MUZAFFARPUR INSTITUTE OF TECHNOLOGY Muzaffarpur

COURSE FILE

of

Analog Electronics(041404)

Faculty Name:Rakesh Kumar
Assistant Professor
Department of Electronics & Communication Engineering

CONTENTS

VISION OF DEPARTMENT

The department is committed for high quality teaching and pursuit of excellence in research. We pledge to serve the nation and society by providing skilled and well developed human resource through brilliance in technical education and research..

MISSION OF DEPARTMENT

- To encourage innovation and research through projects and developmental activities with industries, institutions and government.
- To inculcate moral and ethical values with a sense of competitiveness, self-confidence and sincerity among the students to make them a good human and a good citizen.
- To produce excellent engineers, innovators, entrepreneurs and academicians for the growth of the society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

After successful completion of program, graduates will be able to

PEO1: work in the infrastructure development projects.

PEO2: pursue higher studies.

PEO3: contribute in teaching, research and other developmental activities of electronics & communication engineering and its allied fields.

PEO4: work in the multicultural and multidisciplinary groups for the sustainable development and growth of electronics and communication engineering projects and profession.

PROGRAMME OUTCOMES (PO):

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental

	considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

COURSE OBJECTIVES AND COURSE OUTCOMES:

Institute/college Name	MuzaffarpurInstitute of Technology, Muzaffarpur
Program Name	B.Tech. (ECE – 5th semester)
Course Code/course credits	041811 (5)
Course Name	Analog Electronics
Lecture/ Sessional (per week)	3-0-3

Course objective:

This course is designed for the 5th semester UG students of ECE. This course is intended to develop an understanding of small signal amplifier design using linear transistor models; and its analysis at low and high frequencies, including different feedback topologies and oscillators. The course also indulges power amplifiers, tuned amplifiers and behaviour of noise in an amplifier.

Course outcomes (CO):

After completion of the course, a student would be acquainted with the following:

CO1: Design and analysis of CE, CB, CC amplifiers using small signal h-model and pi-model and derivation of voltage gain, current gain, input impedance and output impedance.

CO2: Design and analysis of RC coupled single stage and multistage amplifiers and their frequency responses; and the effects of coupling and bypass capacitors in amplifiers.

CO3: Design and analysis of common source FET amplifier and its frequency response.

CO4: Design and analysis of negative feedback amplifiers and oscillators.

CO5: Design and analysis of different types of power amplifiers and tuned amplifiers.

CO6: Behaviour of noise in an amplifier.

MAPPING OF COs AND POs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	-	-	-	-	1	-	3
CO2	3	3	2	2	2	1	-	-	-	1	-	3
CO3	3	3	3	3	3	1	-	-	-	3	2	3
CO4	3	3	3	3	2	2	2	2	1	1	3	3
CO5	3	3	3	3	3	2	2	2	1	1	3	3
CO6	3	3	2	1	-	-	-	-	-	-	-	-

Correlation level: 1- slight (Low) 2- moderate (Medium) 3-substantial (High)

COURSE SYLLABUS:

Mid frequency amplifiers : Analysis of CB,CE &CC amplifiers using hybrid model, Low and High Frequency analysis of CB, CE & CC, rise time method for determination of f_b using the formula of $t_r\ f_h - 0.35$ and 10% sag method for thedetermination of f_{lower} using sag method.

Multistage amplifiers: Bootstrapping in emitter follower, Darlington pair, cascade amplifier, CC-CB cascade, band width shrinkage in multi stage amplifiers.

Frequency response of FET: Incremental model of FET and incremental analysis of common source at low & high frequencies.

Feedback Amplifiers: Ideal voltage amplifiers, ideal current amplifiers, ideal transresistance amplifiers and ideal transconductance amplifiers and distortions(amplitude or harmonic distortions, frequency distortion and phase distortion);

Oscillators: Barkhausen criteria for oscillation Wien bridge, RC phase shift, quadrature, Hartley, Colpitts oscillator.

Power amplifiers and tuned amplifier: Class A, Class B and Class AB power amplifiers with reference to Complementary Symmetry Amplifiers, Tuned amplifiers- single tuned amplifiers.

Noise and noise figure in amplifiers: Thermal noise, shot noise, flicker noise, Friss formula.

GATE Syllabus of Analog Electronics: Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor and FET amplifiers. **Amplifiers: single-and multi-stage, differential and operational, feedback, and power. Frequency response of amplifiers**.Simple op-amp circuits.Filters.**Sinusoidal oscillators; criterion for oscillation**; single-transistor and op-amp configurations. Function generators and wave-shaping circuits, 555 Timers. Power supplies.

MUZAFFARPUR INSTITUTE OF TECHNOLOGY

B.Tech. 5th Semester (2016 Batch) w.e.f. 01.07.2018

DAY	I (9-10.00AM)	II (10.00-11.00AM)	III (11.00-12.00PM)	IV (12.00-01.00PM)		V (02.00-3.00PM)	VI (3.00-4.00PM)	VII (4.00-5.00PM)
MON		AE (RAK)EB2			RECESS			
TUE						AE LAB (RAK)		
WED	AE (RAK)EB2							
THU				AE (RAK)EB2				
FRI								
SAT								

Asst. Prof-in-charge (TT) **Prof.-in-charge (TT)** **Principal**

STUDENTS' LIST:

