



**UTTARAKHAND BOARD OF TECHNICAL EDUCATION**  
**JOINT ENTRANCE EXAMINATION AND TRAINING, RESEARCH DEVELOPMENT CELL, DEHRADUN**  
**STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME**

**BRANCH NAME – ELECTRONICS & COMMUNICATION ENGINEERING (TECH ELEX RADIO)**

**SEMESTER – VI**

Subject Code	Subject	L	T	P	T O T	EVALUATION SCHEME						Total Marks	Credit Point
						Internal		External					
						Theory	Practical	Theory		Practical			
						Max Marks	Max Marks	Max Marks	Hrs.	Max Marks	Hrs.		
Period/Weeks													
096003	Optical Fibre Communication	4	-	4	8	25	20	75	2.5	50	3.0	170	7
096002	Mobile Communication	4	-	3	7	25	20	75	2.5	50	3.0	170	7
096001	Microcontrollers and Embedded System	4	-	3	7	25	20	75	2.5	50	3.0	170	7
386001	Antenna and Wave Propagation	4	-	4	8	25	20	75	2.5	50	3.0	170	6
386002	Major Project - II	-	-	10	10	-	45	-	-	150	3.0	195	5
386052	Industrial Exposure (assessment At Inst. Level) +	-	-	-	-	-	25	-	-	-	-	25	1
016054	General Proficiency	-	-	4	4	-	25	-	-	-	-	25	1
016055	Employability Skills	4	-	-	4	25	-	50	-	-	-	75	1
	<b>Total</b>	<b>20</b>	<b>-</b>	<b>28</b>	<b>48</b>	<b>125</b>	<b>175</b>	<b>350</b>	<b>-</b>	<b>350</b>	<b>-</b>	<b>1000</b>	<b>35</b>

# Student Centered Activities will comprise of various co-curricular activities like games, hobby clubs, seminars, declamation contests, extension lectures, NCC, NSS and cultural activities and discipline etc.

+ Industrial visit compulsory at minimum 2 Industries or Department.

**Note:** 1- Each period will be 50 minutes. 2- Each session will be of 16 weeks. 3- Effective teaching will be at least 12.5 weeks.

**Branch Code - 38**



**SIXTH SEMESTER  
ELECTRONICS & COMMUNICATION  
ENGINEERING (INDUSTRY INTEGRATED)**





L	T	P
4	-	4

**Subject Code : 096003**

## **RATIONALE**

Progressing from communication over copper wire to today's fibre optic communication, we have increased our ability to transmit more information, more quickly and over longer distances. This has expanded our boundaries and is finding a good slot in communication system. Optical fibers has replaced existing transmission media due to its advantages. As a result the technicians are supposed to have knowledge of optical communication. This subject will provide basic concepts and requisite knowledge and skill required.

## **DETAILED CONTENTS**

**Unit:- I (10 Periods)**

### **INTRODUCTION**

- Basic block diagram of Optical fiber communication.
- Its advantages & applications.
- Principle of light penetration, Total Internal Reflection, critical angle, Numerical aperture.

**Unit:- II (12 Periods)**

### **OPTICAL FIBRES & CABLES**

- Constructional details of various optical fibers, multimode and single mode fibers, step index and graded index fibers, acceptance angle.

**Unit:- III (12 Periods)**

### **LOSSES IN OPTICAL FIBRE CABLES**

- Absorption Losses: Scattering Losses, Radiation losses, Connector losses, Bending losses.
- Dispersion: Types and its effect on data rate.

**Unit:- IV (15 Periods)**

### **OPTICAL SOURCES & DETECTOR**

- Principle of operation of LED
- Brief introduction of Laser diode (Semiconductor laser).
- Characteristics of photo detectors used in optical communication; PIN diode and Avalanche photo diode (APD).

**Optical Fibre System**

- Optical transmitter circuit, optical receiver circuit, optical power budgeting, multiplexing: WDM (Wavelength Division Multiplexing), Modulation in fibre optics

**LIST OF PRACTICALS**

1. Introduction to various components and tools used in optical fiber communication.
2. Establish the fiber optic analog link & observe its characteristics.
3. Establish the fiber optic digital link & observe its characteristics..
4. Measurement of bending losses in optical fibers.
5. To measure and calculate numerical aperture of optical fiber.
6. To observe characteristics of optical source.
7. To observe characteristics of optical detector.

