Curriculum for

POST GRADUATE DIPLOMA COURSE In COMPUTER HARDWARE & NETWORKING

For the State of Uttar Pradesh

Prepared by:

Institute of Research Development & Training
U. P. Kanpur

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FIRST SEMESTER

SECOND SEMESTER

PREFACE

An important issue generally debated amongst the planners and academicians world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. The rapid industrialization and globalization have created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the forgettable years of closed economy to knowledge based and open economy in the last few decades. In order to cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources, in the delivery system. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by the State Board of Technical Education, UP to revise the existing curricula of diploma programmes as per the needs of the industry and making them NSQF compliant, are laudable.

In order to meet the requirements of future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of diploma programmes. The curricula for diploma programmes have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma programme.

The real success of the diploma programme depends upon its effective implementation. However best the curriculum document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected from the polytechnics to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much needed dynamism in the system.

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Kanpur, U.P.

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6. Faculty/Subject Experts from U.P. Government polytechnics

Coordinator
Institute of Research Development & Training,
Kanpur, U.P.

1. SALIENT FEATURES OF Post Graduate DIPLOMA in Computer Hardware & Networking

1)	Name of the Programme	:	P.G. Diploma in Computer Hardware & Networking
2)	Duration of the Programme	:	One year (Two Semesters)
3)	Entry Qualification	:	Graduation or equivalent NSQF Level as Prescribed by State Board of Technical Education, UP
4)	Intake	:	60 (or as prescribed by the Board)
5)	Pattern of the Programme	:	Semester Pattern
6)	NSQF Level	:	Level - 8
7)	Ratio between theory and Practice	:	1 : 2 (Approx.)

8) Industrial Training

Two weeks of industrial training is included after Ist semester during summer vacation. Total marks allocated to industrial training will be 50.

9) Student Centred Activities

A provision of 3-6 hrs. per week has been made for organizing Student Centred Activities for overall personality development of students. Such activities will comprise of co–curricular activities such as expert lectures, self study, games, hobby classes like photography, painting, singing etc. seminars, declamation contests, educational field visits, NCC, NSS and other cultural activities, disaster management and environmental safety etc.

10) Project work

A project work in the 2nd semester has been included in the curriculum to enable the students to get familiar with the practices and procedures being followed in the industries and provide an opportunity to work on some live projects in the industry.

2. EMPLOYMENT OPPORTUNITIES FOR PG DIPLOMA HOLDERS IN COMPUTER HARDWARE & NETWORKING

PG Diploma holders in Computer Hardware & Networking can find employment in following sectors:

(1) Service Division (IT enabled services, maintenance service and installation of computer services)

(2) Assembly and Quality Control Division

(3) System and Network Administration

(4) Software Development and Testing Industries

(5) Industry Automation

(6) E-Commerce Support Engineer

(7) News and Newspaper/Agencies, Magazines

(8) Data Entry and MIS/ERP Operator

(9) Lab. Assistant/Technician

(10) Hospitals/Healthcare/Institutions/Schools

(11) Cloud Services Support Engineer

(12) Publishing Industry

(13) Marketing Division (Corporate Handling, SME, Institutional Segment, Government Tender Business)

(14) Telecommunication Sector

(15) Teaching Organizations (Polytechnics, Vocational Institutions etc)

(16) Networking (LAN, WAN etc)

(17) Defence Services/Police Services/Cyber Services/Forensic Services

(18) Call Centres, BPO etc.

(19) Telecom Sector

While in employment, the following areas of activity in different organisations (industry and service sector) are visualized for PG diploma holders in Computer Hardware & Networking:

- Assembling Computer System & it‟s peripherals
- Testing and maintenance of Computer System & it‟s peripherals
- Maintenance support of software and hardware
- Teaching and training at educational institutions
- Self-employment – Hardware Repair & maintenance, Networking, etc.
- Network installation, administration and maintenance
- Cyber Cafés

Various Designations for PG diploma holders in Computer Hardware & Networking:

(1) Service engineer/customer support engineer/maintenance engineer in installation, maintenance and service of computer systems and networking
(2) Assembly supervisor in manufacturing and production activity
(3) Technical Assistant/junior engineer in quality control and testing activities of computer systems manufacturing
(4) Junior/senior technical assistant in R&D laboratories and educational institutions to help in maintaining computers and networks
(5) Test engineers in process industry
(6) Network administrator
(7) Network Support Technician
(8) Hardware Repair & Support Engineer
(9) System administrator

3. LEARNING OUTCOMES OF PG DIPLOMA HOLDERS IN COMPUTER HARDWARE & NETWORKING:

After undergoing this programme, students will be able to:

1.	Assembling of Computer System & it‟s peripherals
2.	Repair & Maintenance of Computer System & it‟s peripherals
3.	Understanding of various components of a computer system
4.	Knowledge of different Operating Systems
5.	Perform OS Installation (Windows & Linux Based)
6.	Performing OS diagnosis
7.	Install and manage operating system and application software
8.	Creating network cables
9.	Setting up network (Wired & Wireless)
10.	Perform soldering & de-soldering of circuits & components
11.	Use of measuring instruments
12.	Communicate effectively in English with others
13.	Writing CV/ Resume
14.	Facing a Mock Interview
15.	Set-up, diagnose problems, troubleshoot computer networks and maintain security of the networks
16.	Installation and administration of Network Server
17.	Linux based network operations
18.	Perform data backups & Recovery
19.	Use open source tools and software
20.	Handle malware and viruses
21.	Network Routing Handling
22.	Setup & Configuration of network switches
23.	Installation and administration of DNS, active directory, DHCP, samba, web and print servers

4. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME

The following curriculum area subjects have been derived from learning outcomes:

1.	Assembling of Computer System & it‟s peripherals	PC & Peripheral Architecture
2.	Repair & Maintenance of Computer System & it‟s peripherals	PC & Peripheral Architecture
3.	Understanding of various components of a computer system	PC & Peripheral Architecture
4.	Knowledge of different Operating Systems	Operating System & Diagnostic Utilities
5.	Perform OS Installation (Windows & Linux Based)	Operating System & Diagnostic Utilities
6.	Performing OS diagnosis	Operating System & Diagnostic Utilities
7.	Install and manage operating system and application softwares	Operating System & Diagnostic Utilities
8.	Creating network cables	Basic Networking
9.	Setting up network (Wired & Wireless)	Basic Networking
10.	Perform soldering & desoldering of circuits & components	Basic Electronics & Measuring Instruments
11.	Use of measuring instruments	Basic Electronics & Measuring Instruments
12.	Communicate effectively in English with others	Soft Skills, Student Centered Activities
13.	Writing CV/ Resume	Soft Skills
14.	Facing a Mock Interview	Soft Skills
15.	Set-up, diagnose problems, troubleshoot computer networks and maintain security of the networks	Advance networking
16.	Installation and configuration of Servers	System administration
17.	Linux based network operations	System administration
18.	Perform data backups & Recovery	Operating System & Diagnostic Utilities
19.	Use open source tools and software	Information Security And IT Laws
20.	Handle malware and viruses	Information Security And IT Laws
21.	Network Routing Handling	Advance Networking
22.	Setup & Configuration of network switches	Advance Networking
23.	Managing network server	Advance Networking