1	16EC01	ANKIT KUMAR
2	16EC09	UTSARG RANJAN
3	16EC10	AGHAZ JUNAID
4	16EC11	VIVEK KUMAR SONU
5	16EC12	SUGANDHA KUMARI
6	16EC13	SHREYA ANAND
7	16EC14	MD ARSHADULLAH
8	16EC16	NEHA PRAVEEN
9	16EC17	VISHAL KUMAR
10	16EC20	RAKESH KUMAR
11	16EC23	RAJU KUMAR
12	16EC24	PREM PRAKASH MANGLAM
13	16EC25	MD REHAN
14	16EC26	SUBHAM RAJ
15	16EC29	SANSKRITI SHREE
16	16EC30	VIMLA BHARTI
17	16EC31	PUJA KUMARI
18	16EC32	PRASHANT KUMAR
19	16EC33	PRANAY MOHAN
20	16EC34	OM PRAKASH
21	16EC35	MD SARVAR ALI
22	16EC36	NIDHI
23	16EC37	HIMANSHU RAJ
24	16EC38	NITISH KUMAR
25	16EC39	ANMOL SHRIVASTAVA
26	16EC40	KUNDAN KUMAR
27	16EC41	SHIKHA PURNIMA
28	16EC42	AYUSHMAN KUMAR
29	16EC43	SHIMPI KUMARI
30	16EC44	DEEPAK KUMAR GUPTA
31	16EC45	RAHUL RANJAN KAPRI
32	16EC46	SAKET RANA
33	16EC47	KISHAN KUMAR
34	16EC48	SRISTI SNEHA
35	16EC49	SHIVANI
36	16EC50	MAMTA KUMARI
37	16EC51	RAJ KUMAR
38	16EC52	ABHIMANYU KUMAR
39	16EC53	BRISHNI KANT PATHAK
40	17(LE)EC01	SHRUTI RAJNANDANI
41	17(LE)EC02	RAGINI KUMARI
42	17(LE)EC03	AKASH RAJ

43	17(LE)EC04	ANIL KUMAR
44	17(LE)EC05	JAY PRAKASH
45	17(LE)EC06	RITUL KUMARI
46	17(LE)EC07	MANOJ KUMAR

COURSE PLAN

Topic No.	Topic	No. of Lecture/ lecture no.	Text book
1.	**Mid frequency amplifiers**	**15**	TB1, TB2, TB3
	Introduction and configuration of BJT Amplifiers.	1	
	Introduction to 2-port networks and h-parameter modeling of BJT.	2	
	Analysis of CE configuration using simplified h-model.	3	
	Analysis of CB and CC(Emitter follower) configuration using simplified h-model.	4	
	Analysis of CE with emitter resistance configuration using simplified h-model	5	
	Practice of numerical problems based on mid frequency analysis of amplifiers.	6	
	Low Frequency analysis of CE,CB and CC amplifier using pi-model.	7-9	
	High Frequency analysis of CE,CB and CC amplifier using pi-model.	10-12	
	Practice of numerical problems based on low and high frequency analysis of amplifiers.	13	
	Determinatio – an of higher frequency (n- of amplifier using rise time method.	14	
	Determinatio e) n m of lower frequency (n- of amplifier using 10% sag method.	15	
	ASSIGNMENT-1		
2.	**Multistage Amplifiers**	**5**	TB1, TB2, TB3
	Design and analysis of single and multistageRC (cascaded) coupled amplifiers.	16-17	
	Analysis of Darlington pair (CC-CC) amplifier.	18	
	Analysis of cascode (CE-CB) amplifier.	19	

	Gain bandwidth product (GBW) and bandwidth shrinkage in multistage amplifiers.	20	
	ASSIGNMENT-2		
3.	**Frequency response of FET**	**5**	TB1, TB2, TB3
	Introduction to **FET** andincremental model of FET for small signal analysis.	21	
	Low frequency analysis of common source FET using Pi-model and practice of numerical questions.	22-23	
	High frequency analysis of common source FET using Pi-modelpractice of numerical questions.	24-25	
	Mid semester exam		
4.	**Feedback Amplifiers**	**6**	TB1, TB2, TB3
	Concept of feedback and classification of feedback amplifiers.	26	
	General characteristic of feedback amplifiers and effect of negative feedback on amplifiers.	27	
	Voltage shunt and voltage series feedback configurations.	28	
	current shunt and current series feedback configurations.	29	
	Distortions in amplifiers and numerical problems.	30-31	
	ASSIGNMENT-3		
5.	**Oscillators**	**6**	TB1, TB2, TB3
	Introduction to Barkhausen's criterion and classification of oscillators.	32	
	RC- phase shift oscillators	33	
	Wein bridge oscillators	34	

	General analysis of LC oscillators	35	
	Hartley and colpitt oscillators	36	
	Numerical problems based on oscillators.	37	
6.	**Power amplifiers and tuned amplifier**	**6**	TB1, TB2, TB3
	Introduction and classification of power amplifier.	38	
	Analysis of class A and class B power amplifiers and their efficiency.	39	
	Analysis of class AB and complementary symmetry power amplifiers and their efficiency.	40-41	
	Introduction to Tuned Amplifiers and analysis of single tuned amplifiers.	42-43	
	Assignment-4		
7.	**Noise and noise figure in amplifiers**	3	TB1, TB2, TB3
	Introduction to noise and classification of noise	44	
	Noise in amplifiers and Friis formula	45-46	
Total Number of Lecture		46	

Text Books:

TB1: Micro Electronics by Millman And Grabel , McGRAW HILL
TB2: Integrated Electronics by Millman & Halkias , McGRAW HILL
TB3: Electronic Devices and Circuits by Boylstead & Nashelsky, Pearson

Reference Books:

RB1: Micro electronics circuit by Sedra and Smith, Oxford University;
RB2: Micro electronics circuit analysis and design, by Rashid , PWS publication house;
RB3: Electronic devices and integrated circuit- BP Singh and Rekha Singh, Pearson.
RB4: Electronic Principles, 7th Ed. by Albert Malvino & Davis J.Bates, TMH.