**RECOMMENDED BOOKS**

1. Optical fiber Communication by John M Senior, Prentice Hall of India, New Delhi
2. Optical fiber Communication by J. Gower , Prentice Hall of India, New Delhi
3. Optical fiber Communication by Gerd Keiser, McGraw Hill International Editions
4. Optical Communications – Components and Systems by JH Franz and VK Jain, Narosa Publishing House, New Delhi

**SUGGESTED DISTRIBUTION OF MARKS**

Unit	Time Allotted (Periods)	Marks Allocation %
I	10	14
II	12	18
III	12	18
IV	15	25
V	15	25
<b>TOTAL</b>	<b>64</b>	<b>100</b>

L	T	P
4	-	3

**Subject Code : 096002****RATIONALE**

The wireless/mobile communication technology though complex but is spreading at a very fast rate. People use more mobile phones in comparison to land line phones. It is expected that with in very short period almost everybody will be using mobile communication. Technology is also changing very fast. Therefore, the students should know the functioning of wireless/mobile system/equipment to keep themselves abreast of this latest application of communication.

**DETAILED CONTENTS****Unit:- I****(08 Periods)****WIRELESS COMMUNICATION**

- Basics of wireless communication
- Advantages of wireless communication
- Example of wireless communication:
- Cellular Telephone System

**Unit:- II****(20 Periods)****CELLULAR FUNDAMENTALS**

- Cell area
- Frequency Reuse
- Co-channel Interference
- Adjacent channel Interference
- Power Control for Interference reduction
- Improving coverage and capacity in cellular system
- Cell Splitting. b) Sectoring c) Repeater for Range Extension.

**Unit:- IV****(20 Periods)****Multiple Access Techniques for Wireless Communication**

- Introduction to Multiple Access.
- Frequency Division Multiple Access (FDMA)
- Time Division Multiple Access (TDMA)

- Code Division Multiple Access (CDMA)
- Introduction to Wireless local loop (WLL) technologies.
  - (a) Satellite- Based System
  - (b) Cellular-- Based System
  - (c) Micro Cellular-- Based System
  - (d) Fixed Wireless Access Systems

#### **Unit:- IV**

**(16 Periods)**

#### **DEVELOPMENT OF CELLULAR COMMUNICATION SYSTEM**

- GSM Architecture & it's features.
- Salient features of GPS
- Introduction to Bluetooth, Wi-Fi & Radio Frequency identification (RFID)
- Features of LTE system

#### **LIST OF PRACTICALS**

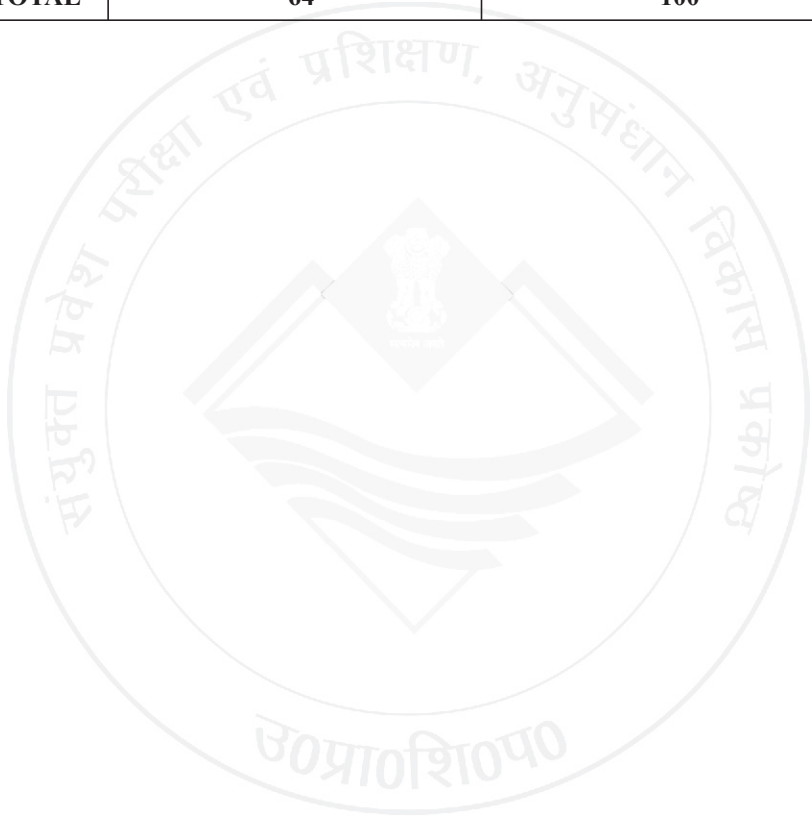
1. To Study the features, specification and working of cellular Telephone system.
2. To observe waveforms at various stages of basic GSM trainer/demonstrator.
3. Fault finding on a basic GSM trainer/demonstrator.
4. Visit of BTS in order to get familiarize with the process.
5. Visit of nearby Mobile Switching Centre with a live demonstration of 'Frequency Reuse/Channel Allocation methods. (Mandatory)

