CURRICULUM

for

DIPLOMA PROGRAMME

in

ELECTRONICS AND COMMUNICATION ENGINEERING

3rd Year (5rd & 6th Semester)

FOR THE STATE OF HIMACHAL PRADESH

June, 2019

Study and Evaluation Scheme

(ELECTRONICS & COMMUNICATION ENGINEERING)

5th Semester

SR. No.	SUBJECTS	HRS/ WEEK		EVALUATION SCHEME								TOTAL MARKS INT. & EXT.
				INTERNAL ASSESMENT			EXTERNAL ASSESMENT					
		Th.	Pr.	Th.	Pr.	Total	Th.	Hr	Pr.	Hr	Total	
5.1	Basics of Management and Entrepreneurship Development*	4	-	50	-	50	100	3	-	-	100	150
5.2	Digital Communication	4	2	30	20	50	100	3	50	3	150	200
5.3	Optical Fibre Communication**	4	2	30	20	50	100	3	50	3	150	200
5.4	Microwave & Radar Engineering	4	2	30	20	50	100	3	50	3	150	200
5.5	Elective 5.5.1 VLSI System Design 5.5.2. Personal Computer Organisation 5.5.3. Satellite Communication 5.5.4. Signals and Systems	4 4 4 4	- - - -	50	-	50	100	-	-	-	150	150
5.6	Minor Project	-	6	-	50	50	-	-	50	3	50	100
	Industrial Training	-		-	50	50	-	-	50	3	50	100
	Student Centered Activities	-	4	-	25	25	-	-	-	-	-	25
Total		**20**	**16**	**190**	**185**	**375**	**500**	**-**	**250**	**-**	**800**	**1125**

Common with other diploma programmes
**Common with Electrical and Electronics Engineering*

Note: *Apart from the above mentioned number of hours for each subject (Theory & Practical), at least **TWO** hours/week for each class should be allocated for Library to motivate the students to attend library compulsory. The attendance of library period should be added in master attendance.*

Study and Evaluation Scheme

ELECTRONICS & COMMUNICATION ENGINEERING

6th Semester

SR. No.	SUBJECTS	HRS/ WEEK		EVALUATION SCHEME								TOTAL MARKS INT. & EXT.
				INTERNAL ASSESMENT			EXTERNAL ASSESMENT					
		Th.	Pr.	Th.	Pr.	Total	Th.	Hrs	Pr.	Hr	Total	
6.1	Programmable Logic Controller & SCADA*	4	2	30	20	50	100	3	50	3	150	200
6.2	Wireless and Mobile Communication	4	2	30	20	50	100	3	50	3	150	200
6.3	Microcontroller and Embedded System	4	2	30	20	50	100	3	50	3	150	200
6.4	Elective 6.4.1 Medical Electronics** 6.4.2 Multimedia Communication 6.4.3 Android Applications Development *** 6.4.4 Internet of Things**** 6.4.5 Computer Networks	4 4 4 4 4	- - 4 2 2	50 50 30 30 30	- - 20 20 20	50	100	3	- - -	- -	100	150
6.5	Major Project	-	8	-	100	100	-	-	100	3	100	200
6.6	Practices in Communication Skills$	-	2	-	50	50	-	-	50	3	50	100
	Student Centered Activities	-	4	-	25	25	-	-	-	-	-	25
		16	20/ 22/ 24	140/ 120	235/ 255	375	400	-	300	-	700	1075

*Common with diploma in Instrumentation Engineering

**Common with diploma in Electrical and Electronics Engineering

*** Common with diploma in Computer Engineering

**** Common with diploma in Computer Engineering, Information Technology, Instrumentation Engg.

$ Common with all diploma programmes

*Note: Apart from the above mentioned number of hours for each subject (Theory & Practical), at least **TWO** hours/week for each class should be allocated for Library to motivate the students to attend library compulsory. The attendance of library period should be added in master attendance.*

5.1 BASICS OF MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

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RATIONALE

In present scenario, there is an urgent need to develop right kind of attitude, knowledge and skills amongst the Diploma engineers leading them to achieve gainful wage/ self-employment. There is a huge gap in perceptions of employers and employees regarding meeting the job requirements. Also the dual challenges of competing in global working environment and keeping pace with the rapid technological advancements call for re-design of curricula and thus enabling the importance of generic and managerial skills. Entrepreneurship development aim at developing conceptual understanding for setting up owns' business/enterprise to cope up with the problem of unemployment and also to promote the socio-economic development of our country. Both the subject areas, "Basics of Management and entrepreneurship development" are supplementary to each other. Knowledge and skills of these must be imparted to diploma engineering students for enhancing their employability and confidence in their personal and professional life.

DETAILED CONTENTS

1. **Introduction to Management** (7 hrs)
   1.1 Definitions and concept of Management
   1.2 Functions of management- planning, organizing, staffing, coordinating and controlling.
   1.3 Various areas of management
   1.4 Structure of an Organization

2. **Self-Management and Development** (10 hrs)
   2.1 Life Long Learning Skills, Concept of Personality Development, Ethics and Moral values
   2.2 Concept of Physical Development; Significance of health, hygiene, body gestures
   2.3 Time Management Concept and its importance
   2.4 Intellectual Development: Reading skills, speaking, listening skills, writing skills (Note taking, rough draft, revision, editing and final drafting), Concept of Critical Thinking and Problem Solving (approaches, steps and cases).
   2.5 Psychological Management: stress, emotions, anxiety and techniques to manage these.
   2.6 ICT & Presentation skills; use of IT tools for good and impressive presentations.

3. **Team Management** (10 hrs)
   3.1 Concept of Team Dynamics. Team related skills, managing cultural, social and ethnic diversity in a team.
   3.2 Effective group communication and conversations.
   3.3 Team building and its various stages like forming, storming, norming, performing and adjourning
   3.4 Leadership, Qualities of a good leader
   3.5 Motivation, Need of Motivation, Maslow's theory of Motivation

4. **Project Management** (5 hrs)
   4.1 Stages of Project Management; initiation, planning, execution, closing and review (through case studies), SWOT analysis concept.

5. Introduction to Entrepreneurship **(10 hrs)**
   5.1   Entrepreneurship, Need of entrepreneurship, and its concept, Qualities of a good entrepreneur
   5.2   Business ownerships and its features; sole proprietorship, partnership, joint stock companies, cooperative, private limited, public limited, PPP mode.
   5.3   Types of industries: micro, small, medium and large

6. Entrepreneurial Support System (Features and Roles in Brief) **(7 hrs)**
   6.1   District Industry Centers (DICs), State Financial Corporations (SFCs), NABARD,
   6.2   MSME (Micro, Small, Medium Enterprises) – its objectives & list of schemes

7. Market Study and Opportunity Identification **(7 hrs)**
   Types of market study: primary and secondary, product or service identification, assessment of demand and supply, types of survey and their important features

8. Project Report Preparation **(8 hrs)**
   8.1   Preliminary Report, Techno-Economic Feasibility Report, Detailed Project Report (DPR).

