

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE: MICROCONTROLLER
(COURSE CODE: 3351101)**

Diploma Programme in which this course is offered	Semester in which offered
Electronics and Communication Engineering	5 th Semester

1. RATIONALE

Microcontroller is the sole of all embedded electronic equipments and is used in most of the areas of electronics. They include product ranges from tiny consumer electronic products to complex industrial process controllers. A diploma engineer needs to maintain such systems. Programming practices will further help the students to develop indigenous microcontroller based applications. Hence this course is designed to achieve the above.

2. LIST OF COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

- **Maintain microcontroller based equipments/system.**

3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Identify features of various microcontroller
- Select appropriate microcontroller for different application
- Interface microcontroller with hardware for given application
- Write and execute assembly language programs(software) for given application
- Develop small microcontroller based applications.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
4	0	2	6	70	30	20	30	150

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE DETAILS

Unit	Major Learning Outcomes (outcomes in Cognitive Domain)	Topics and Sub-topics
Unit – I. Introduction of Microcontro llers	1a. Describe functions of each block. diagram of generic digital computer 1b. Describe common features of Microcontrollers	1.1 Block diagram of microcontroller : CPU, input device, output device, memory and buses 1.2 common features of Microcontrollers : On-chip Oscillator, program and data memory, I/O Ports, Watchdog- timer reset, SFRs, Timers, Counters, Interrupts, ADC, PWM
	1c. Differentiate between microprocessor and microcontroller	1.3 microprocessor and microcontroller
	1d. Describe Evolution of Microcontrollers	1.4 Hierarchy of microcontrollers
	1e. Explain various architectures of microcontroller	1.5 architectures of microcontroller Harvard , Von Neumann RISC and CISC
	1f. Describe applications of microcontrollers	1.6 Applications: House hold , Communication, Office equipment and industrial automation
Unit– II 8051 Hardware	2a Explain functions of each block of 8051microcontroller	2.1 Blocks of Microcontroller 8051: ALU, PC, DPTR, PSW, Internal RAM, Internal ROM, Latch, SFRs, General purpose registers, Timer/Counter, Interrupt, Ports
	2b Explain Pin Diagram of 8051	2.2 Functions of each pin of 8051
	2c Distinguish of clock, reset and machine cycle of 8051with the help of relevant waveform	2.3 Clock circuit, reset Circuit , phase and state in machine cycle of 8051
	2d Explain Memory organization of 8051	2.4 Memory organization of 8051: Program and Data memory Map, External Memory Addressing and Decoding Logic of 8051
	2e Differentiate Stack , Stack Pointer and stack operation	2.5 Stack, Stack Pointer and Stack operation
	2f Describe modes of operation of Timers/Counters	2.6 Timers/Counters logic diagram and its operation in various modes
	2g Explain function and structure of I/O Ports	2.7 I/O Ports structure: Port 0, Port 1, Port2, Port 3.
	2h Describe Serial communication	2.8 Serial Communication in various modes
	2i Justify need of Interrupt Mechanism	2.9 Interrupt structure, vector address, priority and operation

Unit	Major Learning Outcomes (outcomes in Cognitive Domain)	Topics and Sub-topics
	2j Differentiate various types of Interrupts	
	2k Explain various controlling modes of 8051	2.10 Modes of operation: Power down and idle mode
Unit– III 8051 Programm ing	3a Classify addressing modes of 8051 with example	3.1 Addressing Modes : Immediate, Register, Direct, Indirect, Indexed, Relative and bit addressing
	3b Sort the Instruction set of 8051 as per functions performed by them	3.2 Instruction set :Data Transfer, Arithmetic, Logical, Branching, and Machine Control
	3c Explain following Programming concept: Looping, Counting and Indexing	3.3 Looping , Counting, sorting and Indexing
	3d Develop simple programs to perform the following operations: Data manipulation, Masking, Stack operation, Conditional execution	3.4 Data manipulation, Masking , Stack operation, Conditional programming
	3e Explain functions of Timer/ Counters and its application	3.5 Configuration and programming of Timer/Counter using SFRs: TMOD, TCON, THx, TLx.
	3f Describe modes of timers	
	3g Explain the interrupt mechanism with the help of suitable example	3.6 Configuration and programming of interrupts using SFRs: IE,IP
	3h Explain I/O Port Programming	3.7 Configuration and programming of I/O Port : P0,P1,P2,P3

Unit	Major Learning Outcomes (outcomes in Cognitive Domain)	Topics and Sub-topics
Unit-IV 8051 Interfacing	4a Interface Input Devices with 8051 microcontroller	4.1 Switch: Pushbutton, DIP, Thumbwheel, Tilt
	4b Interface Output devices with 8051 microcontroller	4.2 Relay, LED, 7 segment LED, LCD
	4c Interface ADC with 8051 microcontroller	4.3 ADC0804
	4d Interface Analog Input devices with 8051 microcontroller	4.4 Temperature sensor LM35
	4e Interface DAC with 8051 microcontroller	4.5 DAC0808, ADC0804,
	4f Interface Analog Output devices with 8051 microcontroller	4.6 Damper Control, Hoper Control
	4g Interface actuator with 8051 microcontroller	4.7 DC Motor, Stepper motor
	4h Interface PC with 8051 microcontroller 4i Describe functions of MAX232	4.8 Serial communication using MAX 232, Hyperterminal
Unit-V 8051 Applications	5a List Various 8051 Applications	5.1 Application of microcontroller in various field
	5b Room Temperature Indicator	5.2 Using LM35, ADCC0804, Microcontroller, 7 segment LED
	5c Battery voltage logging system	5.3 Using Analog Multiplexer 4051, ADC0804, Microcontroller, 7 segment LED, MAX232
	5d GSM based Security Application	5.4 Using GSM Modem, Microcontroller, Relay, Switches
	5e RPM Meter	5.5 Using Photo interrupter, Microcontroller, 7 Segment LED
	5f Applications based on RTC DS1307	5.6 Using Pushbutton switches, Microcontroller, Relay, NVRAM

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction of Microcontrollers	10	04	04	04	12
II	8051 Hardware	16	08	06	04	18
III	8051 Programming	12	06	05	05	16
IV	8051 Interfacing	10	04	06	04	14
V	8051 Applications	8	02	02	06	10
	Total	56	24	23	23	70

Legends: R = Remember U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

Note: It is preferable to use 8051 Trainer kits rather than Simulation tools for better hands on practice.

S. No.	Unit No.	Practical Exercises (outcomes in Psychomotor Domain)	Approx Hours.
1	I	Use 8051 Simulation tool	2
2	I	Test and verify the features of 8051 Trainer Kit	2
3	II	Write and execute assembly language programs based on Data transfer Instructions	2
4	II	Develop assembly language programs based on Arithmetic Instructions (e.g. 8 bit Addition, Subtraction, Multiplication, Division)	2
5	II	Develop Assembly Language Programs based on Logical Instructions (And, Or etc.)	2
6	II	Develop Assembly Language Programs based on Branch Instructions	2
7	II	Develop Assembly Language Programs based on Looping, Counting and Indexing concept	2
8	III	Develop Assembly Language Programs to introduce delay (e.g. 1ms Delay) using Timer/Counter	2
9	III	Develop Assembly Language Programs for Interrupts	2
10	III	Develop Programs for serial communication	2
11	IV	Develop a program to interface LED with 8051	2
12	IV	Develop a program to interface 7 segment Display with 8051	2
13	IV	Develop a program to Interface 8 bit DAC with 8051	2
14	IV	Develop a program to interface a DC Motor with 8051	2
15	V	Develop a program to interface LCD Module with 8051	2
16	V	Develop a 4 bit binary counter with 8051 and display out put on LCD	2
17	V	Develop a program to interface a Stepper Motor with 8051	2
18	V	Develop a data acquisition system using ADC0804 and Microcontroller	2
Total Hours (perform practical form every unit so that 28 hours are utilized)			36

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities:

- i. Prepare journals based on practical performed in laboratory.
- ii. Prepare chart to represent the block diagram of different interfacing chips.
- iii. Develop a practical application using 8051 Microcontroller
- iv. Prepare ISP board of 89V51RD2Hxx with all ports available as connector
- v. Prepare/Download a dynamic animation to illustrate the following
 - Data transfer operation
 - Keypad Interfacing
 - LCD Interfacing
 - DC Motor Interfacing

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Arrange visit to relevant industry.
- ii. Show video lectures on Microcontroller Applications with help of internet.
- iii. Assemble level programming practices on simulators (free downloadable).