#### **RECOMMENDED BOOKS**

1. Wireless Communications, Principles and Practice, by Theodore S.Rappaport.
2. Wireless Communications by Singal, Tata McGraw Hill Education Pvt Ltd , New Delhi
3. Wireless Communications by Misra, Tata McGraw Hill Education Pvt Ltd , New Delhi
4. Introduction to Wireless and Mobile Systems, by Dharma Prakash Agarwal, Qing-An zeng.
5. Wireless Communications and Networking, by William Stallings.
6. Satellite communication by D C Agarwal Khanna Pub. New Delhi.
7. Electronic Communication by George Kennedy, PHI New Delhi.

### Suggested Distribution of Marks

Unit	Time Allotted (Periods)	Marks Allocation %
I	08	11
II	20	23
III	20	23
IV	20	23
V	16	20
<b>TOTAL</b>	<b>64</b>	<b>100</b>





L	T	P
4	-	3

**Subject Code : 096001**

### **RATIONALE**

This subject aims to expose students to the embedded systems besides giving them adequate knowledge of microcontrollers.

The study of microcontrollers in terms of architecture, software and interfacing techniques leads to the understanding of working of microcontrollers and applications of microcontroller in electronic industries. Microcontroller is the heart of the programmable devices. Embedded systems and Microcontrollers have also assumed a great significance in the electronic and consumer goods industry and are a very vital field. students of electronics and related engineering branches often use microcontroller to introduce programmable control in their projects, automation and fault finding in industry. The subject aims to expose students to the embedded systems besides giving them adequate knowledge of microcontrollers.

### **DETAILED CONTENTS**

#### **Unit:- I**

**(15 Periods)**

#### **MICROCONTROLLER SERIES (MCS) - 51**

- Introduction & features of microcontroller,
- Pin details
- I/O Port structure
- Memory Organization
- External Memory

#### **Unit:- II**

**(15 Periods)**

#### **INSTRUCTION SET**

- Different instruction groups
- Addressing Modes
- Instruction types

#### **Unit:- III**

**(15 Periods)**

#### **Special Function Registers (SFRS)**

- Timer operation
- Serial Port operation
- Interrupts

## Unit :- IV

(8 Periods)

### ASSEMBLER DIRECTIVES & INTERFACING

- Different types of Assembler directives
- Interfacing of Switches and 7- segment display.

## Unit:- V

(11 Periods)

### EMBEDDED SYSTEM

- Introduction, Embedded design concept.
- AVR: ATMEGA 16
- Pin description & features.
- Memory structure
- Architecture
- Interfacing examples of AVR board: LED, 7- segment, LDR, Stepper motor, IR module, Temperature sensor

### LIST OF PRACTICALS

1. Familiarization of Micro Controllers (8051) kit
2. Write ALP for two 8 bit Addition.
3. Write ALP for two 8 bit Subtraction.
4. Write ALP for finding the greatest number out of 10 nos.
5. Write ALP for finding the smallest number out of 10 nos.
6. Write ALP for Ascending and Descending order sorting of 10 numbers.
7. Interfacing of switch with 8051.
8. Study of interfacing LED, 7- segment, LDR, Stepper motor, IR module, Temperature sensor on microcontroller board.