LIST OF TUTORIAL EXERCISES

1. Understanding Self-Management and Development (Related to Chapter 02); through examples, cases, exercises, panel discussions, seminars, meditation and yoga techniques.

2. SWOT Analysis

3. Team Management (Related to chapter 03); through examples, cases, role plays, group discussions and panel discussions.

4. Market Study and Opportunity Identification (Related to Chapter 07); through literature reviewing, making questionnaires, conducting mock interviews and analyzing data for product/service identification and demand assessment.

5. Project Management and Project Report Preparation through exercises on making project reports on micro and small enterprises. Case studies and SWOT analysis of projects can be taken.

RECOMMENDED BOOKS
   1. Generic Skill Development Manual, MSBTE, Mumbai
   2. Lifelong Learning, Policy Brief(www.oecd.orf)
   3. Towards Knowledge Society, UNESCO Publication, Paris
   4. Entrepreneurship Development by CB Gupta and P Srinivasan: Sultan Chand and sons: New Delhi
   5. Essentials of Management by H Koontz, C O' Daniel , McGraw Hill
   6. Principles and Practice of Management by Shyamal Bannerjee: Oxford and IBM Publishing Co, New Delhi
   7. Management by James AF Stoner, R Edward Freeman and Daniel R Gilbert Jr., Prentice Hall of India Pvt. Ltd, New Delhi
   8. Entrepreneurship Development by S. L. Gupta and Arun Mittal: IBH Publication
   9. A Handbook of Entrepreneurship, Edited by B S Rathore and Dr. J S Saini

10. Entrepreneurship Development and Small Business Enterprises by Poornima M: Pearson Education India
11. Handbook of Small Scale Industry by P M Bhandari

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (hrs.)	Marks Allotted (%)
1	07	10
2	10	15
3	10	15
4	05	10
5	10	15
6	07	10
7	07	10
8	08	15
Total	**64**	**100**

5.2 DIGITAL COMMUNICATION

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RATIONALE

This course deals with the fundamentals of digital and data communication. It describes different types of noise & interferences present in digital communication and ways to remove them. It involves the use of modems in synchronous and asynchronous data transmission.

DETAILED CONTENTS

1. **Introduction** **(04 hrs)**

   Basic block diagram of digital and data communication systems. Their comparison with analog communication systems.

2. **Coding** **(12 hrs)**

   2.1 Introduction to various common codes 5 bit Baudot code, 7 bit ASCII, ARQ, EBCDIC
   2.2 Code error detection and correction techniques - Redundancy, parity, block check character (BCC), Vertical Redundancy check (VRC), Longitudinal Redundancy Check (LRC), Cyclic Redundancy check (CRC), Hamming code.

3. **Digital Modulation Techniques** **(14 hrs)**

   - Basic block diagram and principle of working of the following:
   - Amplitude shift keying (ASK): Interrupted continuous wave (ICW), two tone modulation
   - Frequency Shift keying (FSK)
   - Phase shift keying (PSK), Quadrature Phase Shift Keying (QPSK)

4. Characteristics/working of data transmission circuits; bandwidth requirements, data transmission speeds, noise, cross talk, echo suppressors, distortion, equalizers. **(10 hrs)**

5. **Modems** **(12 hrs)**
   Need and function of modems, Mode of modems operation (low speed, medium speed and high speed modems). Modem interconnection, Modem data transmission speed, Modem modulation method.

6. Digital telephone exchange
   Basic block diagram of digital exchange and its working. Stored program control processor (SPC) and its applications in digital electronic exchanges. **(06hrs)**

7. Space and time switching: Working principle of STS and TST switching. **(06 hrs)**

LIST OF PRACTICALS
1. Transmission of Hamming code on a serial link and its reconversion at the receiving end.
2. Observe wave forms at input and output of ASK and FSK modulators with the help of CRO
3. Transmission of data using MODEM.
4. Observe wave forms at input and output of QPSK modulators
5. Observe wave forms at input and output of PSK modulators
6. To study the working of space and time switching circuits.

NOTE: Visits to the sites of all types of telephone exchanges (including mobile and rural exchanges), Carrier telephony should be made with a view to understand their working. A comprehensive report must be prepared by all the students on these visits, especially indicating the dates and locations of their visits.

RECOMMENDED BOOKS

1. Electronic Communication Systems by George Kennedy Tata McGraw Hill Education Pvt. Ltd, New Delhi
2. Communication system by A.K. Gautam S.K. Kataria Sons, Delhi
3. Electronics communication by K.S. Jamwal, Dhanpat Rai and Sons, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	04	07
2	12	18
3	14	20
4	10	15
5	12	20
6	06	10
7	06	10
Total	64	100

5.3   OPTICAL FIBRE COMMUNICATION

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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

1. **Introduction**   (12hrs)
   - Historical perspective, basic optical fibre communication systems, optical frequency range, advantages of optical fiber communication, application of fiber optic communication
   - Electromagnetic spectrum used, Advantages and disadvantages of optical communication.
   - Principle of light penetration, reflection, critical angle.

2. **Optical Fibers and Cables**   (08hrs)
   - Constructional details of various optical fibers, multimode and mono-mode fibers, step index and graded index fibers, acceptance angle and types of optical fiber cables.
   - Optical Fibers cable connectors and splicing techniques (Mechanical, fusion)

3. **Losses in Optical Fiber Cable**   (08hrs)
   - Absorption Losses: Scattering Losses, Radiation losses, Connector losses, Bending loses.
   - Dispersion: Types and its effect on data rate.
   - Testing of losses using OTDR (Optical Time Domain Reflectometer).

4. **Optical Sources**   (10hrs)
   Characteristics of light used in optical communication, principle of operation of LED, different types of LED structures used and their brief description, Injection laser diode, principle of operation, different injection laser diodes, comparison of LED and ILD.

5. **Optical Detectors**   (08hrs)
   Characteristics of photo detectors used in optical communication; PIN diode and avalanche photo diode (APD), Noise in detectors

6. **Optical Amplifiers**   (10hrs)
   Types of optical amplifiers, semiconductor & fiber optical amplifiers Functional types, principal of operation of SOA, types of SOA. FPA, TWA, SOA applications, advantages, Drawbacks, EDFAS, Raman amplifiers

7. **Optical Fiber System Application**   (08hrs)
   Role of OFC in Fiber to the x (FTTx), NGN (Next Generation Network), NFS(Need for Spectrum), IOT(Internet of Things),

LIST OF PRACTICALS
   1. Setting up of fiber analog link
   2. Setting up of optic digital link

3. Measurement of bending losses in optical fibers
4. To measure and calculate numerical aperture of optical fiber
5. To observe characteristics of LED source and detector
6. To demonstrate the splicing of optical fiber
7. Demonstration of various components and tools used in optical fiber communication

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
5. Optical Fiber Communication by Sangar and Sahdev, Uneek Publications, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
1	12	20
2	8	15
3	8	15
4	10	15
5	8	10
6	10	15
7	8	10
Total	**64**	**100**

5.4 MICROWAVE AND RADAR ENGINEERING

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RATIONALE

This subject includes an exposure to microwaves engineering, radar systems, fibre optics and satellite communication. In microwaves industry, job opportunities are available in of assembly, production, installation, repair and maintenance of microwave transmitters and receivers. The knowledge of radar systems allows opportunities with civil and defence organizations dealing with air craft and shipping. Fibre optics is the latest thrust area in communication with vast opportunities in the private sector.

