MUZAFFARPUR INSTITUTE OF TECHNOLOGY, Muzaffarpur

COURSE FILE

OF

Basic Electronics

(041x01)

Faculty Name:

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ASSISTANT PROFESSOR,

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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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 analyze 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 modeling 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 OBJECTIVE AND COURSE OUTCOMES:

Institute / College Name :	MUZAFFARPUR INSTITUTE OF TECHNOLOGY		
Program Name	**B.Tech. ECE**		
Course Code	041301		
Course Name	**BASIC ELECTRONICS**		
Lecture / Tutorial / Practical (per week):	3 – 1 - 2	**Course Credits**	5
Course Coordinator Name	Mr. PAWAN KUMAR JAISWAL		

Course objective:

This course provides the student with the fundamental skills to understand the basic of semiconductor and components like diode, transistor, FET, MOSFET and operational amplifier It will build mathematical and numerical background for design of electronics circuit & component value. Students equipped with the knowledge and training provided in the course will be able to participate in design , development and operation in the different area of electronics system .

Course outcomes (CO):

CO1: To study basics of semiconductor & devices and their applications in different areas.

CO2: To study different biasing techniques to operate transistor , FET , MOSFET and operational amplifier in different modes.

CO3: Analyze output in different operating modes of different semiconductor devices.

CO4: Compare design issues, advantages, disadvantages and limitations of basic electronics.

MAPPING OF COs AND POs

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

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

COURSE SYLLABUS:

Topics	Number of Lectures	Weightage (%)
PN junction diode : Depletion layer, barrier potential, forward and reverse bias, break down voltage, PIV characteristics of PN junction diode, knee voltage, ideal PN junction diode, junction capacitance, break down diode (zener diode). Photo diode and light emitting diode.	10	20
Rectifiers and filters : Half wave and full wave rectifiers (centre tape and bridge), regulation ripple factor, R-C**,**L-C and Pi filters. Clipping and clamping circuit, voltage multiplier	8	10
BJT introduction : Basic theory and operation of PNP and NPN transistors, characteristics of C-B,C-E,C-C configuration. **Biasing :** Base bias, emitter feedback bias, voltage divider bias, load line, operating point. Incremental analysis using h model	12	20
FET : introduction, operation, JFET parameters, JFET characteristics, JFET amplifiers. **MOS FET :** Introduction, operation , MOSFET parameters .	4	15
Feedback amplifiers.	2	10
Integrated circuit : Characteristics of ideal, operational amplifiers. Application as inverting, non Inverting amplifiers. Summer, difference, differentiator, integrator	4	15
Principle and application of SCR and UJT..	2	10

GATE SYLLABUS (Basic Electronics):

Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equations; **P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode and solar cell; Integrated circuit** fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process

* Bold represents the matching part of the Course and Gate Syllabus

MUZAFFARPUR INSTITUTE OF TECHNOLOGY

B.Tech. 3rd (Third) Semester TIME TABLE

WITH EFFECT FROM 10.07.2018

3rd Semester Electronics and Communication Branch								
	09:00	10:00	11:00	12:00	R E C E S S	2:00	3:00	4:00
	1	2	3	4		5	6	7
MON		BE				Weekly Test		
TUES								
WED	BE							
THUR		BE						
FRI								
SAT				BE(T)		BE LAB		

MUZAFFARPUR INSTITUTE OF TECHNOLOGY

B.Tech. 3rd (Third) Semester TIME TABLE

WITH EFFECT FROM 10.07.2018

3rd Semester Information and Technology Branch								
	09:00	10:00	11:00	12:00	R E C E S S	2:00	3:00	4:00
	1	2	3	4		5	6	7
MON				BE(T)			Weekly Test	
TUES								
WED				BE				
THUR	BE							
FRI			BE			BE LAB		
SAT								

MUZAFFARPUR INSTITUTE OF TECHNOLOGY

B.Tech. 3rd (Third) Semester TIME TABLE

WITH EFFECT FROM 10.07.2018

3rd Semester Electrical Engineering Branch								
	09:00	10:00	11:00	12:00	R E C E S S	2:00	3:00	4:00
	1	2	3	4		5	6	7
MON								
TUES						BE LAB		
WED								
THUR						BE LAB		
FRI								
SAT								

STUDENT LIST:

3rd Semester Electronics and Communication Branch		
S .No	**Roll No**	**Name of Students**
1	16EC39	ANMOL SHRIVASTAVA
2	16EC25	MD REHAN
3	17EC23	PRINCE KUMAR
4	17EC37	RAVI KUMAR SINGH
5	17EC35	RAJESH DAS
6	17EC34	GAUTAM KUMAR
7	17EC32	VICKY KUMAR
8	17EC11	SACHIN KUMAR
9	17EC39	BRAJESH KUMAR
10	17EC04	AUSHUTOSH KUMAR
11	17EC15	PRADEEP KUMAR
12	17EC13	SHABAB ANWAR
13	17EC01	ASHMITA KUMARI
14	17EC14	ASTITVA ANAND
15	17EC20	AKASH DEEP
16	17EC03	SHILPA SONALI
17	17EC24	GULEISHAN SHARAFAT
18	17EC33	APARNA RANI
19	17EC05	SUPRIYA BHARTI
20	17EC43	NIDHI SINGH
21	17EC29	PUJA KUMARI
22	17EC12	SUNNY SAURAV
23	17EC10	BIPUL KUMAR
24	17EC41	ABHISHEK RANA
25	17EC22	GAURAV KUMAR
26	17EC21	NANDAN KUMAR
27	17EC26	PRINCE KUMAR
28	17EC40	MANISHA PRAKASH
29	17EC28	SHREYA SWARAJ
30	17EC25	AMBRIN FATMA
31	17EC36	KARSHNI KANT PATHAK
32	17EC30	AMMAR NAJUM
33	17EC27	MD SARFARAZ IQBAL
34	17EC46	NIRBHAY KUMAR PANDEY
35	17EC47	BANTY KUMAR
36	17EC44	KUSH KUMAR

37	17EC16	BITTU KUMAR
38	17EC48	SURAJ KUMAR
39	17EC19	SRIJAN SINGH
40	17EC45	MD SHERIQUE ANWAR
41	17EC42	ROHIT KUMAR
42	17EC38	AADIL RAZA
43	17EC06	SUPRIYA KUMARI

3rd Semester Information & Technology Branch		
S. No	**Roll No**	**Name of Students**
1	16IT15	BHANU KUMAR RANJAN
2	16IT07	RISHIKESH BHARDWAJ
3	16IT30	SUNIL KUMAR
4	17IT13	RIYA AGRAWAL
5	17IT16	ANURAG PRAKASH
6	17IT04	PRATYASHA SHREE
7	17IT01	ANKIT JHA
8	17IT03	PREETI
9	17IT05	SUDHAKAR PRAKASH
10	17IT12	RISHABH KUMAR
11	17IT10	NITISH SHRIVASTAVA
12	17IT08	ALOK KUMAR
13	17IT07	RAHUL KUMAR SINHA
14	17IT21	APURVA SINGH
15	17IT06	ABHISHEK KUMAR
16	17IT18	RITESH KUMAR
17	17IT25	ANUPAM SINGH
18	17IT09	LUV
19	17IT38	ANURAG GUPTA
20	17IT31	SHUBHAM KUMAR
21	17IT32	ARVIND KUMAR
22	17IT24	SHANTANU KUMAR
23	17IT19	ESHA NANDINI
24	17IT35	ABHINAV KUMAR ANAND
25	17IT22	SHUBHAM KUMAR
26	17IT28	IFFAT NAAZ
27	17IT34	VIKASH KUMAR
28	17IT41	ANKIT KUMAR
29	17IT36	MD OBAIDULLAH
30	17IT29	NEESHA BHARTI
31	17IT20	SURBHI KUMARI
32	17IT40	SHUBHAM KUMAR
33	17IT46	AMAN SHRAFF
34	17IT47	RAKESH KUMAR PRASAD
35	17IT39	RAHUL KUMAR JHA
36	17IT27	MALA KUMARI
37	17IT23	NIVEDITA KUMARI
38	17IT43	JUHI KUMARI
39	17IT48	NAVNEET KUMAR

40	17IT37	MASUM RAJA
41	17IT44	ABHISHEK KUMAR
42	17IT42	ANURAG KUMAR SHARMA
43	17IT45	AKANKSHA ANAND
44	17IT26	VINEETA
45	17IT30	KUMAR SHIVAM

TEXT BOOKS:

TB1: ‘Electronic devices and circuit theory by Boylestad and Nashelsky, Pearson

TB2: ‘Electronic principle by Albert Malvino & Davis J Bates, TMH

TB3: ‘Solid state Electronics Devices’ by Sreetman & Banerjee.

REFERENCE BOOKS:

RB1: Principles of electronics by V K Mehta and Rohit Mehta, Chand.