### RECOMMENDED BOOKS

1. Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson education.
2. Ayala Kenneth:- The 8051 microcontroller, Third Edition, Cengage Learning
3. A. V. Deshmukh: Microcontroller (Theory and Application), TMH.
4. Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi.

5. V. Udayashankara and M.S. Mallikarjunaswamy: 8051 Microcontroller, TMH, New Delhi.
6. The AVR microcontroller & embedded system using Assembly & C by M A Mazidi, Naimi: Pearson Education India

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Unit</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allocation %</b>
I	15	25
II	15	25
III	15	25
IV	08	10
V	11	15
<b>TOTAL</b>	<b>64</b>	<b>100</b>

# ANTENNA & WAVE PROPAGATION

L	T	P
4	-	4

Subject Code : 386001

## RATIONALE

This subject aims to develop better understanding of fundamentals of antenna, its types and wave propagation

## DETAILED CONTENTS

### UNIT 1 : ( 26 Periods)

#### RADIATION AND WAVE PROPAGATION

Introduction to Electromagnetic spectrum and its various ranges: VLF, LF, HF, VHF, UHF, SHF Basic idea about different modes of radio wave propagation and typical areas of applications Effect of the environment Ground Wave Propagation, Space Wave Propagation, Sky Wave Propagation, Tropospheric Scatter Propagation. Definition of Refractive index. Critical frequency. Skip distance, Maximum usable frequency, fading, virtual height of antenna

### UNIT 2 : ( 10 Periods)

#### FUNDAMENTAL OF ANTENNA

Basic of antenna: The basic radiation Mechanisem .Wire Radiators in Space. Current and Voltage distributions. Resonant and non resonant antennas. Isotropic Antenna. Terms and Definitions :directive gain, directivity & Power gain, radiation resistance, Antenna Efficiency, Aperture Area, Beamwidth , band width and polarization. Effect of Ground on Antennas: Ungrounded Antenna, Grounded Antenna. Effects of antennas Heights.

### UNIT 3 : ( 10 Periods)

#### FUNDAMENTAL OF HALF WAVE DIPOLE OR DIPOLE ANTENNA

Resonant Antenna Half wave dipole antenna & its Radiation pattern. Folded dipole antenna & its radiation pattern. Radiation pattern for Dipole Antenna of different length Brief description of broadside and end fire arrays, their radiation pattern and applications (without analysis) Non-resonant antennas- The Rhombic antenna.

### UNIT 4 : ( 10 Periods)

#### TYPES OF ANTENNA

Wide Band Antenna Its Construction and working - Yagi antenna, Log

**MICROWAVE ANTENNAS:**

Parabolic antenna , horn antenna, helix , micro strip path antenna.

**LIST OF PRACTICAL**

1. Study of Omni directional antenna. Find out the Radiation Pattern
2. To Study the Phenomenon of Linear Polarization of Antenna.
3. Study of Antenna Resonance, VSWR & Impedance.
4. Study of Dipole & Folded Dipole Antenna.
5. Study of Yagi antenna with reflector and director antenna.
6. Study of any 3 antenna ( Broadside Array, End fire Array, Loop antenna, Log Periodic, Helical Antenna, Rohmbic Antenna, Horn Antenna, Dish Antenna)

**TEXT BOOKS**

1. George Kennedy "Electronics communication system"
2. E.C.Jordan and Balmain, "Electro Magnetic Waves and Radiating Systems", PHI, 1968, Reprint 2003.
3. K. D. PRASAD "Antenna and wave propagation "Satyaprakash Publications.

**REFERENCES**

1. John D. Kraus and Ronald Marhefka, "Antennas", Tata McGraw-Hill Book Company, 2002.
2. R.E. Collins, 'Antennas and Radio Propagation ', McGraw-Hill, 1987.

