Techno India NJR Institute of Technology

Course File

Session 2020-21

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

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For Techno India NJR Institute of Technology
पंकज पोरवाल
Dr. Pankaj Kumar Porwal
(Principal)

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 &Piezoeletric, 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

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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, Bipolar 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 semiconductor 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	PO11	PO12	PSO 1	PSO 2	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

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Course Coverage Module Wise:

LectureNo	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 flip flop, J-K flip flop
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, electronic 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 computations 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 sensors 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.Neil Storey, "Electronics A Systems Approach", 4/e - Pearson Education Publishing Company Pvt Ltd, 2011.

2.Bhargava N. N., D C Kulshreshtha and S C Gupta, "Basic Electronics & Linear Circuits", Tata McGraw 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 : -** http://hillagric.ac.in:999/downloads/gis/notes/4-IntroductiontoRemoteSensing.pdf
- **Unit 9: -** https://nptel.ac.in/courses/105/103/105103193/

Assessment Methodology:

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

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.

$$G_f = 1 + 2v + \left(\Delta\rho/\rho\right)/\varepsilon$$

Write applications of strain gauges.