

TechnoIndia NJR Institute of Technology



Course File

Basic Electronics for Civil Engineering Applications (4CE3-04) Session 2022-23

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RAJASTHAN TECHNICAL UNIVERSITY, KOTA

SYLLABUS

II Year-IV Semester: B.Tech. (Civil Engineering)

4CE3-04: BASIC ELECTRONICS FOR CIVIL ENGINEERING APPLICATIONS

Credit: 2

Max. Marks: 100 (IA:20, ETE:80)

2L+0T+0P

End Term Exam: 2 Hours

SN	CONTENTS	Hrs.
1	Introduction: to objective, scope and outcome of the subject.	1
2	Basic Electronics: Number systems & Their conversion used in digital electronics, Demorgan's theorem, Logic Gates, half and full adder circuits, R-S flip flop, J-K flip flop.	2
3	Introduction to Semiconductors, Diodes, V-I characteristics, Bipolar junction transistors (BJT) and their working, introduction to CC, CB & CE transistor configurations.	3
4	Instrumentation: mechanical, electrical, electronic system and their calibration, Use of automatic and digital levels, electronic theodolites, total stations; Control surveys using GNSS, Total station and traversing methods (adjustment and computations of coordinates).	4
5	Measurement errors: Gross error and systematic errors, absolute and relative errors, accuracy, precision, resolution and significant figures. Full-field measurements;	2
6	Data acquisition system and data processing: analog systems, digital systems using personal computers, dynamic measurement, numerical and graphical data processing and archiving.	3
7	Sensors & Transducers: various types of sensors for displacement, velocity, acceleration, pressure, loads, strains, Displacement sensors, Mass & Piezoelectric, strain gauges, Temperature sensors thermocouple, flow sensors : Ultrasonic, electromagnetic, laser and thermal	5
8	Sensor types characteristics: types of resolution, FOV, IFOV, PSF; Geometric and radiometric distortions, Geo-referencing, re-sampling methods; Atmospheric errors and removal; Satellite orbits and characteristics; Applications of optical and microwave remote sensing techniques in Civil Engineering.	5
9	Digital Image Processing: Digital image, introduction to digital image processing, pre-processing, enhancement, classification, accuracy assessment.	3
	TOTAL	28

Course Overview:

The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the devices, instruments and sensors used in Civil Engineering applications.

Course Outcomes:

CO NO	COGNITIVE LEVEL	COURSE OUTCOME
4CE3-04.1	Synthesis	Learner can define introduction to Semiconductors, Diodes, V-I characteristics, Bi polar junction transistors uses.
4CE3-04.2	Synthesis	Learner can state data acquisition system and data processing.
4CE3-04.3	Synthesis	Students get to understand the basic of Sensors & Transducers Used in various instruments.
4CE3-04.4	Synthesis	Understand the working of various instruments and measure the error.
4CE3-04.5	Synthesis	Understand the concept and processing of digital images.

Prerequisites:

1. Fundamentals of semi conductor devices.

Course Outcome Mapping with Program Outcome:

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO1 1	PO12	PSO1	PSO2	PSO 3
CO243.1	2	2	2	2	1	1	1	1	1	1	1	2	1	1	0
CO243.2	2	2	2	2	3	1	1	2	1	1	1	1	1	1	0
CO243.3	2	1	3	2	2	2	2	1	1	1	1	1	1	1	0
CO243.4	2	1	2	1	1	2	1	2	1	2	1	2	1	1	0
CO243.5	2	2	2	2	1	1	1	1	1	1	1	2	1	1	0
CO243(AVG)	2	1.6	2.2	1.8	1.6	1.4	1.2	1.4	1	1.2	1	1.6	1	1	0

Course Coverage Module Wise:

Lecture No	Unit	Topic
1	1	INTRODUCTION: to objective, scope and outcome of the subject
2	2	BASIC ELECTRONICS: Number systems & Their conversion used in digital Electronics, DeMorgan's theorem, Logic Gates
3	1	Half and full adder, R-S flipflop, J-K flipflop
4	3	INTRODUCTION TO SEMICONDUCTORS, Diodes, V-I characteristics
5	2	Bipolar junction transistors (BJT) and their working, introduction to CC
6	2	CB & CE transistor configurations
7	4	INSTRUMENTATION: mechanical, electrical, electronics system and their
8	3	Use of automatic and digital levels, electronic theodolites
9	3	Total stations; Control surveys using GNSS
10	3	Total station and traversing methods (adjustment and computation of coordinates)
11	5	MEASUREMENT ERRORS: Gross error and systematic errors
12	5	Absolute and relative errors, accuracy, precision, resolution and significant figures
13	6	DATA ACQUISITION SYSTEM and data processing: analog systems
14	6	Digital systems using personal computers, dynamic measurement
15	6	Numerical and graphical data processing and archiving
16	7	SENSORS & TRANSDUCERS: various types of sensors for displacement
17	7	velocity, acceleration, pressure, loads, strains, Displacement sensors
18	7	Mass & Piezoelectric, strain gauges, Temperature sensor thermocouple
19	7	flow sensors: Ultrasonic, electromagnetic, laser and thermal
20	8	SENSOR TYPES CHARACTERISTICS: types of resolution, FOV, IFOV, PSF
21	8	Geometric and radiometric distortions, Geo-referencing, re-sampling
22	8	methods; Atmospheric errors and removal
23	8	Satellite orbits and characteristics; remote sensing