10. SUGGESTED LEARNING RESOURCES**A) List of Books**

S. No.	Title of Book	Author	Publication
1.	Microcontrollers : Principles And Applications	Pal Ajit	EEE, PHI ,New Delhi,(Latest edition)
2.	The 8051 Microcontrollers: Architecture, Programming and Applications	Rao Dr. K Uma	Pearson Education India, New Delhi,(Latest edition)
3.	The 8051 microcontroller and embedded systems	Mazidi Ali, Muhammad Mazidi Gillispie Janice	PHI, New Delhi,(Latest edition)
4.	The 8051 Microcontroller: Architecture, Programming, and Applications	Kenneth Ayala J.	Thomson Delmar learning,(latest Edition)
5.	The 8051 Microcontroller,	Mackenzie	Pearson Education India, New Delhi,(Latest edition)
6.	Programming and customizing the 8051 microcontroller	Predko Michael	McGraw-Hill, International edition

B) List of Major Equipment/ Instrument with Broad Specifications

- i. Microcontroller 8051 trainer Kit
- ii. 8051 Simulator software (Free downloadable)
- iii. Computer System(p-IV and latest version)
- iv. Peripheral Interfacing Trainer kits

C) List of Software/Learning Websites

- i. www.academia.edu
- ii. www.learnersTV.com
- iii. www.nptel.iitm.ac.in
- iv. www.8052.com

- v. <http://www.slideshare.net/aismahesh/memory-8051>
- vi. <http://www.intorobotics.com/8051-microcontroller-programming-tutorials-simulators-compilers-and-programmers/>
- vii. <http://electrofriends.com/articles/electronics/microcontroller-electronics-articles/8051-8951/80518951-microcontroller-instruction-set/>
- viii. <http://www.ikalogic.com/part-1-introduction-to-8051-microcontrollers>
- ix. <http://www.edsim51.com>
- x. <http://www.mikroe.com/chapters/view/64/chapter-1-introduction-to-microcontrollers/>
- xi. <http://www.8051projects.net/download-c4-8051-projects.html>
- xii. <http://cse.iitkgp.ac.in/~soumya/embcs/the-8051-microcontroller-0314772782.pdf>

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. T P Chanpura**, Sr. Lecturer (EC) ,Government Polytechnic Ahmedabad
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- **Prof. N M Rindani**, Sr.Lecturer (EC) ,AVPTI Rajkot
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GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE: MOBILE COMMUNICATION
(COURSE CODE: 3351102)**

Diploma Programme in which this course is offered	Semester in which offered
Electronics and Communication Engineering	5 th Semester

1. RATIONALE

The cellular mobile communication has seen an exponential growth over the years. Not only that, but there are different technologies such as GSM and CDMA with their variations and the 4th generation mobile technology is the latest one. This scenario demands the need for more skilled technicians for operation, maintenance and servicing of mobile cellular systems. This course gives the opportunity to the students to learn the fundamentals of these technologies which they will find in the workplace. Hence this course is designed to maintain various types of mobile communication systems.

2. LIST OF COMPETENCY (Programme outcome according to NBA terminology)

The course content should be taught and with the aim to develop different types of skills

So that students are able to acquire following competency:

- **Maintain mobile communication systems**

3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Identify different standards of mobile communication systems.
- Maintain Global System for Mobile (GSM) systems.
- Troubleshoot GSM mobile handsets.
- Test the functionality of various modules of CDMA cellular systems.
- Test the functionality of various modules of 4G systems.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
4	0	2	6	70	30	20	30	

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE DETAILS

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
Unit – I Fundamentals of Cellular Communication	1a. Describe cellular communication Standards -1G, 2G and 3G.	1.1 Cellular communication Standards-1G, 2G and 3G
	1b. Explain the Basic cellular concept and cellular system	1.2 Basic cellular concept and cellular system
	1c. Explain need of various types of cell shape.	1.3 Type of Cell: macro, micro, Pico, Selective and umbrella cell.
	1d. Explain macro, micro, Pico, Selective and umbrella cell.	
	1e. Calculate GSM user capacity using cluster concept.	1.4 Cluster concept and frequency reuse
	1f. Explain frequency reuse planning.	1.5 GSM capacity
	1g. Discuss the impact of Co- channel and adjacent channel interference.	1.6 Co-channel and adjacent channel interference
	1h. Explain the fixed, dynamic and hybrid channel assignment schemes.	1.7 Channel assignment strategies
	1i. Differentiate cell splitting and cell sectoring.	1.8 Enhancing coverage and capacity of cellular system: cell splitting and cell sectoring.
	1j. Define handoff	1.9 Handoff : soft and hard, inter and intra system
	1k. Differentiate hard and soft, intra and intersystem handoff.	
	1l. Explain Frequency divisions, Multiple Access (FDMA), Time Division Multiple Access (TDMA),	1.10 Multiple access techniques: FDMA, TDMA and CDMA Space Division Multiple Access (SDMA)
	1m. Compare Code Division Multiple Access (CDMA), and Space Division Multiple Access (SDMA).	
Unit– II GSM- Global System for Mobile communication	2a. Describe functions of various blocks of GSM system	2.1 GSM architecture
	2b. List GSM, 900 specifications	2.2 GSM 900 system specification
	2c. Discuss the GSM traffic channel and Control channel.	2.3 GSM channel types: Traffic, control
	2d. Explain Frequency correction control channel (FCCH), Random access Control channel (RACH), Access Grant channel (AGCH)	
	2e. Discuss GSM frame structure	2.4 GSM burst and frame structures
	2f. Describe location updating procedure.	2.5 GSM call Procedure
	2g. Explain call origination (mobile to landline), call termination (landline to mobile) and mobile to mobile call with the help of line diagram.	

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
	2h. Explain frequency hopping. 2i. Describe how power control is achieved for GSM	2.6 Frequency hopping: Fast and Slow 2.7 Power control in GSM
	2j. Explain block diagram of signal processing in GSM	2.8 Signal processing in GSM
	2k. Describe working of GSM speech codec.	2.9 GSM speech codec
	2l. Explain Gaussian minimum shift keying (GMSK) modulation and demodulation technique.	2.10 GSM Modulation Techniques: GMSK
	2l. Explain functional importance of IMSI, IMEI, MSISDN, TMSI, MSRN, LAI and BSIC.	2.11 GSM Identifier: IMSI, IMEI, TMSI, MSISDN, LAI and BSIC
Unit–III Mobile Handset	3a. Explain the block diagram of mobile handset	3.1 Mobile handset: block diagram
	3b. Explain the working principle of baseband section	3.2 Baseband section
	3c. Explain the function of digital signal processing used in mobile handset.	3.3 Digital signal processor used in mobile handset
	3d. Describe working function of charging control section	3.4 Charging control section
	3e. Explain types of batteries used for mobile communication and their importance	3.5 Batteries
	3f. Differentiate various types of memories used in mobile handset	3.6 Memories
	3g. Explain the subscriber identity module (SIM) pin connection	3.7 SIM card and SIM card interface
	3h. Discuss the SIM card interface	
	3i. State the general faults occurring in mobile handset (GSM)	3.8 General faults and fault finding procedures
	3j. Explain the fault finding procedure in mobile handset	
	3k. Explain the effect of radiation hazards due to mobile and SAR.	3.9 Radiation hazards due to Mobile, SAR
Unit– IV Spread spectrum	4a. Explain the concept of spread spectrum techniques.	4.1 Spread spectrum technique and Applications
	4b. Describe advantages of CDMA.	4.2 Advantages of CDMA
	4c. State the criteria and application of spread spectrum.	
	4d. Explain the PN code generator and PN code detector.	4.3 Spreading codes (PN and Walsh code): generation and detection
	4e. Explain Walsh code generator and Walsh code.	