DETAILED CONTENTS

1. **Introduction to Microwaves** (6 hrs)

    Introduction to microwaves and its applications, Classification on the basis of its frequency bands (HF, VHF, UHF, L, S, C, X, KU, KA, mm, SUB mm). Block diagram and working principles of microwave communication link

2. **Microwave Devices** (20 hrs)

    Basic concepts of thermionic emission and vacuum tubes, Effects of inter electrode capacitance Lead Inductance and Transit time on the high frequency performance of conventional vacuum tubes, and steps to extend their high frequency operations. Construction, characteristics, operating principles and typical applications of the following devices (No mathematical treatment)
    - Multi cavity Klystron
    - Reflex Klystron
    - Multi-cavity magnetron
    - Traveling wave tube
    - Gunn diode and
    - Impatt diode

3. **Waveguides** (08hrs)

    Rectangular and circular wave guides and their applications. Mode of waveguide; Propagation constant of a rectangular wave guide, cut off wavelength, guide wavelength and their relationship with free space wave length (no mathematical derivation).Impossibility of TEM mode in a wave guide.

4. **Microwave Components** (12 hrs)

    Constructional features, characteristics and application of tees, bends, matched termination, twists, detector, mount, slotted section, directional coupler, fixed and variable attenuator, isolator, circulator and duplex, coaxial to waveguide adapter

5. **Microwave antennas** (06 hrs)

    Structural characteristics and typical applications of Horn and Dish antennas

6. **Radar Systems** (12hrs)

    6.1 Introduction to radar, its various applications, radar range equation (no derivation) and its applications.
    6.2 Block diagram and operating principles of basic pulse radar. Concepts of ambiguous range, radar area of cross-section and its dependence on frequency.
    6.3 Block diagram and operating principles of FMCW radars, and their applications

LIST OF PRACTICALS

1. To measure electronics and mechanical tuning range of a reflex klystron
2. To measure VSWR of a given load.
3. To measure the Klystron frequency by slotted section method
4. To measure the directivity and coupling factor of a directional coupler.
5. To plot radiation pattern of a horn antenna in horizontal and vertical planes.
6. To verify the properties of magic tee.
7. To carry out installation of a dish antenna.

RECOMMENDED BOOKS

1. Microwave Devices and Components by Sylio, Prentice Hall of India, New Delhi
2. Electronics Communication by Roddyand Coolen
3. Electronics Communication System by KS Jamwal, Dhanpat Rai & Sons, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	10
2	20	28
3	8	12
4	12	20
5	6	10
6	12	20
Total	**64**	**100**

5.5.1 VLSI SYSTEM DESIGN

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RATIONALE

Now-a-days thousands of Digital ICs are embedded on one single chip with the help of VLSI technology. With the help of this technology the Power Consumption of ICs can be reduced (as some devices even works on IV).The size of the overall circuit reduced due to embedding of thousands of Digital IC on one VLSI chip. The VLSI chips are 100 times faster than microprocessors. Every Industry is using this technology. So student should have some knowledge about this technology.

DETAILED CONTENTS

1. **Overview of VLSI** (10hrs)
   Introduction to Computer-aided design tools for digital systems. Hardware-description languages, Introduction to VHDL, Data objects, Classes and data types, Operators, Overloading, Logical operators. Types of delays, Entity and Architecture declaration. Introduction to behavioral, dataflow and structural models.

2. **VHDL Statements** (10hrs)
   Assignment statements, sequential Statements and process, Conditional statements, Case statements, concept and use of Concurrent statements.

3. **Combinational Circuit Design** (12hrs)
   VHDL models and simulation of combinational circuits such as Multiplexers, Encoders, Decoders, Code converters, Comparators, Implementation of Boolean functions etc.

4. **Sequential Circuit Design** (12hrs)
   VHDL Models and simulation of sequential circuits, Shift registers, Counters etc.

5. **Introduction to CPLDs and FPGAs** (10hrs)
   Programmable logic devices: ROM, PLAs, GAL, PEEL, CPLDs and FPGA. FPAA (Field Programmes Analog Array)

6. **Design Flow** (10hrs)
   The conventional ASIC design flow, Introduction to design methodology challenges (Wire load models, Design verification, floor-planning, placement and routing, power, parasitic extraction.)

RECOMMENDED BOOKS

1. VLSI Technologies by SZE, Tata McGraw Hill Education Pvt Ltd , New Delhi
2. IEEE Standard VHDL Language Reference Manual(1993)
3. "Digital System Design using VHDL":Charles. H. Roth; PWS(1998)
4. VHDL-IV Edition: Perry; Tata McGraw Hill Education Pvt Ltd , New Delhi
5. VLSI Design for Analog by Geiger, Tata McGraw Hill Education Pvt Ltd , New Delhi
6. Principles of CMOS VLSI Design by Weste and Kamran Eshraghian.

RECOMMENDED SOFTWARE

Xilinx Synthesis Software (web pack) freely available on internet. On Xilinx.com
VLSI System Design is wind software for designing (System Designing).
VLSI Learning Resource like Ex-VLSI

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
1	10	15
2	10	15
3	12	20
4	12	20
5	10	15
6	10	15
Total	**64**	**100**

5.5.2 PERSONAL COMPUTER ORGANIZATION

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RATIONALE

Personal Computers have become a necessity in Industry, offices and becoming popular in homes too. This course gives organization structure and principles of working of various other components like visual display, keyboard drives and printers etc. Diploma holders will find employment in computer industry, Repair and maintenance field.

DETAILED CONTENTS

1. Mother Board (12 hrs)
   1.1 Introduction to different type of mother boards.
   1.2 Single Board Based System, Block diagram of motherboard. Installation of Computer system.

2. Buses and Ports (12 hrs)
   2.1 Different type of Buses PCI, SCSI and Serial and Parallel ports (COM ports) Ports COM 1, LPTI, USB. RS 232 C, use of computer for instrumentation

3. Memory (10hrs)
   Principle and Construction of Floppy Disk Drive and hard disk device (HDD). Floppy disk Controller & Hard disk controller. Pen Drives, common faults with hard disk drive and floppy disk drive, RAM Module.