24	8	Applications of optical and microwave techniques in Civil Engineering
25	9	DIGITAL IMAGE PROCESSING: Digital Image
26	9	Introduction to Digital Image Processing, Pre-Processing, Enhancement, Classification,
27	9	Accuracy Assessment
28	9	Digital Image Processing: Digital Image, Introduction to Digital Image

TEXT/REFERENCE BOOKS

1. Bolten W., "Mechatronics", Pearson Education, 2013.
2. Morris Mano M., "Digital Logic and Computer Design", PHI Learning Private Limited, 2008.
3. Storey, "Electronics A Systems Approach", 4/e - Pearson Education Publishing Company Pvt Ltd, 2011.
4. Bhargava N. N., D C Kulshreshtha and S C Gupta, "Basic Electronics & Linear Circuits", Tata Mc Graw Hill, 2/e, 2013.

TEACHING AND LEARNING RESOURCES:

- ✓ **Unit 2 & 3:** - Class Notes
- ✓ **Unit 4:** - <https://circuitglobe.com/classification-of-measuring-instruments.html>
- ✓ **Unit 5:** - https://www.tutorialspoint.com/electronic_measuring_instruments/electronic_measuring_instruments_errors.htm
- ✓ **Unit 6:** - https://www.tutorialspoint.com/electronic_measuring_instruments/electronic_measuring_instruments_data_acquisition_systems.htm
- ✓ **Unit 7:** - <https://nptel.ac.in/courses/112/107/112107298/>
- ✓ **Unit 8 :** - <https://nptel.ac.in/courses/105/103/105103193/>
- ✓ <http://hillagric.ac.in:999/downloads/gis/notes/4-IntroductiontoRemoteSensing.pdf>
- ✓ **Unit 9:** - <https://www.tutorialspoint.com/dip/index.htm>

Assessment Methodology:

1. Two assignments.
2. Two Midterm exams where student have to showcase subjective learning.
3. Final Exam (subjective paper) at the end of the semester.

ASSIGNMENT#1

1. Explain full adder full subtractor with the help of suitable diagram and logic expression.
2. Explain R-S flip-flop with the help of Suitable Diagram.
3. What is the disadvantage of R-S flip-flop? What is the remedy to solve this?
4. Explain the working of P-N junction diode. Draw and explain the V-I characteristics of P-N junction diode.
5. Explain the working of NPN transistor with the help of suitable diagram.
6. Explain input and output characteristics of common emitter (CE) transistor.

ASSIGNMENT#2

1. Explain data acquisition system by taking a suitable example.
2. Explain LVDT with the help of suitable example.
3. Explain the block diagram of digital image processing.
4. Explain velocity sensor by taking a suitable examples.
5. Explain analog and digital systems using personal computers.
6. Explain any temperature sensor in detail.

Multiple Choice Questions

What is the cut-in voltage of 'Si' diode?

- (a) 0.4 (b) 0.5 (c) 0.6 (d) 0.7

Which flip-flop has problem with both inputs '1' -

- (a) R-S (b) J-K (c) D (d) T

What is the output of D flip-flop when input is '0' -

- (a) 0 (b) 1 (c) Undefined

In latch -

- (a) Clock is present (b) Clock is not present

Which of this gate is universal gate -

- (a) AND (b) OR (c) NAND (d) NOT

BJT is a -

- (a) Current control Device (b) Voltage control device (c) Both (a) & (b)

Diode works in -

- (a) Forward Biasing (b) Reverse Biasing (c) Both (a) & (b)

Precision depends on -

- (a) Sharp reading (b) Approximate reading (c) Both (a) & (b)

Data acquisition system consist of -

- (a) Processing (b) Conversion (c) Display (d) All above

Which one is most commonly used configuration of transistor -

- (a) CB (b) CE (c) CC

In diode the reverse saturation current flows in-

- (a) Forward biasing (b) Reverse biasing (c) Both (a) & (b)

Which one is the example of data acquisition system-

- (a) Analog/digital systems with computer (b) Data Logger (c) Both (a) & (b)

Which of the following are parts of data acquisition system-

- (a) Transducer (b) Multiplexer (c) Microprocessor (d) All above

At which input combination the J-K flip-flop give toggle output-

- (a) 0, 0 (b) 0, 1 (c) 1, 0 (d) 1, 1

At input condition 1, 1 which flip-flop gives undefined output-

- (a) R-S (b) J-K (c) D (d) T

Which of the combination give Universal gate-

- (a) AND-OR (b) AND-NOT (c) NAND-NOR (d) None of them

Noise can be removed from the image using-

- (a) Pre-processing (b) Enhancement (d) Both (a) & (b)

Which of these flip-flop is used to generate delay-

- (a) R-S (b) J-K (c) D (d) 8

The energy band gap of semiconductor is-

- (a) 1 eV (b) 2 eV (c) 3 eV (d) 4 eV

Which biasing provides stable operating point-

- (a) Collector to base biasing (b) Fixed Biasing (c) Voltage Divider Biasing

4E1314

Roll No.