**SUGGESTED DISTRIBUTION OF MARKS**

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	26	45
2	10	15
3	10	15
4	10	15
5	08	10
<b>total</b>	<b>64</b>	<b>100</b>

# EMPLOYABILITY SKILLS

L	T	P
4	-	-

**Subject Code : 016055**

## RATIONALE

Diploma holders are required to not only possess subject related knowledge but also soft skills to get good jobs and to rise steadily at their workplace. This subject is included to develop employability skills amongst the students.

## DETAILED CONTENTS

**Unit I:** (06 periods)

- Technical Education & Industrial scenario.
- Competency required of an engineer.

**Unit II:** (06 periods)

- Professional Engineer desirable values and ethics and their development.
- Relation between engineering profession, society and environment

**Unit III:** (12 periods)

### Effective Communication

- Reading & Active Listening Skills
- Speaking
- Writing
- Presentation Technique/Seminar
- Group discussion

**Unit IV:** (12 periods)

### Managing project

- Leadership
- Motivation
- Time management
- Resource management
- Interpersonal relationship

**Unit V:** (10 periods)

### Preparing for Employment

- Searching for job/job hunting

- Resume & CV Writing
- Interview technique in personal interview telephonic interview, panel
- Interview, group interview, video conferencing

#### **Unit VI:**

**(08 periods)**

#### **Self Management**

- Self awareness
- Stress Management
- Conflict resolution

#### **Unit VII:**

**(06 periods)**

- Creativity, Innovation and Intellectual property right
- Concept and need in present time for an engineer

#### **Unit VIII:**

**(04 periods)**

#### **Rules & Ethics**

- Basic rules, laws and norms to be adhered by engineers during their working

#### **LIST OF PRACTICAS**

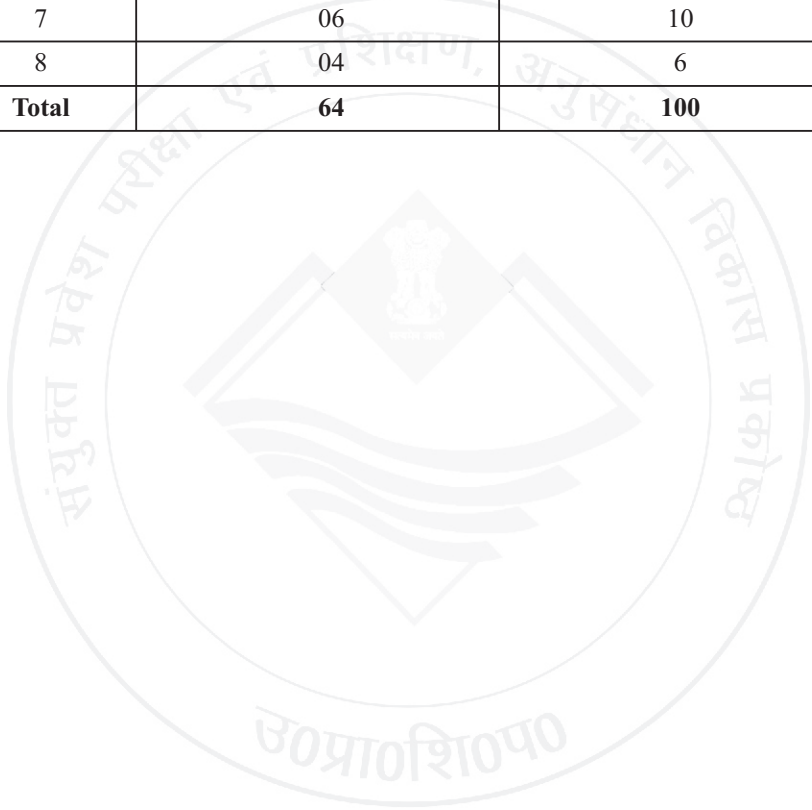
- Steps how to effectively write different types of Letters.
- Steps to make a Presentation in Power Point.
- Steps to make a Resume more effective.
- Steps to conduct Telephonic/On-line Interview (Through skype/Google Hangout).
- Study of Different Techniques of Stress Management.
- Study of Rules & Ethical practices to be followed at Workplace.