5. ABSTRACT OF CURRICULUM AREAS

a) General Studies

1. Soft Skills

b) Basic Courses in Engineering/Technology

2. Pc & Peripheral Architecture
3. Basic Networking
4. Basic Electronics & Measuring Instruments

c) Applied Courses in Engineering/Technology

5. Operating System & Diagnostic Utilities
6. System Administration
7. Advance Networking
8. Information Security And IT Laws
9. Internet Of Things

d) Industrial Training

10. Project

6. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No.	Subjects	Distribution in Periods per week in Various Semesters	
		I	II
1.	PC & PERIPHERAL ARCHITECTURE	09	-
2.	OPERATING SYSTEM & DIAGNOSTIC UTILITIES	10	-
3.	BASIC NETWORKING	11	-
4.	BASIC ELECTRONICS & MEASURING INSTRUMENTS	10	-
5.	SOFT SKILLS	06	-
6.	SYSTEM ADMINISTRATION	-	10
7.	ADVANCE NETWORKING	-	12
8.	INFORMATION SECURITY AND IT LAWS	-	08
9.	INTERNET OF THINGS	-	08
10.	PROJECT	-	08
11.	STUDENT CENTERED ACTIVITIES	02	02
Total		**48**	**48**

7. STUDY AND EVALUATION SCHEME FOR PG DIPLOMA PROGRAMME IN COMPUTER HARDWARE & NETWORKING

FIRST SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	**T**	**P**		*Th*	**Pr**	**Tot**	**Th**	**Hrs**	**Pr**	**Hrs**	**Tot**	
1.1	PC & PERIPHERAL ARCHITECTURE	3	-	6	5	20	30	50	50	2 ½	50	3	100	150
1.2	OPERATING SYSTEM & DIAGNOSTIC UTILITIES	4	-	6	6	20	30	50	50	2 ½	50	3	100	150
1.3	BASIC NETWORKING	6	-	5	6	20	30	50	50	2 ½	50	3	100	150
1.4	BASIC ELECTRONICS & MEASURING INSTRUMENTS	4	-	6	6	20	30	50	50	2 ½	50	3	100	150
1.5	^SOFT SKILLS	2	-	4	4	20	10	30	50	2 ½	20	3	70	100
#Student Centered Activities		-	-	2	1		35	35	-	-	-	-	-	35
Total		**19**		**29**	**28**	**100**	**165**	**265**	**250**	**-**	**220**	**-**	**470**	**735**

^Common course content with Web Designing diploma programme.

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, self study etc.

SECOND SEMESTER (PG DIPLOMA PROGRAMME IN COMPUTER HARDWARE & NETWORKING)

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	**T**	**P**		*Th*	**Pr**	**Tot**	**Th**	**Hrs**	**Pr**	**Hrs**	**Tot**	
2.1	SYSTEM ADMINISTRATION	4	-	6	6	20	30	50	50	2 ½	50	3	100	150
2.2	ADVANCE NETWORKING	6	-	6	6	20	30	50	50	2 ½	50	3	100	150
2.3	INTERNET OF THINGS*	4	-	4	5	20	30	50	50	2 ½	50	3	100	150
2.4	INFORMATION SECURITY AND IT LAWS *	4	-	4	5	20	30	50	50	2 ½	50	3	100	150
2.5	PROJECT I: Industrial Training II: Project	 - -	 - -	 - 8	 2 4	-	 50 50	 50 50	-	-	 100	 4	 100	 200
#Student Centred Activities		-	-	2	1		35	35	-	-	-	-	-	35
Total		**18**	**-**	**30**	**29**	**80**	**255**	**335**	**200**	**-**	**300**	**-**	**500**	**835**

*Common course Content with CS/IT diploma programme.

Student Centred Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

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8. GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 35 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

A) i. 10 Marks for general behavior and discipline
(by HODs in consultation with all the teachers of the department)

ii. 5 Marks for attendance as per following:
(by HODs in consultation with all the teachers of the department)

a)	75 - 80%	2 Marks
b)	80 - 85%	4 Marks
c)	Above 85%	5 Marks

iii. 15 Marks maximum for Sports/NCC/Cultural/Co-curricular/ NSS activities as per following:
(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a)	15	-	State/National Level participation
b)	10	-	Participation in two of above activities
c)	5	-	Inter-Polytechnic level participation

iv. 5 Marks for completing Min. 3 hrs. duration Online Course (Open Source)/Workshop related to Computer/IT domain.

Note: There should be no marks for attendance in the internal sessional of different subjects.

1.1 PC & PERIPHERAL ARCHITECTURE

L	T	P
3	-	6

RATIONALE

The aim of the subject is to teach the basic working of the computer motherboard, peripherals and add-on cards. The subject helps the students to do the maintenance of the Computer, peripherals and its add-on cards. The students will be able to select the proper peripheral as per their specification and requirement. This is the core technology subject. The subject is practical oriented and will develop the debugging skills in the students.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Assemble Computer System & it‟s peripherals
- Repair & Maintenance of Computer System & it‟s peripherals
- Understanding of various components of a computer system

DETAILED CONTENTS

1. Basic building blocks of a computer system (03 Periods)
   Block diagram of a computer, Input & Output devices, CPU, Arithmetic & Logical Unit, Memory & it‟s Types.

2. The concept of hardware & the software - (03 Periods)
   Main components of a computer system, data & information, importance of information flow & its impact on growth & productivity.

3. Study of PC- AT/ATX System, Basics of Processor and CPU Clock , Motherboards, Chipset and Controllers, BIOS and the Boot Process. (05 Periods)

4. IDE and SATA Devices: (09 Periods)
   Hard Disk Drive and CD/DVDs Drives, SCSI Devices, Floppy Disk, Flash Drive, Solid State Drives, Backup Drive, Expansion Cards- LAN Card, IDE Card , VGA and SVGA Cards, Sound Card, Interface Cards, I/O cards, Video Cards, USB Card, Fire- Wire Cards, Internal Ports, Cables and Connector Types.

5. Switch Mode Power Supply: (04 Periods)
   Discrete components, principle of operation SMPS, converter topologies, PWM IC‟s and case study.

6. Monitors: (05 Periods)
   Monitors: - CRT, LCD and LED, Touch Screen Displays, CRT construction and working, 9 pin input type- monitor, block diagram of color monitor.

7. Hard Disk Drive: (04 Periods)

Its construction, basic principle of operation, disk drive types, installation, cables, connectors and jumper details, formatting and managing hard disk drive. Various interface standards.

8. Keyboard: Block diagram of keyboard circuit. (02 Periods)

9. Printer: (07 Periods)
   Types & components of printers, printer interface with computer, function block diagram for various sub- assemblies of printer, principle of operation of Laser and Inkjet printers, various mechanical sub- assemblies, general maintenance aspects.

LIST OF PRACTICALS

1. Study various mother boards- non-integrated, semi-integrated, integrated
2. Understand the mother board component
3. Familiarize the different types of expansion slot (ISA, EISA, PCI, AMR, PCI-E).
4. Study the expansion cards namely add-on-cards (audio, graphics, i/o, tv tuner, etc.).
5. Study different types of switch mode power supply – AT, ATX, NLX
6. Understand the power requirements for various components in a computer system
7. Study the different connectors and ports of a PC
8. Understand the various cables in a computer system
9. Familiarize the different types of memory modules: DDR1, DDR2, DDR3, DDR4.
10. Study various secondary storage- Hard disk, Flash drive, CD/DVD, SSD,
11. Understand the procedure of assembling a computer system.
12. Study the various techniques for formatting/partitioning.
13. Familiarize the hard disk partitioning using different tools.
14. Familiarize the interfacing of printers and installing driver software
15. Understand the interfacing, installation, working of various device such as Scanner, Projector, etc.
16. Understand the system Maintenance and trouble shooting.
17. Wi-Fi Concepts/Bluetooth concepts
18. Microprocessor socket types

INSTRUCTIONAL STRATEGY

Since this subject is practice oriented, the teacher should demonstrate the various components of computer system and it‟s peripherals to students while doing practical exercises. The students should be made familiar with the various components of computer system and it‟s peripherals.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Actual laboratory and practical work, exercises and viva-voce
- Software installation, operation, development and viva-voce

RECOMMENDED BOOKS

1. Electronics and Radio Engineering M.L. Gupta Dhanpat rai & Sons, New Delhi

2. PC And Clones Hardware, Troubleshooting and Maintenance B. Govinda rajalu, Tata Mc-graw-Hill Publication
3. PC Troubleshooting and Repair Stephen J. Bigelow Dream tech Press, New Delhi
4. Computer Installation & Servicing, D. Balasubramanian, Tata McGraw Hill
5. e-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR, Chandigarh.

