **Write a note on EMI/EMC.**
   Write a note on ESD

DEC 2014

3. **Explain important advantages and drawbacks of FDM. [4]**
4. **The radiation resistance of antenna is 72Ω.and loss resistance is 8Ω. Calculate its directivity in dB if power gain 16. [4]**
5. **Derive an expression for radiation resistance of a infinitesimal dipole antenna and explain its significance. [8]**
6. **Give the comparison of FDM, FEM and MOM. [8]**

Chapterwise Plan

Subject Title: ELECTROMAGNETICS ENGINEERING

Chapter No. : 4

Chapter Name : Fundamentals of Antenna

Approximate Time Needed : 10 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
33	**Antenna Parameters:** Radiation intensity, directive gain, directivity, power gain, beam width, band width, gain and radiation resistance of current element
34	**Antenna Parameters:** Radiation intensity, directive gain, directivity, power gain, beam width, band width, gain and radiation resistance of current element
35	**Antenna Parameters:** Radiation intensity, directive gain, directivity, power gain, beam width, band width, gain and radiation resistance of current element
36	**Antenna Parameters:** Radiation intensity, directive gain, directivity, power gain, beam width, band width, gain and radiation resistance of current element
37	**Half-wave dipole and folded dipole:** Reciprocity principle, effective length and effective area
38	**Half-wave dipole and folded dipole:** Reciprocity principle, effective length and effective area
39	**Half-wave dipole and folded dipole:** Reciprocity principle, effective length and effective area
40	**Half-wave dipole and folded dipole:** Reciprocity principle, effective length and effective area
41	Radiation from small loop and its radiation resistance, Helical antenna
42	Radiation from small loop and its radiation resistance, Helical antenna

Objectives:

. Students should know about

1. Antenna parameters
2. Half wave dipole and folded dipole.
3. Helical antenna

Model Questions:

DEC 2014

1. Write sh0rt note on antenna parameters. [8]
2. The height of monopole antenna is ʎ /100. What is the radiation resistance? [4]

Chapterwise Plan

Subject Title: ELECTROMANETIC ENGINEERING

Chapter No. : 5

Chapter Name: Radio Wave Propagation

Approximate Time Needed : 10 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
43	**Types of wave propagation:** Ground, space, and surface wave propagation, tilt and surface waves, impact of imperfect earth and earth's behavior at different frequencies
44	**Types of wave propagation:** Ground, space, and surface wave propagation, tilt and surface waves, impact of imperfect earth and earth's behavior at different frequencies
45	**Types of wave propagation:** Ground, space, and surface wave propagation, tilt and surface waves, impact of imperfect earth and earth's behavior at different frequencies
46	**Space wave propagation:** Effect of imperfection of earth, curvature of earth, effect of interference zone, shadowing effect of hills and building, atmospheric absorption, Super-refraction, scattering phenomena, troposphere propagation and fading
47	**Space wave propagation:** Effect of imperfection of earth, curvature of earth, effect of interference zone, shadowing effect of hills and building, atmospheric absorption, Super-refraction, scattering phenomena, troposphere propagation and fading
48	**Space wave propagation:** Effect of imperfection of earth, curvature of earth, effect of interference zone, shadowing effect of hills and building, atmospheric absorption, Super-refraction, scattering phenomena, troposphere propagation and fading
49	**Sky Wave Propagation:** Reflection and refraction of waves,

		ionosphere and earth magnetic field effect	
	50	**Sky Wave Propagation:** Reflection and refraction of waves, ionosphere and earth magnetic field effect	
	51	**Measures of ionosphere propagation:** Critical frequency, angle of incidence, maximum unstable frequency, skip distance, virtual height, variations in ionosphere	
	52	**Measures of ionosphere propagation:** Critical frequency, angle of incidence, maximum unstable frequency, skip distance, virtual height, variations in ionosphere	

Objectives

The students will learn

1. Types of wave propagation
2. Space wave propagation
3. Sky wave propagation.
4. Wave propagation in ionosphere.

Model Questions:

DEC 2014

1. Write short note on space wave propagation. [5]
2. Explain the mechanism of ionospheric propagation. A high frequency radio transmission link is to be established between two points at a distance of 2000 km. on the earth's surface. Consider the hight of 200km and critical frequency of 5MHz. Calculate MUF for given path. [8]
3. Explain the operating modes of helical antenna. [4]

T. E. Sem V (CBGS) 18/11/14

ETRX - Electromagnetic Eng

QP Code : **14818**

(3 Hours) Total Marks : 80

N. B. : (1) Question **No.1** is **compulsory.**
(2) Solve any **Three** questions form remaining **five** questions.
(3) Draw a **neat** and **clean** diagram whenever **necessary.**
(4) Assume **suitable** data if **required**.

1. Answer the following **(any four)** 20
   (a) What do you understand by conservative field.
   (b) Derive wave equations for time harmonic fields.
   (c) The radiation resistance of antenna is 72Ω and the loss resistance is 8 Ω. Calculate its directivity in dB if the power gain is 16.
   (d) Explain the important advantages and drawback of FDM.
   (e) Define critical frequency, MUF and OWF.