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
	4f. Explain working of DSSS transmitter and receiver. 4g. Explain working of FHSS transmitter and receiver with the help of block diagram .	4.4 Types of spread spectrum technique • DSSS- Direct sequence spread spectrum • FHSS- Frequency hopping spread spectrum
	4h. State need for power control in mobile communication. 4i. Differentiate forward and reverse power control.	4.5 Power control
	4j. Explain channel capacity of CDMA	4.6 Channel capacity
	4k. Describe mode of call processing in CDMA	4.7 Call Processing
Unit-V WCDMA and 4G aspects	5a. Explain working of GPRS with the help of suitable block diagram. 5b. List class of GPRS handset. 5c. State the application of GPRS.	5.1 GPRS- General Packet Radio Service: Block diagram, applications
	5d. Explain concept and transmission scheme in EDGE.	5.2 EDGE- Enhanced Data rate for Global Evolution
	5e. Describe high speed downlink packet access.	5.3 HSDPA
	5f. Describe long term evolution and all IP networks 5g. Explain the OFDM with the help of suitable block diagram . 5h. Explain MIMO system. 5i. Discuss software define radio.	5.4 4 th Generation technology: OFDM, MIMO 5.5 Software define radio

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Cellular Communication	10	02	06	04	12
II	GSM-Global System for Mobile Communication	16	06	08	04	18
III	Mobile Handset	10	02	04	08	14
IV	Spread spectrum	10	04	06	04	14
V	WCDMA and 4G aspects	10	04	06	02	12
	Total	56	18	30	22	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (*outcomes in psychomotor and affective domain*) so that students are able to acquire the competencies/course outcomes. Following is the list of practical exercises for guidance.

*Note: outcomes in psychomotor domain are listed here as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty members should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S.No.	Unit No.	Practical /Exercises (outcomes in psychomotor)	Approx. Hrs.
1	I	Analyze cluster and frequency reuse technique	2
2	II	Analyse GSM signal (signal spectrum) using spectrum analyzer	2
3	II	Measure network information using android applications like signal strength checker, network monitor, network signal info.	2
4	II	To explore various blocks and working of GSM mobile phone	2
5	II	Analyse the waveforms of MSK and GMSK modulation schemes using Matlab	2
6	II	To demonstrate general fault finding procedure in GSM mobile handset	2
7	II	To demonstrate blue tooth applications using btprox software	2
8	II	To Measure the PWM signal on the Vibrator motor and on the buzzer of mobile	2
9	III	To code digital message with Direct Sequence SS system using Matlab or trainer board	2
10	III	To code digital message with Direct Sequence SS system using Matlab or trainer board	2
11	IV	To generate and observe PN signal using software or trainer board	2
12	IV	To use mobile as GPRS modem through cable & via Bluetooth.	2
13	V	To study and observe OFDM signal using software codes	2
14	V	To transmit a message using at command from microcontroller to a mobile (Serial communication)	2

S.No.	Unit No.	Practical /Exercises (outcomes in psychomotor)	Approx. Hrs.
15	V	Introduction to WML script and execute a simple script in mobile browser.	2
Total Hours (perform practical form every unit so that 28 hours are utilized)			30

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

- Industrial visit to BTS site or MSC.
- Workshop on mobile repair by service technician of any mobile repairing centre.
- To explore websites to understand repairing of various mobile handsets.
- To design and develop GSM/GPS and other wireless technology based working models/projects.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- Arrange visit to nearby BTS/BSC/MSC of any service provider.
- Power point presentations with visuals.
- Organise workshop for repairing of mobile hand set.
- Arrange expert lectures on latest mobile communication technologies.
- Expert video lectures on mobile communication technologies.

10. SUGGESTED LEARNING RESOURCES

A) List of Books

S. No.	Title of Books	Author	Publication
1	Wireless communication principle & Practice	Rapport T.S.	PHI Learning, New Delhi, (Latest Edition)
2	Mobile and Personal Communication System and Servicing	Pandya Raj	IEEE
3	Mobile Communication	Lee C. Y.	Pearson, New Delhi (Latest Edition)
4	Mobile Cellular Telecommunication System	Lee C.Y.	TMH, New Delhi, (Latest Edition)
5	Wireless communication	Dalal Upena	OXFORD New Delhi,
6	Advance Mobile Repairing	Pandit Sanjib	BPB, (Latest Edition)
7	Mobile Communication	Schiller	PHI Learning, New Delhi, (Latest Edition)
8	Related IEEE/IEE publication		

B) List of Major Equipment/Instruments with Broad Specifications

i.	Oscilloscope / storage oscilloscope	Dual channel 100 MHz
ii.	Spectrum analyzer	<ul style="list-style-type: none"> Up to 2-3 GHz capture bandwidth
iii.	GSM Trainer	<ul style="list-style-type: none"> GSM wireless standards
iv.	CDMA Trainer	<ul style="list-style-type: none"> CDMA standards

v. Mobile Handset Trainer	<ul style="list-style-type: none"> • GSM based handset trainer with fault creation and test points. •
vi. Modulation technique Trainer board	<ul style="list-style-type: none"> • On board Modulation/Demodulation (GMSK) for mobile system
vii. PN sequence generator training board	<ul style="list-style-type: none"> • Generate different PN Data

C) List of Software/Learning Websites

- i. www.nptel.iitm.ac.in
- ii. www.academia.edu
- iii. www.larnerstv.com

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. S.J. Chauhan,** HOD, (EC), Govt. Polytechnic Rajkot.
- **Prof. R.B. Shah,** Sr. Lecturer (EC), Govt. Polytechnic Ahmedabad.
- **Prof. K.K. Shah,** Sr. Lecturer, (EC), Govt. Polytechnic Rajkot.
- **Prof. A. J. Prajapati,** Sr. Lecturer, (EC), B.S.Patel Polytechnic Kherva.

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. (Mrs.) Anjali Potnis,** Assistant Professor, Department of Electrical and Electronics Engineering.

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM COURSE TITLE: MICROWAVE & RADAR ENGINEERING (COURSE CODE: 3351103)

Diploma Programme in which this course is offered	Semester in which offered
Electronics and communication Engineering	5 th Semester

1. RATIONALE

The knowledge of microwave devices is essential for electronics and communication engineering diploma holders and they need to assimilate it in order to maintain Microwave devices used in Telecommunication Industry. Hence, the basic knowledge of microwave signal generation, propagation, amplification and measurement is vital. This course has been designed to achieve the diploma engineer will maintain microwave devices, components and accessories used in telecommunication industry.

2. LIST OF COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

- **Install and Maintain microwave devices, components and accessories used in telecommunication field.**

3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- i. Distinguish Electromagnetic wave propagation through reflections from voltage and current transmission.
- ii. Analyze performance of microwave components from field point of view.
- iii. Maintain microwave components and Set up of microwave bench for optimum operation.
- iv. Maintain microwave semiconductor devices used to realized amplifiers and oscillators.
- v. Maintain RADAR system as microwave application.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
4	0	2	6	70	30	20	30	

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE DETAILS

Unit	Major Learning Outcomes (Major outcomes in cognitive domain)	Topics and Sub-topics
Unit – I. Transmission lines and Microwaves	1a. Describe EM wave frequency bands and spectrum 1b. State the strengths and limitations of microwave communication	1.1 Microwaves: frequency band, EM waves, General applications of microwaves
	1c. Explain the equivalent circuit of a two wire transmission line. 1d. Obtain the general equation for a two wire transmission line. 1e. State characteristics of lossless transmission line. 1f. Explain impedance matching using stub 1g. Using design equations solve example of single stub matching	1.2 Transmission lines: Parameters, general line equation, lossless line, $\lambda/4$ line, standing waves, VSWR, reflection coefficient, stub matching (single and double), skin effect
Unit– II Microwave Propagation and Components	2a. Describe propagation of microwaves through waveguide and explain cutoff wavelength. 2b. Differentiate between transmission line and waveguide. 2c. Calculate cut off wavelength, group and phase velocities, characteristics wave impedance of any waveguide parameters.	2.1 Waveguides: Wave propagation through guided medium, reflections of waves
	2d. Distinguish the following: cut off wavelength, group and phase velocities, characteristics wave impedance, TE, TM modes, S Parameters.	2.1 Rectangular waveguide : structure, cut off wavelength, group and phase velocities, characteristic wave impedance, TE, TM modes, field patterns, examples, S Parameters basics
	2e. Compare the working of rectangular waveguide and circular waveguide.	2.2 Circular waveguide: structure, cut off wavelength, modes, examples, comparison with rectangular waveguide
	2f. State applications of following microwave components: Tees, hybrid ring, directional coupler, Duplexer, isolator, circulator, cavity resonators 2g. Differentiate E-Plane Tee, H-Plane Tee and magic Tee. 2h. Explain the working of directional coupler, isolator and circulator with	2.3 Microwave Components: Tees, hybrid ring, directional coupler, Duplexer, isolator, circulator, cavity resonators