4. Keyboard and Mouse (10hrs)
   Block Diagram of keyboard Controller, keyboard switches, keyboard faults, mouse, common faults with mouse. Introduction to scanner, digitizer.

5. CRT Display Devices: (10hrs)
   Block Diagram, Principle of operation of Computer Monitor, Difference between TV & Computer Monitor. Video display Adaptors (monochrome and Colour), introduction to solid state displays.

6. Printers (10hrs)
   Printing Mechanism, Construction and working principles of Dot Matrix Printer, Inkjet Printer, Laser Printer, Printer Controller, Centronic Interface, Signals from PC to Printer and Printer to PC.

RECOMMENDED BOOKS
   1. PC Organisation by S. Chowdhury, Dhanpat Rai & Sons, Delhi
   2. IBM PC Colons by Govinda Rajalu, Tata McGraw Hill Publishers, New Delhi.
   3. Text Book by Mark Minasi
   4. Computers by P.Norton

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allocation (%)
1	12	18
2	12	18
3	10	16
4	10	16
5	10	16
6	10	16
Total	64	100

5.5.3 SATELLITE COMMUNICATION

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RATIONALE

To understand the basics of satellite communications, different satellite communication orbits, the satellite segment and earth segment and provide an in-depth treatment of satellite communication systems operation and planning. It aims to analyze the various methods of satellite access, Link budgets & planning. Review the state of the art in new research areas such as speech and video coding, satellite networking and satellite personal communications. Aims to learn Digital audio/video broadcasting using satellites and understand various applications of satellite communications

DETAILED CONTENTS

1. **Introduction to Satellite Communication** (5 hrs)
   Historical background, Basic concepts of Satellite Communications, Orbital and Spacecraft problems, Growth of Satellite communications.

2. **Orbits and Launching Methods** (6 hrs)
   Introduction, Kepler's First Law, Kepler's Second Law, Kepler's Third Law, Definitions of Terms for Earth- Orbiting Satellites, Orbital Elements, Apogee and Perigee Heights, Atmospheric drag.

3. **The Geostationary Orbit** (9 hrs)
   Introduction, Near Geostationary Orbits, Earth Eclipse of Satellite, Sun Transit Outage, Launching Orbits.

4. **The Space Segment** (14 hrs)
   Introduction, The Power Supply, Attitude Control, Spinning satellite stabilization, Momentum wheel stabilization, Station Keeping, Thermal Control, TT&C Subsystem, Transponders, The wideband receiver, The input demultiplexer, The power amplifier, The Antenna Subsystem.

5. **The Earth Segment** (7 hrs)
   Introduction, Receive-Only Home TV Systems, The outdoor unit, The indoor unit for analog (FM) TV, Transmit- Receive Earth Stations.

6. **The Space Link** (16 hrs)
   Introduction, Equivalent Isotropic Radiated Power, Transmission Losses, Free-space transmission, Feeder losses, Antenna misalignment losses, Fixed atmospheric and ionospheric losses, The Link-Power Budget Equation, System Noise, Carrier-to-Noise Ratio, The Uplink, Saturation flux density, Input backoff, Downlink, Output back-off, Combined Uplink and Downlink C/N Ratio.

7. **Satellite Access** (5 hrs)
   Various access methods in satellite communication: Single Access, Preassigned FDMA, Preassigned TDMA

8. **VSAT Introduction to VSAT its feature & applications.** (2 hrs)

RECOMMENDED BOOKS

1. Satellite Communications, by Dennis Roddy (Fourth edition),McGraw Hill.
2. Satellite Communication Systems Engineering, by Wilbur L. Pritchard, Henri G. Suyderhoud, Robert A. Nelson (Second Edition), Pearson

3. Satellite Technology, Principles and Applications, by Anil K. Maini, Varsha Agarwal (Second Edition), Wiley.
4. Satellite Communication, by Timothy Pratt, Charles Bostian, Jeremy Allnutt(Second Edition), John Wiley & Sons.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
1	05	10
2	06	10
3	09	15
4	14	20
5	07	10
6	16	22
7	05	08
8	02	05
Total	**64**	**100**

5.5.4 SIGNALS AND SYSTEMS

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RATIONALE

The course will provide strong foundation on signals and systems which will be useful for creating foundation of communication and signal processing. The students will learn basic continuous time and discrete time signals and systems. Student will understand application of various transforms for analysis of signals and systems both continuous time and discrete time. Students will also explores to power and energy signals and spectrum.

DETAILED CONTENTS

1. Basic definitions   (12 hrs)

Basic definitions, Classification of signals and systems. Signal operations and properties. Basic continuous time signals, signal sampling and quantization, discretization of continuous time signals, discrete time signals. Basic system properties, Representation of digital signals. Case study of different signals form communication and biomedical field

2. Impulse response   (12 hrs)

Impulse response characterization and convolution integral for CT- LTI system, signal responses to CT-LTI system, properties of convolution, LTI system response properties from impulse response. (*Review of Laplace transform with reference to CT signals and systems.)

3. Impulse response   (16 hrs)

Impulse response characterization and convolution sum, Causal signal response to DT-LTI systems. Properties of convolution summation, Impulse response of DT-LTI system. DT-LTI system properties from Impulse response. System analysis from difference equation model

4. Representation of periodic functions   (15 hrs)

Representation of periodic functions, Fourier series, Frequency spectrum of aperiodic signals, Fourier Transform, Relation between Laplace Transform and Fourier Transform and its properties. Introduction to DTFT and DFT

5. The z-Transform   (09 hrs)

The z-Transform, Convergence of z-Transform, Basic z-Transform, Properties of z-Transform, Inverse z-Transform and Solving difference equation using z-Transform

RECOMMENDED BOOKS
1. Signals and Systems; Author: Alan V. Oppenheim, Alan S. Wilsky and Nawab ; Publisher: Prentice Hall
2. Signals and Systems; Author: K. Gopalan; Publisher: Cengage Learning
3. Signals and Systems; Author: Simon Haykin and Bary Van Veen; Publisher: Wiley- India Publications
4. Signal, Systems and Transforms; Author: Charles L. Philips, J. M. Parr and E. A. Riskin; Publisher: Pearson Education
5. Digital Signal Processing Fundamentals and Applications; Author: Li Tan, Elsevier; Publisher: Academic Press

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
1	12	15
2	12	15
3	16	30
4	15	25
5	09	15
Total	**64**	**100**

5.6 MINOR PROJECT

RATIONALE

The project may be small in size but should include only those components which he has studied in earlier classes, with a clear idea of signals processing. It would enable first- hand experience of components, their purchase, assembly, testing and trouble shooting. It would boost up confidence of the students to repair and preparation of electronic gadgets. There should not be more than 2-3 students for each project. A report must be prepared with a hard and soft copy. The following contents will be discussed in lab classes.