Websites for Reference:

1. http://swayam.gov.in
2. http://spoken-tutorial.org

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	3	5
2	3	5
3	5	10
4	9	20
5	4	10
6	5	15
7	4	15
8	2	10
9	7	10
Total	**42**	**100**

1.2 OPERATING SYSTEM & DIAGNOSTIC UTILITIES

L	T	P
4	-	6

RATIONALE

Operating system is the software that makes a computers system operational. It is an interface between the human and machine. It drives all the hardware parts of the computer and is the first piece of software to run on the machine when the system boots. OS is a core technology subject, the knowledge of which is mandatory for every user. It familiarizes a learner with the OS concepts, structure, internal functionality, services and resource sharing. It will help a learner with OS design concepts. This subject will give a learner an overview of Windows and LINUX OS.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Knowledge of different Operating Systems
- Perform OS Installation (Windows & Linux Based)
- Performing OS diagnosis
- Install and manage operating system and application softwares
- Perform data backup and recovery
- Perform PC care and Maintenance

DETAILED CONTENTS

1. Concept of BIOS, POST its error codes and their interpretation (03 Periods)

2. Operating System concepts, definition, Batch processing, Time Sharing, Real Time, Multi-tasking, Multi- Programming. (05 Periods)

3. Steps in the bootingprocess, AUTOEXEC.BAT and CONFIG.SYS files, Memory usage in the DOS environment, Basic DOS commands, internal and external commands Basic file commands. (06 Periods)

4. Making and access directory from windows Console, operations performed on files. Using the FDISK, FORMAT, DEFRAG, SCANDISK, EMMAKER to optimize memory, Understanding .INI files in Windows. (05 Periods)

5. Detailed description of CMOS setup and meaning of its various setting CMOS password setting. (04 Periods)

6. LINUX: Structure, Kernel and Shell, Basic command, File system, VI editor, LINUX Installation, File concepts, File system and structure, Directory structure, Shell Scripting, Multi Boot Operating System, user and group management, super user, file permissions. (06 Periods)

7. Back- Up Procedure & Disaster Prevention:

Back- up & Restore procedures, types of back- up, media for back- up, RAID systems, Preparation of Bootable CD, Using crontab for automating backup procedure in Linux (05 Periods)

8. Diagnostic Tools & PC Maintenance:
Introduction, Virus and its types, Effect of Virus for Computer System, Scanning and Antivirus remover tools, Antivirus Utilities for Diagnostic ,Safety and Preventive Maintenance Tools, Data Recovery, PC care and Maintenance, Electrical Power Issues. (10 Periods)

9. Troubleshooting PC Hardware:- O/S Troubleshooting issues in computer System (04 Periods)

10. Assembly and disassembly of PC and its various parts, startup problems, run problems, their identification and remedy, problem of: keyboard, displays, printers, FDD‟s HDD‟s, CDD‟s, SMPS motherboard, their identification and remedy; Maintenance of UPS. (08 Periods)

LIST OF PRACTICALS

1 Installation of different Operating Systems.
2 Installation of Operating Systems in Dual booting.
3 Taking Data Backup and System Formatting.
4 Backup Recovery.
5 Setup of Live-OS.
6 Converting file system FAT to NTFS Using MS-DOS.
7 Study of various OS troubleshooting issues in computer system.
8 Prevention and recovery of hard disk failures.
9 Manage Disk through computer disk management.
10 Exercise on General Purpose & Communication Commands.
11 Exercise on File & Directory Management Commands.
12 Exercise on Process & User Management Commands.
13 Accessing NTFS partition from Linux OS in dual booting.
14 Using Vi editor for scripting.

INSTRUCTIONAL STRATEGY

This subject is both theory and practical oriented. Therefore, stress must be given on practicals along with theory. Laboratory must have windows as well as Linux operating system. Concepts of O.S. must be taught practically.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Actual laboratory and practical work, exercises and viva-voce
- Software installation, operation, development and viva-voce
-

RECOMMENDED BOOKS

1. Operating System William Stallings Pearson
2. Modern Operating systems Andrew tanenbaum-3rd edition PHI
3. Operating Systems by Achyut S Godbole and Atul Kahate; Tata McGraw Hill Education Pvt Ltd , New Delhi
4. Upgrading & Repairing PCs, Scott Muller, Pearson
5. The Complete PC Upgrade & Maintenance guide, Mark Minasi, Wiley India
6. PC Upgrade and Repair, Barry Press and Maricia Press, Wiley India
7. Bigelow‟s Troubleshooting, Maintaining & Repairing PCs, Begelow, Tata McGraw Hill
8. Managing & Troubleshooting PCs, Mike Meyers Scott Jernigan, Tata McGraw Hill
9. e-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR, Chandigarh.

Websites for Reference:

1. http://swayam.gov.in
2. http://spoken-tutorial.org

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	3	5
2	5	8
3	6	8
4	5	8
5	4	8
6	6	10
7	5	8
8	10	20
9	4	10
10	8	15
Total	**56**	**100**

1.3 BASIC NETWORKING

L	T	P
6	-	5

RATIONALE

The world in the information era has become network centric. A Computer networks has been growing with rapid technological progress. Computer communication through networking becomes essential part of our life. different applications like Railway Reservation, E-banking, E-Governance, On-Line shopping, E-learning etc. may be managed by click of a mouse from our own place. Because of this, world has emerged as the global village. By considering importance of networking towards all aspects of our life, basic concept of networks, network classification, network topologies, network devices, Transmission media, Network reference models and concept of TCP/IP is being introduced here. By exploring this knowledge students would be able to understand current network management technologies.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Understand networks & their significance.
- Understand and describe communication media.
- Compare different types of Topologies.
- Compare different types of network devices.
- Compare OSI and TCP/IP models.
- Understand layers of OSI Model.

DETAILED CONTENTS

1. Introduction to Networks (06 Periods)

Introduction to Computer Networks, Element of Networks, Types of Networks, Network Topologies: Bus, Star, Mesh, Ring

2. Media and Connectors (10 Periods)

Common LAN Media: STP, UTP, Coaxial cable, Optical fibre, TIA/EIA standards, Making & testing Cable, Straight thru Cable, Crossover Cable , Connectors, Jacks, Patch Panels

3.Networking Devices (08 Periods)

NIC, Repeaters, Hub and its types, Bridges and their types, Switches, Routers

4. Network Model (10 Periods)

Description of the seven layers of OSI Model, TCP/IP Model, Comparison of OSI & TCP/IP Model.

5. Physical and Data Link Layer (10 Periods)

MAC Sub- layer, LLC, MAC Addressing, Framing, Error control, Flow control, Token Ring, Ethernet, FDDI, Address Resolution Protocols

6. Network and Transport Layer (12 Periods)

Role of Network layer, Virtual Circuits, Datagram, Packet, Types of Routing, ICMP, Introduction to Transport layer, TCP and UDP Protocols and Comparison . Network Layer, IP address, IP address Classes, Basics of Sub- netting, Subnet Masking

7. Presentation and Session Layer (10 Periods)

Session layer function, Token Management and Session Layer Protocols, Presentationlayer function and Protocols

8. Application Layer (08 Periods)

Introduction to Application Layer Protocols and their role. The Domain name system, Electronic Mail, the World Wide Web, FTP, Telnet, HTTP, DHCP

9. Internet and its Service Providers (10 Periods)

Internet, connection types, ISP

Web hosting, Top Web Hosting Companies

IANA, IANA Root Zone Database, IANA Number Resources

Local Internet registry (LIR),National Internet Registry (NIR), AfriNIC, APNIC, ARIN, LACNIC, RIPE NCC, Regional Internet Registry (RIR).