Unit	Major Learning Outcomes (Major outcomes in cognitive domain)	Topics and Sub-topics
	sketches. 2i. Explain working of cavity resonators with sketches.	
	2j. Describe working of bends, corner, and twist taper with sketches.	2.4 Microwave Accessories: corners and bends, twist and taper
Unit– III Microwave tubes and measurements	3a. Describe the frequency limitation of vacuum tubes at microwave frequency.	3.1 Limitations of vacuum tubes at microwave frequency
	3b. Explain function of reflex klystron with the help apple gate diagram. 3c. Explain structure and effects of various fields' acts on electron moving in the magnetron tube. 3d. Describe working of Travelling Wave Tube as an amplifier. 3e. Explain π mode oscillation and define frequency pushing and pulling. 3f. Explain two cavity klystron with apple gate diagram. 3g. Describe working of Backward Wave Oscillator.	3.2 Microwave tubes amplifiers: Klystron - Two cavity and multi cavity, Travelling Wave Tube 3.3 Microwave tubes oscillators: Reflex klystron, Magnetron, Backward Wave Oscillator
	3h. Explain microwave power measurement methods. 3i. Explain significance of VSWR measurement. 3j. Explain attenuation measurement methods. 3k. Describe Q measurement technique.	3.4 Microwave measurement: power, frequency, wavelength (free space, guided and cutoff), VSWR, attenuation, 'Q'.
	3l. Explain hazards due to microwave radiation.	3.5 Microwave radiation hazards: types (HERP, HERO, HERF), and protection from hazards

Unit	Major Learning Outcomes (Major outcomes in cognitive domain)	Topics and Sub-topics
Unit-IV Microwave semiconductor devices	4a. Explain varactor diode's working with diagrams. 4b. Describe transfer electron effect using the energy level diagram for GUNN diode. 4c. Explain the working of GUNN diode as an oscillator. 4d. Explain principle, construction, working and application of TUNNEL diode 4e. Explain the working of a PIN diode as a switch. 4f. Explain the negative resistance principle for IMPATT/TRAPATT diode with sketches.	4.1 Microwave diodes: VARACTOR diode, GUNN diode, TUNNEL, PIN diode, IMPATT diode, TRAPATT diode
	4g. Explain the parametric amplifier with diagrams. 4h. Explain the frequency up and down conversion concepts for parametric amplifier	4.2 Parametric amplifier 4.3 High electron mobility transistors
	4i. Explain the concept of high electron mobility transistor / strip line and micro strip circuits in brief.	4.4 Strip line and micro strip circuits
	4j. Describe working of RUBY MASER.	4.5 MASER: working principle, solid state RUBY MASER
	Unit-V RADAR systems	5a. Explain basic principle of radar and sonar.
5b. Using given data for RADAR calculate the radar range /minimum received power / operating frequency range. 5c. Obtain the equation for maximum RADAR range. 5d. Using radar range equation describes how the parameters affect the maximum range.		5.2 Radar range equation and examples, factors affecting maximum range.
5e. Explain scanning and tracking methods used in radar communication. 5f. Explain the working of pulsed radar with the help of block diagram. 5g. Describe display methods used for RADAR.		5.3 Pulse radar: block diagram, radar antenna and scanning and tracking methods, Display methods

Unit	Major Learning Outcomes (Major outcomes in cognitive domain)	Topics and Sub-topics
	5h. Explain the principle of CW Doppler radar and define blind speed. 5i. Describe the working of MTI radar with the help of suitable sketch. 5j. Explain how the CW radar used for range measurement. 5k. Compare the pulsed radar and CW radar.	5.4 CW Doppler radar: Moving target indicator radar, blind speed, Frequency modulated CW radar. RADAR applications.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Transmission lines and Microwaves	08	03	03	04	10
II	Microwave propagation and components	14	08	06	04	18
III	Microwave tubes and measurement	14	08	06	04	18
IV	Microwave semiconductor devices	12	02	06	04	12
V	RADAR systems	08	04	02	06	12
	Total	56	25	23	22	70

Legends: R = Remember U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (*outcomes in psychomotor and affective domain*) so that students are able to acquire the competencies/course outcomes. Following is the list of practical exercises for guidance.

Note: outcomes in psychomotor domain are listed here as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of Course Outcomes related to affective domain. Thus over all development of Programme Outcomes (as given in a common list at the beginning of curriculum document for this programme) would be assured.

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S.No.	Unit No.	Practical Exercises (Major outcomes in Psychomotor Domain)	Approx Hrs. Required
1	I	Measure open circuit & short circuit parameters for the given length of Transmission line.	02
2	I	Measure VSWR & reflection coefficient for given length of transmission line.	02
3	II	Set the microwave bench for optimum frequency operation	02
4	II	Measure the voltage maxima and minima on slotted waveguide and calculate free space, cut off and guided wavelength.	02
5	II	Identify various microwave components in the microwave circuit.	02
6	II	Determine the directivity, insertion loss, and coupling factor for a given directional coupler.	02
7	II	Determine the isolation factor for a given isolator.	02
8	II	Determine the coupling factor and, insertion loss, for a given circulator.	02
9	II	Calibrate the given variable attenuator.	02
10	III	Measure microwave frequency using the given (direct and /or indirect) frequency meter.	02
11	III	Measure VSWR for given microwave loads.	
12	III	Measure attenuation of given attenuator.	02
13	IV	Test different controls and functions of GUNN / KLYSTRON power supply.	
14	IV	Determine the characteristic of microwave crystal diode.	02
15	IV	Test the performance of TUNNEL diode	02
16	V	Investigate the fundamental concepts of Doppler radar	02
17	V	Setup radar kit and tune it for best performance.	02
18	V	Measure speed of a fan using RADAR kit.	02
19	V	Measure the variable speeds of moving objects using Velocity simulator	02
20	V	Measure the speed of a moving object with Doppler radar from different angles.	02
21	V	Calculate the speed of a moving object approaching or receding away from radar from different-different angles	02
22	V	Estimate the size of a moving objects using Radar.	02
23	V	Measure the distance traveled by any object using Radar	02
Total Hours			46

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

- i. Prepare chart showing various microwave components.
- ii. Prepare/Download a dynamic animation to illustrate the following:
 - a. Microwave tubes.
 - b. EM waves propagation.
- iii. Visit a place where waveguides are used for microwave communication.
(Such as airport, earth station, Telephone exchange, Microwave link repeater, TV broadcast).

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Show video/animation films or Power point presentation to explain functioning of various microwave components and Microwave tubes.

10. SUGGESTED LEARNING RESOURCES**A) List of Books**

S.No.	Title of Books	Author	Publication
1.	Microwave Engineering	Gupta Sanjeev	Khanna Publication, New Delhi (Latest edition)
2.	Electronics communication system	Kennedy George	Tata McGraw hill, New Delhi (Latest edition)
3.	Microwave engineering	Das Annapurna & Das S. K.	Mc. Graw Hill, New Delhi, (Latest edition)
4.	Microwave Devices & Circuits	Liao Samuel Y.	PHI Learning, New Delhi, (Latest edition)
5.	Microwave & RADAR Engineering	Gautam A. K.	S K Kataria Publications, New Delhi, (Latest edition)

B) List of Major Equipment/ Instrument with Broad Specifications

i.	Transmission line trainer.	
ii.	Gunn / klystron power supply	'X' band
iii.	VSWR meter	Resonated at 01 KHZ
iv.	Microwave bench(Gunn / klystron)	'X' band component.
v.	Microwave accessories	BNC to BNC cables, Main Chords.
vi.	Microwave components	'X' band
vii.	Radar trainer kit	Microwave X band frequency range

C) List of Software/Learning Websites

- i. RF Tool box: MATLAB & SIMULINK:
- ii. http://www.rf-mw.org/transmission_lines_and_distributed_systems_transmission_lines_transmission_lines.html
- iii. http://www.rf-mw.org/transmission_lines_and_distributed_systems_transmission_lines_transmission_lines_video_lectures.html
- iv. www.nptel.ac.in

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. M. N. Charel,** HOD (EC), Government polytechnic, Ahmedabad
- **Prof. K. R. Vadalia,** Sr. Lecturer (EC), Govt. Polytechnic, Rajkot.
- **Prof. K. R. Shah,** Sr. Lecturer (EC), Govt. Polytechnic, Patan.
- **Prof. R. G. Patankar,** Lecturer (EC), Government polytechnic, Gandhinagar.
- **Prof. (Dr). D. R. Bhojani,** HOD (EC), Darshan Institute of Engg. & Tech for Diploma Studies, Rajkot.

