P.R. GOVERNMENT COLLEGE (A), KAKINADA

B.Sc. II Year - Electronics – Semester – 4

PAPER – 4 [Code: EL4202]

w.e.f. 2018-19 ADMITTED BATCH

OP – AMP & Digital IC-applications

4 Hours/Week [Total: 60 hrs] **Credits: 3**

Course Learning Outcomes

The subject aims:

- ✓ Students will reliably demonstrate skills in solving simple second order differential equation.
- ✓ Provide hands-on opportunities for students to construct electronic circuits and build electronic projects of varying difficulty levels, ranging from simple to intermediate
- ✓ Cultivate and sustain students' interest in learning through circuit simulations and self-assessment activities
- ✓ Promote active learning through activities such as information search and presentations.

Learning Outcomes:

Students will be able to:

- ➢ Recall Frequency modulation
- ➢ Illustrate Amplitude modulation

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SYLLABUS

Unit – I (12hrs)

Operational Amplifiers:

Definition, Basic op-amp Ideal op-amp, Block diagram of op-amp, op-amp parameters, inverting - non inverting amplifiers, concept of virtual ground. OP-Amp as a, summing amplifier,, differential amplifier, voltage follower, integrator, differentiator, Logarithmic amplifier.

Unit- II (12 hrs)

Op-Amp applications:

Voltage regulator, comparator, Schmitt trigger. Sine wave generator, square wave generator, triangular wave generator, Active filters (Basics) -low pass filter, high pass filter, band pass filters.

Unit - III (10 hrs)

IC555 Timer:

IC 555 timer pin diagram and its description, astable and monostable multivibrators.

Unit-IV (14 hrs):

Combinational Logic Circuits:

Design of Code convertor: BCD to Decimal decoder (IC7442), BCD to Seven Segment display decoder (logic diagram & truth table only).

Sequential Logic Circuits:

Counters: Counters – Synchronous & Asynchronous, Design of asynchronous Mod16, Mod-10, Mod N counter, Binary Up/Down Counter.

UNIT-V (12 hrs)

Data converters:

A/D converter: - Introduction, Digital to Analog (DAC) converter: Binary weighted Resistor DAC, R-2R Ladder type DAC, Analog to Digital Converters (ADC): Successive Approximation type ADC, Single Slop & Dual-Slope type ADC.

Reference Books:

1. Jacob Millan, Micro Electronics, McGraw Hill.

2. Mithal G K, Electronic Devices and Circuits Thana Publishers.

3. Allan Motter shead, Electronic Devices and Circuits – An Introduction- Prentice Hall

TEXT BOOKS:

1. G.K.Kharate-Digital electronics-oxford university press

2. M.Morris Mano, "Digital Design "3rd Edition, PHI, New Delhi.
3. Op Amp and Linear Integrated Circuits by Ramakant Gaykwad
4. Linear Integrated Circuits by Roy Choudary

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Model Question Paper

Note: - Set the question paper as per the blue print given at the end of this model paper.

Time: $2\frac{1}{2}$ Hrs. Max. Marks: 60

Section	Questions to be given	Questions to be answered	Marks
A	5	3	3 x 10M = 30M
B	9	6	6 x 5 M = 30M
Total	14	9	60M

Blue Print

Chapter Name	Essay Questions 10 marks	Short Questions 5 marks	Problems 5 marks	Marks allotted
Operational Amplifiers	1	1	2	25
Op-Amp Applications	1	2		20
IC555 Timer	1	1	---	15
Combinational Logic Circuits & Sequential Logic Circuits	1	1		15
Data converters	1	2	---	20
Total Marks				95

Note: At least two problems should be answered.

SEM:IV PAPER: OP – **AMP & DIGITAL IC-APPLICATIONS**

QUESTION BANK

ESSAY QUESTIONS

UNIT-I: - Operational Amplifiers:

1. Draw the circuit diagram of an operational amplifier and briefly explain each part
2. Mention the characteristics of an ideal Op-Amp. Explain the concept of virtual ground in Op-Amp. Draw the circuit of an Op-Amp inverting amplifier and its action.
3. Draw the circuit diagrams of inverting and non inverting amplifier and explain their operations.
4. What are ideal characteristics of Op-Amp? Explain briefly about
   (a) Virtual ground
   (b) Input offset voltage
   (c) CMRR
   (d) Slew rate
5. Draw and explain Op-Amp application Integrator and Differentiator with output waveforms.