RB2: ‘electronics devices & Circuit’ by Salivahanan. TMH

COURSE PLAN

Lecture Number	Topics	Text Book / Reference Book	Page no.
1-7	**P-N Junction Diode**	TB 1	1-36
	Depletion layer, barrier potential, forward and reverse bias, breakdown voltage, PIV characteristics of PN junction diode, knee voltage, ideal PN junction diode, junction capacitance, break down diode (zener diode).		
7 - 9	**Other Diodes**	TB1	38-41
	Photo diode and light emitting diode		
10-17	**Rectifiers and filters**	TB1	76-100
	Half wave and full wave rectifiers (centre tape and bridge), regulation ripple factor, R-C,L-C and Pi filters. Clipping and clamping circuit, voltage multiplier		
18-23	**BJT introduction :**	TB1	131-156
	Basic theory and operation of PNP and NPN transistors, characteristics of C-B,C-E,C-C configuration.		
24-30	**Biasing**	TB1	161-212
	Base bias, emitter feedback bias, voltage divider bias, load line, operating point. Incremental analysis using h model.		
31- 32	**FET**	TB1	368-385
	Introduction, operation, JFET parameters, JFET characteristics, JFET amplifiers.		
33-34	**MOSFET**	TB 1	386-399
	Introduction, operation of MOSFET parameters.		
35-36	**Feedback amplifiers.**	TB 1	747-752
	Feedback amplifiers.		
37 - 39	**Integrated Circuits**	TB 1	607-626

	Characteristics of ideal, operational amplifiers. Application as inverting, non -inverting amplifiers. Summer, difference, differentiator, integrator.		
40 - 42	**Principle and application**	TB1	832-848
	SCR and UJT		

ASSIGNMENT

QUESTION BANK:

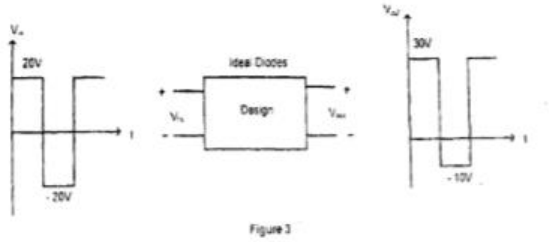

Figure 3

8. (a) Briefly explain the small signal model of JFET.
   (b) An integrator using op-amp has following component values. $R_i = 1k\Omega$, $R_f = 100k\Omega$ and $C_f = 0.1\mu F$. A 1kHz square wave applied to integrator. The amplifier uses ± 15 V supply and output saturates at $\pm 14V$ if input alternates between ± 5 V then. 14
   (i) Determine the maximum change in output
   (ii) Determine the maximum slew rate.
   8+6=14

9. (a) Define the gate power dissipation and explain its importance in SCR.
   (b) Explain the operation of centre tapped full wave rectifier. And calculate the rms load current and voltage for a sinusoidal input. 7+7=14

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Code : 041301

B.Tech 3rd Semester Examination, 2016

Basic Electronics

Time : 3 hours *Full Marks : 70*

Instructions :

*(i) There are **Nine** Questions in this Paper.*
*(ii) Attempt **Five** questions in all.*
*(iii) **Question No. 1 is Compulsory.***
(iv) The marks are indicated in the right hand margin.

1. Answer the following questions: 2×7=14
   (a) Difference between BJT and MOSFET.
   (b) Define thermal run way.
   (c) Difference between depletion mode and enhancement mode MOSFET.
   (d) List the most important SCR parameters for low-current devices.
   (e) Emitter saturation voltage of UJT.
   (f) List the most important parameters of operational amplifier and their typical values.
   (g) Define the Pinch-off voltage JFET.
   (h) Define flat-band voltage.
   (i) State the applications of light emitting diode.
   (j) Why the BJT dimensions of Emitter, Base and Collector of are not same?

P.T.O.

2. (a) Derive and explain an intrinsic carrier concentration (n_i) of a semiconductor.

(b) Explain the operation and characteristics of light emitting diode. 6+8=14

3. (a) For the circuit shown in Figure 1, determine

(i) d.c. output voltage

(ii) rectification efficiency

(iii) peak inverse voltage

(iv) output frequency

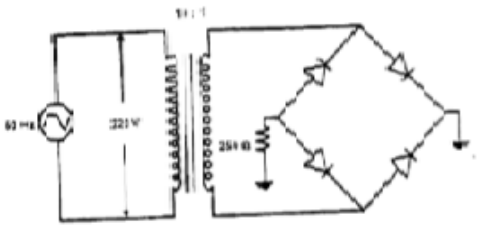


Figure 1

(b) Explain the operation of p-n silicon diode at equilibrium condition. Also derive the expression for the following :

(i) Maximum electric field(E_{max})

(ii) Depletion width (W)

(iii) Built -in potential (ϕ_0) 8+6=14

4. (a) Accurately analyze the collector-to-base bias circuit is shown in Figure 2 to determine the I_B, I_C and V_{CE} when

(i) β=50 and

(ii) β=200 Assume V_{BE}=0.7 V.