Total No. of Pages: 3

4E1314

B. Tech. IV - Sem. (Main) Exam., - 2022

Civil Engineering

4CE3 – 04 Basic Electronics for Civil Engineering
Applications

Time: 3 Hours

Maximum Marks: 70

Instructions to Candidates:

Attempt all ten questions from Part A. Five questions out of seven questions from Part B and three questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

*Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)*

1. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only)

[10×2=20]

All questions are compulsory

Q.1 What is the significance of the number system?

Q.2 The binary number 10101 is equivalent to decimal number.....

Q.3 State DeMorgan's theorem.

Q.4 What are the selection criteria for the transducer?

Q.5 Decimal 43 in hexadecimal, and BCD number system is respectively and

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[1920]

- Q.6 What are the selection criteria for the transducer?
- Q.7 What are the atmospheric errors in the sensors?
- Q.8 How many types of resolutions are in remote sensing?
- Q.9 What causes radiometric distortion?
- Q.10 How do you calculate FOV from IFOV?

PART – B

(Analytical/Problem solving questions)

[5×4=20]

Attempt any five questions (Word limit 100)

- Q.1 How a PN junction diode is working? Draw and explain the V-I characteristics of PN diode with neat diagrams.
- Q.2 Explain in detail about classifications of the transducer.
- Q.3 Differentiate the following in brief -
- (a) Gross errors and systematic errors
 - (b) Absolute and relative errors
 - (c) Accuracy and precision
- Q.4 Draw and explain the capacitive transducer in detail. Also, mention its applications.
- Q.5 Discuss the following in brief -
- (a) Control surveys using GNSS
 - (b) Total station and traversing methods
- Q.6 Draw and explain the resistive transducer in detail.
- Q.7 Draw and explain the working of piezoelectric sensors/transducers.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) [3×10=30]

Attempt any three questions

Q.1 What is data acquisition? Explain in detail about ADC & DAC.

Q.2 Explain the construction and working of BJT. Discuss the CE configuration with the help of input and output characteristics.

Q.3 Write a short note on applications of optical and microwave remote sensing techniques for Civil Engineering.

Q.4 Discuss the following steps of Digital Image Processing in detail –

- (a) Pre-processing
- (b) Enhancement
- (c) Classification
- (d) Accuracy assessment

Q.5 Draw and explain the following using a truth table and logic diagrams –

- (a) J-K Flip - Flop
 - (b) R-S Flip - Flop
-

4E1207

Roll No.

Total No of Pages: 2

4E1207

B. Tech. IV-Sem. (Back) Exam., Oct.-Nov. - 2020
HSMC Civil Engineering
4CE3 - 04 Basic Electronics for Civil Engineering
Applications

Time: 2 Hours

Maximum Marks: 65
Min. Passing Marks: 23

Instructions to Candidates:

Attempt all five questions from Part A, four questions out of six questions from Part B and one questions out of three from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

PART – A

(Answer should be given up to 25 words only)

[5×2=10]

All questions are compulsory

- Q.1 What are universal logic gates? Give symbols with truth table.
- Q.2 Define probable errors and random errors.
- Q.3 Differentiate conductors and semiconductors.
- Q.4 Explain the basic principle of piezo-electric transducer.
- Q.5 Write applications of optical and microwave remote sensing techniques in Civil Engineering.

PART – B

(Analytical/Problem solving questions)

[4×10=40]

Attempt any four questions

- Q.1 Explain the full adder with a neat circuit diagram.
- Q.2 What do you mean by error? Explain Absolute and Relative error with an expression.
- Q.3 Describe the method of measurement of temperature with the use of RTD. Write advantages and disadvantages of RTD.
- Q.4 Explain PN Junction diode with its I-V characteristics.
- Q.5 Explain common base configuration of BJT with the help of a suitable circuit diagram. Give an expression for α β & γ .
- Q.6 What do you mean by Data Acquisition System? Explain digital systems using personal computers.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) [1×15=15]

Attempt any one questions

- Q.1 What do you mean by digital image processing? Explain all the building blocks of digital image processing with a block diagram.
- Q.2 Explain the working of an Electronic Theodolite. Give use of automatic and digital levels.
- Q.3 What are Strain Gauges? Prove the gauge factor.

$$G_f = 1 + 2\nu + \left(\frac{\Delta\rho}{\rho}\right)/\epsilon$$

Write applications of strain gauges.