2. (a) State and Explain Maxwell's equations in differential and internal form for static field. 8
   (b) A 10 GHz plane wave travelling in free space has an amplitude of 8
   $\mathbf{E}_x$ =10V/m
   Find - (i) The phase constant
   (ii) Intrinsic impedance and
   (iii) The amplitude and the direction of **H**
   (c) Explain the operating modes of helical antennas. 4

3. (a) Explain the mechanism of ionospheric propagation. A high frequency radio link has to be established between two points at a distance of 2000 km. on the earth's surface. Considering the height of 200km and critical frequency of 5MHz. Calculate MUF for given path. 8
   (b) Derive an expression for radiation resistance of an infinitesimal dipole antenna and explain its significance. 8
   (c) Derive Laplace's and Poisson's equations. 4

4. (a) Find the transmission and reflection coefficients at the boundary for normal incidence. Given that for region 1: μ_{r1}= 1, ϵ_{r1}= 9 and for region 2 is a free space. Consider the perpendicular polarization. 8
   (b) Derive an expression for vector magnetic potential wave equation. 8
   (c) Explain the physical significance of the terms α, β and γ related to wave propagation in lossy dielectrics. 4

5. (a) Give the comparison of FDM, FEM and MOM. 8
   (b) Determine the Poynting vector theorem and explain the power flow terms due to the time varying fields. 8
   (c) The height of monopole antennna is $\lambda/100$ what is the radiation resistance. 4

6. Write short notes on- 20
   (a) Boundary conditions for static **E** and **M** fields.
   (b) Polarization of waves.
   (c) Antenna parameters.
   (d) Space wave propagation

GN-Con. 5623-14.

1.

SH 2015

Microcontroller & Applications

PADMABHUSHAN VASANTDADA PATIL PRATISHTHAN'S
COLLEGE OF ENGINEERING
SINCERITY SACRIFICE
SYSTEM 1990
Empower The Knowledge

Mrs. PRIYA GUPTA

Subject Plan

GROUP NAME	**: Microprocessor and Microcontroller**
COURSE TITLE	**: Microprocessors & Peripherals**
COURSE CODE	**: EXC501**
SEM	**: V (SH 2015)**
PRE-REQUISITE	: Microprocessor & Microcontroller

RATIONALE

This course aims to create a strong foundation by studying the basics of Microcontroller and interfacing to various peripherals which will lead to a well designed Microcontroller based System. The course is a pre-requisite for all further courses in Microcontrollers and Embedded systems.

OBJECTIVES:

3. To introduce the students with microcontroller 8051
4. To introduce the ARM Processor.
5. To learn Instruction Set of 8051 , programming and its Interrupts.
6. To provide a thorough understanding and knowledge of designing the 8051 module, peripherals controllers & system design.

OUTCOME:

6. Student will be able to understand & design microcontroller based system
7. Student will be able to understand assembly language programming.
8. Student will be able to learn & understand concept of interfacing of peripherals devices & their applications.

LEARNING RESOURCES: -

RECOMMENDED BOOKS: -

1. Kenneth J. Ayala, "*The 8051 Microcontroller architecture, Programming and Applications*" Penram international, Cengage Learning India Pvt. Ltd, (Patparganj), New Delhi.
2. M. A. Mazadi and J. C. Mazadi, "*The 8051 Microcontroller and Embedded Systems*", Pearson Education, Asia
3. V. Udayashankara, "*8051 Microcontroller Hardware, Software and Application*", McGraw-Hill.
4. David Seal, "*ARM Architecture*", Reference Manual (2nd Edition)
5. William Hohl, "*ARM Assembly Language: Fundamentals and Techniques* Microprocessor and interfacing 8085, Douglas V Hall, Tata Mc Gram Hill
6. Han-way Huang, using The MCS-51 microcontroller, Oxford university press.
7. ARM system-on-chip architecture, 2e pearson education

Reference

COURSE MATERIALS MADE AVAILABLE

1. Course instructional objectives & outcomes
2. Syllabus
3. Chapterwise Question Bank

Evaluation :

Theory Exam	80 M
Internal assessment:-. The average marks of Mid-term test (20 M) & End-term test (20 M) will be considered as final IA marks	20 M
Practical & Oral Exam	25 M
Term Work	25 M
Total	150 M

List of Experiments

Atleast 10 experiments based on the entire syllabus **Experiments**

8051

- 1. Write a program for addition of two 16 bit numbers.
- 2. Write a program for addition of two 16 bit numbers.
- 3. Write a program to arrange block of data in Ascending order
- 4. Write a program to arrange block of data in Descending order
- 5. Write a program to find out largest number in a block in Block
- 6. Write a program to find out Smallest number in Block
- 7. Experiment on string instructions
- 8. Write a program to multiply 32 bit number.

Arm Processor

- **To design and test circuits**
- 1. 4 bit LCD driver
- 2. Demonstration of Traffic light
- 3. Implement door bell
- 4. Working of ADC/DAC

Chapterwise Plan

Subject Title: Microcontrollers & Applications

Chapter No. : 1

Chapter Name : 8051 Microcontroller Architecture

Approximate Time Needed : 06 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	8051 Architectural
2	8051 Features and its purpose
3	8051 Advantages

Objectives:

To teach students

:

1. To define scope of microcontroller.

2. To give a brief idea of architecture and fundamentals of Microcontroller

3. To discuss about feature of microcontroller

Lesson Outcome:

Students will able to

1. Basic building blocks of microcontroller.
2. Features of 8051 microcontroller.
3. Advantages of microcontroller.

Model Questions.

1. Write a short note on Port structure of 8051 (PO& P1 only)

2. Explain the physical structure of I/O ports of 8051 microcontroller.

3. Write a short note on: Power saving modes of 8051.

4. Explain how to interface an External 16KX8 Data RAM and Program RAM with 8051 microcontroller. Draw the interface circuit Diagram.