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. (Dr.) (Mrs.) Anjali Potnis,** DEEE, NITTTR, Bhopal

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**COURSE CURRICULUM****COURSE TITLE: SOFTWARE LAB PRACTICE****(CODE: 3351104)**

Diploma Programmes in which this course is offered	Semester in which offered
Electronics and Communication Engineering	5 th Semester

1. RATIONALE

It is the era of customized solutions, where fundamental knowledge of electronics and communication principles along with software support plays important role in the prototype application development. Hence the knowledge of popular industrial software helps the Electronics and Communication Engineering diploma students to maintain systems which are based on hardware and software. Programming practices will further help the students to develop indigenous hardware and software based applications.

2. LIST OF COMPETENCY

The course content should be taught and implemented with the aim to develop basic concepts and different types of skills so that students are able to acquire following competency:

- **Develop and test models of electronic (Analog and Digital) circuits using scientific and technology support software and simulation tools.**

3. COURSE OUTCOMES

The practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Simulate and test mathematical and functional aspects of electronics and communication engineering principles using the basic features of software tools.
- Develop script files for analog electronic circuits.
- Develop model using blokset and toolbox functions.
- Simulate and test analog and digital communication circuits using available functions and toolboxes.
- Simulate and test Digital electronic circuits using available functions and toolboxes.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	50
0	0	2	2	0	0	20	30	

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE CONTENT DETAILS

Note: There is no exclusive input sessions for theory in this course, however following theory should be discussed during practice sessions. There is no theory based exams for this course.

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
Unit – I Introduction to scientific software (like: MATLAB or SCILAB)	1a. Explore the default window basic features, commands and of the scientific and technology support software (like: MATLAB or SCILAB) environment.	1.1 Default Window view Command ,Figure ,Editor window, help window
	1b. Creating, saving and executing a script file	1.2 On-line help 1.3 Input-output 1.4 File types
	1c. Perform simple arithmetic operations.	1.5 Basic arithmetic and logical operations
	1d. Creating and perform arrays operations.	1.6 Trigonometric and exponential functions operation
	1e. Plot the given data using various plot functions.	1.7 Plotting functions
	1f. Creating and plotting basic signals (Sine, Cosine, Square, Triangle) .	
Unit – II Analog Electronics Circuits	2a. Plot input output characteristics of diode.	2.1 Plot the characteristic curves of Linear and nonlinear analog electronic devices.
	2b. Plot input output characteristics of npn Transistor	2.2 Simulate and test model /equivalent circuit of analog electronic devices.
	2c. Simulate and test model for bias stability of transistor.	
	2d. Simulate and test MOSFET equivalent circuit and plot input output characteristics.	
	2e. Plot frequency response of Common Emitter Amplifier.	
Unit – III Introduction to toolbox and blockset library (MATLAB, Simulink)	3a. Creating, saving and executing a model file.	3.1 Basic features of blockset library
	3b. Develop model of rectifiers using blockset.	3.2 Sources : Voltage and current sources ,power supply, RF generators, digital signal generators
	3c. Develop model of filters using blockset.	3.3 Sinks : Display instruments, meters,
		3.4 Various functions .
		3.5 Toolbox related to electronic

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
		circuits, communication ,and antenna
Unit – IV Analog and Digital Communication	4a.Develop a software program to plot amplitude modulated-DSB Waveform	4.1 Mathematical equations and functions to represent of analog modulation and demodulation principles
	4b.Develop a software program to plot amplitude modulated-SSB Waveform	
	4c.Develop a software program to plot Frequency Modulation Waveform	
	4d.Develop a software program to plot Phase Modulation Waveform	
	4e.Develop a software program to plot Low Pass, High Pass, Band Pass and Band Stop filter design and its frequency response using toolbox	4.2Mathematical equations and parameters to develop analog filter circuits : Low Pass, High Pass, Band Pass and Band Stop Filter
	4f.Develop a software program to plot ASK Modulation Waveform	4.3 Mathematical equations and functions to represent of digital modulation and demodulation principles
	4g.Develop a software program to plot FSK Modulation Waveform	
	4h.Develop a software program to plot PSK Modulation Waveform	
	4i.Develop a software program to plot QPSK Modulation Waveform	
Unit – V Digital Electronics Circuits using Toolbox and Blocksets	5a.Simulate AND, OR, NAND,NOR, XOR , NOT Gates using blocksets	5.1Digital circuit: basic gates, combinational and sequential circuits and their truth table, characteristic table, excitation table and waveforms.
	5b.Develop a model of full adder and subtractor	
	5c.Develop a model of multiplexer and demultiplexer.	
	5d.Develop a model of D, T and JK Flip-flop .	
	5e.Develop a model for a 3–bit Up / Down binary counter	

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS

Not Applicable

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. required
1	I	Explore the basic features, commands and general structure of the MATLAB environment. 1.Start and exit the session 2.MATLAB Windows: Figure, Editor and command window 3.On-line help 4.Input-output 5.File types	02
2	I	Minimum MATLAB Session: 1.Perform arithmetic operations on scalar. 2.Perform arithmetic operations on arrays. 3.Plot and print simple plots using plot functions. 4.Creating, saving and executing a script file.	04
3	I	Develop a program to plot waveforms: Sine, Cosine, Square, Triangle	01
4	II	Develop a program to plot input output characteristics of diode.	01
5	II	Develop a program to plot input output characteristics of npn Transistor.	01
6	II	Develop a program to plot bias stability of transistor.	01
7	II	Develop a program to plot Frequency response of Common Emitter Amplifier.	01
8	II	Develop a program to plot input output characteristics of MOSFET.	01
9	III	Develop model for various types of rectifiers	02
10	III	Develop model for various types of filters	02
11	IV	Develop a program to plot Amplitude Modulation (DSB) Waveform	01
12	IV	Develop a program to plot Amplitude Modulation (SSB) Waveform	01
13	IV	Develop a program to plot Frequency Modulation Waveform	01
14	IV	Develop a program to plot Phase Modulation Waveform	01
15	IV	Develop a program to plot Low Pass, High Pass, Band Pass and Band Stop Filter design and its Frequency response using toolbox	01
16	IV	Develop a program to plot ASK Modulation Waveform	01
17	IV	Develop a program to plot FSK Modulation Waveform	01
18	IV	Develop a program to plot PSK Modulation Waveform	01
19	IV	Develop a program to plot QPSK Modulation Waveform	01
20	V	Develop model of Multiplexer and Demultiplexer using blockset functions.	02
21	V	Develop model for Addition and Subtraction of 4bit binary	01
22	V	Simulate AND, OR, NAND,NOR, XOR , NOT Gates using blockset functions	01
23	V	Simulate full adder using Simulink.	01
24	V	Simulate full adder using Simulink for four bit .	01
25	V	Simulate D and JK Flip-flop using Simulink.	01
26	V	Develop a model for a 3-bit Up / Down binary counter using simulink	01
Total			28

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

- i. Revise the concept of electronics and communication from the relevant books.
- ii. Practices various features of MATLAB for developing various types of circuits from the reference books on MATLAB.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Expert Lecture from faculties working on MATLAB.

10. SUGGESTED LEARNING RESOURCES**A) List of Books**

S. No.	Title of Book/user manual	Author	Publication
1.	Getting started with Matlab	Pratap Rudra	Oxford University Press, New Delhi (latest edition)
2.	Matlab in Engineering	Tyagi	Oxford University Press, New Delhi (latest edition)
3.	Engineering Education and Research using matlab	Assi Ali H.	Intech Publication
4.	Essential MATLAB for Engineers and Scientist	Hahn Brian D. Valentine Daniel T.	Elsevier publications Ltd., Third edition, 2007 (or latest edition)

B) List of Major Equipment/ Instrument/Software with Broad Specifications

- i MATLAB
- ii SCILAB
- iii Computer terminals in networking
- iv Internet connection

C) List of Software/Learning Websites

- i www.mathworks.com
- ii www.learnerstv.com
- iii courses.washington.edu/css457/matlab/learning_matlab.pdf
- iv www.ngohaibac.com/how-to-learn-matlab-programming.
- v www.matlabtips.com

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- Prof. S. N. Sampat, I/C Head (EC) Government Polytechnic, Gandhinagar.
- Prof. M. S. Dave, Sr. Lecturer (EC) Government Polytechnic, Ahmedabad
- Prof. S. D. Parmar, Lecturer (EC), Government Polytechnic, Gandhinagar
- Prof. K. J. Pithadiya, Lecturer (EC), B & B Polytechnic Vallabh Vidyanagar

Coordinator and Faculty Members from NITTTR Bhopal

- Prof. (Mrs.) Anjali Potnis, Department of Electrical and Electronics Engineering

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE: PROJECT-I
(COURSE CODE: 3351107)**

Diploma Programmes in which this course is offered	Semester in which offered
Electronics & Communication	5 th Semester

1. RATIONALE

provide an opportunity to the students for applying the knowledge and technical skills acquired by identifying real life problem of the industries /research organization / society as a whole and providing it's innovative solution with partial implementation , which is economically and technologically viable.

