

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT****COURSE CURRICULUM****COURSE TITLE: ENTREPRENEURSHIP AND INDUSTRIAL MANAGEMENT  
(COURSE CODE: 3361101)**

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
ELECTRONICS & COMMUNICATION ENGINEERING	Sixth

**1. RATIONALE**

This course deals with the concern areas of entrepreneurship and industrial management that has significant impact on current developing economy. The social expectations towards engineering professionals is certainly emerging as job creators and not as purely job seekers, especially with the thrust given to “Make in India” campaign. Hence this course focuses on the basic roles, skills and functions of entrepreneurship and industrial management, with special attention to managerial responsibility for effective and efficient achievement of goals. The course is directed to help students to enhance capabilities in the field of managing the given task as well as to understand peripheral influencing aspects. The content will certainly help students to think in a direction to establish an enterprise using fundamental know how.

**2. COMPETENCY**

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Establish and maintain different types of small to medium enterprises.**
- **Use concepts of management, organization structure and dynamics effectively to achieve organizational goals.**

**3. COURSE OUTCOMES (COs)**

The theory should be taught and practical should be undertaken in such a manner that students are able to acquire required learning outcomes in cognitive, psychomotor and affective domains to demonstrate the following course outcomes:

- i. Select and develop a small or medium business idea
- ii. Select various institutions for finance and working for a particular idea application.
- iii. Make and Implement project proposals and reports to hunt for venture capital etc.
- iv. Develop managerial skills to achieve goals.
- v. Plan and implement projects applying management techniques.
- vi. Understand social responsibility as a modern management concept.

#### 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	0	4	70	30	00	00	100

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

#### 5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
<b>UNIT-I</b> <b>The Nature of Entrepreneurship</b>	1a. Appreciate the concept and need of entrepreneurship development. 1b. Develop qualities of entrepreneur. 1c. Discuss characteristics and functions of entrepreneur. 1d. Compare the concepts entrepreneur and intrapreneur. 1e. Present the role of entrepreneurship in economic development.	<b>Basics of Entrepreneurship</b>  1.1 Entrepreneurship - Definition and Meaning 1.2 Characteristics of Entrepreneurship / Traits of an Entrepreneur 1.3 Functions of Entrepreneurship - Job Creation, Innovation, Inspiration, Economic Development 1.4 Types of Entrepreneurship 1.5 Entrepreneurship and Intrapreneurship 1.6 Entrepreneurship Strategy
	1f. Develop the plan for creating and starting the venture.	<b>The Business Plan: Creating and Starting the Venture</b>  1.7 The Marketing Plan 1.8 The Financial Plan 1.9 Sources of Capital
	1g. Explain the legal issues related with enterprise 1h. Explain the supply chain management 1i. Describe the concept of Retail business. 1j. Discuss issues of FDI	<b>Legal Issues for the Entrepreneur</b> 1.10 IPR 1.11 Patents, Trademarks, Copyrights, Trade Secrets 1.12 Licensing 1.13 Product Safety and Liability 1.14 Insurance 1.15 Contracts 1.16 Advertising 1.17 Supply Chain Management 1.18 Retail & FDI
	1k. Explain types of	<b>Industry Size &amp; Current schemes</b>

	<p>enterprise.                      1l. Identify various avenues of entrepreneurship.                      1m. Describe role of various central and state government agencies supporting MSME.</p>	<p>1.19 Micro, Small, Medium- Industry                      1.20 Registration Process                      1.21 State &amp; National Level Support agencies for                      a) Information                      b) Finance                      c) Technology                      d) Training                      e) Quality control                      f) Marketing                      1.22 Current Promotional Schemes for new Enterprise</p>
	<p>1n. Describe concept of risk                      1o. Prepare a project report                      1p. Perform SWOT for risk management in a given proposal.</p>	<p><b>Proposals &amp; risks</b>                      1.23 7-M Resources                      1.24 Market Survey Concept                      1.25 Project Report Preparation (Feasibility, Cost Estimation, CVP Analysis, Detailed Project Report                      1.26 Concept of Risk and decision making                      1.27 Risk Management-SWOT etc</p>
<p><b>UNIT-II</b>  <b>The importance of Entrepreneurship</b></p>	<p>2a. Define Innovation.                      2b. Explain the importance of innovation for entrepreneurship                      2c. Describe the innovation process.                      2d. Explain product life cycle and mortality curve</p>	<p><b>Entrepreneurship and Innovation</b>                      2.1 The Innovation Concept                      2.2 Importance of Innovation for Entrepreneurship                      2.3 Source of Innovation for Opportunities                      2.4 The Innovation Process                      2.5 Product life cycle, new product development process, mortality curve                      2.6 Creativity and innovation in product modification/ development</p>
	<p>2e. Describe the role of entrepreneur in modern economy.</p>	<p><b>Entrepreneurship and Economic Development</b>                      2.7 Role of Entrepreneurship in Modern Economy</p>
	<p>2f. Compare the managers with entrepreneurs.</p>	<p><b>Managers Vs Entrepreneurship</b>                      2.8 Characteristic of Managers                      2.9 Characteristic of Entrepreneurs                      2.10 Similarities and differences between Managers and Entrepreneurs</p>
<p><b>UNIT-III</b>  <b>Introduction to Management and Organization</b></p>	<p>3a. Explain the concept and differences between industry, commerce and business.                      3b. Describe various types of ownership in the organization.</p>	<p><b>Introduction</b>                      3.1 Industry, Commerce and Business                      3.2 Types of ownership in the organization – Definition, Characteristics, Merits &amp; Demerits                      3.3 Single ownership, Partnership                      3.4 Cooperative Organizations                      3.5 Joint Stock Companies                      3.6 Government owned</p>
	<p>3c. Distinguish management and</p>	<p><b>Management and Administration</b>                      3.7 Differences between Management and</p>

	administration. 3d. Describe the role of management	Administration 3.8 Management as a science and as an art
	3e. Explain different types of leadership models.	<b>Leadership Models</b> 3.9 Different Leadership Models 3.10 Autocratic Leader 3.11 Democratic Leader 3.12 Free Rein Leader 3.13 Freelance Leader
<b>UNIT-IV</b> <b>Functions of Management</b>	4a. Analyze the nature and importance of planning. 4b. Discuss various types of planning. 4c. Describe types of plan. 4d. Explain basic steps in planning.	<b>Function of Management: Planning</b> 4.1 What is planning? Definition and Meaning 4.2 Types of Planning - Strategic Plan, Tactical Plan and Operation Plan 4.3 The Basic Steps in the Planning Process 4.4 Why Managers Plan? 4.5 Planning as a Function of Management 4.6 Emerging issues in Effective Planning
	4e. Discuss the nature and purpose of organizing. 4f. Describe the types of organizing. 4g. Explain basic steps in organizing process. 4h. Discuss emerging issues in effective planning and organizing.	<b>Function of Management: Organizing</b> 4.7 Organizing – Definition and Meaning 4.8 Types of Organizing 4.9 The Basic Steps in the Organizing Process 4.10 Organizing – Merits & Demerits 4.11 Emerging issues in Organizing
	4i. Explain the meaning and types of staffing. 4j. Describe the meaning of recruitment and selection	<b>Function of Management: Staffing</b> 4.12 Staffing – Definition and Meaning 4.13 Types of Staffing – Internal & External 4.14 The Basic Steps in the Staffing Process 4.15 Staffing – Merits & Demerits 4.16 Emerging issues in Staffing
	4k. Explain the meaning and nature of direction.	<b>Function of Management: Directing (Leading)</b> 4.17 Directing – Definition and Meaning 4.18 The Basic Steps in the directing Process 4.19 Directing – – Merits & Demerits 4.20 Emerging issues in Directing
	4l. Describe the meaning and essentials of controlling. 4m. Explain basic steps of establishing	<b>Function of Management: Controlling</b> 4.21 Controlling – Definition and Meaning 4.22 Types of Controlling 4.23 The Basic Steps in the Controlling

	control.	Process 4.24 Relationship between Planning and Controlling 4.25 Feedback
<b>UNIT-V Social Responsibility and Managerial Ethics</b>	5a.– Describe social responsibility and relate with economic performance. 5b. Explain the concept of greening of management.	<b>Social Responsibility</b> 5.1 What is Social Responsibility? 5.2 Social Responsibility and Economic Performance 5.3 The Greening of Management – Social Obligation, Social Responsiveness and Social Responsibility
	5b. Explain managerial ethics.	<b>Managerial Ethics in Modern Times</b> 5.4 Value Based Management 5.5 Managerial Ethics 5.6 Different NGOs 5.7 Social Responsibility and Ethics Issues in Today's World

## 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	The Nature of Entrepreneurship	16	06	08	06	20
II	The Importance of Entrepreneurship	08	03	04	03	10
III	Introduction to Management and Organization	08	03	04	03	10
IV	Functions of Management	16	06	08	06	20
V	Social Responsibility and Managerial Ethics	08	03	04	03	10
	<b>Total</b>	<b>56</b>	<b>16</b>	<b>16</b>	<b>24</b>	<b>70</b>

**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 SELF EXERCISES/ TUTORIALS

-----Not applicable-----

## 8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed activities, students should prepare a portfolio of the completed activities for future use:

- i. Develop two products from household waste (attach photographs).
- ii. Download product development and innovative films from internet.
- iii. Prepare a collage for "Traits of successful entrepreneurs."

- iv. Invite entrepreneurs, industry officials, bankers for interaction. Interview at least four entrepreneurs or businessman and identify
- v. Charms of entrepreneurship and Traits of successful entrepreneurs
- vi. Identify your hobbies and interests and convert them into business idea.
- vii. Convert you project work into business.
- viii. Mock Business Model- Choose a product and design a unique selling proposition, brand name, logo, advertisement (print, radio, television), jingle, packing, packaging, label for it.
- ix. Develop your own website. Share your strengths and weakness on it. Declare your time bound goals and monitor them on the website.
- x. Choose any product/ advertisement and analyse its good and bad points/ cost sheet/ supply chain etc
- xi. Study schemes for entrepreneurship promotion of any bank.
- xii. Visit industrial exhibitions, trade fairs and observe nitty-gritty of business. Get news of Vibrant Gujarat Events. (Upcoming in Jan 2015)
- xiii. Open a savings account and build your own capital.
- xiv. Arrange a visit to a Mall and prepare report.
- xv. Organise industrial visit and suggest modifications for process improvement.
- xvi. Conduct a market survey for a project. Collect data on machinery specifications, price, output/hr, power consumption, manpower requirement, wages, raw material requirement, specification, price, competitor's product price, features, dealer commissions, marketing mix etc.
- xvii. Prepare a business plan and organize a business plan competition.
- xviii. Select a social cause, set objectives, plan and work for its accomplishment. Find details about Different NGOs.

## 9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Instructors should emphasise more on exemplery and deductive learning.
- ii. Students should learn to recognise, create, shape opportunities, and lead teams for providing economic-social value to society.
- iii. Business simulations should be used to enhance behavioural traits of successful intrapreneurs and entrepreneurs amongst students.
- iv. Emphasis should be on creating entrepreneurial society rather than only setting up of enterprise.
- v. They must be encouraged to surf on net and collect as much information as possible.
- vi. Each student should complete minimum ten activities from the suggested list. Minimum possible guidance should be given for the suggested activities.
- vii. Students should be promoted to use creative ideas, pool their own resources, finish their presentation, communication and team skills.
- viii. Alumni should be frequently invited for experience sharing, guiding and rewarding students.
- ix. Display must be arranged for models, collages, business plans and other contributions so that they motivate others.
- x. You may show video/animation film / presentation slides to demonstrate various management functions, traits of entrepreneur etc.
- xi. Arrange a visit to nearby venture capital firm.
- xii. Give 1 Mini project and 1 project report for future business to all the students.
- xiii. The following pedagogical tools will be used to teach this course:
  - a) Lectures and Discussions
  - b) Role Playing

- c) Assignments and Presentations
- d) Case Analysis
- e) Quiz on Management and Entrepreneurship