4. Write the assembly language program for 8085 and draw the flow chart to Convert 2 digit numbers to their equivalent (a) BCD to HEX and (b) HEX to BCD.
5. Explain following pins of8051
   1. EA/ Vpp 2.PSEN 3.ALE/PROG 4.RST 5. XTAL1 & XTAL2

6. Explain program status word (flag register) of 8051.

7. Give the comparison of salient features of 8051 with its derivatives like 89C51,89C52 & 89C2052.

8. Explain the reset state of 8051 microcontroller.

9. What is stack? Explain its operation with the help of PUSH and POP commands.
10. To discuss about the internal memory organization of 8051.
11. To learn about the various pins, I/O ports, timers counters of 8051.
12. To briefly discuss the power saving modes used in 8051 using PCON

Chapterwise Plan

Subject Title: Microcontrollers & Applications

Chapter No. : 2

Chapter Name : 8051 Microcontroller assembly language programming

Approximate Time Needed : 12 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Bit, byte, word processing, format conversion between HEX, BCD, ASCII
2	Data movement / copy operations, Block transfer of data, data swap / Exchange
3	Arithmetic, logical, and stack operation, loops, condition evaluation, decision making based on flags
4	Call, return, jumps, serial and parallel port handling, timer / counter handling, interrupts and its handling

Objectives:

To teach students:

1. To discuss the need of programming a microprocessor.
2. To introduce various instruction sets used for programming.
3. To make the students understand the importance of shorter T-states and machine cycles and also discuss the affects of wait states on processor performance.
4. To learn about the need and types of addressing modes used in 8051.
5. To introduce the bit level instructions and their significance.
6. To make the students understand how to write programs of 8051.

Lesson Outcome:

Students will able to

After this chapter the students should have knowledge about the following concepts

1. Various Instruction sets
2. Writing programs.
3. ***Debugging programs***

Model Questions:

1. Write the assembly language program and draw the flow chart to find smallest and largest element in a block of 20 elements for 8051 microcontroller.

2. Explain the following Instructions :- 1.SWAP 2.DAA 3.SUBB 4. RET

3. Explain Interrupts of 8051 (8 bit) Microcontroller.

4. Write the assembly language program for 8051 to sort the array of 20 elements in Ascending order. Draw flow chart for same

5 . Explain the working of following instructions of 8051& identify addressing modes of each instruction.

(i) XCHD A, @Ri
(ii) SWAP A
(iii) RR A
. (iv) RETI
(v) XRL A, # data

6. Write ALP for 8051 Microcontroller to find out how many Negative bytes in given series of Ten bytes.

7 . Explain the following Instructions:

(i) MOVC A, @ A +.PC
(ii) AJMP Addr

8. Write a program to convert 2 digit Binary number into its equivalent BCD No. Stored Result in R2 - R1 - RO.

Chapterwise Plan

Subject Title: Microcontrollers & Applications

Chapter No. : 3

Chapter Name : Microcontroller Hardware & software applications

Approximate Time Needed : 10 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Addressing modes
2	Interpreting logical, electrical, timing specification
3	Requirement of following interfaces and interfacing and accessing/controlling using assembly programs
4	External memory interfacing and memory access cycles, polled I/O, Interrupt I/O.
5	**Serial communication using RS232**: Pulse width modulation and DC , motor interfacing, electromagnetic relay, stepper motor interfacing, switch interfacing, SCR firing circuit (with electrical isolation)
6	**Parallel input/output interfacing**: 7-segment LED display interfacing, 8- bit parallel DAC interfacing, 8-bit parallel ADC interfacing, 4x4 matrix keyboard interfacing, temperature (resistive, diode based) sensor, optical (photodiode/ phototransistor, LDR) sensors interfacing, 16x2 generic alphanumeric LCD interfacing

Objectives:

To teach students:

1. To discuss the need of interfacing different peripheral devices
2. 2. To discuss how an instruction is actually executed using timing
3. Diagrams.
4. 3.To make the students understand about the peripheral devices
5. After learning instructions students will learn to write assembly programs of 8086.

Lesson Outcome:

Students will able to

After this chapter the students should have knowledge about the following concepts

1. They are able to interface different interfacing devices.
2. They draw timing diagrams
3. How peripheral devices works , there control regisrters etc

Model Questions:

1. List the various addressing modes of 8086 with examples
2. Interface with 8051 microcontroller Analog to Digital converter ADC 804.
3. Draw the interface diagram and Read, Write pulses input waveforms.
4. Write a program to transfer message 'PASS' using serial communication of 8051 at 4800 baud Rate. Oscillator frequency is 11.0592 MHz~
5. Write a program to generate square wave of 500 Hz on P1.0 using TIMER 1 of 8051. Oscillator frequency is 12 MHz.
6. Design 8051 based microcontroller system with following details -

(i) 2764 to be used as program memory .

(ii) 4 digit multiplexed seven segment display connected at Port 1. Use 7447/7448

Chapterwise Plan

Subject Title: Microcontrollers & Application

Chapter No. : 4

Chapter Name : ARM7TDMI(ARMv4T) Architectural

Approximate Time Needed : 10 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	**Features, purpose, and advantages**
2	Processor operating states, memory formats, data types, operating modes, Registers
3	The program status registers, exceptions, interrupt latencies, and pipelined architecture advantage

Objectives:

To teach students:

1. To discuss the limitations of ARM PROCESSOR.
2. To make the students learn about the difference in architecture of Microprocessor and microcontroller & ARM PROCESSOR
3. To introduce to the students the advent of ARM processor and its architecture.
4. To make the students understand how does its register architecture look like and uses of it.
5. To learn about the memory access and addressing modes of ARM

Lesson Outcome:

Students will able to learn

After completing this chapter student should have good understanding of the following concepts

1. The difference in architecture of microprocessor and microcontroller ARM PROCESSOR
2. Internal memory organization of ARM PROCESSOR.
3. Interrupts in ARM PROCESSOR.
4. Architecture of ARM processor.

Model Questions:

1. Explain the **CPSR** register of ARM processor.
2. Explain register architecture of ARM processor.
3. Explain Program status register & Barrel shifter of ARM processor.
4. Briefly describe different types of addressing modes of ARM processor.

Chapterwise Plan

Subject Title: Microcontrollers & Application

Chapter No. : 5

Chapter Name : ARM7TDMI(ARMv4T) Assembly Language Programming

Approximate Time Needed : 10 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	8,16,32 bit and floating point numbers processing, format conversion between Hex, BCD, ASCII, data movement/copy operations, block transfer of data, data swap/exchange
2	Arithmetic, logical, and stack operation, loops, condition evaluation and decision making based on flags, control transfers (Call, Return, Jumps), processor state changing (ARM THUMB)
3	Exceptions, interrupts and its handling

Objectives:

To teach students:

1. To discuss the various instruction set ARM PROCESSOR.
2. To learn about the need and types of addressing modes used in ARM PROCESSOR.
3. To introduce the bit level instructions and their significance.
4. To make the students understand how to write programs of ARM PROCESSOR.
5. To introduce Interrupt subsystem of ARM PROCESSOR.
6. Its instruction set.