2. COMPETENCY

The IDP-I/UDP-I is to be selected by the students and the problem is to be identified for providing solution under the mentoring of the institute Guide and the Industry mentor to develop following competencies...

- i. Co-creation & Interpersonal abilities**
- ii Design & Troubleshooting**
- iii Programming/simulation/ debugging skills**
- iv Developing PCB design/soldering skills**
- v Documentation & Presentation skill**

3. Course Outcomes

At the end of the course, student will able to

- i. Create familiarity with the industry personnel & industrial environment as well as processes.
- ii Survey the related literature.
- iii Define the problem and the objectives of the project.
- iv Suggest various design alternatives and justification of the selection of the design methodology for the problem solution along with design specifications.
- v Modeling and analysis of the proposed solution.
- vi. Simulate, Design and debugging of the circuit
- vii Partial Implementation of the proposed solution
- viii. Develop program logic of the proposed solution
- ix. Locate the problem and troubleshoot.
- x. Work in team cohesively & effectively
- xi Prepare project report having organized documentation.
- xii. Prepare & deliver presentation.
- xii. Enhance awareness for latest technologies and tools
- ix. Visualize the roadmap of the further development.

4. Teaching and Examination Scheme

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	100
0	0	4	04	0	0	40	60	

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE DETAILS

Stage	Major Learning Outcomes	Topics and Sub-topics
Stage-I Shodhyatra*	1.a. Interact with the industry/research organization personnel 1.b. Gather information and organise	1.1 Information gathering through websites and media. 1.2 Identification of Industry/research organization 1.3 Visiting Industry/research organization 1.4 Creating awareness about the industrial premises , personnel , processes and products 1.5 Review of literature
Stage- II Problem Definition & Submission	2.a. Define & explain Problem definition 2.b. Prepare & submit problem definition	2.1 Defining problem in consultation with institute guide & industry mentor 2.2 Preparing problem definition statement in the prescribed format of GTU and submit in soft and hard copy.
Stage- III Design Solution	3.a. Conceive and draw General block diagram of solution . 3.b. Develop circuit diagram in detail. 3.c. Write algorithm and draw flowchart	3.1 Block Diagram of project 3.2 Draw & Develop circuit diagram using circuit design softwares/tools 3.3 Development of algorithm and flowchart if applicable.
Stage – IV Hardware/software simulation and partial Implementation	4.a. Design PCB Layout 4.b. Simulate circuit 4.c. Assemble circuit 4.d. Test the Hardware circuit 4.e. Troubleshoot the hardware circuit.	4.1 PCB Layout preparation using software tools 4.2 Circuit simulation 4.3 Partial implementation using Breadboard or General purpose PCB 4.4 Test and troubleshoot hardware if applicable.
Stage – V Documentation	5.a. Prepare project report 5.b. Prepare PPT presentation	5.1 Prepare project report as per GTU guideline.

Stage	Major Learning Outcomes	Topics and Sub-topics
on & Presentation	5.c. Present project work	5.2 Prepare PPT and present as per schedule.

*Note: Shodhyatra(Two weeks - Immediately after completion of Sem-IV End Semester Exam)

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Contact Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Shodhyatra	04	00	10	05	15
II	Problem Definition & Submission	08	05	10	05	20
III	Design Solution	20	10	10	10	30
IV	Hardware/software simulation and partial Implementation	16	00	10	10	20
V	Documentation & Presentation	08	00	05	10	15
	Total	56	15	45	40	100

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

- i. Prepare and submit project definition document in prescribed format.
- ii. Visit industry regularly.
- iii. Get help from innovative council/research organization for design solution.
- iv. Report regarding stage wise progress to institute guide/industry mentor regularly.
- v. Continuous practicing of latest circuit design and simulation tools/software.
- vi. Study of intellectual property rights for patenting the project.

8. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. One day IDP awareness workshop.
- ii. Industry survey.
- iii. Seminar/Symposium
- iv. Group discussion/Debate
- v. Expert lectures of resource persons from industries/research organizations.
- vi. Arranging Industrial visit.

9. SUGGESTED LEARNING RESOURCES

A) List of Magazines.

- i. Electronics for you.

ii. Electronic design news.

iii. Elector electronics.

iv. Electronics project manuals

B) List of Major Equipment/ Instrument with Broad Specifications

- 1) Computer
- 2) Digital storage oscilloscope (DSO).
- 3) Spectrum analyzer.
- 4) Universal programmer.
- 5) Wide band function generator.
- 6) Soldering station with drill machine
- 7) PCB formulation kit
- 8) Clip on meter/ Multimeter / Power Supplies /
- 9) IC Tester / Continuity Tester /Component Tester
- 10) LCR Q –meters
- 11) Other equipments as per the need of project work.

C) List of Software/Learning Websites

<http://www.electronicproject.org>

<http://www.circuiteasy.com>

<http://www.electronics-project-design.com>

<http://www.electronicsschematic.com>

(The above list of websites are merely examples for the reference, students should go through many other similar websites .)

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. D.H.AHIR** , Sr.Lecturer , Dept of EC engineering, G.P.,Rajkot
And Associate Dean- GTU Zone-4
- **Prof.K.N.VAGHELA**, Sr.Lecturer ,Dept of EC engineering,
G.P.,Ahmedabad
- **Prof. M.S.DAVE** , Sr.Lecturer ,Dept of EC engineering, G.P.,Ahmedabad

Coordinator and Faculty Members from NITTTR Bhopal

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

**COURSE CURRICULUM
COURSE TITLE: COMPUTER NETWORKS
(COURSE CODE: 3351105)**

Diploma Programme in which this course is offered	Semester in which offered
Electronics and Communication Engineering	5 th Semester

1. RATIONALE

Computers and computer networks are the sole of the present telecommunication system. Advanced digital communication system is based on the computer networks. Now a days every organisation, industry or the service sector own their private computer networks. Therefore in every organisation, the maintenance of the computer networks becomes one of the essential jobs of a diploma electronics engineer too. This course is therefore designed to help the Electronics and Communication diploma holders to develop this competency.

2. LIST OF COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

- **Maintain hardware of various types of computer networks.**

3. COURSE OUTCOMES

The theory should be taught and practical should be performed in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Identify computer network on the basis of various network parameters.
- Identify OSI-ISO and TCP/IP computer network models.
- Select guided and unguided medium for various types of data transmission.
- Assign IP address to the network and network component as per the networks.
- Install various types of modems and other network hardware.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
4	0	2	6	70	30	20	30	

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

5. COURSE DETAILS

Unit	Major Learning Outcomes (Outcomes in Cognitive Domain)	Topics and Sub-topics
Unit – I Network Fundamentals	1a. State the necessity of Computer Networks	1.1 Need and Advantages of Computer Networks
	1b. Discuss the applications of Computer Networks	1.2 Applications of computer networks: Business, Industrial and home applications
	1c. Describe the functions of various components of Computer Networks	1.3 Components of Computer Networks: hardware and software
	1d. Compare various computer network topologies.	1.4 Network topologies: Star, Ring, Bus, Mesh, Tree, Hybrid
	1e. Classify computer networks- Based on Transmission, scale, and Architecture	1.5 Network Classification
	1f. Differentiate LAN, WAN, MAN 1g. Describe configuration of PAN with example 1h. State the applications service offered by WAN 1i. Explain functions of VPN with example	i. Based on Transmission Technologies: Point-to-point, broadcast ii. Based on scale: PAN, LAN, WAN, MAN, VPN, Internet iii. Based on Architecture: Peer to Peer, Client Server, advantages of Client Sever over Peer-to-Peer Model
Unit – II Reference Model	2a. Define the terms: Protocol, Interface, Services, Primitives, semantics, syntax	2.1 Terms :Protocol, Interface, Services, Primitives, semantics, syntax
	2b. Explain the need for layer modelling. 2c. Describe the functions of each layer of OSI Reference model.	2.2 The OSI-ISO Reference Model:, Brief functional description of each layers with list of protocols
	2d. Describe the functions of each layer of TCP/IP Reference model. 2e. Compare the major features of OSI and TCP/IP model	2.3 The TCP/IP Reference Model: Brief functional description of each of the Layer with list of protocols
	Unit – III Network Media and Hardware	3a. Explain characteristics of guided and unguided transmission media 3b. Describe specifications of UTP and coaxial cable 3c. Sketch constructional details of UTP and coaxial cable with labels
3d. Sketch the various line signals 3e. Describe characteristics of physical layer connectors 3f. Explain need of line coding.		3.2 Physical Layer Interfaces: Types of Connectors and Signals 3.3 Line coding and Line coded signal
3g. Explain structure of MAC and LLC sublayers		3.4 Sub layers of Data Link Layers: MAC, LLC