## 10. SUGGESTED LEARNING RESOURCES

### [A] List of Books

Sl. No.	Title of Book	Author	Publication
1.	Entrepreneurship in Action	Coulter	PHI 2nd Edition
2.	Entrepreneurship Development	E. Gordon & K. Natarajan	Himalaya 2008
3.	Entrepreneurial Development	S S Khanka	S Chand & Co., New Delhi
4.	Entrepreneurship Development and Management	A. K. Singh	Jain Book Agency (JBA) publishes, New Delhi
5.	Small Scale Industries and Entrepreneurship	Vasant Desai	Himalaya 2008
6.	Entrepreneurship	Roy Rajeev	Oxford Latest Edition
7.	Industrial Engineering and Management	O.P.Khanna	Dhanpat Rai and Sons, Delhi
8.	Industrial Organization and Management	Tara Chand	Nem Chand and Brothers; Roorkee
9.	Industrial Management and Entrepreneurship	V. K. Sharma.	Scientific Publishers, New Delhi
10.	Project profile for reserved	Govt. of India.	Development commissioner SSI, Items VOL,I,II & III New Delhi.
11.	New project opportunities	Govt. of Gujarat	GITCO series - I, II and III.
12.	Small scale industry	Govt. of India.	Ministry of Industry Govt. of India Policy & Perceptive
13.	Import-Export Policy for SSI	Govt. of India.	Govt. of India.
14.	Dialogue with the Entrepreneur	Govt. of Gujarat	GSFC

### [B] List of Software/Learning Websites:

- i. <https://www.e-elgar.co.uk/PDFs/WebCats/EntrepreneurshipUK.pdf>
- ii. Dabbawalas Case- <http://www.youtube.com/watch?v=N25inoCea24>
- iii. Barefoot College [http://www.ted.com/talks/bunker\\_roy.html](http://www.ted.com/talks/bunker_roy.html)
- iv. Entrepreneurship Class XI, XII- CBSE, New Delhi
- v. The Art of the Executive Summary by Bill Reichert [www.garage.com/resources/writingexecsum.shtml](http://www.garage.com/resources/writingexecsum.shtml)
- vi. Write a Business Plan – Essential Elements of a Good Business Plan



- www.sba.gov/smallbusinessplanner/plan/writeabusinessplan/SERV\_ESSENTIAL.html
- vii. <http://www.entrepreneur.com>
  - viii. [www.nabard.com](http://www.nabard.com)
  - ix. <http://www.businessesforsale.com>
  - x. <http://www.youngentrepreneur.com>
  - xi. <http://www.ediindia.org>
  - xii. [www.msme.gov.in](http://www.msme.gov.in)
  - xiii. [www.nimsme.org](http://www.nimsme.org)
  - xiv. [www.smallb.in](http://www.smallb.in)
  - xv. [www.gujagro.org/pdf/guidelines.pdf](http://www.gujagro.org/pdf/guidelines.pdf)
  - xvi. <http://www.entrepreneurship.org>
  - xvii. <http://www.loopnet.com>
  - xviii. My Own Business: A Course on How to Start Your Own Business – Sec. 1, 2, & 8
    - a. [www.myownbusiness.org/course\\_list.html](http://www.myownbusiness.org/course_list.html)

[C] **Some Films** (To be seen on Sundays/holidays by students on their own, not to be shown in polytechnics in any case)

- i. Any Body Can Dance (2013)
- ii. Corporate (2006)
- iii. Do Duni Char (2010)
- iv. Guru (2007)
- v. Oh My God (2013)
- vi. Pirates of Silicon Valley (1999)
- vii. Pursuit of Happiness (2006)
- viii. Rocket Singh (2010)
- ix. Start-up.com (2001)
- x. The Social Network (2010)
- xi. Wall Street (1987)
- xii. Band Baja Barat (2010)

## 11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

### Faculty Members from Polytechnics

- **Prof. U.V. Buch**, Sr. Lecturer in EC, Government Polytechnic for Girls, Surat
- **Prof. Rajan Popat**, Sr. Lecturer in EC, Government Polytechnic, Rajkot
- **Dr. Vijay Pithadia**, Sr. Lecturer in EC, Government Polytechnic, Amreli

### Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. (Mrs.) Susan S. Mathew**, Associate Professor, Dept. of Electrical and Electronics Engineering.
- **Dr. Joshua Earnest**, Professor, Dept. of Electrical and Electronics Engineering.



**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM  
COURSE TITLE: CONSUMER ELECTRONICS  
(COURSE CODE: 3361102)**

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
Electronics & Communication Engineering	Sixth

**1. RATIONALE**

In developing nations demand of consumer electronic appliances is increasing day by day. This requires large number of technically trained men power in relevant industries. Looking towards the need of the country, in-depth knowledge for maintaining various electronics audio-video systems and home appliances is necessary for diploma engineering students. This subject will introduce the students with working principles, block diagram and advance features of consumer electronics appliances like audio-video systems, microwave oven, washing machine, air-conditioner, camcorder etc. which in-turn will develop skills to diagnosis fault and rectification of that in systematic way. Knowledge so gained would also help in working in production units of these consumer gadgets. Students may also start their own repair workshops and may engage in fruitful self employment.

**2. COMPETENCY**

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Maintain various consumer electronic applications.**

**3. COURSE OUTCOMES (COs)**

The theory should be taught and practical should be undertaken in such a manner that students are able to acquire required learning outcomes in cognitive, psychomotor and affective domains to demonstrate the following course outcomes:

- Troubleshoot different types of microphones.
- Troubleshoot audio systems
- Test working of various colour TV
- Troubleshoot colour TV receivers.
- Maintain various electronic home appliances.

**4. TEACHING AND EXAMINATION SCHEME**

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

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

## 5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (Outcomes in Cognitive Domain)	Topics and Sub-topics
<b>UNIT-I Audio Fundamentals and Devices</b>	1a. Describe the fundamental audio signal characteristics: sound intensity, pitch, fidelity and loudness 1b. Describe the method of sound intensity measurement 1c. With sketches describe operating principles of different types of microphones 1d. With sketches describe operating principles of different types of loud speakers 1e. Explain optical sound recording process 1f. Compare stereophony and multichannel sound recording 1g. Describe MP3 standard 1h. Describe the troubleshooting procedure of audio devices	1.1 Basic characteristics of sound signal: level and loudness, pitch, frequency response, fidelity and linearity, Reverberation 1.2 Audio level metering, decibel level in acoustic measurement 1.3 Microphone: working principle, sensitivity, nature of response, directional characteristics, 1.4 Types: carbon, condenser, crystal, electrets, tie- clip, wireless 1.5 Loud speaker: working principle, characteristic impedance, watt capacity, 1.6 Types: electrostatic, dynamic, permanent magnet etc , woofers and tweeters 1.7 Sound recording: Optical recording, stereophony and multichannel sound, MP3 standard
<b>UNIT-II Audio Systems</b>	2a. Describe the working of the digital console and home theatre system with a block diagram 2b. Explain working principle of digital FM tuner 2c. Select a PA address system configuration for different configurations 2d. Describe the troubleshooting procedure of audio systems	2.1 Audio system: CD player, home theatre sound system, surround sound 2.2 Digital console: block diagram, working principle, applications 2.3 FM tuner: concepts of digital tuning, ICs used in FM tuner TDA 7021T 2.4 PA address system: planning, speaker impedance matching, Characteristics, power amplifier, Specification

Unit	Major Learning Outcomes (Outcomes in Cognitive Domain)	Topics and Sub-topics
<b>UNIT-III Television Systems</b>	3a. Describe scanning process with the help of suitable sketch 3b. Differentiate salient features of monochrome and colour TV camera 3c. Explain various components of composite video signal with suitable sketch 3d. Differentiate between hue, brightness, saturation, luminance and chrominance 3e. Describe the working of colour TV camera 3f. Describe the troubleshooting procedure of a typical TV camera	3.1 Monochrome TV standards, scanning process, aspect ratio, persistence of vision and flicker, interlace scanning, picture resolution 3.2 Composite video signal: horizontal and vertical sync details, scanning sequence 3.3 Colour TV standards, colour theory, hue, brightness, saturation, luminance and chrominance 3.4 Different types of TV camera 3.5 Transmission standards: PAL system, channel bandwidth
<b>UNIT-IV Television Receivers and Video Systems</b>	4a. Describe functioning of colour TV receiver with the help of block diagram 4b. Explain working of flat panel displays 4c. Identify various interfaces available in digital TV receivers 4d. Describe working of DTH receiver. 4e. Describe operating principles of CD/DVD players 3g. Describe the troubleshooting procedure of a typical TV receivers and video systems	4.1 PAL-D colour TV receiver, block diagram, Precision IN Line color picture tube. 4.2 Digital TVs:- LCD, LED, PLASMA, HDTV, 3-D TV, projection TV, DTH receiver. 4.3 Video interface: Composite, Component, Separate Video, Digital Video, SDI, HDMI (Multimedia Interface), Digital Video Interface 4.4 CD and DVD player: working principles, interfaces
<b>UNIT-V Home / Office Appliances</b>	5a. Describe working of FAX and photocopier machine with its specifications 5b. Explain working of Microwave oven with sketches and specification 5a. Describe working of Washing machine with sketches., 5c. Discuss electronic control blocks of Air conditioner and Refrigerators 5b. Explain working of Digital camera and cam Coder 3h. Describe the troubleshooting procedure of a office/home appliances	5.1 FAX and Photocopier 5.2 Microwave Oven: types, single chip controllers, wiring and safety instructions, technical specifications 5.3 Washing Machine: wiring diagram, electronic controller for washing machine, technical specifications, types of washing machine, fuzzy logic 5.4 Air conditioner and Refrigerators: Components features, applications, and technical specification, 5.5 Digital camera and cam coder: - pick up devices - picture processing - picture storage

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

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Audio fundamentals and Devices	10	05	07	00	12
II	Audio systems	10	05	06	00	11
III	Elements of Television Systems	10	06	10	00	16
IV	Television Receivers and Video Systems	12	04	06	04	14
V	Home/Office Appliances	14	06	06	05	17
<b>Total</b>		<b>56</b>	<b>26</b>	<b>35</b>	<b>09</b>	<b>70</b>

**Legends:** R = Remember, U = Understand, A= Apply and above Level (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 EXERCISES/PRACTICALS

The practical 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. However, if these practical 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)	Hrs. required
1	I	Measure audio intensity level with the help of suitable audio level meter	02
2	II	Build and Test FM tuner	04
3	II	Build Test 2 channel audio power amplifiers.	04
4	II	Build Test sound mixer circuit	02
5	III	Verify graphic equalizer circuit	02

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hrs. required
6	IV	To obtain composite video signal by using TV pattern generator and measure its dimensions	02
7	IV	To visualize / compare the various patterns of colour TV pattern generator for fault finding.	02
8	IV	Operate digital TV trailer kit and observe wave form	02
9	IV	Verify the performance of LED TVs. Compare performance parameters of at least three brands.	02
10	V	Explore the various functions of automatic washing machine and locate various sensors used in that washing machines	02
11	V	Check the wiring of ACs and explore all the functions	02
12	V	Test various functions of microwave oven	02
13	V	Verify functions of Camcorder	02
14	V	Explore digital cameras settings.	02
15	V	To build and test temperature control system	02
16	V	To build and test circuit for AC motor control	02
Total Hours			36
<p><b>Note:</b> Perform any of the practical exercises from above list for total of minimum 28 hours depending upon the availability of resources so that skills matching with the most of the outcomes of every unit are included.</p>			

## 8. SUGGESTED STUDENT ACTIVITIES

- i. Trouble shoot the common consumer electronics products like T.V., Washing machine, microwave oven, FAX, Copier machine,
- ii. Conduct market survey for latest home appliances and compare specifications of reputed brands and prepare a report
- iii. Make visit to service centers of gadgets covered in curriculum and if possible work there for some days on voluntarily basis during holidays.
- iv. Search internet websites for DYS (Do Your Self) repair of electronic gadgets and try your hands to repair some gadgets based on that.

## 9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Arrange demonstration sessions in labs by inviting technicians working in service centers of reputed makes as visiting lecturers for lab sessions

- ii. Show video/animation films to demonstrate the working principles, constructional features, testing and maintenance procedures of various home appliances.
- iii. Arrange a visit to nearby manufacturer of consumer electronics products.
- iv. Use Flash/Animations to explain the working of different electronics control circuits.
- v. Implement value addition circuits for the consumer electronic product based on Innovative ideas.