Registration of a domain, Top Domain Registrars, Registrar for .EDU.IN, .RES.IN, .AC.IN, .GOV.IN in INDIA

LIST OF PRACTICALS

1. To connect and built computers in different ways in a LAN (Topologies-star, ring, bus, tree)
2. To connect and understand different network devices used in LAN- Hubs, Switches, Routers, Bridges, Repeaters, Gateways, Modems.
3. To study the constructional details of transmission media- co-axial cables, twisted pair cables, optical fiber cable.
4. To create network cable using RJ 45 connectors.
5. Connections of two hubs by creating cross over connections.
6. To install a network interface card (NIC) and locate mac address of computer
7. To install TC/IP protocol and configure its advance property.
8. To discover and assign IP address in windows & linux.
9. Setting up a work group in windows PC.
10. To identify different problems and troubleshooting of network exm- no network, card problem, cable problem, server errors.

INSTRUCTIONAL STRATEGY

Explanation of concepts using real time examples, diagrams etc. For practical sessions demonstration of various networking devices are required. Various exercises and small applications should be given along with theoretical explanation of concepts.

MEANS OF ASSESSMENT

– Assignments and quiz/class tests, mid-term and end-term written tests

- Actual laboratory and practical work, exercises and viva-voce
- Software installation, operation, development and viva-voce

RECOMMENDED BOOKS

1. Data Communications and Networks, Achyut S. Godbole ,Tata McGraw Hill
2. Data Communications and Networking (Forth Edition), Behrouz A. Forouzan, Tata McGraw Hill
3. Complete Reference Networking ,Craig Zacker ,Tata McGraw Hill
4. Computer Networking, Tularam M Bansod Dreamtech, Wiley
5. Networking + Certification (Second Edition) Microsoft Press PHI(Prentice-Hall of India Private Limited)
6. Computer Network by Andrew S. Tanenbaum Pearson
7. Software to be used as recommended by AICTE/UPBTE/NITTTR.

Websites for Reference:

http://swayam.gov.in
http://spoken-tutorial.orgs

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	6	10
2	10	10
3	08	10
4	10	15
5	10	10
6	12	15
7	10	10
8	08	10
9	10	10
Total	**84**	**100**

1.4 Basic Electronics & Measuring Instruments

L	T	P
4	-	6

RATIONALE

Knowledge of Basic Electronics components & measuring Instruments is quite essential for a student of computer hardware and networking PG. diploma programme. The study of this subject will help students to gain the knowledge of working principles and operation of different instruments.

LEARNING OUTCOMES

After undergoing the subject, the student will be able to:
- Identify and distinguish electronic components like Resistor, Capacitor, inductor etc.
- Understand voltage and current sources as well as their interconversions.
- Understand the working and application of semiconductor diode including half wave rectifier & Full wave rectifier.
- Verify and interpret truth tables for all logic gates.
- Realize all logic functions with NAND and NOR gates
- Design and demonstrate adder and subtractor circuits
- Verify and interpret truth tables of multiplexer, demultiplexer, encoder and decoder ics
- Design and realize different sequential circuit(Flip flops, counters and shift registers)
- Demonstrate the working principle voltage, current and resistance measurement along with their applications.
- Measure frequency, voltage, time period and phase using CRO and DSO

.

DETAILED CONTENTS

1. Basic Electricity and conducting Material (08 Periods)
Introduction, Current, Voltage, emf, Power generation system, Switch- plug wiring, Analyzing Conductivity of elements, Types of Conductors, Semi conducers - Silicon, Germanium.

2. Electronics Components (08 Periods)
Resistors, Capacitors, Inductors, Transforms, Types, working and Properties, Voltage and currant sources, Diode, Zener diode, Photo diode, Light emitting diode(LED), Transistors (NPN, PNP), their characteristics and uses, Field effect transistor, Photo transistor.

3. Electronics Circuits (08 Periods)
AC Fundamentals, Ohm‟s law, Series and Parallel connection of Registers and Capacitors, Half wave rectifier, Full wave rectifier and Bridge rectifier.

4. Regulated Power Supply (08 Periods)
Basic regulated power supply using Zener diode, Block diagram of IC based Power supply, Basic Switch Mode Power Supply (SMPS), Basic uninterrupted Power Supply (UPS)

5. Basic Measuring Instruments (10 Periods)
Multimeters – Electronics and Digital, Cathode Ray Oscilloscope (CRO), Block diagram and basic working, Different uses of CRO, LCR – Q meter, Measurement.

6. Digital and Integrated Circuits (14 Periods)

Introduction to logic levels & gates, Definition symbols and truth tables of NOT.AND, OR, NAND, NOR, EXOR Gates Latches, unidirectional & bi- directional buffers, tristate devices, Clock generators, Flip- flops, Registers, Counters, Multiplexers & Demutiplexers.
Introduction to various logic families and their characteristic, Bipolar Logic Family, Unipolar Logic Families. Latest trends in packaging.
Semiconductor Memories: Hierarchy of memories used in a computer, Classification of memories and trends in PC memory modules.

LIST OF PRACTICALS

1. Switch Board Wiring and Testing
2. Component Testing and Symbols
3. Voltage Measurement of Different Circuits
4. Soldering and De-Soldering Practice exercise
5. Half wave, Full wave & Bridge rectifiers
6. Testing and Measurement of SMPS
7. Verification of truth table for 2 input NOT, AND, OR, NAND, NOR, XOR Gates.
8. To construct a 4- bit even/odd parity generator/checker using XOR gates and to verify their truth tables.
9. To decode a 3 line to 8 line, encode from 8 line to 3 line and to observe input and outputs.
10. Measurement of voltage, Frequency of a signal using CRO.
11. Different applications of a multimeter
12. LCR meter measurement Practice exercise

INSTRUCTIONAL STRATEGY

The teacher should give emphasis on understanding of concept and various terms used in the subject. Practical exercises will reinforce various concepts.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Actual laboratory and practical work exercises
- Viva-voce

RECOMMENDED BOOKS

(1) Mason Basic Electronics By D.B. Kadia, B.K. Kadia
(2) Electronics Principles By Malvino Mc Graw-Hill Publication
(3) Digital computer Electronics. By Albert Paul Malvino Tata Mc Graw-Hill Public
(4) Basic Electronics by VK Mehta; S Chand and Co., New Delhi
(5) Electronic Devices and circuits by Rama Raddy Narora Publishing House Pvt. Ltd. New Delhi.
(6) e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	08	15
2.	08	15
3.	08	15
4.	08	15
5.	10	20
6.	14	20
Total	**56**	**100**

1.5 Soft Skills

L	T	P
2	-	4

RATIONALE

Soft Skills plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill and focuses on learning various interview techniques.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

.