Some of the projects are listed below which is just a guide line for selecting the minor project. Students can also select any other project with the advice of his teacher.

LIST OF PROJECTS

1. Regulated power supply
2. Timers using 555 and other oscillators
3. Touch plate switches– transistorized or 555 based
4. Doorbell/cordless bell
5. Clapping switch and IR switch
6. Blinkers
7. Sirens and hooters
8. Single hand AM or FM
9. Electronic toy gun, walker, blinkers
10. Electronic dice
11. Cell charger, battery charger, mobile charger
12. Fire/smoke/intruder alarm
13. Liquid level controller
14. Counters
15. Combination locks
16. Electronics musical instruments
17. Telephone handset
18. Electronic Ballasts
19. Audio amplifiers
20. Tape recorders
21. Automatic stabilizer/CVT
22. Emergency light
23. Design and manufacture of transformer
24. Fan regulator
25. Dish Antenna

6.1 PROGRAMMABLE LOGIC CONTROLLERS AND SCADA

L T P
4 – 2

RATIONALE

A diploma holder when employed in automated industrial process controls or in automated power station will be required to know the basics of latest controlling techniques like DCS,SCADA and Programmable Logic Controllers, their working and their programming. In industry, many manufacturing processes demand a sequence of operation, which are to be performed repetitively. Early automation systems were mechanical in design, timing and sequencing being effected by gears and cams. Slowly these design concepts were replaced by electrical drives which were controlled by relays and now by programmable logic controllers (PLCs), SCADA etc. A diploma holder in industry is called upon to design, modify and troubleshoot such control circuits. Looking at the industrial applications of these techniques in the modern industry, this subject finds its usefulness in the present curriculum.

DETAILED CONTENTS

1. Introduction to PLC   (10Hrs)

Relays based logic circuits, limitations of relays based logic circuit, Concept of PLC, Advantages of PLCs over electromagnetic relays based logic circuits, Different programming languages used in PLC, PLC specifications.

2. Architectural Detail and Working of PLC   (10Hrs)

2.1 Basic operation and principle of working of PLC
2.2 Architectural details of PLC
2.3 Input & Output Modules in PLC
2.4 Opto-isolation Circuit in PLC and its need
2.5 Memory structures in PLC,
2.6 HMI (Human Machine Interface) used in PLC system
2.7 Power supply requirements in PLC

3. Instructions Set   (16Hrs)

3.1 Addressing in PLC: I/O Address
3.2 Basic instructions: Examine ON, Examine OFF, Latch/Unlatch, Output Energize, Hold ON.
3.3 Timer instructions: On delay timer, Off delay timer, retentive/non-retentive timers, resetting of timers.
3.4 Counter instructions: Up Counter, Down Counter, resetting of counters.
3.5 Sequencers.
3.6 Comparison instructions like equal, not equal, greater, greater than equal, less than, less than equal.

4. Ladder Logic Programming   (16Hrs)

Introduction to Ladder Logic programming, Ladder logic programming examples based on basic instructions, timer and counter instructions. Simple Applications of PLCs:
4.1 Bottle filling Process
4.2 Traffic Light Control
4.3 Material handling
4.4 Elevator
4.5 Oven Control
4.6 Stirred tank reactor (Process Control)
4.7 Forward/reverse control of motor using PLC

5. DCS & SCADA   **(12Hrs)**
   5.1 Introduction & History of DCS
   5.2 Hierarchical Architecture of DCS
   5.3 System Elements of DCS(Field Station, Intermediate Station and Central Computer Station)
   5.4 Advantages and Disadvantages of DCS
   5.5 Definition of SCADA
   5.6 Major elements of SCADA
   5.7 Advantages and Disadvantages of SCADA
   5.8 Application areas of SCADA
   5.9 Comparison of PLC, SCADA and DCS

LIST OF PRACTICALS
   1. Develop a ladder logic Program for Elevator.
   2. Develop a ladder logic Program for Oven Control.
   3. Develop a ladder logic Program for Bottle Filling.
   4. Develop a ladder logic Program for Stirrer Tank Control.
   5. Develop a ladder logic Program for Switching of Lights.
   6. Study of basic SCADA system.
   7. Study of basic DCS system.

RECOMMENDED BOOKS
   1. Process Control Instrumentation Technology, Curtis D. Johnson, Pearson
   2. Programmable Logic Controllers and Industrial Automation, Madhuchhanda Mitra, PHI
   3. Basic Instrumentation System & Programmable Logic Controller, Dr. Umesh Rathore, S.K. Kataria Publication
   4. Process Control –Principles & Applications, Surekha Bhanot, Oxford University Press
   5. Instrument Engineer's Handbook: Bela G. Liptak

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	10	15
2.	10	15
3.	16	25
4.	16	25
5.	12	20
Total	**64**	**100**

6.2 WIRELESS AND MOBILE COMMUNICATION

L T P
4 - 2

RATIONALE

The wireless/mobile communication technology though complex but is spreading at a very fast rate. People use more of mobile phones in comparison to land line phones. It is expected that within 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

1. Wireless Communication (12hrs)
  1.1 Basics
  1.2 Advantages of wireless communication
  1.3 Electromagnetic waves
  1.4 Frequency Spectrum used
  1.5 Cellular Network Systems
  1.6 Propagation considerations
    a) Range
    b) Atmospheric Effect
    c) Geographic Effect
    d) Fading
    e) Doppler Effect
    f) Multipath Effect

2. Cellular Concept (12hrs)
  2.1 Cell area
  2.2 Cell Site Structure
  2.3 Capacity of cell
  2.4 Frequency Response (ARFCN Concepts)
  2.5 Interference (Co-channel, Adjacent channel)
  2.6 Power Control for reducing Interference
  2.7 Fundamentals of cellular network planning
    a) Coverage planning
    b) Capacity planning

3. Multiple Access Techniques for Wireless Communication (16hrs)
  3.1 Introduction to Multiple Access.
  3.2 Frequency Division Multiple Access (FDMA)
  3.3 Time Division Multiple Access (TDMA)
  3.4 Code Division Multiple Access (CDMA), WCDMA
  3.5 Spread Spectrum Techniques

4. Mobile Communication Systems (16hrs)
  4.1 Introduction of Global Systems for Mobile Communication (GSM) and its architecture, Introduction of CDMA System, comparison of CDMA and GSM Systems
  4.2 Introduction of GPRS and EDGE.

5. Introduction to 3G & 4G (08hrs)
  5.1 Introduction to Architecture and Features of UMTS
  5.2 HSPA (High Speed Packet Access)
  5.3 4G/LTE Architecture

LIST OF PRACTICALS
1. Study the features, specification and working of cellular mobile
2. Measurement of signal strength at various points from a transmitting antenna/cordless phone
3. Demonstration of Base Trans Receiver(BTS) with nearby cellular tower
4. Observing call processing of GSM trainer Kit.
5. Practice of setting GPRS on Mobile phone
6. Observing call processing of CDMA trainer kit.