Lesson Outcome:

Students will able to

1. Write programs of ARM PROCESSOR.
2. Understand the addressing modes.

.

Model Questions:

1. Explain the following ARM instructins
   - i) ADDEQ R0,R1,R2
   - ii) MLA R4,R3,R2,R1
   - iii) TST R2,R3
   - iv) BLX R0
   - v) RSB R2,R3,R1,LSL#2
   - vi) ADDS
2. Write the assembly language program and draw the flow chart to find smallest and largest element in a block of 20 elements for ARM processor microcontroller.

Chapterwise Plan

Subject Title: Microcontrollers & Application

Chapter No. : 6

Chapter Name : LPC2148 based C program Applications

Approximate Time Needed : 04 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Applications for On-chip ADC, DAC, parallel port, and serial port accessing

Objectives:

To teach students:

1. They learn about the different applications of on chip ADC, DAC, parallel ports.
2. To learn about the need of serial port accessing.

Lesson Outcome:

Students will able to
The student should be able to

1. different applications of on chip ADC, DAC, parallel ports.
2. How serial port accessing is possible.

Model Questions:

1. Explain the different addressing modes in ARM processor with suitable example.

2. Explain the different operating modes of ARM processor with different SFR' in each mode.

Assignments

ASSIGNMENT 1 (DATE : 04th AUG 2015)

1. Write a short note on Port structure of 8051 (PO & P1 only)
2. Explain the physical structure of I/O ports of 8051 microcontroller.
3. Write a short note on: Power saving modes of 8051.
4. Write difference between microprocessor & microcontroller
5.

ASSIGNMENT 2 (DATE : 4th SEPTEMBER 2015)

1. Explain arithmetic instructions with examples.
2. Write the assembly language program and draw the flow chart to find smallest and largest element in a block of 20 elements for 8051 microcontroller.
3. Explain the following Instructions: - 1.SWAP 2.DAA 3.SUBB 4. RET
4. Explain Interrupts of 8051 (8 bit) Microcontroller

ASSIGNMENT 3 (DATE :5th OCTOBER 2015)

1. Explain the **CPSR** register of ARM processor.

2. Explain register architecture of ARM processor.
3. Explain Program status register & Barrel shifter of ARM processor.
4. Briefly describe different types of addressing modes of ARM processor.
5. Explain the following ARM instructins
    1. ADDEQ R0,R1,R2
    2. MLA R4,R3,R2,R1
    3. TST R2,R3
    4. BLX R0
    5. RSB R2,R3,R1,LSL#2

T.E. Sem. V – CBGS → MU EA 25/05/2015

(ETRX) (Micro Controllers)

QP Code : 3308

(3 Hours) [Total Marks : 80

N.B. 1) Question no. one is compulsory
2) Solve any three from the remaining five questions.
3) Assume suitable additional data if necessary.

Q.1. Answer the following questions. (Any FIVE) (20)
a) Explain the difference between RET and RETI instructions as implemented in 8051 architecture.
b) What is the maximum address range of conditional jump instructions for 8051 architecture and justify the reason for the same.
c) Illustrate the circuit representation for interfacing single LED and relay to the port pins of 8051 architecture based processor.
d) Explain pipelining feature in ARM7TDMI architecture. Justify advantages and disadvantages.
e) Explain the significance of letters and numbers in – 'ARM7TDMI'.
f) Explain the bit orientations of CPSR register for ARM7TDMI architecture.

Q.2. a) Write a note on the various modes of operation of ARM7TDMI based processor. (10)
b) Explain the following 8051 architecture based instructions:
i) MOV C,0X10 ii) MUL AB iii) MOVC A, A+@0x2000 iv) INC 0X45
v) ANL A,@R0 (10)

Q.3. a) With a neat circuit representation illustrate interfacing of a typical 8-bit DAC to 8051 architecture based processor. Using DAC write a program in 8051 assembly to generate a triangular wave. (12)
b) Explain the programmer's model (register structure) in ARM7TDMI architecture. (08)

Q.4. a) Explain the various addressing modes with suitable examples available in 8051-architecture. (10)
b) Using internal timers write a program in 8051 assembly to generate a square wave of 10kHz frequency and 50% duty cycle on port pin P1.0. (10)

Q.5. a) Explain the following ARM7TDMI architecture based instructions as well as their implications
i) BL Square ii) ADD R0, R1, R2, LSL#3 iii) MOVEQS R1,R0
iv) LDR R8, [R3, #4] v) STR R2, [R1, #0x100] (10)
b) Write a brief note on the process of interrupts and their mechanism of acknowledgement in 8051 – architecture. (10)

Q.6. Write brief notes on
a) ARM7TDMI thumb mode of operation. (07)
b) Interfacing stepper/continuous motor to 8051 based microcontroller. (07)
c) Serial port and modes of operation in 8051 architecture. (06)

SH 2015

SIGNAL AND SYSTEMS

Mrs Radha Wanode

Subject Plan

GROUP NAME : SIGNALS AND SYSTEM
COURSE TITLE: Signal & System **COURSE CODE : EXC 504** **SEM : V (SH 2015)**
PRE-REQUISITE : Basic knowledge of Fourier analysis, Laplace Transform and sampling theorem

RATIONALE

Signal and system is designed to provide a platform for engineers and designers who would like to work in the most challenging and emerging field of signal processing. As high speed computational machines are now available for processing, the concepts and techniques allied with signal processing field assume a broader and a versatile approach. Thus the study of signals and systems has opened up a whole new era of solutions to resolve many intricate signal processing problems.