- Understand the importance of effective communication
- Describe the process of communication
- Communicate effectively in different contexts
- Reproduce and match words and sentences in a paragraph
- Write various types of paragraphs, notices for different purposes and composition on picture with appropriate format
- Read unseen texts with comprehension
- Acquiring skills to prepare CV/Resume
- Acquiring skills to face an interview

DETAILED CONTENTS

1. Basics of Communication (04 periods)

   1.1 Definition and process of communication
   1.2 Types of communication - formal and informal, oral and written, verbal and non-verbal
   1.3 Communications barriers and how to overcome them
   1.4 Barriers to Communication, Tools of Communication

2. Reading Skill (06 periods)
   Unseen passage for comprehension (one-word substitution, prefixes, suffixes, antonyms, synonyms etc. based upon the passage to be covered under this topic)

3. Writing Skill (04 periods)
   Picture composition, Writing paragraph, Notice writing

4. Curriculum Vitae and Resume: Overview, types of CV, Covering Letter, Resume, Types of Resume, Difference between CV and Resume. (08 periods)

5. Interview Techniques & Interview Preparation Preparing for an interview, Interview Formats, Types of Interview Questions, Mock Interviews, the benefits of mock interviews. (06 periods)

LIST OF PRACTICALS

Note: Teaching Learning Process should be focused on the use of the language in writing reports and making presentations. Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project oriented manner where the learning happens as a by product.

Listening and Speaking Exercises

1. Self and peer introduction
2. Newspaper reading
3. Just a minute session-Extempore
4. Greeting and starting a conversation
5. Leave taking
6. Thanking
7. Wishing well
8. Talking about likes and dislikes
9. Group Discussion
10. Listening Exercises.
11. Mock Interview

INSTRUCTIONAL STRATEGY

Student should be encouraged to participate in role play and other student centered activities in class room and actively participate in listening exercises.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by RevathiSrinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; DhanpatRai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. Excellent General English-R.B.Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra
5. The Functional aspects of Communication Skills – Dr. P. Prsad, S.K. Katria & Sons, New Delhi
6. Q. Skills for success – Level & Margaret Books, Oxford University Press.
7. e-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

Websites for Reference:

1. http://www.mindtools.com/ page 8.html
2. http://www.letstalk.com.in
3. http://www.englishlearning.com

4. http://learnenglish.britishcouncil.org/en/
5. http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	20
2	06	15
3	04	15
4	08	30
5	06	20
Total	**28**	**100**

2.1 SYSTEM ADMINISTRATION

L	T	P
4	-	6

RATIONALE

The primary objective of this course is to give students a comprehensive overview of the tools and techniques needed for network administrator. The course is designed so as to cover topics that are relevant to the role of a network administrator. Topics include installation, configuration, and administration of servers on common hardware/software platforms and installation and configuration of Linux & it‟s services.

LEARNING OUTCOMES

After undergoing this course, the students must be able to:

- To become proficient in tasks performed by server administrator.
- To acquire an appreciation for issues relevant to network server administration
- Use of resource sharing on network.
- Manage different roles of Servers.
- Understand WAN and remote connectivity
- Work efficiently with LINUX OS
- Perform Linux Services and Network Security

DETAILED CONTENTS

1. Introduction and Installation of Server (06 Periods)

What is System Administration, Role of a System Administrator. Installation of server like Windows Server, Linux Server, user account administration, group management, file permissions.

2. Virtualization (06 Periods)

Concept of virtualization, Installing & configuring a virtual machine. Installing windows server and Linux in Virtual Machine. Guest Additions, Virtual Networking & security, VBox , , Dockers & containers installation & management.

3. Windows Administration Concepts (10 Periods)

Active Directory, Organizational Unit, DNS Server, DHCP Server, RAS, Volumes and Disk management, Auditing and Resource Access, Remote Desktop Services, VPN, Local and Domain security policy, Group Policies, Windows Server as a router, IIS.

4. Introduction and installation of Linux (08 Periods)

History of Linux, Linux distributions, Features of Linux, advantages of Linux, GUI, CLI, Installation of Red Hat/CentOS, Debian Family and Kali Linux, System requirements, Disk partition, Mount points, Installation method, Booting procedure, creating the boot disk, Utilities of Linux, TAR Program, Pine, Browsers.

5. Working with Linux GNOME and KDE (06 Periods)

User Management, Mounting, X- windows Desktop environment, Using Gnome and KDE Desktop environment, Linux commands, Linux file system, directories, Text Editors, Linux Shell, Feature of Shell, Types of Shell, Installing windows applications in Linux.

7 Linux Administration (08 Periods)

Installing and setting up a Network card, Setting TCP/IP parameters with Linux, Testing the network, SMTP, Bind DNS Server, DHCP, NFS and Samba Configuration, Apache Web Server configuration, FTP Server.

8 Server Hardening & Monitoring (10 Periods)

Installing Security patches, updation, Password policy & restrictions, Network Services, Proxies, Firewalls, IP tables, NIS and Host Security, Minimizing packeges, Check listening network ports, Lockdown cronjobs, System monitoring & cron scheduling, Performance monitoring tools, Disable USB, Viewing Logs, Monitoring user activities.

LIST OF PRACTICALS

1. Installation & configuration of Windows Server OS
2. Installation & configuration of RedHat/CentOS
3. Installing & configuring a Virtual Machine.
4. Using various Linux networking commands
5. Managing the User‟s Shell Environment
6. Installing Software from Tarballs, RPM and YUM.
7. Using the mount Command to Mount & Unmount the Disks, Devices.
8. Managing the GRUB Boot Loader, The GRUB Configuration File, Installing GRUB
9. Setting up SSH and Telnet.
10. Setting up FTP Server.
11. Configuring Apache Web Server.
12. Configuring an NFS Server & Client

13. Configuring the Samba Server and Client Access
14. Installing and configuring Bind DNS Server.
15. Installing and configuring DHCP.
16. Firewall and security configuration.
17. Installing dockers & containers

INSTRUCTIONAL STATREGY

Since this subject is practical oriented, the teacher should demonstrate the capabilities of different server to students while doing practical exercises. The students should be made familiar with server and related tools and techniques.

MEANS OF ASSEMENTS

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Actual Lab & Practical Work,
- Viva-voce

RECOMMENDED BOOKS

- Steve Silva, Web Server Administration, Course Technology.
- Byron Wright, Hands-on Microsoft Windows Server 2003 Networking, CourseTechnology.
- Mark Minasi Mastering Windows Server 2008 Wiley India
- Hassell Windows Server 2008 : definitive guide Oreilly
- Doug Lowe Networking for Dummies Wiley India
- Richard Burke Network Management Concepts and practice. Pearson
- Microsoft Press MCSE Training Kit Tata Mc graw Hill
- George Reese Cloud Application architectures Oreilly
- e-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR,Chandigarh.

Websites for Reference:

1. http://swayam.gov.in
2. http://spoken-tutorial.org

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted(%)
1	06	10
2	06	10
3	06	10
4	06	15
5	08	15
6	06	10
7	08	15
	10	15
Total	**56**	**100**

2.2 ADVANCE NETWORKING

L	T	P
6	-	6

RATIONALE

The future of computer technology is in Computer Networks. Global connectivity can be achieved through computer networks. A PG diploma holder in Computer Hardware Networking should therefore understand the advance function of networks and get exposure to different existing and upcoming communication technologies. Knowledge about advance hardware and software requirements of networks is essential.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Setup IP addresses in Computer network nodes
- Setup IP subnetting for network
- know about different routing methodologies
- setup & Configure L2 network Switches
- diagnose & solve network problems
- diagnose & solve network problems remotely
- provide security to networks
- manage & handle wan

DETAILED CONTENTS

1. Internetworking Basics (10 Periods)

•Internetworking Basics, Broadcast domain, Collision Domain, Hub, Switch & Router ,Ethernet Cabling: - Straight- Through Cable, Crossover Cable, Roll over Cable

•Internet Protocols: - TCP/IP Model, IP Addressing, IP Terminology, IP Addressing Scheme, Private IP Addresses ,TCP/IP Troubleshooting utilities, Troubleshooting IP Addressing