RECOMMENDED BOOKS

1. Wireless Communications, Principles and Practice, by Thedore 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. Mobile and Personal Communication Systems and Services, by Raj Pandya, Prentice Hall of India, New Delhi
7. Mobile Communication by John Schiller, Prentice Hall of India, New Delhi
8. Wireless Communications by Pahalwan, Pearson Publishers
9. Wireless and Mobile Communication VK Sangar, Ishan Publications.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	12	20
2.	12	20
3.	16	25
4.	16	25
5.	08	10
Total	**64**	**100**

6.3 MICROCONTROLLERS AND EMBEDDED SYSTEM

L T P
4 – 2

RATIONALE

Embedded systems and Micro-controllers have also assumed a great significance in the electronic and consumer goods industry and are a very vital field. The subject aims to expose students to the embedded systems besides giving them adequate knowledge of Micro controllers.

DETAILED CONTENTS

1. **Microcontroller series (MCS) – 51 Overview**   **(14 hrs)**
   * Architecture of 8051 Microcontroller
   * Pin details
   * I/O Port structure
   * Memory Organization
   * Special Function Registers (SFRs)
   * External Memory

2. **Assembler and addressing modes**   **(16 hrs)**
   * Instruction types
   * Instruction set of 8051
   * Addressing modes
   * Assembler directives
   * Assembler operation

3. **Timer and interrupts**   **(12 hrs)**
   * Timer operation
   * Serial Port operation
   * Interrupts

4. **Design and Interface**   **(12 hrs)**
   Examples like: keypad interface, 7- segment interface, LCD, stepper motor.
   A/D, D/A, RTC interface.

5. **Block diagram and pin details: ARDUINO**   **(04 hrs)**

6. **Application of Micro controllers in Communication System**   **(06 hrs)**

LIST OF PRACTICALS
1. Demonstration of Micro-controller Kit
2. Assembly Language Programming
3. C Language Programming- (PC Based)
4. To study the LCD Interface.
5. To study the interface of A/D converter
6. To study the interface of D/A converter
7. To study the interface of controller with sensors

RECOMMENDED BOOKS

1. Microcontrollers by Deshmukh, Tata McGraw Hill Education Pvt Ltd, New Delhi
2. Microcontrollers by Ayala
3. Microcontrollers by Mazidi, Pearon Education, Delhi
4. Microcontrollers by Neil Makanzi, Pearon Education, Delhi
5. Embedded GSM Applications
6. Microcontrollers and Embedded Systems by Sangar and Sahdev, Uneek Publications, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	14	20
2.	16	30
3.	12	20
4.	12	10
5.	04	10
6.	06	10
Total	**64**	**100**

6.4.1 MEDICAL ELECTRONICS

L T P
4 - -

RATIONALE

A large number of electronic equipment's are being used in hospitals for patient care and diagnosis or carry out advanced surgeries. This subject will enable the students to learn the basic principles of different instruments used in medical science.

DETAILED CONTENTS

1. Overview of Medical Electronics Equipment, classification, application and specifications of diagnostic, therapeutic and clinical laboratory equipment, method of operation of these instruments
   (08 hrs)

2. **Electrodes** **(10 hrs)**

   Bioelectric signals, Bio electrodes, Electrode, Electrode tissue interface, contact impedance, Types of Electrodes, Electrodes used for ECG, EEG

3. **Transducers** **(10 hrs)**

   Typical signals from physiological parameters, pressure transducer, flow transducer, temperature transducer, pulse sensor, respiration sensor,

4. **Bio Medical Recorders** **(12 hrs)**

   Block diagram description and application of following instruments
   • ECG Machine
   • EEG Machine
   • EMG Machine

5. **Patient Monitoring Systems** **(12 hrs)**

   • Heart rate measurement
   • Pulse rate measurement
   • Respiration rate measurement
   • Blood pressure measurement
   • Principle of defibrillator and pace mark

6. **Safety Aspects of Medical Instruments** **(12 hrs)**

   • Gross current shock
   • Micro current shock
   • Special design from safety considerations.
   • Safety standards.

Note: Students must be taken for a visit to hospital for exposure of various medical electronics related equipments like ventilator, boyles apparatus, pulse ox meters, defibrillators, bedside monitor and x-ray equipment etc.

RECOMMENDED BOOKS

1. Handbook of Biomedical Instrumentation by RS Khandpur,Tata McGraw Hill Education Pvt Ltd, New Delhi
2. Biomedical Instrumentation by Cromwell
3. Modern Electronics Equipment by RS Khandpur, TMH, New Delhi
4. Introduction to Biomedical Electronics by Edward J. Perkstein; Howard Bj, USA

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (hrs)	Marks Allotted (%)
1	08	12
2	10	14
3	10	14
4	12	20
5	12	20
6	12	20
Total	**64**	**100**

6.4.2 MULTIMEDIA COMMUNICATION

L T P
4 - -

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.

DETAILED CONTENTS

1. **Basics of Switching Systems and Telephone Networks**
    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 Signaling techniques and their comparison
    1.8 Network traffic load and parameters
    1.9 Grade of service and blocking probability
    1.10 EPABX

2. **Satellite Communication**
    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

3. **Integrated Services Digital Networks (ISDN)**
    3.1 ISDN concepts , standards, protocol architecture
    3.2 Transmission channels , Signaling: user level, network level
    3.3 ISDN services: videotext, Email, digital facsimile, tele text, database access
    3.4 Interworking
    3.5 Broadband ISDN

4. **Multimedia Communication Techniques and Standards**
    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

5. **Multimedia Communications Across Networks**

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

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

RECOMMENDED BOOKS

1. Telecommunication Switching Systems And Networks by Viswanathan, Thiagarajan; PHI Learning, New Delhi
2. Electronic Communications by Roddy, Dennis Coolen John; Pearson Education, New Delhi
3. Satellite Communications by Pratt, Bostian, Allnutt; Wiley,India, New Delhi
4. Multimedia Communication systems by Rao, Bojkovic, Milovanovic; Pearson education
5. Multimedia communication systems by Fred Halsall by Pearson education, ,New Delhi
6. Principles of Multimedia by Parekh Ranjan , Ranjan; Tata McGraw-Hill, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (hrs)	Marks Allotted (%)
1	13	20
2	13	20
3	10	16
4	14	22
5	14	22
Total	**64**	**100**

6.4.3 ANDROID APPLICATION DEVELOPMENT

L T P
4 - 4

RATIONALE

Android Application Development enables students to successfully apply core Java programming languages features & software patterns needed to the design and implementation of Android applications for mobile devices. Students will develop an application from scratch, assuming a basic knowledge of Java, and learn how to set up Android Studio, work with various Activities and create simple user interfaces to make their apps run smoothly.

