

Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title: : Analog Electronics		Course Code: 15MC32T
Mode(L:T:P) : 4:0:0	Credits: 4	Core/ Elective: Core
Type of Course: Lectures & Student Activities		Total Contact Hours: 52
CIE= 25 Marks		SEE= 100 Marks

Prerequisites: Knowledge of Applied science and Basic Electrical and Electronics Engineering

Course Objectives: Understand the circuit aspects of Linear power supplies, Amplifiers, Oscillators, OPAMPs and Multi vibrators.

Course Outcomes: At the end of the course, the students will be able to

1. Understand the working of DC regulated power supply and basics of UPS & SMPS.
2. Understand the construction, operation of bipolar junction transistor amplifiers.
3. Know the Feedback technique, construction, and operation of Oscillators.
4. Understand the construction, operation and Linear applications of OP-AMP
5. Apply OPAMP in various Non-Linear applications.
6. Applications of IC as a Timer, PLL and PWM

Course Outcome		Cognitive Level	Linked with PO	Teaching Hours
CO1	Understand the working of DC regulated power supply and basics of UPS & SMPS.	U	1,2	10
CO2	Understand the construction, operation of bipolar junction transistor amplifiers	U	1,2	10
CO3	Know the Feedback technique, construction, and operation of Oscillators	U	1,2	10
CO4	Understand the construction, operation and Linear applications of OP-AMP	U/A	1,2	08
CO5	Apply OPAMP in various Non-Linear applications	U/A	1,2	08
CO6	Applications of IC as a Timer, PLL and PWM	U/A	1,2	06
		Total sessions		52

Legend: R; Remember, U: Understand A: Application

Mapping Of Course Outcomes with Program Outcomes

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Analog Electronics	3	3	-	-	-	-	-	-	-	-

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If $\geq 40\%$ of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If $< 5\%$ of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Content and Weightage For SEE

Unit No	Unit Name	CO	Hour	Marks allocated for different Cognitive level Questions			Marks weightage (%)
				R	U	A	
1	Power Supplies	1	10	-	25	-	17.25
2	Amplifiers	2	10	-	20	-	13.75
3	Oscillators	3	10	-	30	-	20.68
4	Op-Amp Linear Applications	4	08	-	10	20	20.68
5	Op-Amp Non-Linear Applications	5	08	-	05	20	17.25
6	Applications Of IC As A Timer, PLL And PWM	6	06	-	05	10	10.34
	Total		52	145 marks			100

Contents

Unit-I

POWER SUPPLIES

Block diagram of Linear Power supply, operation of, HWR, Bridge rectifier. Filter:- Necessity of filters, L type and Pi type filters. Voltage Regulators: Zener diode regulator, Series voltage regulator, IC Voltage Regulators: IC 723, IC 78XX and 79XX. Block diagram of UPS and SMPS

10Hours

Unit-II

AMPLIFIERS

Working of transistors in CB, CE and CC configuration. Necessity of Biasing and different biasing circuits. Multi Stage Amplifiers, frequency response of Two stage RC coupled amplifier Power Amplifier: Difference between voltage and power amplifier, operation of Class A, class B, class AB and class C, Push pull power amplifier, FET Amplifier:

10Hours

Unit-III

OSCILLATORS

Feed Back Amplifier: principle of Feedback and types of feedback, the Effect of feedback on amplifier performance, Study the typical feedback circuits. Positive feedback, Barkhausen's Criteria. working of RC oscillators and study the working of RC-Phase shift Oscillators. working of LC oscillators: Hartley Oscillator, Colpitt's Oscillators, Piezo Electric Effect, Piezo electric crystal, Crystal oscillator.

10Hours

Unit-IV

OP-AMP LINEAR APPLICATIONS

Differential Amplifier: Operational Amplifier: Block diagram, characteristics of ideal Op-Amp, IC 741 Linear Applications of Op-Amp: Inverting amplifier, Non-inverting amplifier, Summer, Subtractor, Voltage follower, Differentiator, Integrator.

8Hours

Unit-V

OP-AMP NON-LINEAR APPLICATIONS

Non-Linear Applications of Op-Amp Schmitt trigger. Oscillators: RC Phase shift Oscillators using OPAMP. Active Filters: Advantage of active filters over passive filters. The operation of Low pass, high pass, band pass and band stop filters.

8Hours

Unit-VI

APPLICATIONS OF IC AS A TIMER, PLL AND PWM

IC 555: internal structure, the operation of monostable, bistable and astable multivibrators using IC 555 Timer. List the applications of IC 555 Timer. Phase Lock Loop (PLL): Circuit, Operation, applications of PLL. Power Interfaces, power OPAMP used in industries, Switch Mode Servo Amplifiers, Pulse Width Modulation and working of PWM IC

6Hours

Reference

- 01 A Text Book Of Electrical Technology - B.L.Theraja Volume I and II
- 02 Electronic Principles - Malvino
- 03 Op-Amp and Other Linear Integrated Circuits - Gayekwad
- 04 Basic electrical Engineering, Kulashreshtha, TMH

e-References/ URLS

<http://www.allaboutcircuits.com/>

<http://www.allaboutcircuits.com/videos>

Student Activity

Activity No.	Description of the Student Activity
1	Build hobby circuit such as door bell, calling bell, blinking LED etc
2	Students can Build a Miniature circuits consists of Transistors, OP-AMP and IC555.