Unit	Major Learning Outcomes (Outcomes in Cognitive Domain)	Topics and Sub-topics
	3h. Explain functions of following network devices: Repeater, Hub, Bridge, Switch, Router, B-router, Gateway, Network Adapter, Access point, Wireless Access points 3i. Differentiate between FDDI and CDDI	3.5 Network devices: Repeater, Hub, Bridge, Switch, Router, B-router, Gateway, Network Adapter, Access point, Wireless Access points, 3.6 Fast and Gigabit Ethernet 3.7 FDDI and CDDI
	3j. Describe functions of remote connecting devices: DTE and DCE	3.8 Remote connecting device: DTE and DCE 3.9 Digital Subscriber Line technology: DSL, ADSL, HDSL
	3k. Compare the functions of various types of Servers	3.10 Servers: File, Print, Mail, Proxy, Web
Unit – IV Internet architecture	4a. Explain IP addressing scheme with examples	4.1 Internet addresses: gateway addressing, network and broadcast addressing, dotted decimal notation, loopback addressing
	4b. Distinguish various components of IP v4 and IPv6 protocol.	4.2 IP layer Protocols: IPv4 and IPv6 frame Format
	4c. Compare functions and services TCP and UDP	4.3 Connection oriented and Connectionless services 4.4 TCP and UDP frame format
	4d. Differentiate between DNS, Email and FTP	4.5 Domain Name System: Introduction, mapping to IP addresses
	4e. Explain the working of a Firewall used for network security. 4f. Describe role of Cyber security Laws	4.6 Security –Social issues, Hacking, precautions and Firewall, Cyber security Laws
Unit – V Internet Services and its applications	5a. Describe the functions of cable modem.	5.1 Cable modem system
	5b. Compare ADSL and broad band modem	5.2 ADSL and broad band modem
	5c. Classify different Internet Services	5.3 Internet Services
	5d. Differentiate FTP and Remote login	World Wide Web: Web browser, HTML, web servers
	5e. Explain how Voice and Video is transferred over IP.	5.4 Electronic Mail: Functions of E-mail system, User agent, Message format, Mail Protocols (SMTP, POP3), FTP, Remote

Unit	Major Learning Outcomes (Outcomes in Cognitive Domain)	Topics and Sub-topics
		Login 5.5 Voice and Video over IP 5.6 Social services: Forum, Newsgroup, blog

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Network Fundamentals	12	4	7	4	15
II	Reference Models	08	5	5	3	13
III	Network Media and Hardware	12	5	5	4	14
IV	Internet architecture	14	6	4	3	13
V	Internet Services and Applications	10	5	6	4	15
Total		56	25	27	18	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as only general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (*outcomes in psychomotor and affective domain*) so that students are able to acquire the competencies/course outcomes. Following is the list of practical exercises for guidance.

Note: outcomes in psychomotor domain are listed here as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of Course Outcomes related to affective domain. Thus over all development of Programme Outcomes (as given in a common list at the beginning of curriculum document for this programme) would be assured.

Faculty members should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Exercise (Outcomes in the Psychomotor Domain)	Apprx. Hrs. Required
1	I	Prepare detailed report of existing LAN in the Department/Institute	04
2	I	Connect computer terminal in various physical topologies and test	02

S. No.	Unit No.	Practical/Exercise (Outcomes in the Psychomotor Domain)	Apprx. Hrs. Required
		the data transfer	
3	III	Compare performance of various types physical layer Connectors	02
4	III	Compare performance of various types of Transmission media. and Connectors	02
5	III	Prepare and Test Straight UTP Cable	02
6	III	Prepare and Test Cross UTP Cable	02
7	III	Prepare and Test Cross CAT5,CAT6 and RJ11Cable	03
8	III	Install/configure/Test Network Interface Card/port	03
9	III	Install/configure/Test Networking devices	04
10	III	Install/configure/Test small LAN using Hub/switch	03
11	III	Install/configure/Test File Server	03
12	III	Install/configure/Test Print Server	03
13	III	Install/configure/Test Web Server	03
14	IV	Install/configure/Test a small wireless network using access points	02
15	IV	Install/configure/Test Peer to Peer LAN and sharing of resources	03
16	IV	Install/configure/Test Network operating System	03
17	IV	Configure/Test Internet connectivity	03
18	IV	Install and configure a Firewall for the network security	02
19	IV	Check performance of network using ping, trace route commands	02
20	V	Prepare report on e-mail service: contact list, group list, sorting, searching, spam, inbox, sent mail, draft	02
21	V	Compare the performance of various web browser: home page, cookies, bookmark, history, favourites, download folder etc	02
22	V	Use simple Network Commands for the network control operations	02
Total Hours (perform practical form every unit so that 28 hours are utilized)			57

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

- i. Prepare technical report on Current Network at your Department/ Institute.
- ii. Test the performance of HUB, Switches, router and Servers.
- iii. Project- Build a small PAN/ LAN at your Home /Community.
- iv. Enhance security of your network by introducing Firewall.

9. INSTRUCTIONAL STRATEGY

- i. Lecture and demonstration
- ii. Online animation/flash
- iii. Practical exercises, LAN implementation
- iv. Mini project related with industrial applications and house hold applications

10. SUGGESTED LEARNING RESOURCES**(A) List of Books**

S. No.	Title of Books	Author	Publication
1.	Data Communication and Networking,	Forouzen	Tata McGraw Hill, Education New Delhi (Latest edition)
2.	Computer Networks	Tannebaum AndrewS Wetherall David J.	Pearson, New Delhi, 5 th Edition, 2011
3.	Data and Computer Communication,	Stallings Williams	PHI Learning, New Delhi (Latest edition)
4.	Data Communication Networks	Sharma Sanjay	S.K.Kataria and Sons, New Delhi (Latest edition)
5.	Computer Networks	Trivedi Bhushan	Oxford University Press, New Delhi 2013

(B) List of Major Equipment/accessories

- i. Computer systems(P-IV and above)
- ii. Network Cable Cat 5/Cat 6.
- iii. Crimping Tool (RJ45,RJ11, Cat 5/Cat 6)
- iv. UTP Cable Tester
- v. Layer 2 Switch ,Hub(16 I/O)
- vi. Wireless Access point and Wireless router
- vii. Network cable connectors(Cat 5/Cat 6/C2G, RJ45,RJ11)
- viii. Network Trainer Kit

(C) List of Software/Learning Websites

- i. <http://nptel.iitm.ac.in/courses.php?disciplineId=106>
- ii. <http://www.edrawsoft.com>
- iii. Network Simulator Tool: GNS3 v0.8.5, NetSimK
- iv. www.learnerstv.com

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. D B VAGADIA** HOD (EC) Govt. Poly, Rajkot
- **Prof S N SAMPAT,** Sr. Lecturer (EC) Govt. Poly Gandhinagar.
- **Prof U V BUCH,** Sr. Lecturer (EC) Govt. Poly for Girls, Surat
- **Prof P.G.PATEL,** Lecturer (EC) Govt. Poly Ahmedabad.

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. (Dr.) (Mrs.) Anjali Potnis,** Department of Electrical and Electronics Engineering

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

**COURSE TITLE: INSTRUMENTATION & CONTROL ENGINEERING
(COURSE CODE: 3351106)**

Diploma Programme in which this course is offered	Semester in which offered
Electronics and Communication Engineering	5 th Semester

1. RATIONALE

Electronics is part and parcel of all modern instrumentation systems. Transducers, automatic process control, telemetry system, recorders, computer aided process control, data acquisition system and such others use a lot of electronics. Therefore, it is essential that every electronic and communication diploma engineer should know the basics of modern instrumentation and control systems so that the associated electronics can be maintained effectively. Hence, this course is developed to provide the fundamental knowledge of industrial instrumentation and control system to students to enable them to maintain the electronics modules.