## 10. SUGGESTED LEARNING RESOURCES

### A) BOOKS

No.	TITLE	AUTHOR	PUBLISHER
1.	Consumer Electronics	Bali S.P.	Pearson Education India, 2010 , latest edition
2.	Audio video systems : principle practices & troubleshooting	Bali R and Bali S.P.	Khanna Book Publishing Co. (P) Ltd., 2010 Delhi , India, latest edition
3.	Modern Television practices	Gulati R.R.	New Age International Publication (P) Ltd. New Delhi Year 2011, latest edition
4.	Audio video systems	Gupta R.G.	Tata Mc graw Hill, New Delhi, India 2010, , latest edition
5.	Mastering Digital Television	Whitaker Jerry & Benson Blair	McGraw-Hill Professional, 2010 , latest edition
6.	Standard handbook of Audio engineering	Whitaker Jerry & Benson Blair	McGraw-Hill Professional, 2010 , latest edition

### B) Major Equipment/Materials

- i. CRO (100Mhz)
- ii. Multimeter(3and1/2 digit digital) ,
- iii. Pattern generator
- iv. Audio level meter
- v. DB Meter
- vi. Microphone of Different Types
- vii. Loudspeaker
- viii. Digital TV trainer
- ix. Continuity tester

### C) Software/Learning Websites:

- i. [www.nptel.ac.in](http://www.nptel.ac.in)
- ii. [www.youtube.com](http://www.youtube.com)
- iii. [www.wikipedia.com](http://www.wikipedia.com)
- iv. [www.learnerstv.com](http://www.learnerstv.com)

**11. COURSE CURRICULUM DEVELOPMENT COMMITTEE****Faculties from Polytechnics, Gujarat**

- **Prof. M. S. Dave**, Sr. Lecturer (EC) G .P. Ahmedabad
- **Prof. N. R. Merchant**, Lecturer (EC) G .P .Ahmedabad
- **Prof. Hitesh Patel**, Lecturer (EC) B. S. Patel Poly., Kherva.
- **Prof. K. P. Patel**, Lecturer (EC) K D Polytechnic , Patan

**Coordinator Faculty Members from NITTTR Bhopal**

- **Dr. Anjali Potnis**, Assistant Professor, Department of Electrical and Electronics Engineering
- **Prof. Joshua Earnest**, Professor, Department of Electrical and Electronics Engineering



**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM**

**COURSE TITLE: MAINTENANCE OF ELECTRONICS EQUIPMENT  
(COURSE CODE:3361103)**

Diploma Programme in which this course is offered	Semester in which offered
Electronics and Communication	Sixth

**1. RATIONALE**

Equipment with electronic circuitry are increasingly being used in all the Industry and maintenance of them is the essential work for the proper functioning of the complete system. This course will enable the students to develop skills to maintain the basic electronic circuitry used in these equipment, which are employed in Industry and in consumer goods segments. This course will also enable them to fulfill the basic prerequisite for the advance maintenance issues which they will face in the Industry. After learning this course students can also start their own electronic repair workshop as a self-employer.

**2. COMPETENCY**

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Maintain the electronic circuits of various equipment.**

**3. COURSE OUTCOMES (COs)**

The theory should be taught and practical should be undertaken in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domains to demonstrate the following course outcomes:

- Identify and test various active and passive components.
- Handle different types of Electronic measuring Instruments
- Diagnose faults in electronics equipments.
- Troubleshoot computer hardware and networking
- Maintain SMPS, UPS, Inverter, solar power system, various analog and digital circuits, internal section of computer system, LED/ LCD TV, Cell phone (Mobile)/ microwave oven etc

**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	50
0	0	2	2	00	00	20	30	

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

## 5. COURSE CONTENT DETAILS

**Note:** There would not be separate classes for following theory content, this has to be discussed by the faculty while demonstrating practical in the lab.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
<b>Unit – I Concept of Maintenance</b>	1a. Explain the basic steps of electronic equipment maintenance. 1b. Describe the types of maintenance 1c. Select the desired or proper instrument for suitable measurement. 1d. Summarize safety measure before troubleshooting. 1e. Explain troubleshooting procedure, fault analysis and fault location. 1f. Define reliability and its associated parameter. 1g. Identify with specification, commonly used tools. 1h. List dos and don'ts for use and maintenance of tools.	1.1 Maintenance steps and its types 1.2 Preventive, predictive and breakdown maintenance 1.3 Measuring instruments 1.4 Precaution 1.5 Safety measures 1.1 Troubleshooting procedure 1.2 Equipment reliability and its parameter 1.3 Demonstration and use of hand tools: Screw driver, pliers, tweezers, wire stripper, scribes, hacksaw, files, bench vice, drilling machine, drilling bits (0.8, 1.0, 1.2, 1.5mm)
<b>Unit – II Testing of Electronic Component</b>	2a. Use data book and hand book to find out the device specifications 2b. Identify various connectors. 2c. Describe procedure for testing connectors.	2.1 Various parameters of electronic active/passive components using data book 2.2 Search and know various parameters of different types of ICs using data book 2.3 Testing of passive components separately or Mounted on PCB like: Resistor, Capacitors Other components : Switches, Inductors, Relays, Transformers 2.4 Fuses, Connectors, Single/three phase MCBs, single phase ELCBs, RJ45 connector
	2d. Identify and test various electronics components. 2e. Describe procedure for testing various electronics components	2.5 Testing of all kind of active electronics components separately or Mounted on PCB using DMM or CRO like: Diodes, Transistors, FETs, MOSFET's, SCR, DIAC, TRIAC, Displays using LCD or LED, TTL and CMOS IC's, Opto electronics components, Crystal
	2f. Describe Soldering and de-soldering process of various types	2.6 Prepare component for soldering, soldering and de soldering using

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	of electrical and electronics components.	soldering stations , concept of machine soldering
<b>Unit – III Testing of Electronic Circuits</b>	3a. Describe procedure for conducting A.C./D.C. voltage measurement and continuity test 3b. Inspect the various solder joints of given circuits 3c. Describe steps for testing of on board passive components 3d. Describe steps for testing of on board active components 3e. Describe steps for testing of on board ICs 3f. List steps for diagnosing faults of nonworking circuit and rectifying it.	3.1 Measurement of A.C. voltage and D.C. voltage using millimeter for the given circuit. 3.2 Continuity test of PCB track, wiring, switch etc. 3.3 Inspection of solder joints, defects of soldered joints in given circuits, familiarizations to rework and repair using multi-meter 3.4 Test the components like resistors, capacitors, inductors etc. connected on given PCB 3.5 Test the components like transistors, diodes etc. connected on given PCB 3.6 Test the ICs connected on given PCB 3.7 Diagnose fault and troubleshoot that in a given electronic circuit
<b>Unit – IV Maintenance of Computer System</b>	4a. List steps for assembling a Computer system 4b. Install operating system software on a Computer system 4c. Install Application software on a Computer system 4d. Uninstall software and reinstall that step by step 4e. Configure Computer to connect in a LAN network environment	4.1 Various parts of computer system and its assembling 4.2 Installation of operating system, application software, antivirus etc. 4.3 Computer system hardware maintenance 4.4 Formatting and maintenance of computer system 4.5 Network installation, IP address setting etc. and its maintenance
<b>Unit – V Maintenance of Home Appliances and Industrial Equipments</b>	5a. Describe common Step of maintenance of various type of home appliances 5b. Describe common Step of maintenance of various type of Industrial equipments 5c. Describe common Step of Maintenance of solar power system 5d. Describe common Step to Troubleshoot mobile	5.1 Maintenance of home appliances like microwave oven, LED/LCD TV, music player, mobile phone, laptop, camera, etc. 5.2 Maintenance of Industrial electronic equipments like ...medical equipments, CRO, PLC based instruments. 5.3 Installation of solar power system. 5.4 Mobile hardware.

## 6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARK (Theory)

There is no end of the semester theory examination and hence it is not applicable

## 7. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical 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. However, if these practical 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. Hours Required
1.	I	Demonstrate use of various hand held tools.	02
2.	II	Test the performance of different passive electronic components (fixed/variable)	04
3.	II	Test the performance of active electronic components like general purpose transistor/FET/MOSFET/SCR/DIAC/TRIAC with DMM and CRO OR Components Tester	06
4.	II	Test the performance of miscellaneous electronics components(transformers ,Loudspeaker, microphone, Relays, Solenoid, Switches, DC Motors, Stepper Motor ,sensors, opto electronics components	06
5.	II	Verify the functionality of TTL and CMOS Digital IC's using IC tester	02
6.	II	Explore datasheet of minimum any five electronics components and analog/ Digital IC's.	02
7.	III	Draw the given regulated power supply circuit/ SMPS ( from any television/fridge/ computer system/ laboratory etc)	02
8.	III	Demonstrate steps of installation of online/ Offline UPS..	04
9.	IV	Identify basic sections of a personal computer	02
10.	IV	List the technical specifications of various computer peripherals. (e.g. CPU, Monitor, Keyboard, Mouse, Speaker, Web cam, Printer, Scanner, microphone, speakers, modem, projector etc).	04
11.	IV	Examine different types of motherboards and identify various ports and slots on it.	02
12.	IV	Test the voltage at different output points of SMPS of desktop and laptop computer system	02

S. No.	Unit No.	Practical/Exercises (outcomes in psychomotor domain)	Approx. Hours Required
13.	IV	Troubleshoot the booting process of computer system	02
14.	V	Explore circuit diagram of LED, and LCD TV.	02
15.	V	Demonstrate troubleshooting steps of Laptop for the common fault	02
16.	V	Explore circuit of any home theatre system and prepare its circuit diagram /wiring diagram	02
17.	V	Demonstrate any one the medical equipment troubleshooting steps	02
18.	V	Demonstrate installation Solar power system	02
19.	V	Demonstrate Installation of DTH system	02
20.	V	Demonstrate the steps of maintenance of copier machine	02
21.	V	Practice steps for mobile troubleshooting	02
<b>Total Hours</b>			<b>54</b>
<b>Note:</b> Depending upon the availability of resources, perform any of the practical exercises from above list for total of minimum 28 hours so that skills matching with the most of the outcomes of every unit are included.			

### 8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

- i. Maintain domestic electronic devices.
- ii. Diagnose fault in the non working home appliance and rectify that.
- iii. Discuss case study of any fault detection and rectification problem
- iv. Maintain the office electronic equipment.
- v. Make visit to service centers of gadgets/equipment covered in curriculum and if possible work there for some days on voluntarily basis during holidays.
- vi. Search internet websites for DYS (Do Your Self) information for repair of electronic gadgets/equipment or collect manuals for repair and maintenance and try your hands to repair some gadgets/equipment based on that.

### 9. SPECIAL INSTRUCTIONAL STRATEGY (If Any)

- i. Show Video/ Animation film explaining different field applications of PLC, DCS and SCADA.
- ii. Prepare a chart related to PLC,DCS and SCADA Hierarchy
- iii. Arrange demonstration sessions of maintaining equipment/gadgets in labs by inviting engineers/technicians working in service centers of reputed makes as visiting lecturers for lab sessions
- iv. Arrange visit to repair centers of reputed makes of consumer goods/Industrial equipment suppliers.
- v. Arrange group discussions on the troubleshooting of electronic equipment issues.
- vi. Arrange Seminar on Safety and Maintenance issues (ask students to explore the internet and visit nearby industries to collect information regarding the chosen topic/issue)

## 10. SUGGESTED LEARNING RESOURCES

### A) Books

S. No.	Title of Books	Author	Publication/Year
1.	Troubleshooting and Maintenance of Electronics Equipment	Singh K. Sudeep	Katson Book ,New Delhi ,II edition , Reprint 2014
2.	Troubleshooting Electronic Equipment: Includes Repair and Maintenance, Second Edition	Khandpur R. S.	Tata McGraw-Hill Education, New Delhi ,India , latest edition
3.	Mobile repairing Books	Manohar Lotia	BPB Publication, New Delhi , latest edition
4.	Data Books	National semiconductor	National semiconductor

### B) Major Equipment/Materials with specification

1. CRO (Analog/ DSO),
2. Multimeter (Analog/ Digital)
3. Soldering and Desoldering Station
4. Different types of electronic and electrical cables, connectors, sockets, terminations.
5. Various analog and digital ICs
6. Neon tester 500 V.
7. Screw driver set (set of 5 )
8. Insulated combination pliers 150 mm
9. Insulated side cutting pliers 150 mm
10. Long nose pliers 150 mm
11. Soldering iron 25 W. 240 V. with solder materials
12. Electrician knife
13. Tweezers 100mm
14. Soldering Iron Changeable bits 10 W
15. De- soldering pump
16. Crimping tool (pliers)
17. Allen key set (set of 9)
18. Magnifying lenses 75mm with illumination
19. Continuity tester
20. Dual DC regulated 15-0-15 volt, 2 Amp
21. LCR meter (Digital)
22. Signal Generator, 0-100 KHz
23. Battery Charger
24. Digital and Analog IC Tester
25. General purpose PCBs, bread board, MCB , ELCB
26. Clip on ammeter
27. RF Power meter
28. Field strength meter
29. Air Blower (500 Watt)

**C. Learning Websites/ Software**

- i. [http:// youtube.com](http://youtube.com) (Repairing of various gazette)
- ii. [http:// www.computerhope.com/basic.htm](http://www.computerhope.com/basic.htm)
- iii. <http://computer.howstuffworks.com/computer-hardware-channel.htm>
- iv. <http://www.automationtechnology.de/cms/en/markets-solutions/electronics.html>
- v. <http://www.talkingelectronics.com>
- vi. [www.fixya.com](http://www.fixya.com)
- vii. [www.ifixit.com](http://www.ifixit.com)
- viii. [www.fastrepairguide.com](http://www.fastrepairguide.com)
- ix. [ww.repairfaq.org](http://ww.repairfaq.org)

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

- **Prof. S J Chauhan**, HOD (EC) , Government Polytechnic, Rajkot
- **Prof. S G Valvi**, Sr. Lecturer , Government Polytechnic for Girls, Surat
- **Prof. B B Renuka**, Sr. Lecturer AVPTI , Rajkot
- **Prof. R G Patankar**, Lecturer Government Polytechnic. Gandhinagar

**Coordinator and Faculty Members from NITTTR Bhopal**

- **Dr. Anjali Potnis**, Assistant Professor, Department of Electrical and Electronics Engineering
- **Prof. Joshua Earnest**, Professor, Department of Electrical and Electronics Engineering



**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM  
COURSE TITLE: PROJECT-II  
(COURSE CODE: 3361109)**

<b>Diploma Programmes in which this course is offered</b>	<b>Semester in which offered</b>
ELECTRONICS & COMMUNICATION	SIXTH

**1. RATIONALE**

To 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 implementation , which is economically and technologically viable.