#### **RECOMMENDED BOOKS**

- Employability skills by Kapil Dev, Vishnu P. Singh Asian Pub. New Delhi
- Employability skills for Diploma students by Dr. S.K. Singh, Vayu Education, New Delhi

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted(%)
1	06	10
2	06	10
3	12	18
4	12	18
5	10	16
6	08	12
7	06	10
8	04	6
<b>Total</b>	<b>64</b>	<b>100</b>





## MAJOR PROJECT - II

L	T	P
-	-	10

Subject Code : 386002

**Each teacher is expected to supervise and guide 5-6 students. Some of the project activities are given below:**

one third part of Major Project is all ready Completed in 5<sup>th</sup> Sem.

- a) Projects related to designing small electronic equipment / instruments.
- b) Projects related to increasing productivity in electronic manufacturing areas.
- c) Projects related to quality assurance.
- d) Projects connected with repair and maintenance of plant and equipment.
- e) Projects related to design of PCBs.
- f) Projects related to suggesting substitutes of electronics components being used.
- g) Projects related to design of small oscillators and amplifier circuits.
- h) Projects related to design, fabrication, testing and application of simple digital circuits and components.
- i) Projects related to microprocessor/microcontroller based circuits/ instruments.

**A. SOME OF THE PROJECTS BASED ON ABOVE AREAS ARE LISTED BELOW FOR THE BENEFIT OF STUDENTS**

1. Microprocessor/Microcontroller based rolling display/bell and calendar
2. Microprocessor based stepper motor control.
3. Speed control of DC Machines by Microprocessor/Microcontrollers
4. Temperature monitoring using Microprocessor/Microcontroller based systems.
5. Microprocessor/Microcontroller based liquid level indicator and control
6. Fabrication and assembling of digital clock.
7. Fabrication of PCB circuits using ORCAD/ EAGLE Software.
8. Fabrication of ON line/OFF line UPS of different ratings and inverters
9. Design, fabrication and testing of different types of experimental boards
10. Repair of oscilloscope, function generator
11. Design and developing web sites of organizations
12. Installation of computer network (LANS).
13. Microprocessor/Microcontroller based solar tracking system
14. GSM based car or home security system
15. Bank token display using microcontroller
16. Printer sharing unit
17. Microprocessor/Microcontroller Based A/D converter

18. Microprocessor/Microcontroller Based D/A converter
19. Simulation of half wave and full wave rectifiers using Simulation Software
20. Simulation of class A, Class B, Class AB and Class C amplifiers
21. Simulation of different wave forms like sine, square, triangular waves etc.
22. GPS based vehicle tracking system
23. Calculate Bit Error Rate (BER) of various modulation techniques
24. Design ALU using CPLD/FPGA
25. Design Display System using CPLD/FPGA
26. Electronic Weighing Machines

**B. FABRICATION AND TESTING (AT LEAST TWO OF THE FOLLOWING):**

- 1 Voltage Stabilizer for Refrigerator, Air-Conditioner
- 2 Emergency Light using SCR
- 3 Power amplifier
- 4 Low cost intercom for home
- 5 Analog computer
- 6 Regulated power supply (+ 12V and + 6V) using 7812, 7912 and 7806, 7906
- 7 Automatic battery charger using SCR
- 8 Burglar Alarm
- 9 Automatic street light/dressing table light
- 10 Inverter circuit 500 watt.
- 11 Microprocessor/Microcontroller Based A/D converter
- 12 Microprocessor/Microcontroller Based D/A converter
- 13 Simulation of half wave and full wave rectifiers using Simulation Software
- 14 Simulation of class A, Class B, Class AB and Class C amplifiers
- 15 Inverter/Emergency light circuit using power transistors
- 16 SCR based automatic battery charger
- 17 SCR operated illumination controller
- 18 SCR operated automatic water level controller
- 19 SCR based speed controller for DC shunt motor
- 20 Three phase full wave rectifier using power diodes
- 21 Timer circuit using 555-IC
- 22 SCR controlled rectifier circuit
- 23 Speed control circuit of DC shunt motor using SCR
- 24 Inverting and non-inverting amplifiers using OPAMP(741)
- 25 Comparator circuits using OPAMP(741)