2. IP Subnetting and Variable Length Subnet Masks (VLSM) (10 Periods)

•Subnetting Basics, How to Create Subnets, Subnet Masks, Classless Inter- Domain Routing (CIDR), Subnetting Class C Addresses, Subnetting Class B Addresses, Subnetting Class A Addresses

•Variable Length Subnet Masks (VLSMs), VLSM Design, Implementing VLSM Network

3. Routing Basics (08 Periods)

•IP Routing, Routing Basics, Static Routing, Default Routing, Dynamic Routing, Routing Protocol Basics

4.Switching Basics (10 Periods)

• Layer 2 Switching basics, Configuring the L2 Switches,L2 Switch Startup, Setting the Passwords, Setting the Hostname, Setting IP Information, Configuring Interface Descriptions, Erasing the Switch Configuration

5. VLAN Basics (12 Periods)

•Virtual LANs (VLANs) VLAN Basics, Broadcast Control, Security, Flexibility and Scalability, VLAN Memberships, Static VLANs, Dynamic VLANs, Identifying VLANs, Frame Tagging, LAN Identification Methods, Inter- Switch Link (ISL) Protocol

•VLAN Trunking Protocol (VTP),VTP Modes of Operation, VTP Pruning, Routing between VLANs ,Configuring VLANs, Assigning Switch Ports to VLANs ,Configuring Trunk Ports ,Configuring Inter- VLAN Routing, Configuring VTP.

6. Managing Traffic with Access Control Lists (10 Periods)

•Managing Traffic with Access Lists Introduction to Access Lists, Standard Access Lists, Wildcard Masking, Standard Access List Example, Controlling VTY (Telnet) Access, Extended Access Lists, Extended Access List Example, Named Access Lists, Monitoring Access Lists

7. Network Address Translation (08 Periods)

•Network Address Translation NAT, Introduction to Network addresses Translation (NAT), Port address translation (PAT), Static NAT, Dynamic NAT, NAT Overloading

8.WAN Protocols (08 Periods)

•Introduction of WAN, Cabling the WAN, HDLC, PPP, LCP, Frame Relay, ISDN, DSL/ADSL

9.Introduction To Wireless LAN (08 Periods)

•ISM band, 802.11a/b/g wireless standards

•Adhoc, infrastructure mode of WLAN, Access Point in Repeater Mode

•Security in WLAN, MAC Filtering, WEP/WPA

•Evaluation of WLAN, Wireless Home Networking, IEEE 802.11 standard for WLAN

LIST OF PRACTICALS

1 To study Router & its interface. (Console port, AUI, Serial, Auxiliary, Ethernet, Fast Ethernet, BRI)
2 To study, Switch & its interface. (Console port, Ethernet, Fast Ethernet)
3 To setup up a router , logging into a router, basic commands, saving NVRAM configuration.
4 To configure a router for different LAN segments.
5 To configure IP Routing by creating Static Routes. (Static Routing)
6 Backing Up and Restoring the IOS, Configuration File using TFTP server
7 To Setup up a Switch first time, logging into a switch, basic commands
8 To configure VLANs and Inter-VLAN Routing.
9 To manage traffic using standard IP Access list.
10 Configuring Static NAT on router
11 Configuring Dynamic NAT on router
12 Wireless LAN Setup using ADHOC mode.
13 Wireless LAN Setup using Infrastructure mode.

INSTRUCTIONAL STRATEGY

Explanation of concepts using real time examples, diagrams etc. For practical sessions teacher may use simulator software to demonstrate various scenarios related to advance networking.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Actual laboratory and practical work, exercises and viva-voce
- Software installation, operation, development and viva-voce

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. Network+ Lab manual,- BPB Publications -by Tami Evanson
6. Networking Essentials – BPB Publications New Delhi
7. Computer Network and Communications By V.K. Jain and Narija Bajaj, Cyber Tech
8. E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

http://swayam.gov.in
http://spoken-tutorial.orgs

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	10
2	10	10
3	08	10
4	10	15
5	12	15
6	10	10
7	08	10
8	08	10
9	08	10
Total	**84**	**100**

2.3 INTERNET OF THINGS

L	T	P
4	-	4

RATIONALE

Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain like agriculture, space, healthcare, manufacturing, construction, water, and mining. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology. This introductory syllabus will enable learners to leverage their business and/or technical knowledge across IoT-related functions in the workplace.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- understand the concepts of Internet of Things.
- understand what constitutes an IoT design solution
- identify the sensors and other devices needed for different IoT solutions
- understand the component parts of an IoT network and its connections
- build small IoT applications.

DETAILED CONTENTS

1. Introduction to Internet Of Things (IoT) (10 Periods**)**

Introduction to IoT, Defining IoT, Things in IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, IoT Protocols, IoT communication Models, IoT communication API‟s, IoT enabling Technologies.

2. IoT Devices (**22** Periods**)**

How electronic devices fit with the Internet of Things, and why they are important

Electronic Components **:** Breadboard and its internal connections, Seven segment display on bread board, LED and its connections, Tri-color LED, Resistor

Introduction to the many „end devices‟, sensors and actuators, differentiate between different sensor types

3. IoT Networks (**22** Periods**)**

Introduction to the components of basic IoT networks, the types of network connections and how data travels through them, and the role of Internet Protocols. Basic understanding of microcontrollers/Arduino and communication protocols

4. Arduino (**22** Periods**)**

Ardunino device introduction, feature of arduino device **,**Components of Arduino board**,**Understanding of basic of Arduino IDE, Arduino Programming Language (C Language) : variables **,**datatype, loops, control statement, function

5. IoT and M2M (**2**0 Periods**)**

Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT- Software defined networking, network function virtualization, IoT and WoT.

LIST OF PRACTICALS

Practical using Arduino-Interfacing Sensors :

1. Installation of Arduino IDE
2. Interfacing Light Emitting Diode (LED)- Blinking LED
3. Interfacing Button and LED – LED blinking when button is pressed**.**
4. Interfacing Light Dependent Resistor (LDR) and LED, displaying automatic night lamp
5. Interfacing Temperature Sensor (LM35) and/or humidity sensor (e.g. DHT11)
6. Interfacing Liquid Crystal Display (LCD) – display data generated by sensor on LCD
7. Interfacing Air Quality Sensor-pollution (e.g. MQ135) - display data on LCD, switch on LED when data sensed is higher than specified value.
8. Interfacing Bluetooth module (e.g. HC05)- receiving data from mobile phone on Arduino and display on LCD
9. Interfacing Relay module to demonstrate Bluetooth based home automation application. (using Bluetooth and relay).

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment, seminar or case study method. The teacher will discuss case studies with students to feel the importance of the subject, since this subject is practical oriented, the teacher should demonstrate functioning of various sensors and demonstrate building of IoT applications. Solution to various regression and classification problems should also be built

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- viva-voce
- Actual laboratory and practical work exercises
- Software installation, operation, development

RECOMMENDED BOOKS

1. The Internet of Things: Connecting Objects to the Web,Wiley Publisher Hakima Chaouchi
2. Internet of Things: A Hands On Approach, University Press,Vijay Madisetti, Arshdeep Bahga.
3. 21 Internet Of Things (IOT) Experiments,BPB Publications Yashavant Kanetkar
4. Arduino Projects For Engineers **,**BPB Publications **,**Neerparaj Rai
5. Internet of Things – A Hands on Approach, By Arshdeep Bahga and Vijay Madisetti Universities Press, ISBN: 9788173719547
6. The Internet of Things , Pearson, By Michael Miller ISBN: 9789332552456

7. e-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR, Chandigarh.