**2. COMPETENCY**

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

- i. Co-creation & Interpersonal abilities
- ii analysis Test and Troubleshooting skills
- iii Programming/simulation/ debugging skills
- iv PCB fabrication/soldering skills
- v modeling skill
- v Documentation & Presentation skill

**3. Course Outcomes**

At the end of the course, student will able to

- i. Develop ability to create PCB
- ii Identify component and check their ratings
- iii Develop soldering skills and mounting components on PCB
- iv Test Continuity of the wires/tracks and leads
- v. Develop software development skill
- vi. Simulate, Design and debugging of the circuit
- vii. Implementation of the proposed solution
- viii. Troubleshooting hardware in final implementation
- ix. Observe responses using CRO
- x. Work in team cohesively & effectively
- xi. Design and fabricate model
- xii. Prepare project report having organized documentation.
- xiii. Prepare & deliver presentation.
- ix. Visualize the roadmap of the further expansion

#### 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	300
0	0	06	06	0	0	100	100	

**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
<b>Stage-I</b> Create PCB/Write Program Codes	1.a. Build actual PCB from the PCB layout design. 1.b. Identify components and assure their ratings 1.c. Write actual code from algorithm	1.1 Physical creation of Printed Circuit Board 1.2 Verification of Component ratings and specifications 1.3 Program development in Assembly/high level language
<b>Stage- II</b> Component Mounting and soldering/rect ification of syntax errors	2.a. Check all tracks for continuity 2.b. Mount and solder components on PCB 2.c. Run program modules and check for syntax errors	2.1 Continuity test for PCB tracks 2.2 Mounting and Soldering component on PCB 2.3 Execute program modules and debugging for syntax errors
<b>Stage- III</b> Software Testing and Loading/ Hardware Test	3.a. Unit Testing of software 3.b. Program testing 3.c. Loading program on chip/ on system	3.1 Debug system modules for logical errors 3.2 Test program as a whole after linking modules to main program 3.3 Test program and load on chip/on system 3.4 Test Hardware circuit if software is not there in scope of project
<b>Stage – IV</b> Final Implementati on	4.a. Execute program 4.b. Test for various inputs 4.c. Troubleshoot final hardware/software	4.1 Execute loaded program on actual hardware and observe response. 4.2 Test hardware behavior for all possible inputs to the circuit. 4.3 Troubleshoot hardware/software for unexpected/faulty behaviour 4.4 Correct Hardware/software and execute the program until getting desired/expected response.
<b>Stage – V</b> Model design	5.a. Prepare model design 5.b. Create model	5.1 Design model and

Stage	Major Learning Outcomes	Topics and Sub-topics
	5.c. Test Model	5.2 Create list of requirement for implementation of model 5.3 fabricate and construct model 5.4 Connect circuit responses to model and test model for its working.
<b>Stage – VI</b> Documentati on & final Presentation	5.a. Prepare project report 5.b. Prepare PPT presentation 5.c. Present final project work	5.1 Prepare project report as per GTU guideline. 5.2 Prepare PPT and present as per schedule. 5.3 Demonstrate with model*

\*Note: Model(It is not compulsory but desirable if there is any scope of modeling for effective realization of functioning of project work.)

## 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	Create PCB/Write Program Codes	08	05	05	20	30
II	Component Mounting and soldering/rectification of syntax errors	12	05	05	20	30
III	Software Testing and Loading/ Hardware Test	20	05	10	25	30
IV	Final Implementation	20	00	05	25	30
V	Model design	12	00	05	25	30
VI	Documentation & final Presentation	12	00	00	30	50
	Total	<b>84</b>	<b>15</b>	<b>35</b>	<b>50</b>	<b>200</b>

**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. Create actual PCB in laboratory from layout
- ii. Component mounting and soldering practice
- iii. Visit industry regularly.
- iv. Get help from Innovation council/research organization for implementation methods/strategy
- v. Report regarding stage wise progress to institute guide/industry mentor regularly.
- vi. Continuous test and debugging of software using various tools for error free compact solution.
- vii. Study of intellectual property rights for patenting the project.

viii. Fabrication and construction of models

## 8. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Seminar/Symposium
- ii. Group discussion/Debate
- iii. Expert lectures of resource persons from industries/research organizations.
- iv. Arranging Industrial visit.
- v. Project Exhibition
- vi. Mock presentation of project

## 9. SUGGESTED LEARNING RESOURCES

### A) List of Magazines.

- i. Planet Analog
- ii. Elector electronics.
- iii. Electronic design
- iv. EDA Tech Forum
- 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.
- 12) Simulation tools
- 13) Cross compilers

### C) List of Software/Learning Websites

<http://www.electronicshub.org>  
<http://www.engineersgarrage.org>  
<http://www.electronics-project-design.com>  
<http://www.eleccircuit.com>  
<http://www.circuit-projects.com>  
<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**

- Mr. P M Patel, I/C Principal , GGP surat
- Mr.K.N.VAGHELA, Sr. Lecturer, G.P., Ahmedabad
- Mr. D.H.AHIR , Sr. Lecturer G.P.,Rajkot
- Mr. M.S.DAVE , Sr. Lecturer G.P.,Ahmedabad

### **Coordinator and Faculty Members from NITTTR Bhopal**

1. Dr. Anjali Potnis , NITTTR, bhopal

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM  
COURSE TITLE: VLSI  
(COURSE CODE: 3361104)**

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
Electronics and Communication Engineering	Sixth

### 1. RATIONALE

Digital integrated circuits are integral part of electronic equipment/gadgets starting from small toys to complex computer systems including personal digital assistants, mobile phones and Multimedia agents. This course will enable the students to acquire the basic skills to develop codes for VLSI circuits through VHDL programming. This course will also enable them to use FPGA and ASIC chips for design and development of various applications. Thus this course is an advance but very useful course for electronic engineers.

### 2. COMPETENCY

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Develop codes through VHDL programming for VLSI based electronic systems**

### 3. COURSE OUTCOMES

The theory should be taught and practical should be undertaken in such a manner that students are able to acquire required learning outcomes in cognitive, psychomotor and affective domains to demonstrate the following course outcomes:

- Maintain MOS based systems
- Maintain MOS inverters
- Maintain MOS circuits
- Develop VHDL Programs related to Combinational circuits
- Develop VHDL Programs related to Sequential circuits

### 4. TEACHING AND EXAMINATION SCHEME

<b>Teaching Scheme (In Hours)</b>			<b>Total Credits (L+T+P)</b>	<b>Examination Scheme</b>				
				<b>Theory Marks</b>		<b>Practical Marks</b>		<b>Total Marks</b>
<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>ESE</b>	<b>PA</b>	<b>ESE</b>	<b>PA</b>	
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 (in cognitive domain)	Topics and Sub-topics
<b>Unit – I. Digital System and MOS Transistor</b>	1a. Describe of design methodologies and detail of Y Chart.	1.1 VLSI design flow, Y chart, Practical design flow
	1b Describe different domain and Define different terms regarding design Hierarchy.	1.2 Design Hierarchy-Structural Decomposition in the physical (geometrical) domain
	1c Explain the types of FPGA Technology.	1.3 FPGA, Gate Array Design, Standard Cell Based Design, Full Custom Design
	1d Explain Energy Band Diagram and Structure of MOS	1.4 MOS structure
	1e Explain effect of external bias on two terminal MOS device with energy band diagram.	1.5 MOS system under external bias
	1f Explain Formation of channel with different symbols of MOSFET.	1.6 Structure and operation of MOSFET transistor
	1g Explain gradual channel approximation.	1.7 MOSFET current- voltage Characteristics
<b>Unit– II MOS Inverters</b>	2a Explain the working of MOS Inverter	2.1 MOS Inverter : concept and working
	2b Explain operation of resistive load inverter without mathematical derivation of $V_{OL}$ , $V_{OH}$ , $V_{IL}$ , $V_{IH}$ , $V_{TH}$ . (Write Only Final Equation).	2.2 Resistive load Inverter
	2c Describe inverter circuit with saturated and Linear Enhancement and Depletion type load.	2.3 Inverter with n-type MOSFET Load, Enhancement load NMOS, Depletion Load NMOS
	2d Compare enhancement load NMOS and Depletion Load NMOS.	2.4 Enhancement load and Depletion Load NMOS
	2e Explain CMOS Inverter with Different Operating Modes of nMOS and pMOS transistor.	2.5 CMOS Inverter: Circuit operation and description
	2f Describe the working of Cascaded stages	2.6 Cascaded CMOS Inverter stages
<b>Unit– III MOS Circuits</b>	3a Explain two input NAND and NOR Gate with depletion NMOS load.	3.1 Combinational MOS Logic Circuits.
	3b Explain Two input NAND and NOR Gate using CMOS logic.	3.2 CMOS logic circuits
	3c Differentiate AOI and OAI Logic.	3.3 Complex logic circuit
	3d Design simple XOR function.	
	3e Describe the working of SR latch circuit.	3.4 Sequential MOS circuit
	3f Distinguish Clocked latch and Flip-Flop circuit.	3.5 VLSI Technology-Environment & Processes in brief



Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
<b>Unit-IV</b> Introduction to VHDL	4a Introduction to VHDL Programming methodology	4.1 Data flow, behavioural, structural
	4b Develop VHDL Programs related to basic logic gates.	4.2 Logic operations viz. AND,OR, NOR,NAND,NOT,EXOR, EXNOR etc.
	4c Develop VHDL Programs related to Fundamental Arithmetic operations.	4.3 Adder and Subtractor.
<b>Unit-V</b> VHDL Programming	5a. Develop VHDL Programs related to Combinational circuits.	5.1 Combinational circuits- Multiplexer and De multiplexer, Decoder and Encoder. 5.2 4 bit Parallel Adder. 5.3 Parity Generator and parity checker.
	5b. Develop VHDL Programs related to Sequential circuits.	5.4 Basic sequential circuits- SR , D Latch, RS, T, JK Flip flop 5.5 Parallel input Parallel output Shift Register, Up Counter, Down Counter

## 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	Digital System and MOS Transistor	8	4	6	6	16
II	MOS Inverters	12	4	4	6	14
III	MOS Circuits	12	5	5	8	18
IV	Introduction to VHDL	12	4	4	4	12
V	VHDL Programming	12	3	3	4	10
<b>Total</b>		<b>56</b>	<b>20</b>	<b>22</b>	<b>28</b>	<b>70</b>

**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 EXERCISES/PRACTICALS

The practical 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. However, if these practical 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. Hours Required
1	IV	Identify VHDL entities and coding styles.	2
2	IV	Simulate the Basic logic gates using VHDL.	2
3	IV	Simulate the Universal logic gates using VHDL	2
4	IV	Simulate X-OR and X-NOR logic gates using VHDL	2
5	IV	Simulate Half Adder using VHDL	2
6	IV	Simulate Full Adder using VHDL	2
7	IV	Simulate Half Subtractor using VHDL	2
8	IV	Simulate Full Subtractor using VHDL	2
9	V	Simulate 4 : 1 mux using VHDL	2
10	V	Simulate 1 : 4 de-mux using VHDL	2
11	V	Simulate 3 : 8 decoder using VHDL	2
12	V	Simulate 8 : 3 encoder using VHDL	2
13	V	Simulate SR flip-flops using VHDL	2
14	V	Simulate D flip-flops using VHDL	2
15	V	Simulate JK flip-flops using VHDL	2
16	V	Simulate T flip-flops using VHDL	2
17	V	Simulate 4 bit parallel adder using VHDL	2
18	V	Simulate 4 bit Up counter using VHDL	2
19	V	Simulate 4 bit Down counter using VHDL	2
20	V	Simulate any three above listed programs using Structural coding method	2
21	V	Hardware implementation of all above listed program	2
<b>Total Hours</b> (perform any of the practical exercises for a total of minimum 28 hours from above list depending upon the availability of resources so that skills matching with the most of the outcomes in the every unit is included)			<b>42</b>

## 8 SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities like:

- Survey Current requirement for Hardware/ Chip at your Company/ Department/ Institute.
- Identify basic Circuits etc.
- Project- Build a small ASIC for your Home /Community.
- Enhance features and components of your ASIC by providing more Hardware.
- Visit industries where equipment/gadgets using VLSI are being manufactured/assembled.