OBJECTIVES:

1. To provide a comprehensive coverage of continuous time and discrete time of Signals and Systems.
2. To introduce various time domain and frequency domain methods for analysis of Signals and systems

OUTCOME:

1. Student will be able to differentiate between continuous time and discrete time of Signals and Systems.
2. Student will be able to do time domain analysis of Signals and systems
3. Student will be able to do frequency domain analysis of Signals and systems
4. To understand properties of system

LEARNING RESOURCES: -

RECOMMENDED BOOKS: -

1. Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab, "*Signals and Systems*", 2nd Edition, PHI learning, 2010.
2. Tarun Kumar Rawat, "*Signals and Systems*", Oxford University *Press 2010.*
3. John Proakis and Dimitris Monolakis, "*Digital Signal Processing*", Pearson Publication, 4th Edition.

COURSE MATERIALS MADE AVAILABLE

1. Course instructional objectives & outcomes
2. Syllabus
3. Chapterwise Question Bank

Evaluation:

Theory Exam	80 M
Internal assessment:-. The average marks of Mid-term test (20 M) & End-term test (20 M) will be considered as final IA marks	20 M
Term Work	25 M
Total	125 M

Chapterwise Plan

Subject Title: Signal & System

Chapter No. : 1

Chapter Name : Continuous And Discrete Time Signals And Systems

Approximate Time Needed : 08 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
1	Mathematical representation, classification of CT and DT signals,
2	Arithmetic operations on the signals,
3	Transformation of independent variable
4	Mathematical representation,
5	Classification of DT systems
6	Classification of CT systems
7	Sampling and reconstruction,
8	Aliasing effect

Model Questions:

1. If F, is sampling frequency then the relation between analog frequency F and digital frequency f is:-
   i) f= F/2Fs
   ii) f= Fs/F
   iii) f= F/Fs
   iv) f= 2F/Fs
   Justify the answer with an example.
7. Explain the difference between DT and CT
8. State and prove Sampling theorem
9. Explain aliasing effect
10. Explain the different types of CT and DT signals

Chapterwise Plan

Subject Title: Signals and Systems

Chapter No. : 2

Chapter Name : Time Domain Analysis Of Continuous And Discrete Signals And Systems

Approximate Time Needed : 06 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
9	Properties of LTI systems,
10	Impulse and step response
11	Use of convolution integral
12	Convolution sum for analysis of LTI systems.
13	Properties of convolution integral.
14	Properties of convolution sum.

Model Questions:

1. Convolve the following signal

$x(s) = e^{-t} u(t)$;

$h(t) = e^{-2t} u(t)$

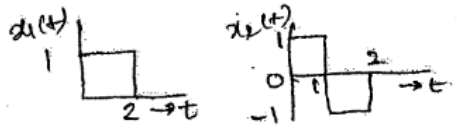
2. Explain convolution theorem and perform the convolution in time domain if-

$x(t) = t\, u(t)$,

$h(t) = e^{-t}$ for $t >= 0$

$= 0$ otherwise

3. Convolve the following signals in time domains. Do not uses transform? Sketch the convolution result



4. Determine the output y(n) of a relaxed LTI system with impulse responses

$h(n) = a^n u(n)$, $|a| < 1$ when the input is a unit step sequence is $x(n) = u(n)$

5. A DT LTI system has a difference equation

$2y(n) + 3y(n-1) + y(n-2) = u(n) + u(n-1) - u(n-2)$ with initial conditions $y(-1) = 2$, $y(-2) = -1$

Find:

a. Zero input response

b. Zero state response

c. Total response

Chapterwise Plan

Subject Title: Signals and Systems

Chapter No. : 3

Chapter Name : Frequency Domain Analysis Of Continuous Time System Using Laplace Transform

Approximate Time Needed : 08 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
15	Need of Laplace transform, review of Laplace transform,
16	Properties of Laplace transform
17	Inverse of Laplace transform,
18	Concept of ROC, poles and zeros
19	Unilateral Laplace transform
20	Analysis and characterization of LTI system using Laplace transform: impulse and step response
21	Causality, stability, stability of causal system
22	Block diagram representation

Model Questions:

1. Obtain the inverse Laplace transform of

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

For all possible region of convergence.

2. For all possible ROC conditions, obtain inverse Laplace Transform of-

$$X(s) = \frac{5s^2 - 15s - 11}{(s+1)(s-2)^2}$$

3. Derive the relation between unit impulse, unit step and unit ramp signals.

4. Derive the relation between Laplace transform and Fourier transform. Determine the inverse Laplace transform for all possible ROC's of X(s)

$$X(s) = \frac{s^2 + 2s + 5}{(s+3)(s+5)^2}$$

5. Impulse response of a system is $G(t) = -3e^{2t} u(t)$

Find whether the system is causal/non-causal and stable /unstable

Chapterwise Plan

Subject Title: Signal and System

Chapter No. : 4

Chapter Name : Frequency Domain Analysis Of Discrete Time System Using Z Transform

Approximate Time Needed : 14 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
23	Need of Z transform
24	Definition of Z transform
25	Properties of unilateral Z Transform
26	Properties of bilateral Z Transform
27	Mapping with s plane
28	Relationship with Laplace transform Z transform of standard signals
29	ROC
30	Poles and zeros of transfer function
31	Inverse Z transform
32	Analysis and characterization of LTI system using Z transform: impulse response
33	Analysis and characterization of LTI system using Z transform step response
34	Causality, stability, stability of causal system
35	Block diagram representation,
36	system realization

Model Questions:

1. State the relationship between Z- transform and DTFT

2. Using Z transform Properties, prove that:

$$n\,x[n] \overset{z}{\longleftrightarrow} -z\frac{dx(z)}{dz}$$

$$\text{if } x[n] \overset{z}{\longrightarrow} x(z)$$

3. Find the Z transform and hence DFT of – $x(n) = (1/4)^n u(n+4)$

4. Determine the inverse ZT for

$$X(Z) = \frac{z}{3z^2 - 4z + 1} \quad \text{ROC } |Z|>1$$

5. Determine the inverse Z – transform for the following x(z) by partial fraction expansion method

$$x(z) = \frac{z+2}{2z^2 - 7z + 3}$$

if Roc's are (i) $|z| > 3$

(ii) $|z| < \frac{1}{2}$

(iii) $\frac{1}{2} < z < 3$

6. Find the Z transform of the sequence x(n) = u(n) – u(n-8) and sample it at 6 points on the unity circle, using the relation

$$x(k) = x(z)\big|_{z = e^{j2\pi k/6}} ; k = 0,1.....5.$$

Find the inverse DFT of x(k) and compare it with x(n)

Chapterwise Plan

Subject Title: Signal and System

Chapter No. : 5

Chapter Name : Frequency Domain Analysis Of Continuous And Discrete Signals

Approximate Time Needed : 12 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
37	Review of Fourier series
38	Discrete time Fourier series
39	Properties of Discrete time Fourier series
40	Properties of Discrete time Fourier series
41	Properties of Fourier transform
42	Relationship with Laplace and Z transform
43	Discrete time Fourier transform
44	Properties of Discrete time Fourier transform
45	Frequency sampling
46	Discrete Fourier transform
47	Properties of Discrete Fourier transform
48	Properties of Discrete Fourier transform

Model Questions:

1. Find the DFT of the following sequence using FFT:
   x[n] = {1,1,1,0,0,0,1,1}
2. Using the result derived in above qu. Find the DFT of the signal and not otherwise
   a. x1[n] = {1,0,0,0,1,1,1,1}
   b. x2[n] = {1,1,1,1,1,0,0,0}
3. find the 4 point DFT of the sequence:

$$x[n]=\cos\frac{n\pi}{4}$$

4. Properties of Discrete time Fourier series
5. Determine causal, non causal and both sided signal associated with z- transform

$$x(z) = \frac{1}{1 + 1{\cdot}5\, z^{-1} + 0{\cdot}5\, z^{-2}}.$$

6. Consider a sequence x[n] = {1,2,1,2,0,2,1,2}. Determine DFT using DITFFT
7. Find DFT of the sequence x[n] = {1,2,3,4} and using this result and not otherwise. Find DFT of –
   a. x1[n] = {1,0,2,0,3,0,4,0}
   b. x2[n] = {1,2,3,4,0,0,0,0}
   c. x3[n] = {1,2,3,4,1,2,3,4}

Chapterwise Plan

Subject Title: Signal and System

Chapter No. : 6

Chapter Name : Correlation And Spectral Density

Approximate Time Needed : 04 hrs

Lesson Schedule :

Lecture No.	Portion covered per hour
49	Comparison of convolution and correlation, Auto and cross correlation
50	Energy/power spectral density
51	Relation of ESD, PSD with auto-correlation
52	Relationship between ESD/PSD of input and output of LTI system

Model Questions:

1. Define ESD and PSD. What is the relation of ESD and PSD with auto correlation?
2. Determine the signal energy and signal power for $f(t) = e^{-5t} u(t)$
3. Find whether following signals are Energy or powers. Find corresponding Energy / Power if –
   a. $X(t) = A e^{-at} u(t)$, $a>0$
   b. $X(t) = \text{rect}[t/T_0]$
4. The evaluation of correlation involves:-
   a. Shifting, rotation and summation
   b. Shifting , multiplication and Summation
   c. Change of index, folding and Summation
   d. Change of index, folding and shifting

2. ASSIGNMENT 1 (DATE : 9th Aug 2015)

1.

Obtain output y (t) = x (t) * h (t) using graphical convolution.

$$x(t) = 1+t \quad \text{for } -1 \le t \le 0$$
$$= 1-t \quad \text{for } 0 \le t \le 1$$

$$h(t) = 1 \quad \text{for } 0 \le t \le 2$$
$$= 0 \quad \text{elsewhere}$$

2.

Determine energy and/or power of following signals.

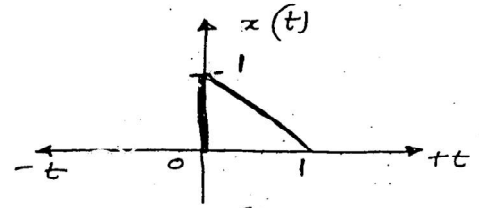
(i) $x(n) = \left(\frac{3}{5}\right)^n u(n) - (4)^n u(-n-1)$

(ii) $x(t) = 4e^{-2t} u(t)$

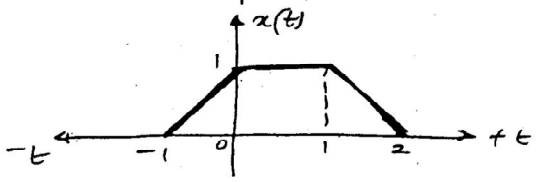
3.

Obtain Laplace Transform of following waveforms using its properties.

(i)

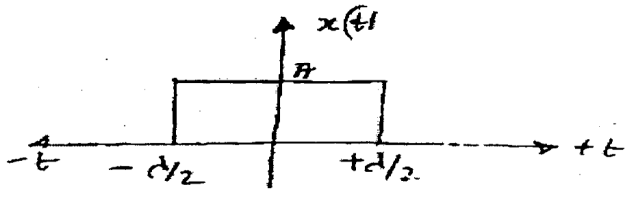


(ii)



4.

Obtain Fourier transform of a rectangular pulse.



3. ASSIGNMENT 2 (DATE : 14th Sep 2015)

1.

A DT. LTI system is specified by

y(n) = -7y(n - 1) - 12y(n - 2) + 4x(n - 1) - 2x(n)

y(- 1) = -2 y(-2) = 3.