DETAILED CONTENTS

1. **Android Platform and Development Environment**   **(6 hrs)**
    Intoduction to Android OS and its versions, Android Platform, Linux kernel, libraries, Android Runtime : core libraries and Dalvik Virtual Machine, Application Framework and Applications; Android Development Environment: Android SDK and JDK, Android Studio IDE, Android Emulator, Debugging Android applications.

2. **Fundamentals of Android Application**   **(10 hrs)**
    Components of android application: activity, service, broadcast receiver and content provider, fragments, views, layouts and intents; Manifest : role, declaring components and component capabilities; Creating Android application: define resources, implement application classes, package application and install & run application.

3. **The Activity Class**   **(10 hrs)**
    Activity class, task backstack; activity states and life cycle, activity callback methods: onCreate, onStart(), onResume(), onPause(), onRestart(), onStop() and onDestroy(); Starting Activities; Handling Configuration Changes; Configuring the Manifest: declaring activities, intent filters and permissions.

4. **Intents, Permissions and Fragments**   **(10 hrs)**
    Use of intent, Intent class, intent types, building an intent, intent filter, intent resolution; Android permissions, defining & using application permissions, Component permissions; fragment, fragment life cycle and its states, fragment callback methods, adding fragments to activities.

5. **Android User Interface**   **(10 hrs)**
    Views: TextView, EditText, AutoCompleteTextView, Button, ImageButton, CheckBox, ToggleButton, RadioButton, RatingBar; View Groups: RadioGroup, TimePicker, DatePicker, WebView, MapView, Gallery, Spinner; AdapterViews: ListView, Spinner, Gallery; View Events : view event sources, handling view events, common view operations; Layouts: Constrained Layout, Linear Layout, Relative Layout, Table Layout, Absolute Layout, Frame Layout, Grid View.

6. **Android User Notification and Broadcast Receiver**   **(10 hrs)**
    Toast, creating toast notification, notification area, broadcast receiver, create and register broadcast receiver, broadcasting custom intents, broadcast receiver event handling.

LIST OF PRACTICALS

1. To install the Java Development Kit (Latest Version) and Android Studio (Latest Version).
2. To explore the Android Studio (Toolbar, Navigation Bar, Editor Window, Editor Tabs, Project Explorer, Tool Window Bar, Tool Windows, Status Bar etc.)

3. To create an Android project to display the message "Hello World!", run it on Android Virtual Device (AVD) and deploy the application on a real Android device.
4. To develop an Android application Cap Quiz that tests the user's knowledge of country's capital. The name of a random country, a capital and TRUE/FALSE buttons should the displayed on the screen. The application should evaluate the user response and provide the instant pop-up message.
5. To modify the application developed in experiment-4 to add the provision of navigation to 'Next' and 'Previous' questions and evaluate the response only after user presses the 'Submit' image button.
6. To develop an Android application to implement a basic arithmetic calculator.
7. To develop an Android application to demonstrate the working of Broadcast Receiver.

RECOMMENDED BOOKS
1. Android Application Development for Dummies By Donn Felker, Wiley Publishing Inc.
2. Android Programming: the Big Nerd Ranch Guide By Bill Phillips et al., Pearson Publication

REFERENCE BOOKS / WEBSITES
1. https://developer.android.com/guide/
2. https://www.tutorialspoint.com/android/index.html
3. https://www.javatpoint.com/android-tutorial

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	10
2	10	20
3	10	20
4	10	15
5	10	20
6	10	15
Total	**56**	**100**

6.4.4 INTERNET OF THINGS

L T P
4 - 2

RATIONALE

Internet of Things (IoT) is all about connecting physical objects to the Internet to enable same level of interaction with rest of the world as any other computing device. Applications of IoT include homes, buildings, environment, transport, education, logistics, security and many more. Raspberry Pi is a single-board computers made by the Raspberry Pi Foundation that aims to educate people in computing. People use Raspberry Pi to learn programming skills, build hardware projects, do home automation, and even use them in industrial applications. This practical-only course is designed to promote creativity and innovation in the students by designing and implementing IoT based projects. The students may choose either a Raspberry Pi or Arduino board to implement small projects.

DETAILED CONTENTS

1. Introduction to Internet of Things **(10 hrs)**
Internet of Things (IoT), Characteristics of IoT, Key features of IOT, Advantages and Disadvantages of IOT, IoT Applications, Physical Design of IoT, logical design of IoT, Generic block diagram of an IoT Device.

2. IoT Architecture **(14 hrs)**
Architecture of IoA, SOA based Architecture, API-Oriented Architetecture, Resource management-resource partioning, computation offloading, communication model, IoT levels and deployment templates.

3. Communication Technologies **(12 hrs)**
Protocol standardization for IoT – ZigBee architecture, BLE protocol , Wifi, LTE, IEEE 802.11, 802.15.4 – LR-WPAN, RFID protocols, NFC

4. IoT Physical Devices and End points **(12 hrs)**
Introduction to embedded electronics, introduction to Arduino, Arduino UNO, fundamentals of Arduino programming, introduction to Raspberry Pi. Building IoT with any platform.

5. IoT Security **(8 hrs)**
IoT security issues, IoT security threats, security requirements – IP protocol based IoT, hetrogenous IoT, light weight security.

(i) LIST OF PRACTICALS
1. To setup development environment for Raspberry Pi or Arduino
2. To understand the logical board layout of Raspberry Pi or Arduino
3. To interface basic sensors and actuators with development board
4. To interface various communication modules (Bluetooth, WiFi) with development board
5. To design a project using sensors, actuators, communication modules (at least one each), draw the circuit diagram and prepare the list of required parts
6. To develop, test and implement the designed project

(ii) LIST OF PARTS

1.	Development Board : Raspberry Pi or Arduino with Power Supply and Case	12.	PIR Motion Sensor
2.	Bluetooth module: HC05	13.	Ultrasonic Sensor : HC-SR04
3.	MicroSD Card	14.	Infrared distance meter : GP2Y0A02YK
4.	HDMI – HDMI cable	15.	Inductive RFID card reader : RFID-RC522
5.	Jumper Wires : M-M, M-F, F-F	16.	Gyroscope : MPU-6050
6.	Red, Green, Blue, White LEDs	17.	Realtime clock : DS1307 RTC
7.	Bread Boards	18.	Servo Motor
8.	LCD Module	19.	Stepper Motor
9.	Push Buttons	20.	Servo Board : PCA9685
10.	Humidity / Temperature Sensor : DHT11, DHT22, DS18B20 and DS18S20	21.	Relays
11.	Gas Sensor : MQ-2	22.	Photoresistors

RECOMMENDED BOOKS
1. Internet of Things with Raspberry Pi 3 By Maneesh Rao, Packt Publication
2. Raspberry Pi IoT Projects By John C. Shovic, Apress Publication
3. Programming Arduino : Getting Started with Sketches By Simon Monk, McGraw Hill

REFERENCE DIGITAL RESOURCES
1. https://www.electronicsforu.com
2. https://projects.raspberrypi.org
3. https://create.arduino.cc

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	14	25
3	12	25
4	12	20
5	08	10
Total	**56**	**100**

6.4.5 COMPUTER NETWORKS

LT P
4 - 2

RATIONALE

The future of computer technology is in computer networks. Global connectivity can be achieved through computer networks. A diploma holder in electronics and communication engineering should therefore understand the function of networks. Knowledge about hardware and software requirements of networks is essential.