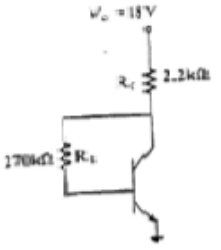


Figure 2

(b) Sketch typical BJT common-emitter input and output characteristics. Explain the shapes of the characteristics. 8+6=14

5. (a) Draw the two biasing circuits for JFET and explain.

(b) Derive the gain expression of an integrator and a differentiator using op-amp. 8+6=14

6. (a) Explain the basic operation and characteristics of n-channel depletion type MOS FET.

(b) Sketch a 180° phase control for an SCR. Draw the load waveform and explain the circuit operation. 8+6=14

7. (a) Draw Sketches to show the basic construction and equivalent circuit of a unijunction transistor (UJT). Briefly explain the device operation.

(b) Design a clamper to perform the function shown in the Figure 3 shown below. 8+6=14

Code : 041301

B.Tech 3rd Semester Exam., 2015

BASIC ELECTRONICS

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Answer the following questions : 2×7=14

(a) Why is silicon preferred over germanium in making of semiconductor devices?

(b) What do you understand by transition capacitance of a diode?

(c) Why we cannot measure the barrier potential of a diode using voltmeter?

(d) Explain one disadvantage of bridge rectifier.

(e) Capacitor filter is not suited for heavy loads. Why?

2. (a) Derive and explain an intrinsic carrier concentration (n_i) of a semiconductor.

(b) Explain the operation and characteristics of light emitting diode. 6+8=14

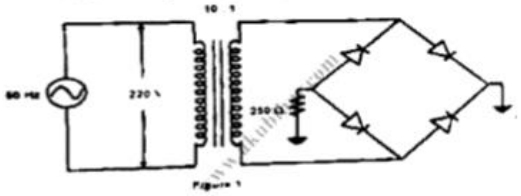
3. (a) For the circuit shown in Figure 1, determine

(i) d.c. output voltage

(ii) rectification efficiency

(iii) peak inverse voltage

(iv) output frequency



(b) Explain the operation of p –n silicon diode at equilibrium condition. Also derive the expression for the following :

(i) Maximum electric field (E_{max})

(ii) Depletion width (W)

(iii) Built -in potential (V_{bi}) 8+6=14

4. (a) Accurately analyze the collector-to-base bias circuit is shown in Figure 2 to determine the I_B, I_C and V_{CE} when

(i) β=50 and

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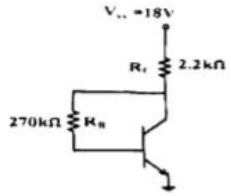

Figure 2

(b) Sketch typical BJT common-emitter input and output characteristics. Explain the shapes of the characteristics. 8+6=14

5. (a) Draw the two biasing circuits for JFET and explain.

(b) Derive the gain expression of an integrator and a differentiator using op-amp. 8+6=14

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7. (a) Draw Sketches to show the basic construction and equivalent circuit of a unijunction transistor (UJT). Briefly explain the device operation.

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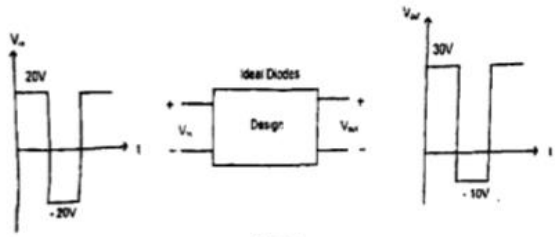

Figure 3

8. (a) Briefly explain the small signal model of JFET.

(b) An integrator using op-amp has following component values. $R_i = 1k\Omega$, $R_f = 100k\Omega$ and $C_f = 0.1\mu F$. A 1kHz square wave applied to integrator. The amplifier uses ± 15 V supply and output saturates at $\pm 14V$ if input alternates between ± 5 V then. 14

(i) Determine the maximum change in output

(ii) Determine the maximum slew rate. 8+6=14

9. (a) Define the gate power dissipation and explain its importance in SCR.

(b) Explain the operation of centre tapped full wave rectifier. And calculate the rms load current and voltage for a sinusoidal input. 7+7=14

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LIST OF THE EXPERIMENT

1. Measurement of different signal parameters using oscilloscope.
2. Lissajous pattern.
3. V-I characteristics of ordinary p-n junction diode.
4. Full wave rectifier –with and without filter.
5. Zener diode as a voltage regulator.
6. Input and output characteristics of BJT.
7. Input and output characteristics of FET.
8. Op-amp based inverting and non-inverting amplifier.
9. Op-Amp based differentiator and integrator.
10. Op-Amp based adder and subtractor.