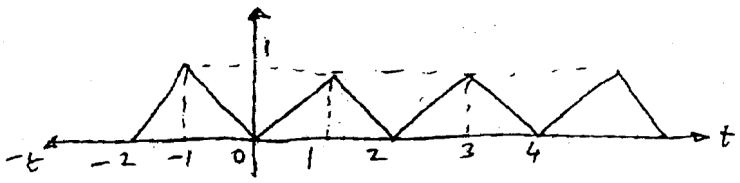
Determine (a) Zero input respouse

(b) Zero state response if $x(n) = (6)^n u(n)$

(c) Total response of the system.

2.

Obtain Fourier series of the following signal.



3.

Obtain Linear convolution of

$x(n) = 3\delta(n+3) + 2\delta(n+1) + \delta(n) - \delta(n-1)$

$h(n) = 2\delta(n+2) - 3\delta(n) + 2\delta(n-1) + 4\delta(n-2).$

4.

Obtain h (t) for causal and stable system If

$$H(s) = \frac{s^2 - 3s + 11}{(s-1)(s+2)(s+3)}$$

Plot the ROC and pole's and zero's of the system.

T.E. Sem V (CBGS) ETRX. 4/12/14.

SBS.

QP Code : 14933

(3 Hours) **[Total Marks : 80**

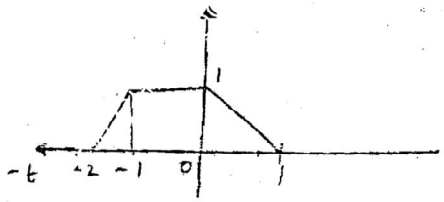
N.B : (1) Question No.1 is **compulsory**.
(2) Attempt any **three** questions from the remaining questions.
(3) **Solve** every question in a serial order.

1. (a) Prove differentiation property of Z.Transform. **20**
   (b) Check if the system is Linear and time invariant.
   (i) $y(t) = t^2x(t) + 3$
   (ii) $y(n) = x(-n) + 3x(n+1)$
   (c) Prove Time shift property of Laplace Transform.
   (d) Determine energy or power of the following signals.
   (i) $x(t) = 5u(t)$
   (ii) $x(n) = 10\, n\, u(n)$.
   (e) State Initial and final value Theorem of Z. Transform and Laplace Transform.

2. (a) Determine h(n) for all possible ROC condition. **10**

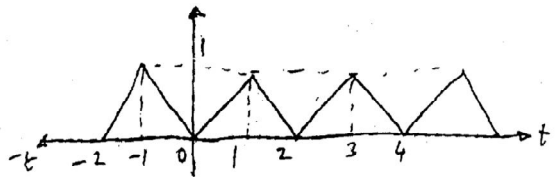
$$H(z) = \frac{z(z^2 - 3z + 11)}{\left(z - \frac{1}{4}\right)(z-4)(z+6)}$$

plot all the ROC's, poles and zeros also comment on stability of the system.
   (b) Obtain even and odd parts of the signal. **5**



Also obtain and plot :
   (i) $x_{even}(2t-1)$
   (ii) $x_{odd}\left(\frac{t}{2}+1\right)$
   (c) Determine Fourier transform of a signum signal. **5**

3. (a) Obtain Fourier series of the following signal. **8**

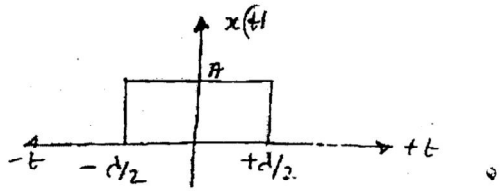


(b) Obtain Linear convolution of **6**

$x(n) = 3\delta(n+3) + 2\delta(n+1) + \delta(n) - \delta(n-1)$

$h(n) = 2\delta(n+2) - 3\delta(n) + 2\delta(n-1) + 4\delta(n-2)$.

(c) Obtain Fourier transform of a rectangular pulse. **6**



4. (a) A DT. LTI system is specified by **10**

$y(n) = -7y(n-1) - 12y(n-2) + 4x(n-1) - 2x(n)$

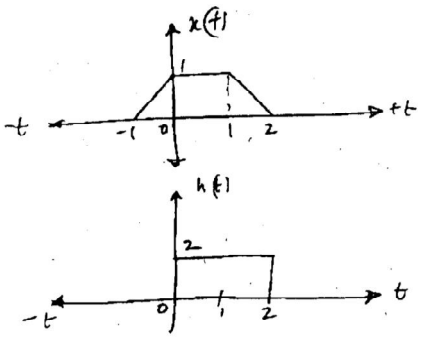
$y(-1) = -2$ $y(-2) = 3$.

Determine (a) Zero input respouse

(b) Zero state response if $x(n) = (6)^n u(n)$

(c) Total response of the system.

(b) Obtain $y(t) = x(t)*h(t)$ using graphical convolution **10**



10

5

5

6

5. (a) Obtain output response of a third order C.T. LTI non-realxed system.

$$\frac{d^3y(t)}{dt^3}+\frac{8d^2y(t)}{dt^2}+\frac{17dy(t)}{dt}+10y(t)=\frac{d^2x(t)}{dt^2}-\frac{3dx(t)}{dt}+7x(t)$$

If $y(0) = -0.5$

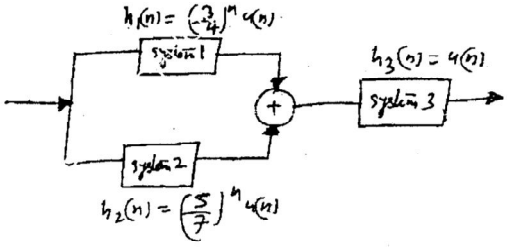
$y'(0) = 2$

$y''(0) = -1$

(b) Determine Z. Transform of $x(n) = (a)^n \sin[\Omega_0 n]\, u(n)$ using properties of Z.T.