Note:

1. Group of max four students should do any one of the above activity or any other similar activity related to the course Cos and get it approved from concerned Teacher and HOD.
2. No group should have activity repeated or similar
3. Teacher should ensure activities by group must cover all COs
4. Teacher should asses every student by using suitable **Rubrics** approved by HOD

Rubrics

Dimension	Exemplary	Accomplished	Developing	Beginning	Roll No. of the Student				
	5/4	3	2	1	1	2	3	4	5
Organization	Information presented in logical, interesting sequence	Information in logical sequence	Difficult to follow presentation-- student jumps around	Cannot understand presentation-- no sequence of information	Ex: 2				
Subject Knowledge	Demonstrates full knowledge by answering all class questions with explanations and elaborations	At ease with expected answers to questions but does not elaborate	Uncomfortable with information and is able to answer only rudimentary questions	Does not have a grasp of the information. Cannot answer questions about subject	3				
Graphics	Explain and reinforce screen text and presentation	Relate to text and presentation	Occasionally uses graphics that rarely support text and presentation	Uses superfluous graphics or no graphics	4				
Oral Presentation	Maintains eye contact and pronounces all terms precisely. All audience members can hear	Maintains eye contact most of the time and pronounces most words correctly. Most audience members can hear presentation	Occasionally uses eye contact, mostly reading presentation, and incorrectly pronounces terms. Audience members have difficulty hearing	Reads with no eye contact and incorrectly pronounces terms. Speaks too quietly	5				
Total Score=2+3+4+5=14/4=3.5=4									

Institutional Activity

Activity No.	Description of the Institutional Activity
1	Organize Seminar, workshop, Lecture, from an experts in the following domain: 1. Power Supplies 2. Amplifiers 3. Oscillators 4. Op-Amp Linear Applications 5. Op-Amp Non-Linear Applications 6. Applications of IC as a Timer, PLL And PWM
2	Organize an industrial visit.
3	Motivate student to take case study on Transistors, OPAMP and IC-555, to inculcate self and continuous learning.

Course Assessment Pattern

Particulars			Max Marks	Evidence	Course outcomes
Direct Assessment	CIE	Three test (Average of three tests)	20	Blue books	1,2,3,4,5,6
		Student Activity	05	Student Activity Sheets	1,2,3,4,5,6
	SEE	End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course	Middle of the course		Feedback forms	1, 2&3
		End of the course		Feedback forms	1,2,3, 4, 5&6

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks			
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM		20			
	Year:					
Name of Course coordinator : CO's: _____			Units: ____			
Question no	Question	MARKS	CL	CO	PO	
1						
2						
3						
4						

Note: Internal Choice may be given in each CO at the same cognitive level (CL).

Model Question Paper (CIE)

Date and Time	Semester	Course	Max Marks		
2 Test(10 th weak of sem) 10-11 Am	III SEM	Analog Electronics	20		
	Year: 2015-16	Course code:15MC32T			
Name of Course coordinator : All questions carries equal marks			Units:3,4 Co: 3,4		
Question No	Question	CL	CO	PO	
1	Explain the feedback technique OR Explain Barkhausen's criterion for sustained oscillations	U	3	1,2	
2	Explain the working of Colpitt's oscillator with neat circuit diagram. OR Explain the working of Hartley oscillator with neat circuit diagram	A	3	1,2	
3	Explain the working of op-amp as Summing Amplifier OR Explain the working of op-amp as Difference Amplifier.	A	4	1,2	
4	Explain the block diagram of Op-Amp OR Explain the working of op-amp as Integrator	U	4	1,2	

Model Question Paper
III Semester Diploma in Mechatronics Engineering
Analog Electronics

Instructions: Answer any six questions from part A and Seven full questions from part B

PART- A

Answer any six questions.

5X6=30 marks

1. Explain the Linear power supplies with neat block diagram.
- 2 Differentiate between voltage amplifiers and power amplifiers.
- 3 How amplifiers are classified according to the method of operation
4. Explain the feedback technique
- 5 Explain Barkhausen's criterion for sustained oscillations.
6. Explain the block diagram of Op-Amp.
7. Explain the characteristics of an ideal Op-Amp.
8. Explain the working of Schmitt trigger circuit using OP-AMP
9. Explain PLL.

PART- B

Answer any seven full questions.