2. LIST OF COMPETENCY

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competency

- **Analyze different types of instrumentation and control systems**

3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Identify various types of instrumentation systems and their modules.
- Select appropriate transducer for measurement of physical parameters.
- Monitor working of different types of process control systems.
- Select appropriate types of telemetry system and recorders for relevant applications.
- Analyzes various types of computer aided process control system.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	150
04	00	02	06	70	30	20	30	

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE DETAILS

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
Unit-I Introduction to Instrumentation	1a. Describe different elements of instrumentation system with examples	1.1 Elements of instrumentation system including process and biomedical instrumentation
	1b. Classify the instrumentation systems	i. Null and Deflection ii. Control and Monitoring iii. Analog and Digital
	1c. With sketches describe various types of standard instrumentation signals	1.2 Standard instrumentation signals: Pneumatic, Current loop, 0-10 volts.
	1d. Justify the need of signal conditioning 1e. Explain different types of Signal conditioning systems	1.3 Signal conditioning: DC signal and AC signal conditioning.
Unit-II Measurement of Physical Parameters	2a. Describe measurement techniques of physical parameters like torque, length, speed, level	2.1 Measurement techniques i. Measurement of torque ii. Measurement of length iii. Measurement methods of level measurement: Laser, Microwave, Optical, Ultrasonic, Eddy current.
	2b. Explain working of magnetic flow meter	2.2 Magnetic flow meter
	2c. Describe different types of pressure measurement techniques	2.3 Pressure measurement techniques by i. Strain gauge, ii. Potentiometer, iii. Pressure switch
	2d. Classify temperature measurement techniques 2e. Describe working of different types of pyrometers	2.4 High and low temperature measurement i. Radiation type pyrometer ii. Optical type pyrometer
	2f. Explain working of various types of position sensors	2.5 Position sensor i. Resistive type ii. Optical type iii. Inductive type
	2g. Describe measurement techniques to measure humidity and moisture for different applications	2.6 Measurement of moisture and humidity
	2h. Describe working principle of Magneto-strictive, Hall effect, Ionization and Electrochemical Transducers	2.7 Special types of transducers: i. Magneto-strictive transducers ii. Hall effect Transducers iii. Ionization Transducers iv. Electrochemical Transducers

Unit	Major Learning Outcomes (outcomes in cognitive domain)	Topics and Sub-topics
Unit-III Automatic Process Control	3a. Explain need for automatic process control system. 3b. Explain different elements of automatic process control system. 3c. Describe different modes of process control system	3.1 Need of automatic process control elements of process control 3.2 Advantages of automatic process control system 3.3 Modes of process control system: i. Open loop ii. Closed loop(manual, on-off, P, I, D, PI, PD, PID)
Unit-IV Telemetry System And Recorders	4a. Differentiate the different types of telemetry systems 4b. Explain working of various types of electronic telemetry systems. 4c. Describe the function of smart and intelligent transmitters. 4d. Explain the working of different types of recorders with block diagram 4e. Name the electronic components used in Telemetry System And Recorders	4.1 Electrical telemetry system (current, position, impulse) 4.2 Electronic telemetry system(pulse telemetry-Pulse Amplitude Modulation ,Pulse Frequency Modulation, Pulse Duration Modulation, Pulse position modulation) 4.3 Smart (intelligent) transmitters 4.4 Recorders Types i. Strip chart ii. Circular chart iii. X-Y plotter
Unit-V Computer Aided Control Systems	5a. State the application of computers in process control. 5b. Explain at the block diagram level the different elements of computer based control systems 5c. Describe the function of various blocks of CNC machine. 5d. Describe the use of the different computer interfaces to connect various electronic devices. 5e. Describe the functions of Data acquisition systems 5f. Explain concept of virtual instrumentation.	5.1 Role of computer in process control 5.2 Block diagram of the computer based control 5.3 CNC machine, various blocks of CNC machine 5.4 Standard interfaces: RS-232,RS-422A,RS-485,GPIB 5.4 Data acquisition system. 5.5 Virtual Instrumentation: Conventional and Graphical Programming.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I.	Introduction to Instrumentation	8	4	6	2	12
II.	Measurement of Physical Parameters	12	4	5	6	15
III.	Automatic Process Control	12	4	6	5	15
IV.	Transmitters, Telemetry System and Recorders	12	4	5	4	13
V.	Computer Aided Control Systems	12	6	4	5	15
Total		56	22	26	22	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (*outcomes in psychomotor and affective domain*) so that students are able to acquire the competencies/course outcomes. Following is the list of practical exercises for guidance.

Note: outcomes in psychomotor domain are listed here as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of Course Outcomes related to affective domain. Thus over all development of Programme Outcomes (as given in a common list at the beginning of curriculum document for this programme) would be assured.

Faculty members should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Exercises	Approx Hrs. Required
1	I	Analyze standard instrumentation signals waveforms.	2
2	II	Test the performance of pressure type Potentiometer	2
3	II	Measure torque using strain gauge	2
4	II	Check the performance of synchros	2
5	II	Measure temperature using radiation/optical pyrometer	2
6	II	Measure pressure using strain gauge	2
7	II	Test a DC position control system	2
8	II	Measure water level using resistive transducer	2
9	II	Measure water level using capacitive transducer	2
10	II	Measure water Level using ultrasonic transducer	2

S. No.	Unit No.	Practical/Exercises	Approx Hrs. Required
11	II	Analyze the time response of second order processes with P Control	2
12	III	Analyze the time response of second order processes with P+I Control	2
13	III	Analyze the time response of second order processes with P+D Control	2
14	III	Analyze the time response of second order processes with P+I+D Control	2
15	IV	Use x-y recorder and graphic recorder for the appropriate quantity measurement.	2
16	IV	Analyze performance of PAM type telemetry system	2
17	IV	Analyze performance of PPM type telemetry system	2
18	V	Analyze performance of data acquisition system	2
19	V	Transfer various type of data using RS-232,RS-422A,RS-485,GPIB standard cables.	2
Total Hours (perform practical from all units so that 28 hours are utilised)			38

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

- Test different types of transducers using simulation software like Prosim, simulink, lab volt etc.
- Present seminar on any one topic related to the subject.
- Develop a small Instrumentation and Control project using LAB VIEW software.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- Industrial Visit
- Internet based assignments
- Organising expert lecture
- Display of appropriate video films

10. SUGGESTED LEARNING RESOURCES

A) List of Books

S.No.	Title of Books	Author	Publication
1.	Industrial instrumentation and control	Singh, S.K.	TATA McGraw-Hill, New Delhi (Latest Edition)
2.	Introduction to Instrumentation and Control	Ghosh, A. K.	PHI Learning, New Delhi (Latest Edition)
3.	Electronic measurement & Instrumentation systems	Jones, Larry, Chin, A foster	Prentice Hall International Edition
4.	Industrial Instrumentation and Control	Kumar, Sunil	S.K.Kataria and Sons, New Delhi (Latest Edition)
5.	Transducers and	D. V. S. Murthy	PHI Learning, New Delhi

S.No.	Title of Books	Author	Publication
	Instrumentation		(Latest Edition)
6.	Industrial Instrumentation	Krishnaswamy, Vijayachitra, K. S.	New Age International, New Delhi (Latest Edition)
7.	Process Control Instrumentation Technology	Curtis D. Johnson	Pearson Publication, New Delhi
8.	Hand book of Maintenance Engineering.	Garg, H. P.	TATA McGraw-Hill, International Edition
9.	Computer-Based Industrial Control	Kant, Krishna	PHI Learning, New Delhi (Latest Edition)
10.	Virtual Instrumentation Using Lab View	Gupta, Sanjay and John, Joseph	TATA McGraw-Hill, New Delhi (Latest Edition)

B) List of Major Equipment/Materials with Broad Specifications

- i. Instrumentation and control trainer kits
- ii. DC Regulated Power supply
- iii. Function generator
- iv. CRO
- v. Digital Storage Oscilloscope

C) List of Software/Learning Websites

Any simulation software that shows working of different instrumentation and control circuits like Prosim, simulink, LAB VIEW etc.

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Shri B. P. Raval,** Sr. Lecturer (EC), Govt. Polytechnic, Rajkot.
- **Shri T. R. Parmar,** Sr. Lecturer (EC), Govt. Polytechnic, Palanpur.
- **Shri B.B.Renuka,** Sr. Lecturer (EC), AVPTI, Rajkot.

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