## 9 SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- Show Video/ Animation film explaining VLSI Design which are available on internet.
- Arrange expert lecture on VHDL programming for real life applications.

## 10 SUGGESTED LEARNING RESOURCES

### A) Books

S. No.	Title of Book	Author	Publication
1.	CMOS DIGITAL INTEGRATED CIRCUITS	Sung Mo Kang	TMH
2.	Introduction to VLSI Circuits and Systems.	Uyemura J.P.	WILEY INDIA PVT. LTD.
3.	VLSI DESIGN	Das Debaprasad	OXFORD
4.	VLSI DESIGN Theory and Practice	Vij Vikrant, Er. Syal Nidhi	LAXMI PUBLICATIONS PVT. LTD.
5.	Circuit design with VHDL	Pedroni V.A.	PHI
6.	VHDL Modelling of systems	Znawabi	TMH
7.	VHDL Programming by Example	Perry Douglas L.	MGH
8.	VHDL design	Bhaskar J	Pearson
9.	VLSI Technology	Chang C.Y. and Sze S. M.	McGraw Hill

### B) Major Equipment/Instruments with Broad Specifications

- i. Computer System
- ii. VLSI Trainer Kits
- iii. VHDL Simulator Software

### C) Software/Learning Websites

- i. QUARTUS-II-ALTERA EVAL VERSION
- ii. ModelSim® HDL simulator for use by students in their academic coursework.
- iii. ISE Simulator
- iv. <http://www.youtube.com/watch?v=9SnR3M3CIm4>

## 11 COURSE CURRICULUM DEVELOPMENT COMMITTEE

### Faculty Members from Polytechnics

- **Prof. K N Vaghela**, Sr. Lecturer in EC, Govt. Poly, Ahmedabad
- **Prof. U V Buch**, Sr. Lecturer in EC, Govt. Poly for Girls, Surat
- **Prof. J D Chauhan**, Lecturer in EC, Band B Poly, V. V. Nagar
- **Prof. L J Vora**, Lecturer in EC, Govt. Poly, Vadnagar

### Coordinator and Faculty Members from NITTTR , Bhopal

- **Prof. Sanjeet Kumar**, Assistant Professor, Department of Electrical and Electronics Engineering.
- **Dr. Anjali Potnis**, Assistant Professor, Department of Electrical and Electronics Engineering

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM  
COURSE TITLE: EMBEDDED SYSTEM  
(COURSE CODE: 3361105)**

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
Electronics and Communication Engineering	Sixth

**1. RATIONALE**

To add luxury to any product requires fully automation and for that we need embedded system, where we don't need user intervention. By learning this course students can develop their own embedded system which is application specific to solve given real time problem by using open source platform. Thus this course is an important course for students who want to work in the automation sector of electronic industry.

**2. COMPETENCY**

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Develop embedded systems for given application.**

**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.

- Maintain microcontroller based system.
- Select appropriate family of microcontroller for different application.
- Interface relevant hardware for given application.
- Develop programme for given application.
- Integrate hardware and software for embedded system for given application.

**4. TEACHING AND EXAMINATION SCHEME**

<b>Teaching Scheme (In Hours)</b>			<b>Total Credits (L+T+P)</b>	<b>Examination Scheme</b>				<b>Total Marks</b>
<b>L</b>	<b>T</b>	<b>P</b>		<b>Theory Marks</b>		<b>Practical Marks</b>		
			<b>C</b>	<b>ESE</b>	<b>PA</b>	<b>ESE</b>	<b>PA</b>	
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 CONTENT DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
<b>Unit – I Overview of Embedded System</b>	1a. Define basic concept of embedded system.	1.1 Embedded system: Embedded System Characteristics
	1b. Explain Characteristics of embedded system.	1.2 Examples: Washing Machine, Chocolate Vending Machine, Room Temperature Controller
	1c. Compare different Operating Systems used for embedded system designing.	1.3 Operating System(OS): Types of OS, Types of Mobile OS 1.4 Characteristics of Real Time Operating System
<b>Unit– II 8-bit Microcontrol lers Architecture (Atmega 8,AVR)</b>	2a. Compare different micro controllers used for embedded system designing.	2.1 Microcontroller Types: PIC, AVR, ARM: features and applications
	2b. Describe AVR microcontroller with its functional diagram .	2.2 AVR microcontroller: Types , Architecture
	2c. Describe block diagram of Atmega 8.	2.3 Internal Architectural ,Block diagram of controller (Atmega 8)
	2d. With a sketch, identify pins of ATmega 8.	2.4 Functions of each pins of ATmega 8
	2e. Introduce time delay using Timers and counters.	2.5 Configuration of Two 8-bit and One 16-bit Timers and Counters
	2f. Describe Operation of Analog to Digital Converter.	2.6 6-channel ADC Working
	2g. Describe Basic peripheral circuits connection required for the operation of 8 bit microcontroller (ATmega8).	2.7 Essential Peripheral circuits: Crystal Circuit, Power supply, Oscillator Circuit
	2h. Explain basic circuit and code required for programming (Boot Code).	2.8 Initial programming configurations of Atmega8: port, counter, timer 2.9 Bootloader Circuit
	2i. Compare basic features specifications of microcontrollers Atmega 8 and Atmega 328	2.10 ISP of Atmega 8 2.11 Tmega8 and ATmea328

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
<b>Unit- III Open Source Embedded Development Board (Arduino)</b>	3a Overview of open source embedded development board (Arduino). 3b Explain working of open source embedded development board using block diagram. 3c Identify pins of embedded development board. 3d Explain circuit diagram of open source embedded Hardware. 3e Describe the features of open source tool used for programming a development board. 3f Describe programming of embedded development board. 3g Interface Serial Port with embedded development board. 3h Make a Basic Circuit of embedded development Board.	3.1 Arduino: Birth, Open Source community 3.2 Functional Block Diagram of Arduino. 3.3 Functions of each Pin of Arduino 3.4 Arduino Development Board diagram (including different blocks only): IDE, I/O Functions, Looping Techniques, Decision Making Techniques 3.5 Designing of 1 <sup>st</sup> sketch 3.6 Programming of an Arduino (Arduino ISP) 3.7 Arduino Boot loader 3.8 Serial Protocol (serial port Interfacing) 3.9 Initialization of Serial Port using Functions 3.10 Basic Circuit For Arduino
<b>Unit-IV Interface Digital and Analog I/O Devices (Arduino Interfacing)</b>	4a Explain concept of input and output port of embedded development board (Arduino Interfacing Concept). 4b Explain Interfacing of Digital I/O devices with program (Digital I/O Interfacing). 4c Explain Interfacing of Analog I/O devices program (Analog I/O Interfacing ). 4d Explain interfacing of Keypad with programming (Keypad Interfacing).	4.1 Basic Interfacing and I/O Concept 4.2 Interfacing LED, Switch, 7seg LED its and Code 4.3 Interfacing POT, LM35, Accelerometer (ADXL35C) and its Code 4.4 Interfacing keypad and Code for it

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	4e Explain Interfacing of Serial port with programming (Serial Port Interfacing). 4i Explain Interfacing of DC motor with programming. 4k Explain Interfacing of 16x2 LCD with programming.	4.5 Initialization for serial port and code for it 4.10 Interfacing DC motor and its Code 4.12 Interfacing 16x2 LCD and its code
<b>Unit-V Embedded system Applications (Arduino)</b>	5a. Explain functional blocks of Line Follower Robot using Arduino. 5b. Explain functional blocks of Accelerometer Based Gesture Control Robot. 5c. Explain functional blocks of Home Automation using RF control. 5d. Design Basic ATmega8 Circuit 5e. Design an embedded development board (Arduino) . 5f. Test the designed circuit	5.1. Motor Driver L293D, IR Sensor 5.2. Interfacing L293D with Arduino 5.3. Code for Line Follower Robot 5.4. Interfacing Accelerometer with Arduino 5.5. Record Gestures, Code For Accelerometer based Robot 5.6. Interfacing of RF Tx/RF Rx with Arduino 5.7. Interfacing of Relay Driver ULN2803 with Arduino 5.8. Code for Home automation and its Control 5.9. Basic ATmega8 Circuit 5.10. Upload Bootcode for ATmega8 5.11. Interfacing of USB-UART

*Note: IDE commands are for programming only and for theory portion of subject (ch-4 and ch-5), students should draw the logical diagrams of different applications with digital and analog I/O connections.*

## 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
<b>I</b>	Overview of Embedded System	08	04	04	02	10
<b>II</b>	8 Bit Microcontrollers Architecture (Atmega 8,AVR)	10	04	04	02	10
<b>III</b>	Open Source Embedded Development Board (Arduino)	14	06	06	07	19
<b>IV</b>	Interface Digital and Analog I/O devices (Arduino Interfacing)	14	06	06	07	19
<b>V</b>	Embedded System Applications (Arduino)	10	02	04	06	12
	<b>Total</b>	<b>56</b>	<b>22</b>	<b>24</b>	<b>24</b>	<b>70</b>

**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 EXERCISES/PRACTICALS

The practical 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. However, if these practical 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 Hours required
1	II	Test AVR Micro-Controller Architecture.	2
2	II	Identify each block of ATmega8 with Pins.	2
3	III	Use Arduino Architectural diagram .	2
4	III	Test the different Arduino Boards, Open-Source and Arduino Shields.	2
5	III	Install Arduino IDE and its development tool.	2
6	V	Design an embedded development Board.(arduino)	6
7	III	Develop a program to Blink LED for 1second.	2
8	III	Develop a program to interface Input Switches and output LEDs with development board (arduino).	2
9	III	Interface 7 seg display with development board(arduino) and Write a program to count and display 0 to 9 on it.	2
10	IV	Develop a program to generate led pattern using computer serial control.	2
11	IV	Interface potentiometer with development board (arduino) and write a program to generate Led pattern on it.	2
12	IV	Interface LM35 temperature sensor with arduino and monitor temp. on serial monitor.	2
13	IV	Interface DC motor using L293D Motor Driver.	2
14	IV	Interface RF Tx/RF Rx with Arduino	4
15	IV	Interface 16x2 LCD and Display "HELLO WORLD".	2
16	IV	Make Line-Follower Robot using Arduino.	4
17	V	Build Digital thermometer using LM35 and LCD 16x2.	4
18	V	Build Gesture Control Robot using Accelerometer.	4
<b>Total Hours</b>			<b>48</b>
<b>Note:</b> Perform any of the practical exercises from above list (depending upon the availability of resources) for total of minimum 28 hours so that skills matching with the most of the outcomes of every unit are included.			

**8. SUGGESTED STUDENT ACTIVITIES**

Following is the list of proposed student activities such as:

- i. Prepare journals based on practical performed in laboratory.
- ii. Do assignments on theory
- iii. Prepare chart for different interfacing block diagram
- iv. Develop a practical application using Arduino
- v. Prepare your own Atmega8 Board with all ports available as connector

**9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)**

- i. Show video/animation film on Embedded Systems Applications with help of internet.
- ii. Arrange a visit to IITRAM, IGTR, nearby Centre of Excellence setup by CTE, Gujarat (in Engg. College etc.) or any such laboratory. Arrange a visit to a plant/ manufacturer having automatic assembly line. Arrange at least one of the above visits.
- iii. Give Mini projects to students.
- iv. Arrange expert lectures by engineers working in the area of embedded systems.