10x7=70 Marks

1. a). Describe the term Rectification.
b). Explain with a neat circuit diagram with necessary wave forms, the working of bridge rectifier
(2+8)m
2. a). Describe the term Regulation.
b). Explain the working of zener diode voltage regulator. **(2+8)m**
3. a). Explain the term amplification.
b). Explain class AB amplifiers with circuit diagrams and necessary waveforms. **(3+7)m**
4. Explain the working of Hartley's oscillator with neat circuit diagram. **10m**
5. Explain the working of Crystal oscillator with neat circuit diagram **10m**
6. a). Explain the working of op-amp as Non-Inverting amplifier
b). Explain the working of op-amp as Differentiator. **(5+5)m**
7. a). Explain the working of op-amp as Voltage follower.
b). Explain the working of op-amp as Summing Amplifier. **(5+5)m**
8. With a neat circuit diagram, explain the operation of active high pass filter. **10m**
- 9 With a neat circuit diagram explain the operation of active Band pass filter. **10m**
10. Explain the working of Astable multivibrator using IC 555 timer. **10m**

Model Question Bank
III Semester Diploma in Mechatronics Engineering
Analog Electronics

Unit-I

Power Supplies

Cognitive level- Understanding

1. Explain the Linear power supplies with neat block diagram.
2. Explain with a neat circuit diagram with necessary wave forms, the working of (half wave/full wave/bridge) rectifier.
3. List the differences between the Half wave and Full wave rectifiers.
4. Explain the necessity of filters in power supplies.
5. Explain working of L type filter.
6. Explain the working of pie filter
7. Describe the terms:
 - i. Peak Inverse Voltage
 - ii. Rectification Efficiency
 - iii. Rectification
8. Explain the working of zener diode voltage regulator.
9. Explain series voltage regulator.
10. Explain the block diagram of a 3-terminal IC regulator.
11. Write the basic circuit of IC 723 voltage regulator.
- 12.** Explain the need for DC regulated power supply
13. Explain the line and load regulation

Unit-II

Amplifiers

Cognitive level- Understanding

1. Explain the input and output characteristics of a transistor in CB/CE configuration with neat circuit diagram.
2. Explain the operation of transistor as switch
3. Explain the operation of transistor as an amplifier
4. Explain the term amplification.
5. Explain voltage divider bias with a circuit diagram.
6. How amplifiers are classified according to the method of operation?
7. Explain class A amplifiers with circuit diagrams and necessary waveforms.
8. Explain class B amplifiers with circuit diagrams and necessary waveforms.
9. Explain class AB amplifiers with circuit diagrams and necessary waveforms.
10. Explain the push-pull amplifier with circuit diagram.
11. With a neat circuit diagram explain the working of two stage RC coupled amplifier.
12. Explain the working of FET amplifier with neat sketch.
13. Mention the applications of FET amplifier.

14. Differentiate between voltage amplifiers and power amplifiers.
15. Write the circuit diagram of Darlington pair amplifier.

Unit-III

Oscillators

Cognitive level- Understanding

1. Explain LC Tank Circuit and stability
2. Explain Barkhausen's criterion for sustained oscillations.
3. Explain the working of Colpitt's oscillator with neat circuit diagram.
4. Explain the working of Hartley's oscillator with neat circuit diagram.
5. Explain the piezo electric effect.
6. Explain the working of Crystal oscillator with neat circuit diagram.
7. List the advantages and applications of crystal oscillators.
8. Explain the feedback technique.

Unit-IV

Op-Amp Linear Applications

Cognitive level- Understanding

1. Explain the characteristics of an ideal Op-Amp.
2. Explain the block diagram of Op-Amp.
3. Discuss the applications of Differential amplifier
4. Describe the working principle of basic differential amplifier circuits
5. Explain the following Op-amp parameters Power Supply Rejection Ratio, CMRR, Input impedance, output impedance, gain, gain bandwidth product, slew rate

Cognitive level- Application

1. Explain the working of op-amp as Inverting amplifier.
2. Explain the working of op-amp as Non-Inverting amplifier
3. Explain the working of op-amp as Integrator.
4. Explain the working of op-amp as Summing Amplifier.
5. Explain the working of op-amp as Difference Amplifier.
6. Explain the working of op-amp as Differentiator.
7. Explain the working of op-amp as Voltage follower.

Unit-V

Op-Amp Non-Linear Applications

Cognitive level- Understanding

1. Explain high pass and low pass filters
2. Explain band pass and band stop filters

3. Explain passive and active filters

Cognitive level- Application

1. Explain the working of Schmitt trigger circuit using OP-AMP.
2. With a neat circuit diagram, explain the operation of active high pass filter.
3. With a neat circuit diagram, explain the operation of active Low pass filter.
4. With a neat circuit diagram explain the operation of active Band pass filter.
5. With a neat circuit diagram explain the operation of active Band stop filter.
6. Explain RC phase shift oscillator using OP AMP

Unit-VI

Applications of IC as a Timer, PLL and PWM

Cognitive level- Understanding

1. Explain the internal block diagram of IC555 timer
2. Explain the operation of PLL
3. Explain the applications of PLL
4. Explain power operational amplifier
5. Discuss the applications of multivibrators

Cognitive level- Application

1. Explain the working of monostable multivibrator using IC 555 timer.
2. Explain the working of Astable multivibrator using IC 555 timer.
3. Explain the working of bistable multivibrator using IC 555 timer
4. Explain the working of PWM IC