Websites for Reference:

http://www.spoken-tutorial.org
http://swayam.gov.in

LIST OF COMPONENTS

1. One kit for 3-4 students : Arduino Uno, sensors(Bluetooth module(HC05), MQ135, DHT11, breadboard , LCD, 2-relay module etc)
2. Consumables : LED, button, connecting wires, LDR, LM35, battery, etc

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	10	16
2.	12	22
3.	12	22
4.	12	22
5.	10	18
Total	**56**	100

2.4 INFORMATION SECURITY AND IT LAWS

L T P
4 - 4

RATIONALE

Contents of this course provide understanding of Information Security & theirs measures. Content of this course will enable students to use techniques like Cryptography, VPNs, IDS etc. and IT Laws in the field of Information Technology.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Understand the need for security, Security principles related to Information Management.
- Understand the various computer related attacks.
- Apply different types of cryptography techniques to encrypt/decrypt data or information.
- Understand the network security measures and the concept of VPNs.
- Understand concept of IDS, Operating system security and web security
- Understand the IT Laws and latest amendments applicable in India as well as Intellectual property laws

DETAILED CONTENTS

1. **INTRODUCTION AND SECURITY TRENDS :** (08 Periods)

   1.1 Need for security, Security principles, Authentication, Access control.
   1.2 Threats to security : Viruses and Worms, Intruders, Insiders, Criminal organization, Terrorist, Information Warfare (IW), Avenues of attack, Steps in Attack.
   1.3 Types of attack : Active and Passive attacks, Denial of service, backdoors and trapdoors, sniffing, spoofing, man in the middle, replay, TCP/IP Hacking, Encryption attacks, Malware : Viruses, Logic bombs.

2. **ORGANIZATIONAL/ OPERATIONAL SECURITY :** (08 Periods)

   2.1 Role of people in security : Password selection, Piggybacking, Shoulder surfing, Dumpster diving, Installing unauthorized software/hardware, Access by non-employees, Security awareness, Individual users responsibilities.
   2.2 Physical security : Access controls Biometrics : Fingerprints, hand prints, retina, patterns, voice patterns, signature and writing patterns, keystrokes and physical barriers.
   2.3 Network security basics, model for network security.

3. **CRYPTOGRAPHY AND PUBLIC KEY INFRASTRUCTURE :** (16 Periods)

   3.1 Introduction: Cryptography, Cryptanalysis, Cryptology, Substitution techniques; Caesar's cipher, monoalphabetic and polyalphabetic transposition techniques- Rail fence technique, simple columnar, steganography.
   3.2 Hashing - Concept

3.3 Symmetric and asymmetric cryptography : Introduction Symmetric encryption: DES (Data Encryption Standard) algorithm, Diffle-Hellman algorithm, Problem of key distribution, Asymmetric key cryptography : Digital signature, key escrow.
3.4 Public key encryption : Basics, digital certificates, certificate authorities, registration authorities, steps for obtaining a digital certificate, steps for verifying authenticity and integrity of a certificate.

4. **NETWORK SECURITY :** (08 Periods)

4.1 Firewalls : Concept, design, principles, limitations, trusted system, Kerberos-concept.
4.2 Security topologies - Security zones, DMZ, Internet, Intranet, VLAN, Security implication, Tunnelling.
4.3 IP security : Overview, architecture, IPSec, IPSec configuration, IPSec security.
4.4 Virtual Private Network.
4.5 Email security : Email security standards : Working principles of SMTP, PEM, PGP, S/MINE, spam.

5. **WEB SECURITY :** **(**08 Periods)

5.1 Application hardening, application patches, Web servers, Active director.
5.2 Web security threats, Web traffic security approaches, Secure socket layer and transport layer security, secure electronic transaction software development : secure code techniques, buffer overflow, code injection, least privilege, good practices, Testing.

6. **IT LAWS :** (08 Periods)

6.1 Information Security Standards - ISO, IT Act, Copyright Act, Patent Law, IPR, Cyber Laws in India. IT Act 2000 Provisions and latest amendments.

6.2 Intellectual property law : Copy Right Law, Software License, Semiconductor Law and Patent Law.

LIST OF PRACTICAL

1. Knowledge the security provided with windows operating system.
2. Recovery the password of window machines using password recover utility (John the ripper) or any other utility.
3. Tracing of email origin using email trace pro utility.
4. Use of Keylogger and anti-keylogger to secure yours system.
5. Encrypt and decrypt the message using simple transposition - Permutation (Cryptool)
6. Encrypt and decrypt the message using Caesar Cipher With variable key (Cryptool)
7. Encrypt and decrypt the message using 3 X 3 Hill Ciper (Cryptool)
8. Create Digital Signature document using (Cryptool)
9. Send and receive secret message using stenography techniques using steghide.
10. Recover the data from formatted Pen Drive and Hard Disk using Power Data Recovery Utility or any other utility.

INSTRUCTONAL STRATEGY

The content of this course is to be taught on conceptual basis with real world examples. Since this subject is practice oriented, the teacher should demonstrate the capabilities of websites/Webpages to students while doing practical exercises for information security. The students should be made familiar with preventive measures for information and computer security.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Actual laboratory and practical work, exercises and viva-voce
- Software installation, operation, development and viva-voce

RECOMMENDED BOOKS

1. Information Security Handbook by Darren Death ,Packt Publishing
2. Principles of Information Security by Whitman , Cengage Publisher
3. Cyber Security by Nina Godbole, Wiley Publisher
4. Introduction to Information Security And Cyber Laws by Dr. Surya Prakash Tripathi
5. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices by Nina Godbole, Wiley Publisher
6. Cryptography and Network Security - Principles and Practice by Stallings William, Pearson Education Publisher.
7. Cyber Law & Cyber Crimes Simplified ,by Cyber Infomedia Publisher
8. Information Technology Act, 2000 Along with Rules & Regulations by Universal Law Publishing
9. e-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR, Chandigarh.

Websites for Reference:

http://swayam.gov.in
http://spoken-tutorial.org

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	15
2	08	15
3	16	20
4	08	15
5	08	15
6	08	20
Total	**56**	**100**

2.5 I - INDUSTRIAL TRAINING

INDUSTRIAL TRAINING OF STUDENTS

It is needless to emphasize further the importance of Industrial Training of students during their studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of 4 weeks duration to be organized during the semester break starting after 1st semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An external assessment of 50 marks has been provided in the study and evaluation scheme of 2nd Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 1st semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

a) Punctuality and regularity 15%
b) Initiative in learning new things 15%
c) Presentation and VIVA 15%
d) Industrial training report 55%

2.5 II - PROJECT

L	T	P
-	-	8

RATIONALE

Project Work aims at 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. 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. It is also essential that the faculty of the respective department may have a brainstorming 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 students should identify themselves or accept the given project assignment at least two to three months in advance. The project work identified in collaboration with industry should be preferred. Each teacher is expected to guide the project work of 5–6 students.
The project assignments may consist of:

- Hardware based Project
- PC Repair & Maintenance Project
- Simulation of Server software services
- IoT Project

LEARNING OUTCOMES

After undergoing this subject, the student will be able to:

- Use effectively oral, written and visual communication
- Demonstrate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.
- Identify, analyse and solve problems creatively through sustainment critical investigation.
- Develop, leadership abilities.
- Apply fundamental and disciplinary concepts and methods in ways appropriate to their areas of study.

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

Sr. No	Performance criteria	Max.** marks	Rating Scale				
			Excellent	Very Good	Good	Fair	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
Total marks		**100**	**100**	**80**	**60**	**40**	**20**

The overall grading of the practical training shall be made as per following table

	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

In order to qualify for the diploma, students must get "Overall Good grade" failing which the students may be given one more chance of undergoing 8 -10 weeks of project oriented professional training in the same industry and re-evaluated 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.