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

S. No.	Title of Book	Author	Publication
1.	Exploring Arduino	Jeremy Blum.	Wiley
2.	30 Arduino Projects for Evil Genius	Simon Monk	McGraw-Hill Professional
3.	Beginning Arduino	Michael McRoberts	Technology in Action
4.	Arduino For Teens	Kathleen Patterson	Course Technology
5.	Make: Arduino Bots and Gadgets	Kimmo and Tero Karvine	O'REILLY
6.	Arduino Cookbook	Michael Margolis	O'REILLY
7.	Arduino Internas	Dale Wheat	Technology in Action
8.	Arduino Projects to save the world	Brian Evans	Emery Premeaux
9.	Arduino Robotics	John-david, Warren Josh Adams, Harald Molle	Technology in Action
10	Beginning Arduino Programming	Brian Evans	Technology in Action
11	Getting Started with Arduino	Massimo Banzi	O'REILLY
12	Practical Arduino : Cool Projects for open source hardware	Jonathan Oxer, Hugh Blemings	Technology in Action
13	Practical Arduino Engineering	Harold Timmis	Technology in Action

S. No.	Title of Book	Author	Publication
14	Learn Electronics with Arduino	Don wilcher	Technology in Action

**B) Major Equipment/ Instrument with Broad Specifications**

- i. Embedded development board (Arduino Board ) - 20
- ii. Open Source IDE for embedded systems (Arduino)
- iii. Computer System - 20
- iv. Consumable as needed in application suggested by concern Faculty.

**C) Software/Learning Websites**

- i. <http://arduino.cc>
- ii. [www.instructables.com/id/Arduino-Projects/](http://www.instructables.com/id/Arduino-Projects/)
- iii. <http://www.jeremyblum.com/category/arduino-tutorials/>
- iv. <https://learn.sparkfun.com/tutorials/what-is-an-arduino>
- v. [http://en.wikibooks.org/wiki/Embedded\\_Systems](http://en.wikibooks.org/wiki/Embedded_Systems)
- vi. <https://www.udemy.com/blog/embedded-c-tutorial/>

**11. COURSE CURRICULUM DEVELOPMENT COMMITTEE**

**Faculty Members from Polytechnics**

- **Prof. R D Raghani** HOD EC ,LE College Morbi
- **Prof. T P Chanpura** Lecturer EC ,Government Polytechnic,Ahmedabad
- **Prof. N M Rindani**, Lecturer EC ,AVPTI Rajkot
- **Prof. Kunal Pithadiya**, Lecturer EC,B and B Polytechnic,Vallabh Vidhyanagar

**Coordinator and Faculty Members from NITTTR Bhopal**

- **Prof. Sanjeet Kumar**, Assistant Professor, Department of Electrical and Electronics Engineering.
- **Dr. Anjali Potnis**, Assistant Professor, Department of Electrical and Electronics Engineering

## GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

### COURSE CURRICULUM COURSE TITLE: MULTIMEDIA COMMUNICATION (COURSE CODE: 3361106)

Diploma Programme in which this course is offered	Semester in which offered
Electronics & Communication Engineering	Sixth

#### 1. RATIONALE

Multimedia communications have brought the paradigm shift in electronic communication system. The most common day to day gadgets and applications which use multimedia are telephone, television, wireless systems, internet and video call and video conferencing, satellite television, remote file transfer etc. The objective of this course is to introduce the topics like multimedia file formats, multimedia network standards, satellite communication and telecommunication switching systems, which are used for communication everywhere. This course will help the students to develop the skills to operate and maintain the multimedia communication system and will also strengthen the job opportunities of electronics and communication engineering students.

#### 2. COMPETENCY

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Operate and maintain multimedia communication systems in the communication chain**

#### 3. COURSE OUTCOMES (COs)

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

- i. Explain telecommunication network architecture and performance of telecommunication switching system
- ii. Describe components satellite communication system
- iii. Identify requirements and of ISDN
- iv. Identify different standards for multimedia communication.
- v. Choose required networks standards and file formats for multimedia communication.

#### 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 CONTENT DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
<b>Unit I. Basics of Switching Systems and Telephone Networks</b>	1a. Describe basics functions of a Switching systems. 1b. List the signalling tones used for the telephony 1c. Explain stored program control switching system 1d. Compare two stage and single stage network Switching network . 1e. Outline subscribe loop system 1f. Explain architecture of the switching network. 1g. Compare signalling techniques. 1h. Calculate network traffic. 1i. Evaluate quality of switching system 1j. Define Grade of service and blocking probability 1k. Draw the Block diagram of EPABX and explain.	1.1 Switching Systems 1.1.1 Evolution of telecommunications 1.1.2 Elements of switching system 1.1.3 Switching network configurations 1.2 Signaling tones and DTMF signaling 1.3 Stored program control 1.3.1 Centralized 1.3.2 Distributed 1.4 Two stage networks and its comparison with single stage network 1.5 Subscriber Loop system 1.6 Switching Hierarchy and routing 1.7 Signalling techniques and their comparison 1.8 Network traffic load and parameters 1.9 Grade of service and blocking probability 1.10 EPABX
<b>Unit II Satellite Communication</b>	2a. State Kepler's Laws of satellite motion orbital motion of satellite. 2b. Compare LEO, MEO and GEO 2c. Sketch the block diagram of satellite systems and explain each block. 2d. Describe working of satellite antennas. 2e. Draw the block diagram of satellite earth stations 2f. Discuss working of DTH receiver	2.1 Introduction to satellite communication: Kepler's three laws of satellite motion in Orbits 2.2 Satellite Orbits: LEO, MEO and GEO 2.3 Basics of space craft: Power systems, Attitude and orbit control system, Telemetry tracking and Command, Communication subsystem, Spacecraft antenna 2.4 Earth station and receivers: Block diagram of an earth station, Direct broadcast satellites DTH receivers
<b>Unit III</b>	3a. Summarise concept of ISDN	3.1 ISDN concepts, standards, protocol architecture

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
<b>Integrated Services Digital Networks (ISDN)</b>	3b. Describe architecture of ISDN 3c. Write ISDN standards and signalling 3d. Explain need for broadband ISDN 3e. List ISDN services 3f. Discuss need for broadband ISDN	3.2 Transmission channels , Signaling: user level, network level 3.3 ISDN services: videotext, E-mail, digital facsimile, tele text, database access 3.4 Interworking 3.5 Broadband ISDN
<b>Unit IV Multimedia Communication Techniques and Standards</b>	4a. Describe challenges of multimedia communication. 4b. Explain needs of multimedia processing. 4c. Identify applications of DMS. 4d. List multimedia standards for audio, video and image 4e. Describe ITV and VOD services 4f. Summarized ITU-T standardization.	4.1 Multimedia Communications: Multimedia Communication Model, Elements of Multimedia Systems, User and, Network requirements. 4.2 Multimedia processing for communication: digital media, signal processing elements, digital audio file formats, digital image file formats, digital video file formats 4.3 Distributed Multimedia Systems: main features and resource management, Distributed Multimedia application ITV, VOD 4.4 Multimedia communication standards: MPEG approach to multimedia standardization, MPEG-1 encoding and decoding, MPEG-4 coding of audiovisual objects, JPEG 2000, ITU-T standardization of audiovisual communication systems
<b>Unit V Multimedia Communications Across Networks</b>	5a. Explain the use of IP networks for multimedia communication. 5b. Describe use of DSL for multimedia communication. 5c. Compare DSL and ADSL for multimedia communication 5d. List use of wireless network for multimedia communication.	5.1 Multimedia across IP Networks: audio and video transmission across IP network 5.2 Multimedia across DSLs, VODSL architecture, voice services, Multimedia across ADSL 5.3 Multimedia Across Wireless, Speech transmission in GSM, Video across GSM, Mobile ATM, Mobile IP, Wireless multimedia delivery

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
	5e. Summarize multimedia broad band broadcasting services.	5.4 Digital video broadcasting: Data transmission using MPEG-2 and DVB, Broadband Multimedia Satellite systems, Digital television infrastructure for interactive multimedia Services, Interactive broadcast data (IDB) services

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

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of Switching Systems and Telephone Networks	12	04	04	04	12
II	Satellite Communication	12	04	04	02	10
III	Integrated Services Digital Networks (ISDN)	08	03	03	02	08
IV	Multimedia Communication Techniques and Standards	12	08	08	04	20
V	Multimedia Communications Across Networks	12	08	08	04	20
<b>Total</b>		<b>56</b>	<b>27</b>	<b>27</b>	<b>16</b>	<b>70</b>

**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/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/Exercise (outcomes in psychomotor domain)	Approx. Hours Required
1	I	Demonstrate the complete call procedure using Telephone trainer.	2
2	I	Demonstrate the EPBX working	2
3	I	Develop a software program to configure various switching networks using MATLAB.	2
4	I	Estimate network traffic using MATLAB.	2
5	I	Calculate the blocking probability of any network using MATLAB.	2
6	II	Develop a code to observe the variations in the antenna look angles for the earth station antennas. (look_angle_variation.m) using MATLAB	2
7	II	Develop a code to analyze of link Budget Equation using MATLAB	2
8	II	Develop a code to analyze SNR of satellite Link using MATLAB	2
9	III	Prepare a presentation on architecture of ISDN and broadband ISDN	2
10	IV	Develop a code to convert the from any source video format to mobile compatible form MP4/3GP/AVI/FLV/GIF/MOV/SWF/MPG .	2
11	IV	Develop a code to convert from any source audio format to MP3/MPZ/WAV/FLAC/WMA etc Using format factory	2
12	IV	Develop a code to convert from any source picture format to JPG/PNG/BMP/GIF/TIF/ PCX/ TGA etc	2
13	IV	Develop a code to convert from DVD format to Video format using format factory	2
14	IV	Develop a code to convert from music CD to audio file using format factory	2
15	IV	Develop a code to convert DVD/CD to ISO/CSO using format factory.	2
16	IV	Develop a code to read audio file to WAV format in matrix form and write a noise version of the file using function such awgnc( ) of MATLAB(or related function of SCILAB )	2
17	IV	Develop a code to change the two channel stereo audio WAV file into single channel mono audio WAV file using MATLAB or SCILAB.	2
18	IV	Develop a code to compare the performance of audio WAV file by changing sampling rate and no of bits of it using MATLAB or SCILAB.	2
19	IV	Develop a code to get information about a graphic file using imread( )function of MATLAB	2

S. No.	Unit No.	Practical/Exercise (outcomes in psychomotor domain)	Approx. Hours Required
20	IV	Develop a code to write image matrix in to a file using imwrite( )function of MATLAB	2
21	IV	Develop a code to enhance an image by intensity adjustment using imadjust ( ) function of MATLAB.	2
22	IV	Develop a code to add noise in an image using filter2 ( ) function of MATLAB.	2
23	IV	Develop a code to deblurr the image	2
24	V	Demonstrate the transmission of audio file (MP3/MPZ/WAV/FLAC/WMA) on IP based wired/wireless network.	2
25	V	Demonstrate the transmission of video file (MP4/3GP/AVI/FLV/GIF/MOV/SWF/MPG) on IP based wired/wireless network.	2
<b>Total</b>			<b>50</b>

**Note:** Perform any of the practical exercises for a total of minimum 28 hours from above list depending upon the availability of resources so that skills related with the most of the outcomes in all the units are developed.

## 8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

- i. Visit digital telephone exchange of any service provider.
- ii. Demonstrate the operation of EPABX of any organisation
- iii. Visit satellite Earth station
- iv. Prepare models of different satellites.
- v. Visit Akashwani and prepare report on Audio recording, multiplexing and broadcasting.
- vi. Visit Doordarshan Kendra and prepare report on video recording, multiplexing and broadcasting setup.

## 9. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- i. Show Video/ Animation film to develop the concept of satellite communication
- ii. Arrange seminar on the recent communication trends related to the curricula
- iii. Arrange visit to AIR and Doordarshan Kendra to explore the latest multimedia communication setup.
- iv. Arrange visit to digital telephone exchange and mobile switching centre
- v. Arrange expert lectures of engineers working in Durdarshan, satellite communication etc.
- vi. Group discussion on multimedia file format

## 10. SUGGESTED LEARNING RESOURCES

### (A) List of Books:

S. No.	Title of Books	Author	Publication
1	Telecommunication Switching Systems And Networks	Viswanathan, Thiagarajan	PHI Learning, New Delhi, latest edition
2	Electronic Communications	Roddy, Dennis Coolen John	Pearson Education, New Delhi, latest edition
3	Satellite Communications	Pratt, Bostian, Allnutt	Wiley, India, New Delhi, latest edition
4	Multimedia Communication systems	Rao, Bojkovic, Milovanovic	Pearson education
5	Principles of Multimedia	Parekh Ranjan , Ranjan	Tata McGraw-Hill, New Delhi, latest edition
6	An Introduction to Digital Multimedia	Savage T. M. , Karla E. Vogel	Jones & Bartlett Learning, New Delhi, latest edition
7	Multimedia communication systems	Fred Halsall	Pearson education, ,New Delhi, latest edition
8	Satellite communication	Dennis Roody	Tata McGraw-Hill, ,New Delhi, latest edition

#### B. List of Major Equipment/Materials

- i. Spectrum Analyzer ,10GHz
- ii. Computers ,workstations
- iii. Telephone trainer kit
- iv. Mobile trainer kit
- v. Satellite Trainer kit
- vi. ISDN trainer kit

#### C List of Software/Learning Websites

- i. MATLAB including and Simulink including satellite tool box, image processing tool box ,communication toolbox
- ii. SCILAB
- iii. Format factory
- iv. FLV simulator for Video
- v. Photoshop
- vi. Windows movie maker
- vii. Speech synthesizer

### 11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

#### Faculty Members from Polytechnics

- Prof. S. N. Sampat, Sr. Lecturer(EC) G .P. Gandhinagar
- Prof. P. P. Gajjar, Sr. Lecturer(EC) GGP, Surat
- Prof. M. S. Dave, Sr. Lecturer(EC) G. P. Ahmedabad
- Prof. K. K. Shah , Sr. Lecturer(EC) G. P. Rajkot

**Coordinator and Faculty Members from NITTTR Bhopal**

- **Dr. Anjali Potnis**, Assistant Professor, Department of Electrical and Electronics Engineering
- **Prof. Joshua Earnest**, Professor, Department of Electrical and Electronics Engineering

GTUQuestionPapers.com

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM  
COURSE TITLE: INDUSTRIAL AUTOMATION  
(Code: 3361107)**

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
Electronics and Communication Engineering	Sixth

**1. RATIONALE**

The aim of this course is to introduce students with present Industrial Automation scenario in India. The broad knowledge of essential component of present industrial Automation Industry such as Programmable Logic Controller (PLC), Distributed Control System (DCS), Supervisory Control and Data Acquisition (SCADA), industrial drives, human machine interface will enable the students to maintain the above automation controls systems used in the present industry. Thus this course is very important for students who want to use their knowledge of electronic engineering for working in industrial automation sector.