**NOTE:** The list is only the guideline for selecting a project; however a student is at liberty to select any other related project of his choice independently under guidance of his teacher

A suggestive criterion for assessing student performance by the external (person from industry) and internal (teacher) examiner is given in table below:

Sr. No.	Performance criteria	Max. marks	Rating Scale				
			Excellent	Very Good	Good	Satisfactory	Poor
1.	Selection of project assignment	10	10	8	6	4	2
2.	Planning and execution of considerations	10	10	8	6	4	2
3.	Quality of performance	20	20	16	12	8	4
4.	Providing solution of the problems or production of final product	20	20	16	12	8	4
5.	Sense of responsibility	10	10	8	6	4	2
6.	Self expression/communication skills	5	5	4	3	2	1
7.	Interpersonal skills/human relations	5	5	4	3	2	1
8.	Report writing skills	10	10	8	6	4	2
9.	Viva voce	10	10	8	6	4	2
	<b>Total marks</b>	<b>100</b>	<b>100</b>	<b>80</b>	<b>60</b>	<b>40</b>	<b>20</b>

The overall grading of the practical training shall be made as per following table. In order to qualify for the diploma, students must get “Overall Good grade” failing which the students may be given one more chance to improve and re-evaluate before being disqualified and declared “not eligible to receive diploma”. It is also important to note that the students must get more than six “goods” or above “good” grade in different performance criteria items in order to get “Overall Good” grade.

### Range of maximum marks Overall grade

- i) More than 80 Excellent
- ii)  $79 > 65$  Very good
- iii)  $64 > 50$  Good
- iv)  $49 > 40$  Fair
- v) Less than 40 Poor Important

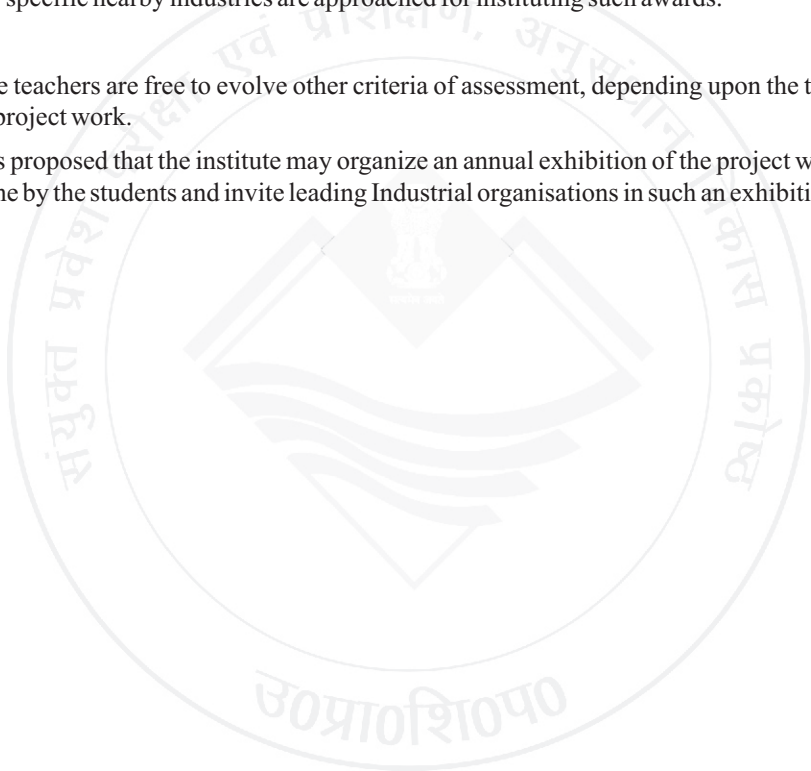
### Notes

1. This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.

2. The criteria for evaluation of the students have been worked out for 200 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.
3. The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the above criteria.
4. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations in such an exhibition