DETAILED CONTENTS

1. **Networks Basics** (14 hrs)
   - What is network
   - Peer-to –peer Network
   - Server Client Network
   - LAN, MAN and WAN
   - Network Services
   - Topologies
   - Switching Techniques

2. **Reference models** (10 hrs)
   - OSI Reference Model, functions of layers in OSI reference model
   - TCP/IP reference model, TCP/IP network mode
   - Stan-dards

3. **Interworking** (12 hrs)
   - Concept of physical and logical addressing
   - Different classes of IP addressing, special IP address
   - Sub netting and super netting
   - Loop back concept
   - IPV4 and IPV6 packet Format
   - Configuring IPV4 and IPV6

4. **Cables and Connectors** (10 hrs)
   - Types of Cables(Coaxial, Twisted Pair), Shielded and Unshielded Pair of Cables (Straight wire Cable, CrossOver Cables) with colour coding.
   - Ethernet Specification and Standardization:
     10 Mbps (Traditional Ethernet), 100 Mbps (Fast Ethernet) and 1000 Mbps (Gigabit Ethernet), Leased lines.
   - Use of RJ45, RJ11, BNC, SCST.

5. **Network Connectivity** (8 hrs)
   - Network connectivity Devices
   - NICs
   - Hubs
   - Repeaters
   - Switches
   - Routers and Routing Protocols.

6. **Network Trouble Shooting Techniques**   **(5hrs)**
    -   Trouble Shooting process
    -   Trouble Shooting Tools: PING,IPCONFIG, IFCONFIG, NETSTAT, TRACEROOT, Wiresharp/ Dsniffer/ Pcop

7. **Wireless Networking**   **(5 hrs)**
    Basics of Wireless: Wireless MAN, Networking, Wireless LAN, Wi-Fi, WiMax (Broadband Wireless) and Li-Fi.

LIST OF PRACTICALS

1. Recognize the physical topology and cabling (coaxial, OFC, UTP, STP) of a network.
2. Recognition and use of various types of connectors RJ-45, RJ-11,BNC and SCST
3. Making of cross cable and straight cable.
4. Install and configure a network interface card in a workstation.
5. Identify the IP address of a workstation and the class of the address and configure the IP Address on a workstation
6. Study and demonstration of sub netting of IP address
7. Use of Netstat and its options.
8. Connectivity troubleshooting using PING, IPCONFIG, IFCONFIG

Required tools and Supplies
1. Crimping tool, crone Tool, Cable tester,
2. RJ 45 connectors, RJ-11, BNC, SCST
3. Coaxial Cable, UTP, STP, OFC cable
4. Screwdriver Kit
5. Switch/Hub
6. Manageable Switch

RECOMMENDED BOOKS
1. Computer Networks by Tanenbaum, Prentice Hall of India, New Delhi
2. Data Communications and Networking by Forouzan, (Edition 2nd and 4th),Tata McGraw Hill Education Pvt Ltd , New Delhi
3. Data and Computer Communication by William Stallings, Pearson Education, New Delhi
4. Local Area Networks by Peter Hudson
5. Understanding Local Area Network by Neil Jenkins
6. Area Networks by Stan Schatt, Prentice Hall of India, New Delhi
7. Network+ Lab manual,- BPB Publications -by Tami Evanson
8. Networking Essentials – BPB Publications New Delhi
9. Computer Network and Communications by V.K. Jain and Narija Bajaj, Cyber Tech Publications, New Delhi.
10. Linux – The complete Reference by Richard Peterson, Tata McGraw Hill Education Pvt Ltd, New Delhi.
11. Linux – Install and Configuration Black Book by Dee Annleblanc and Issac Yates, IDG Books India Private Limited, Delhi.
12. Computer Network by J.S. Katre, Tech-Max Publication, Pune

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (hrs.)	Marks Allotted (%)
1.	14	22
2.	10	14
3.	12	18
4.	10	16
5.	08	10
6.	05	10
7.	05	10
Total	**64**	**100**

6.5 MAJOR PROJECT

L T P
- – 8

RATIONALE

Major Project Work aim sat developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period with a view to:

i)   Develop understanding regarding the size and scale of operations and nature of field-work in which students are going to play their role after completing the courses of study.
ii) Develop understanding of subject based knowledge give ninth e classroom in the context of its application at work places.
iii) 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.
iv) Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc.

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (say at the end of second year). Students should be allotted a problem of interest to him/her as a major project work. It is also essential that the faculty of the respective department may have a brain storming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

This practical training cum project work should not be considered as merely conventional industrial training in which students are sent at work places with either minimal or no supervision. This experience is required to be planned in advance and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches with the curricular interest of students and of professional value to industrial/field organizations. Each teacher is expected to supervise and guide 5-6 students.

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 as per the curriculum of Electronics and Communication Engineering.
10. Repair of oscilloscope, function generator
11. Design and developing websites 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 BER (Bit Error Rate) of various modulation techniques
24. Design ALU using CPLD/FPGA
25. Design display system using CPLD/FPGA
26. Fibre Optic based controller for data transfer.
27. Optical switch to be used in Computer networking

6.6 PRACTICES IN COMMUNICATION SKILLS

L T P
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RATIONALE

For successful completion of diploma programme, the students should possess adequate command on language and communication skills so that they are able to express themselves with ease and felicity. The language used by the students should be appropriate to objectives and occasion. The contents of this subject shall provide them practical training through language laboratory.

LIST OF PRACTICALS

1. **Exercises on phonetics** (8 hrs)
    1.1 Identifications of English phonemes
    1.2 Stress and Intonation
    1.3 Speaking exercises with emphasis on voice modulation (reading and extempore)

2. **Group Discussion** (4 hrs)

3. **Exercises on** (4 hrs)
    - Self-assessment using tools like SWOT analysis
    - Listening skills

4. **Internet communication and Correspondence** (4 hrs)
    4.1 Resume writing
    4.2 Covering letter
    4.3 Agenda and Minutes of meeting
    4.4 Business Correspondence

5. **Exercises on** (4 hrs)
    5.1 Body language and Dress sense
    5.2 Etiquettes and mannerism in difficult situations like business meetings, table manners, Telephone etiquette
    5.3 Manners related to opposite gender
    5.4 Cross-cultural Communication

6. **Mock interviews** (telephonic/personal) (4 hrs)

7. **Role plays for effective Communication** (4 hrs)