**2. COMPETENCY**

The course content should be taught and with the aim to develop required skills in the students so that they are able to acquire following competency :

- **Maintain electronic circuitry of different types of industrial automation systems**

**3. COURSE OUTCOMES**

The theory should be taught and practical should be undertaken in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domains to demonstrate the following course outcomes:

- Describe working of various blocks of basic industrial automation system
- Connect the peripherals with the PLC
- Use various PLC functions and develop small PLC programs
- Summarize Distributed control system and SCADA system
- Use various industrial motor drives for the Industrial Automation

**4. TEACHING AND EXAMINATION SCHEME**

<b>SCHEME Teaching Scheme (In Hours)</b>				<b>Total Credits (L+T+P)</b>	<b>Examination Scheme</b>				<b>Total Marks</b>
					<b>Theory Marks</b>		<b>Practical Marks</b>		
<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>ESE</b>	<b>PA</b>	<b>ESE</b>	<b>PA</b>	<b>150</b>	
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 CONTENT DETAILS

Unit	Major Learning Outcomes ( in cognitive domain)	Topics and Sub-topics
<b>Unit-I PLC Basics</b>	1a. Explain block diagram for PLC based automation system with sketch. 1b. Draw block diagram of various PLC modules and explain them in brief. 1c. Interface the input analog and digital devices to PLC 1d. Interface the output analog and digital devices to PLC	1.1 Need and benefit of automation 1.2 PLC system: applications of PLC, PLC modules, I/O module, Communication module, PID module 1.3 Input analog and digital devices 1.4 Output analog and digital devices
<b>Unit-II PLC Functions</b>	2a. Describe the function of five common types of registers used in PLC and describe its applications. 2b. Develop ladder logic for flip flops (R-S, ONE SHOT, D, T, and J-K) in PLC. 2c. Describe PLC delay timer and counter functions 2d. Describe how different simple arithmetic operations can be performed by PLC. 2e. Describe how logical operations can be performed by PLC 2f. Formulate the applications of advanced PLC functions 2g. Describe PLC sequencer functions.	2.1 PLC registers 2.2 PLC timer function 2.3 PLC counter function 2.4 PLC simple arithmetic and logical functions 2.5 PLC ladder logic diagram 2.6 Advanced PLC functions like SKIP, MASTER CONTROL RELAY, JUMP with non return, jump with return 2.7 Sequencer function
<b>Unit-III PLC Programm ing and Applicatio ns</b>	3a. Draw neat sketches of PLC process applications. 3b. Identify Input and Output devices for the given application 3c. Develop simple ladder Logic diagram for PLC process 3d. State the trouble shooting steps for any PLC system	3.1 PLC application: Bottling filling plant, Material handling elevator, 2-axis robot with sequencer control, Level control 3.2 Troubleshooting
<b>Unit-IV DCS and SCADA</b>	4a. Explain concept of DCS. 4b. Draw and describe hierarchy of DCS. 4c. List and describe functions of each level of DCS. 4d. Summarize functions each component of SCADA system. 4e. Explain architecture of SCADA system.	4.1 Introduction to DCS, concept of DCS, hierarchy of DCS, function of each level of DCS. 4.2 Introduction to supervisory Control and Data Acquisition system ( SCADA), SCADA Architecture, Interfacing SCADA with PLC

	4f. Describe how PLC can interfacing with SCADA	
<b>Unit-V Industrial Drives</b>	5a. Explain working of V/F speed control of induction motor. 5b. Describe speed control of stepper motor 5c. Describe construction, characteristics, working and application of SERVO motor 5d. Describe construction, characteristics, working and application of DC motor	5.1 Induction motor drive: V/F Control, Direct torque control 5.2 Stepper motor drives 5.3 AC and DC Servo motor drives 5.4 DC motor drives

## 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	PLC Basics	08	7	3	0	10
II	PLC Functions	12	7	7	0	14
III	PLC Programming and Application	12	3	3	10	16
IV	DCS and SCADA	12	4	8	4	16
V	INDUSTRIAL DRIVES	12	3	8	3	14
Total		56	24	29	17	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 EXERCISES/PRACTICALS

The practical 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. However, if these practical 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/Exercise (Outcomes in Psychomotor Domain)	Approx. Hours Required
1	I	Install hardware and software components of Given PLC system. Check it's working by running a sample program	2



S. No.	Unit No.	Practical/Exercise ( Outcomes in Psychomotor Domain)	Approx. Hours Required
2	I	Identify intelligent, PID , Input , Output , Communication module	2
3	I	Wire Inputs , Outputs via PLC input output modules	2
4	I	Wire intelligent, PID , Communication module with PLC	2
5	II	Develop ladder logic to realize D flipflop	2
6	II	Develop ladder logic to realize RS flipflop	2
7	II	Develop ladder logic to realize JK flipflop	2
8	II	Develop ladder logic to realize T flipflop	2
9	II	Simulate Industrial application of PLC On Delay Timer.	2
10	II	Check the delay timer operation using actual PLC	2
11	II	Check the UP/DOWN COUNTER operation using actual PLC	2
12	III	Check the SUBTRACTION Function using actual PLC	2
13	III	Simulate Bottle filling process on PLC simulator. Verify operation of the same process using actual PLC. Draw connection details for the same process	2
14	III	Simulate material handling elevator operation on PLC simulator. Verify operation of the same process operation using actual PLC. Draw connection details for the same process.	2
15	IV	Testt the DCS	2
16	IV	Test the SCADA.	2
17	IV	Set up a SCADA configuration	2
18	V	Test the induction motor drive.	2
19	V	Test the Vector control modes of operation of AC drive.	2
20	V	Test the AC drive	2
21	V	Interfacing AC drive with PLC	2
22	V	Test the stepper motor drive	2
23	V	Test the servo drive and position control	2
Total Hours			46
<b>Note:</b> Perform any of the practical exercises from above list for a minimum of 28 hours depending upon the availability of resources so that skills matching with the most of the outcomes of every unit are included.			

## 8. SUGGESTED STUDENT ACTIVITIES

- i. Test different types of transducers using simulation software like pro-sim, simulink, lab volt etc.
- ii. Present seminar on any one topic related to the subject
- iii. Develop a small project using LAB VIEW software

## 9. SPECIAL INSTRUCTIONAL STRATEGIES ( if any)

- i. Arrange visits to nearby Industries where automation is employed considerably.
- ii. Give Internet based assignments on different aspects of industrial automation to groups of students and ask them to submit report and present in class.
- iii. Organise expert lecture by engineers who are installing/commissioning/maintaining industrial automation systems.
- iv. Display of video/animation films explaining working of different automation components and systems.

## 10. SUGGESTED LEARNING RESOURCES

### A) Books

S.No.	Title of Books	Author	Publication
1.	Programmable Logic Controllers Principles and applications	Webb John W. and Reis A. Ronald	PHI ,New Delhi, Latest edition
2.	Programmable Logic Controllers	Bolton W .	Elsevier India Pvt. Ltd. New Delhi
3.	Programmable Logic Controllers	John R Hackworth	Pearson education New Delhi, Latest edition
4.	Process Control Instrumentation	C. D. JOHNSON	John Wiley and Sons
5.	PLCs & SCADA: Theory and Practice	Rajesh Mehra and Vikrant Vij	Laxmi Publications, New Delhi, Latest edition
6.	Instrumentation Engineering Handbook	LIPTAK	Chilton Book Company , Latest edition
7.	Distributed Computer Control for Industrial Automation	POPOVIC & BHATKAR	CRC Press, New Delhi, Latest edition
8.	Computer Based Industrial Control	KRISHNA KANT	PHI, New Delhi, Latest edition
9.	Power Electronics – Circuits, Devices and Applications	RASHID M. H	PHI / Pearson Education

### B) Major Equipment/Materials with Broad Specifications

- i. PLC trainer
- ii. AC drive trainer
- iii. DC drive trainer
- iv. DCS Trainer

### C) Software/Learning Websites

- (1) PLC simulator (freeware)
- (2) DCS simulator
- (3) Learning Websites
  - i. [www.control.com](http://www.control.com)
  - ii. [www.plcs.net](http://www.plcs.net)
  - iii. [www.pacontrol.com](http://www.pacontrol.com)
  - iv. [En.wikipedia.org](http://En.wikipedia.org)
  - v. [www.seimens.com](http://www.seimens.com)
  - vi. [www.ab.rockwellautomation.com](http://www.ab.rockwellautomation.com) › Allen-Bradley
  - vii. [www.abb.co.in](http://www.abb.co.in)
  - viii. [www.triplc.com](http://www.triplc.com)
  - ix. <http://plc-training-rslogix-simulator.soft32.com/free-download/>
  - x. [www.youtube.com](http://www.youtube.com)
  - xi. [www.ourinstrumentationgroup.com](http://www.ourinstrumentationgroup.com)
  - xii. [www.plcsimulator.net/](http://www.plcsimulator.net/)
  - xiii. <http://scada.winsite.com>

xiv. <http://sourceforge.net/projects/scadabr/files/latest/download?source=directory>

## 11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

### **Faculty Members from Polytechnics**

- **Prof. B. P. Raval**, Lecturer, Electronics and Comm. Engineering, G.P. Rajkot
- **Prof. K.R. Vadalía** Lecturer, Electronics and Comm. Engineering, G.P. Rajkot
- **Prof. T. R. Parmar**, Lecturer, Electronics and Comm. Engineering, G.P. Palanpur
- **Prof. B.B. Renuka**, Lecturer, Electronics and Comm. Engineering, AVPTI, RAJKOT
- **Prof. A.R. Chandegara**, Lecturer, Electronics and Comm. Engineering, G.P. Palanpur

### **Coordinator and Faculty Members from NITTTR Bhopal**

- **Dr. Anjali Potnis**, Assistant Professor, Department of Electrical and Electronics Engineering
- **Prof. Joshua Earnest**, Professor, Department of Electrical and Electronics Engineering

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM**  
**COURSE TITLE: ROBOTICS & AUTOTRONICS**  
**(Code: 3361108)**

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
Electronics and Communication Engineering	Sixth

### 1. RATIONALE

Today's industrial assembly line is equipped with robots and man vs. machine interface has been replaced by automation. Most of the machines including our automobiles are available with variety of models and controls. We see luxury cars around us and simply dream of having one. These luxury cars offer varied and many features including safety (central lock, parking assistance, air bags etc.), economy (at times) and comfort as per buyer's criteria. It is therefore need of the day for students to learn Robotics and Auto- electronics shortened as autotronics for working in industry. This course therefore attempt to build required skills of this field in students. Further in order to tune up with growth engine of Gujarat i.e. automobile sector this course has become inevitable.

### 2. COMPETENCY

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Maintain various Robotic controls and Autotronics features**

### 3. COURSE OUTCOMES

The theory should be taught and practical should be undertaken in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domains to demonstrate the following course outcomes:

- Identify a Robot for a specific application.
- Interface various Servo and hardware components with Controller based projects.
- Identify parameters required to be controlled in a Robot.
- Develop small automatic / autotronics applications with the help of Robotics.
- Test the robotics circuit.