## LEARNING OUT COMES AND MEANS OF ASSESSMENT

**BRANCH NAME: ELECTRONICS AND COMMUNICATION ENGINEERING (TECH ELEX RADIO)**

**SEMESTER – VI**

S.NO.	Title of Subject/Unit	Learning Outcomes	Means of Assessment
1	Optical Fibre Communication	<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>• demonstrate various types of optical fibres.</li> <li>• identify and test losses in optical fibres.</li> <li>• explain and demonstrate characteristics of optical source and optical detector.</li> <li>• understand optical fibre system.</li> </ul>	<ul style="list-style-type: none"> <li>• Assignments and quiz/class tests, mid-semester and end-semester written tests.</li> <li>• Ability to analyze different characteristics of optical fibre.</li> <li>• Seminars and Viva-Voce.</li> </ul>
2	Mobile Communication	<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>• explain the concept of wireless communication and cellular fundamentals.</li> <li>• describe and analyze deferent multiple access techniques (FDMA, TDMA, CDMA and WLL)</li> <li>• understand third generation mobile services.</li> <li>• demonstration of LTE, Vo-LTE and mobile network</li> <li>• describe deferent mobile communication system (GSM, GPS etc).</li> </ul>	<ul style="list-style-type: none"> <li>• Assignments and quiz/class tests, mid-semester and end-semester written tests.</li> <li>• Ability to configure WLL, IP addresses PAN, WLAN and Adhoc Networks,etc.</li> <li>• Presentations and Viva-Voce.</li> </ul>
3	Microcontroller and Embedded System	<p>The student should be able to:</p> <ul style="list-style-type: none"> <li>• understand the working of microcontrollers.</li> <li>• understand the Instruction set and programming related to microcontrollers.</li> <li>• describe embedded system.</li> <li>• interface sensors with microcontroller.</li> </ul>	<ul style="list-style-type: none"> <li>• Assignments and quiz/class tests, mid-semester and end-semester written tests.</li> <li>• Programming on 8051 trainer kit and interfacing of sensors.</li> <li>• Presentations and Viva-Voce.</li> </ul>
4	Antenna & Wave Propagation	<p>The student should be able to:</p> <ul style="list-style-type: none"> <li>• understand electromagnetic waves and wave propagation.</li> <li>• define different terminologies of antenna.</li> <li>• describe the various types of antennas.</li> <li>• understand and apply the knowledge of antenna and its types.</li> </ul>	<ul style="list-style-type: none"> <li>• Assignments and quiz/class tests, mid-semester and end-semester written tests.</li> <li>• Laboratory and practical work.</li> <li>• Assembly and disassembly exercises.</li> <li>• Presentation and Viva-Voce.</li> </ul>



5	Employable Skills	<p>The student should be able to:</p> <ul style="list-style-type: none"> <li>• communicate effectively.</li> <li>• develop competent qualities required of an engineer.</li> <li>• lead a project.</li> <li>• work in a group.</li> <li>• plan and organise the task allotted within a given stipulated time.</li> <li>• enhance the ability of problem solving.</li> <li>• develop the qualities of self management, creativity and innovation.</li> </ul>	<ul style="list-style-type: none"> <li>• Assignments and quizzes.</li> <li>• Group discussions.</li> <li>• Seminars.</li> <li>• Organizing events.</li> <li>• Presentations and Viva-Voce.</li> </ul>
6	Major Project-II	<p>The students will be able to:</p> <ul style="list-style-type: none"> <li>• Apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project.</li> <li>• Develop understanding regarding the size and scale of operations and nature of fieldwork in which students are going to play their role after completing the courses of study.</li> <li>• Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.</li> <li>• Develop firsthand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems related to the world of work.</li> <li>• Assemble/fabricate and test an electronics gadget.</li> </ul>	<p>Based on:</p> <ul style="list-style-type: none"> <li>• Selection of project</li> <li>• Planning and execution</li> <li>• Quality of performance</li> <li>• Solution of problems</li> <li>• Communication skills</li> <li>• Interpersonal skill</li> <li>• Report writing skill</li> <li>• Viva-voce</li> </ul>