(c) Obtain auto-correlation of $x_1(t)=4e^{-3t}u(t)$ 6

6. (a) Obtain overall impulse response signal of the interconnected system. 8



(b) Obtain Laplace Transform of

(i) $x(t) = e^{-9t}\, u(t) + e^{+6t}\, u(-t)$

(ii) $x(t) = (t-1)\, u(t-2) + tu(t)$

(c) Prove Parsavel's Theorem of Fouirer Transform and Fourier Series.

GN-Con. 9929-14.

T.E. II C.B.G.S.
Electronics SS
29/05/15

QP Code : 3313

(3 Hours) **[Total Marks : 80**

N.B. : (1) Questions **No.1** is **compulsory**.
(2) Attempt any **three** questions from the remaining questions.
(3) Solve **every** question in an **order**.

1. (a) Prove convolution property of Fourier Transform. **20**
(b) State and prove final value Theorem of Laplace Transform.
(c) Prove shifting property of Z transform.
(d) Determine energy and/or power of following signals.

(i) $x(n) = \left(\frac{3}{5}\right)^n u(n) - (4)^n u(-n-1)$

(ii) $x(t) = 4e^{-2t} u(t)$

2. (a) Obtain output $y(t) = x(t) * h(t)$ using graphical convolution. **10**

$x(t) = 1+t$ for $-1 \le t \le 0$
$= 1-t$ for $0 \le t \le 1$

$h(t) = 1$ for $0 \le t \le 2$
$= 0$ elsewhere

(b) Obtain h (n) for all possible ROC conditions. Also plot the ROC comment on causality and stability at the system. **10**

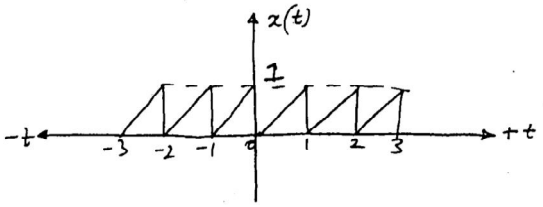
$$H(z) = \frac{4z(z^2-8z+9)}{(z-\frac{1}{3})(z-3)(z+4)}$$

3. (a) A C.T. LTI system has **8**

$$\frac{d^2y(t)}{dt^2} + \frac{5dy(t)}{dt} + 6y(t) = \frac{7dx(t)}{dt} - 3x(t)$$

(i) Determine Transfer function.
(ii) Obtain impulse response.
(iii) Obtain unit Ramp response.

(b) Plot the magnitude and phase spectrum of the periodic signal. Shown below. **8**



TURN OVER

JP-Con. : 11308-15.

(c) Obtain initial and final value 4

$$\text{if } X(z) = \frac{3z^2}{4z^2 - 5z + 1}$$

4. (a) If two subsystem are connected in cascade 8

$h_1(n) = (0.9)^n \; u(n) - 0.5(0.9)^{n-1} \; u(n-1)$

$h_2(n) = (0.5)^n \; u(n) - (0.5)^{n-1} \; u(n-1)$

Determine overall impulse response of the interconnected system.

(b) Obtain z transform of the following signal using properties of z transform. 6

$$x(n) = \left(\frac{3}{4}\right)^{n-1} \sin\left(\frac{\pi}{6} n\right) u(n)$$

(c) Prove Parsevals theorem of Fourier series. 6

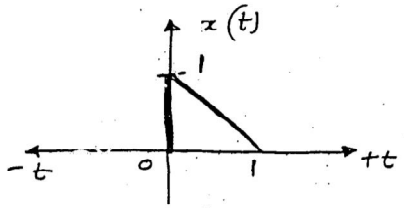
5. (a) Obtain circular convolution of 5

$x_1(n) = [3\ 2\ 1\ 4]$

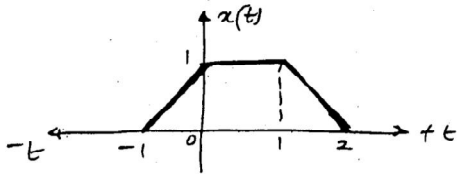
$x_2(n) = [5\ 7\ -8\ 2]$

(b) Obtain Laplace Transform of following waveforms using its properties. 5

(i)



(ii)



(c) Obtain zero input response, zero state response and total response of a 10
D. T. L. T. I. system.

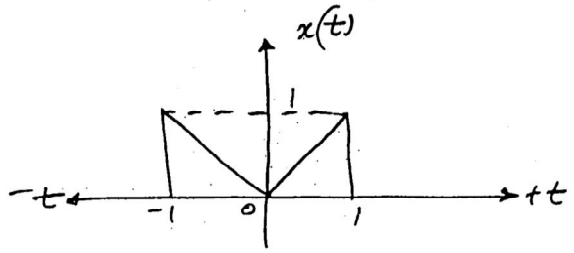
$y(n) + 7y(n-1) + 12\,y(n-2) = 4\,x(n) - 11\,x(n-1)$

If $y(-1) = 1 \quad y(-2) = 2 \quad x(-1) = 0.$

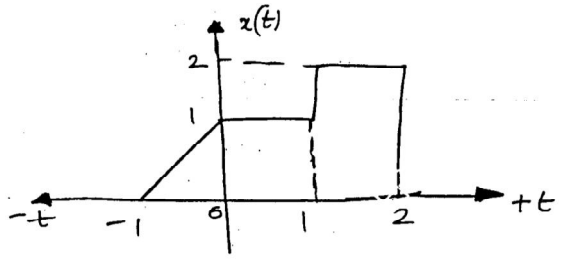
If input $x(n) = u(n)$ = unit step signal

TURN OVER

6. (a) Obtain Fourier transform of the following signal. 6



(b) Plot even and odd parts of following signals. 6



(c) Obtain h (t) for causal and stable system If 8

$$H(s) = \frac{s^2 + 3s + 11}{(s-1)(s+2)(s+3)}$$

Plot the ROC and pole's and zero's of the system.