### 4. TEACHING AND EXAMINATION SCHEME

<b>Teaching Scheme (In Hours)</b>			<b>Total Credits (L+T+P)</b>	<b>Examination Scheme</b>				
				<b>Theory Marks</b>		<b>Practical Marks</b>		<b>Total Marks</b>
<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>ESE</b>	<b>PA</b>	<b>ESE</b>	<b>PA</b>	
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 CONTENT DETAILS

Unit	Major Learning Outcomes (Outcomes in Cognitive Domain)	Topics and Sub-topics
<b>UNIT-I</b> <b>Basic Components of Robotics Systems</b>	1a. Define the terms used in robotics. 1b. Identify components used in robots. 1c. Explain structure of the robot. 1d. Explain various types of movements. 1e. Describe the advantages and limitations of robots 1f. Troubleshoot robot systems	1.1 Definition, need, brief history, social justification 1.2 Basic Robot terminology configuration and its working 1.3 Robot components (Anatomy)– manipulator, end effects, drive system, controller, sensors (Optical, Proximity, LVDT, Thermocouple-RTD-Thermistor, Force sensing – strain gauge-piezoelectric, Acoustic) 1.4 Basic structure of a Robot and Classification – Cartesian, cylindrical, spherical, horizontal articulated(SCARA), Mechanical arm, Degree of freedom, Links and joints, Wrist rotation, Mechanical transmission-pulleys, belts, gears, harmonic drive
	1g. Specify the methods of linear motion into rotary motion and vice-verse. 1h. Describe robot configuration. 1i. Select of robot for specific application.	1.5 Linear and rotary motion and its devices 1.6 Robot configurations: (1) stand above (2) in line (3) cycle independent, 1.7 Selection criteria for robot 1.8 Robot machine vision
<b>Unit– II</b> <b>Servo Mechanism and Motion Systems</b>	2a. Explain robotic controls. 2b. Explain block diagrams of control systems. 2c. Apply various controls as per requirement. 2d. Differentiate the various controls.	2.1 ROBOTIC CONTROLS-Purpose and Levels- Device controller, Work cell controller, Area controller, Plant host 2.2 Servo and non servo control systems – Types, basic principles and block diagram 2.3 Types, working (with diagrams), and applications of various controls- Computed torque technique, New minimum time control , Variable structure control Non linear decoupled feedback control, Resolved motion control , Adaptive control

<b>Unit</b>	<b>Major Learning Outcomes (Outcomes in Cognitive Domain)</b>	<b>Topics and Sub-topics</b>
	2e. Identify programming languages. 2f. Describe robot as work cell controller. 2g. Explain robot path control. 2h. Distinguish different types of motors and their drives. 2i. Explain microprocessor based control system. 2j. Describe the working of microprocessor based control system components.	2.4 Types, electrical hardware, programming languages used, advantages, limitations and specific examples of control systems. 2.5 Robot as work cell controller-PLC 2.6 Work cell control with local area networking, Multiple network level 2.7 Level of Robot controller 2.8 Robot path control (Point to point, Continuous path, Sensor based path) 2.9 Controller programming 2.10 Actuators: DC servo motors, Stepper motor, Hydraulic and pneumatic drives 2.11 Feedback devices 2.12 Microprocessor based control system
<b>Unit- III Sensors and Actuators</b>	3a. Distinguish the mechanical and electrical measurement. 3b. Interpret the various physical quantities used in automobile engines. 3c. Select appropriate sensors for automobile applications. 3d. Maintain the electronic circuits using sensors for physical parameter measurement in vehicles. 3e. Interpret the sequence tasks in robotic control. 3f. Describe the functions of PLCs	3.1 Concept of general measurement system and difference between Mechanical and electrical/electronics instruments; 3.2 Measurement of Pressure : Working of Thermocouple vacuum gauge And Pirani vacuum gauge; 3.3 Measurement of Flow: Hot wire Anemometer, Ultrasonic flow meter; 3.4 Measurement of Speed: Contact less electrical tachometer, Inductive, Capacitive type tachometer, Stroboscope; 3.5 Electrical method for moisture measurement; 3.6 Basic requirement of Sensors, Functions, 3.7 Applications and Circuitry arrangement of various Sensors such as Mass Air flow rate sensor, Exhaust gas Oxygen concentration, Throttle plate angular position, Crankshaft angular position, Coolant temperature, Intake air

Unit	Major Learning Outcomes (Outcomes in Cognitive Domain)	Topics and Sub-topics
		temperature, Manifold absolute pressure (MAP), Vehicle speed Sensor. Transmission gear selector position, Methanol sensor, Rain Sensor; Sensor Calibration, 3.8 Task oriented controls and sequencing, Robotic conventions 3.9 PLC basics
<b>Unit-IV Programm ing and Application in Manufactur ing</b>	4a. Explain robot programming methods. 4b. Develop simple programmes to simulate robot movements. 4c. Describe the procedure to test and troubleshoot robots. 4d. Describe the procedure to common troubles and remedies in robot operation 4e. Describe the safety rules in robot handling.	4.1 Methods of robot programming : Manual Teaching, Lead through 4.2 Programming languages, Programming with graphics. 4.3 Types, features and applications of various programming languages. 4.4 Simulation for robot movements 4.5 Applications of robots (including special types) 4.6 Robot maintenance: Need and types. 4.7 Common troubles and remedies in robot operation. 4.8 General safety norms, aspects and precautions in robot handling
<b>Unit-V Applications in Auto Electronics</b>	5a. Select the electronics for automation in vehicles. 5b. Describe the working of the various automated controls in automobiles.	5.1 Automobile Battery 5.2 Hybrid Synergy Vehicles 5.3 Automation in Automobiles: MPFI, ABS, SRS, Stability and Cruise Control, Electronic Power Steering, Parking Assistant System, Central lock system, Immobilizer system

## 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	Basic Components of Robotics Systems	10	06	04	02	12
II	Servo Mechanism and Motion Systems	12	04	04	08	16
III	Sensors and Actuators	12	04	04	06	14
IV	Programming and Application in	12	04	06	06	16



Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	Manufacturing					
V	Applications in Auto Electronics	10	02	04	06	12
	<b>Total</b>	<b>56</b>	<b>20</b>	<b>22</b>	<b>28</b>	<b>70</b>

**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 EXERCISES/PRACTICALS

The practical 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. However, if these practical 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. Hour. required
1	I	Configure the working of robots	2
2	I	Use the robot end effecters	2
3	II	Control servo and non-servo system	2
4	III	Use the different types of sensor in robotics.	2
5	III	Interface sensors using $\mu$ P or $\mu$ C	4
6	III	Measure various parameters of Electro-Mechanical Instruments- Pressure, Flow, Speed and Moisture	6
7	III	Interface Actuators using $\mu$ P or $\mu$ C	2
8	III	Interface Drives using $\mu$ P or $\mu$ C	2
9	III	Interface Stepper Motor using $\mu$ P or $\mu$ C	2
10	IV	Interface PLC and prepare Ladder Diagram	2
11	IV	Use robot trainer to perform different tasks	2
12	IV	Develop a Program for Line Follower Configuration.	2
13	IV	Develop a Program for golfer /thrower configuration	2
14	IV	Develop a Program for coffee maker configuration	2
15	IV	Develop a Program for draw robot configuration	2
16	IV	Develop a Program for strider configuration	2
17	IV	Use Robot programming commands	2

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hour. required
<b>Total Hours</b> (Depending upon the availability of resources, perform any of the practical exercises for a total of minimum 28 hours from above list so that skills matching with the most of the outcomes in the every units are included)			<b>40</b>

### 8. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities :

- i. Prepare journals based on practical performed in laboratory.
- ii. Do assignments on modeling robotics.
- iii. List various Robot controlling parameters and find how they affect the performance of Robots
- iv. List two different types of Robots and their application.
- v. Download free simulation software and check program on it.
- vi. Visit Industries having robots and prepare specification list, understand operational and maintenance practices.
- vii. Download videos of robotic applications.

### 9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- i. Show video/animation film to demonstrate the working principles, constructional features, testing and maintenance of different types of Robots Sensors and Actuators
- ii. Arrange a visit to IITRAM, IGTR, nearby Centre of Excellence setup by CTE, Gujarat (in Engg. College etc.) or any such laboratory. Arrange a visit to a plant/ manufacturer having automatic assembly line. Arrange at least one of the above visits.
- iii. Use Flash/Animations to explain the working of different Robots Sensors and Actuators devices.
- iv. Give Mini projects to students. Try to develop Robotics as Hobby.
- v. Arrange expert lectures by engineers working in the area of robotics/automation/autotronics.

### 10. SUGGESTED LEARNING RESOURCES

#### A) Books

S. No.	Title of Book	Author	Publication
1.	Robotics for Engineers	Koren Yoram	McGraw - Hill Education, New Delhi, 1 <sup>st</sup> Edition
2.	Textbook On Industrial Robotics	Hedge, G S	Laxmi Publications, New Delhi, ,1st Edition
3.	Industrial Robotics: Technology, Programming and Applications	Groover Mikell P.	McGraw - Hill Education, New Delhi 2 <sup>nd</sup> Edition
4.	Robotics	Fu K. S., Gonzalez R C., Lee C S G .	McGraw - Hill Education, New Delhi Pvt Ltd
5.	Robotic Engineering	Richard k lafter	PHI, New Delhi, 2012
6.	Robot applications design manual	Jon Hoshizaki, Emily Bopp	John Wiley and Sons, Ne Delhi

S. No.	Title of Book	Author	Publication
7.	Robot Reliability and safety	Dhillon, B.S.	Springer
8.	Automobile Electrical and Electronic systems	Denton, Tom	Arnold
9.	Understanding Automotive Electronics	William B. Ribbens Marcel Dekker.	Newnes, New York
10.	Automobile Electric equipments	Crouse WH	McGraw - Hill Education, New Delhi
11.	Understanding Automotive Electronics	William Ribbens	Newnes ; 6th Revised edition
12.	Automotive Electronics Handbook	Ronald K. Jurgen	McGraw-Hill Professional; 2 edition

### B) Major Equipment /Instrument with Broad Specification

Programmable Robot trainer [Minimum 3 linkages, Minimum 4 degree of freedom, mechanical end effect or with servo control Interfacing card(RC servo output, sensors input)]

### C) Software/Learning Websites:

- i. <http://www.mtabindia.com/>
- ii. <http://www.robotics.org/>
- iii. <http://pcbheaven.com>
- iv. <http://www.servodatabase.com>
- v. <https://www.youtube.com/watch?v=fH4VwTgfyRQ>
- vi. [https://www.youtube.com/watch?v=aW\\_BM\\_S0z4k](https://www.youtube.com/watch?v=aW_BM_S0z4k)
- vii. [http://www.autotronicsinc.com/pdf\\_files/design\\_notes.pdf](http://www.autotronicsinc.com/pdf_files/design_notes.pdf)
- viii. <http://www.yellowpages.com.au/content/if/extract/contentstore/2014/05/22/15/51/1079877236/1/automobileelectricalelectronicsystemsurgent.pdf>
- ix. [http://ave.dee.isep.ipp.pt/~mjf/act\\_lect/SIAUT/Material%20Auxiliar/Automotive%20electrical%20systems.pdf](http://ave.dee.isep.ipp.pt/~mjf/act_lect/SIAUT/Material%20Auxiliar/Automotive%20electrical%20systems.pdf)
- x. [http://www.iestcfa.org/presentations/wfcs04/keynote\\_leohold.pdf](http://www.iestcfa.org/presentations/wfcs04/keynote_leohold.pdf)
- xi. <http://ebooksgo.org/>
- xii. <http://www.ignou.ac.in/upload/Unit-3-61.pdf>
- xiii. [http://www.lucas-nuelle.com/index.php/fuseaction/download/lrn\\_file/automotive-engineering.pdf](http://www.lucas-nuelle.com/index.php/fuseaction/download/lrn_file/automotive-engineering.pdf)
- xiv. [http://www.oldfordcrewabs.com/public\\_pdf/Book%20-%20Understanding%20Automotive%20Electronics%20\(Newnes\).pdf](http://www.oldfordcrewabs.com/public_pdf/Book%20-%20Understanding%20Automotive%20Electronics%20(Newnes).pdf)

## 11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

### Faculty Members from Polytechnics

- **Prof. U V Buch**, Sr. Lecturer in EC, Govt. Poly for Girls, Surat
- **Prof. P P Gajjar**, Sr. Lecturer in EC, Govt. Poly for Girls, Surat

**Coordinator and Faculty Members from NITTTR Bhopal**

- **Prof. Sanjeet Kumar**, Assistant Professor, Department of Electrical and Electronics Engineering.
- **Dr. Anjali Potnis**, Assistant Professor, Department of Electrical and Electronics Engineering

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