UNIT-II: - Op-Amp applications:

1. Explain the working of Op-Amp as: (b) Differentiator (c) Integrator
2. Explain the working of Op-Amp as: (a) Comparator
3. Draw the circuit of Schmitt trigger using Op-Amp and describe its working with the help of waveforms.
4. Draw the circuit of Triangular Wave generator using Op-Amp and describe its working with the help of waveforms.
5. Explain how operational amplifier can be used as a:
   (a) Summing amplifier
   (b) Band pass filter

UNIT-III: - IC555 Timer:

1. Draw the circuit of Astable multivibrator using IC-555 and describe it's working. Draw the relevant output wave forms.
2. What is a multivibrator? Describe the operation of Monostable and Astable multivibrator using timer IC-555.
3. Draw the circuit of a Monostable multivibrator using IC-555 and describe it's working. Draw the relevant output wave forms.
4. Draw the pin diagram of Timer IC-555 and explain each pin.

UNIT-IV: - Combinational Logic Circuits:

1. Design BCD to Seven Segment display decoder with a logic diagram & give its truth table.
2. What is a counter? Design and explainMod-16 counter.
3. What is a counter? Design and explain Mod-10 counter.
4. Draw and explain BCD to Decimal decoder (IC7442).
5. What is a counter? Design and explain Mod-N counter.

UNIT-V: - Data converters:

1. Explain the working of an A/D converter.
2. Explain the working of a D/A converter.
3. Draw and explain Single Slope & Dual-Slope type ADC.
4. Draw and explain R-2R Ladder type DAC

SHORT ANSWER TYPE QUESTIONS

UNIT-I: - Operational Amplifiers:

1. Give the characteristics of an ideal Op-Amp.
2. What is the concept of virtual ground and explain it.
3. Define an ideal differential amplifier.
4. Describe the working of Op-Amp as Logarithmic amplifier.
5. Explain Op- Amp as summing amplifier.
6. How does Op-Amp act as a voltage follower?

UNIT-II: - Op-Amp applications:

1. Discuss the working of Op- Amp voltage regulator.
2. Explain the working of Op-Amp as comparator.
3. Explain how Op-Amp acts as low, high pass filters
4. Explain how Op-Amp acts as band pass filter
5. Explain any two Active filters using Op-Amp.

UNIT-III: - IC555 Timer:

1. Give the pin diagram of IC 555 timer.
2. Write a brief note on Monostable multivibrator using IC-555.
3. Write a brief note on Astable multivibrator using IC-555..

UNIT-IV: - Combinational Logic Circuits:

1. Compare Asynchronous and synchronous counters.
2. Draw Mod-16 Counter.
3. Draw Mod- 10 Counter.
4. Design binary up/down counter

UNIT-V: - Data converters:

1. Explain Binary weighted Resistor DAC.
2. Explain Successive Approximation type ADC.
3. Give a brief explanation of Single Slope ADC.
4. Give a brief explanation of Dual Slope ADC.

PROBLEMS

UNIT-I: - Operational Amplifiers:

1. The open loop output impedance of a Op-Amp is 5KΩ. It's open loop gain is 60dB. The feedback component R_1 = kΩ and R_0 =200kΩ are connected. Find the value of closed loop output impedance.

2. An inverting amplifier has R_1 =10kΩ and R_0=125kΩ. Calculate the output voltage, input resistance and input current for an input voltage 4 volt.

3. Design a non-inverting amplifier circuit that is capable of providing a voltage gain of 10. Assume on ideal operational amplifier. Resistor should not exceed 30kΩ.

4. What is the maximum closed-loop voltage gain that can be used when the input signal varies by o.5 V in 10μs, for an OP-AMP having slew rate SR =4V/μs?

5. An inverting amplifier has R_1 =10KΩ and R_f = 150kΩ. Find the output voltage, the input resistance and the input current for an input voltage of 1V.

6. Calculate the output voltage of a non-inverting constant gain multiplier with R_1 = 100kΩ, R_f =600kΩand V_1 = 2V.

7. Calculate the ouput voltage of lan OP-AMP amplifier for the following set of voltages and resistors. R_f =1MΩ

(a)v_1 = 1V, v_2 = 2V, v_3 = 3V, R_1 = 500kΩ, R_2 = 1MΩ, R_3 = 1MΩ.

8. In a subtractor circuit R_1 = 10kΩ, R_f = 20KΩ, v_1 = 5V and v_2 = 10V. Find the value of output voltage.

9. The input to the differentiator circuit is a sinusoidal voltage of peak value 5 mV and frequency 1 kHz. Find the output voltage if R= 10KΩ and C = 1μF.