Important Notes

1. **These 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 100 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 another criterion of assessment, depending upon the type of project work.

The students must submit a project report of not less than 50 pages (excluding coding). The report must follow the steps of Software Engineering Concepts

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organizations in such an exhibition. 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 industries are approached for instituting such awards.

10. RESOURCE REQUIREMENT

10.1 Physical Resources

10.1.1 Space Requirement:

Norms and standards laid down by All India Council for Technical Education (AICTE) may be followed to work out space requirement in respect of class rooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

10.1.2 Laboratoires/Shops

- Communication Skill Lab
- Programming Lab
- Hardware and Networking Lab
- IoT Lab
- Digital Electronics And Microprocessors Laboratory

LIST OF EQUIPMENT FOR PG DIPLOMA IN COMPUTER HARDWARE & NETWORKING

Sr. No.	Description	**Qty**	**Approx. Price (Rs)**
COMMUNICATION SKILL LABORATORY			
1.	Stools	40	10,000
2.	Display Board/Screen	2	6,000
3.	Sound recording and playing system	1	6,000
4.	Audio cassettes	60	2,000
5.	Overhead Projector	1	5,000
6.	Transparencies slides	100	500
7.	TV, VCR and camera for video recording	1 each	20,000
8.	English spoken course	1	2,000
9.	A Quiz room equipped with two way audio system, back projection system and slide projector	1	30,000
10.	Miscellaneous	LS	1,500

PROGRAMMING LAB for Computer Hardware & Networking Course			
Sr. No.	**Description**	**Qty**	**Approx. Price (Rs)**
1.	Computer Server (Quad core, intel processor 32 GB RAM)	1	5,00,000/-

2.	Computer Desktop (i7,8th Generation, 1TB Hard disk, 8Gb RAM, Pre loaded window with 5 year warranty)	60	48,00,000/-
3.	Switch with 24 port speed 10/100/1000 (Manageable)	3	1,50,000/-
4.	Multifunctional Laser/Ink tank Printer	3	90,000/-
5.	Laptop	1	75,000/-
6.	Online UPS, 6KVA with battery	2	2,00,000/-
7.	Internet Connectivity	60 Nodes	3,00,000/-
8.	LCD/DLP Projector with Screen (HD/Full HD/4K)	1	60,000/-
9.	Linux Operating System (Open Source)	-	-
10.	Visual Studio Community Edition (Freeware, Open Source)	-	-
11.	Visual Studio Code (Open Source)	-	-
12.	Multimedia Tools – Software - Blender (Freeware) - Gimp Animation Tool (Freeware)	-	-
13.	Mongo DB (Freeware)	-	-
14.	Python IDE (PyCharm/Eclipse with PyDev/VS Code	-	-
	etc) – Freeware		
15.	HTML & CSS, Java Script, Ajax (Open Source)	-	-
16.	PHP IDE XAMPP/WAMPP/VS Code (Freeware)	-	-
17.	Word press (Open Source)	-	-
18.	Oracle XE (Freeware)/MySql (Open Source)	-	-
19.	Rstudio (Open Source)	-	-
20.	Java for Internet Environment (latest version) – software	-	-
21.	MS Office latest or equivalent FOSS - Libre Office/Open Office (Freeware)	1 -	20,000/- Per year -
22.	Compiler Turbo C, C++ or equivalent FOSS	1	10,000/-
23.	Web camera, Mike and speakers	LS	20,000/-
24.	Air Conditioner 2 ton	2	70,000/-
25.	STARUML (Open Source)	-	-
26.	J-Meter (Performance Testing)- Open Source	-	-
27.	Lucid Chart (Developing DFD Model)- Open Source	-	-
28.	Selenium (functional Testing and Web Application)- Open Source	-	-
29.	J Unit (Java Testing) Open Source	-	-
30.	Cross browser Testing (Compatibility Testing) - Open Source	-	-
31.	Gantt Project (Project Plan)- Open Source	-	-

32.	Video Editing Tools (Open Source)	-	-
33.	- Eclipse IDE for Java programming/JDK (Open Source) - Apache Tomcat Web Server for Advanced Java Web Applications	- -	- -
34.	Antivirus Software	5 Users	10,000/-
35.	Miscellaneous- cables and connectors, computer stationery, printer consumables (inks), toner etc.	LS	30,000/-
Total Approx. Price			63,35,000/-

HARDWARE AND NETWORKING LAB for Computer Hardware & Networking Course			
1.	Computer Server (Quad core, intel processor 32 GB RAM)	1	5,00,000/-
2.	Computer Desktop (i7,8th Generation, 1TB Hard disk, 8Gb RAM, Pre loaded window with 5 year warranty)	20	16,00,000/-
3.	Online UPS, 6KVA with battery	1	1,00,000/-
4.	Switch with 24 port speed 10/100/1000 (Manageable)	1	50,000/-
5.	Connectors (RJ-45, RJ-11, BNC, SC, ST)	LS	10,000/-
6.	Cables: (UTP,STP,OFC) - 25 m each	LS	10,000/-
7.	Multifunctional Laser/Ink tank Printer	1	30,000/-
8.	Router	1	40,000/-
9.	Modem cum Router	2	10,000/-
10.	Compact Disk/DVD R/W	100	2000/-
11.	Hardware kit (for computer Assembling/de-assembling)	8	1,50,000/-
12.	External Hard Disk	4	30,000/-
13.	Networking Printer	1	1,25,000/-
14.	Internet Connectivity	20 Nodes	1,00,000/-
15.	Computer System Demonstration Kit	1	1,50,000/-
16.	Printer Demonstration Kit	1	1,00,000/-
17.	SMPS Demonstration Kit	1	20,000/-
18.	LAN Trainer	4	10.000/-
19.	Antivirus Software	5 Users	10,000/-
20.	Unmanaged Switch	4	60,000/-
21.	Hub	2	20,000/-
22.	Air Conditioner 2 ton	2	70,000/-
23.	Miscellaneous- cables and connectors, computer stationery, printer consumables (inks), toner etc.	LS	30,000/-
Total Approx. Price			32,27,000/-

INTERNET OF THINGS (IoT) LAB for Computer Hardware & Networking Course			
Sr.No.	Description	Qty	Approx. Price(Rs)
1.	Computer Desktop (i7,8th Generation, 1TB Hard disk, 8Gb RAM, Pre loaded window with 5 year warranty)	60	48,00,000/-
2.	Switch with 24 port speed 10/100/1000 (Manageable)	3	1,50,000/-
3.	Multifunctional Laser/Ink tank Printer	1	30,000/-
4.	Online UPS, 6KVA with battery	2	2,00,000/-
5.	Interactive Panel (75 Inch or more)	1	5,00,000/-
6.	Laptop	1	75,000/-
7.	Internet Connectivity	60 Nodes	3,00,000/-

8.	Photocopier Compatible with Computer System: Colour/Mono Photo-copier	1	1,50,000/-
9.	LCD/DLP Projector with Screen (HD/Full HD/4K)	1	60,000/-
10.	Video Conferencing System	1	2,00,000/-
11.	Android Studio (Open Source)	-	-
12.	Antivirus Software	5 Users	10,000/-
13.	Windows Latest or equivalent FOSS	1	10,000/-
14.	SciLab (Open Source)	-	-
15.	Microsoft Azure/AWS/EC2 (Open Source)	-	-
16.	Own Cloud (Open Source)	-	-
17.	CloudSim (Open Source)	-	-
18.	Digital Board	1	30,000/-
19.	Air Conditioner 2 ton	2	70,000/-
20.	Arduino Uno IDE with built in Wifi	20	20,000/-
21.	Raspberry pi	2	6,000/-
22.	Sensor Kits (e.g. MQ135, DHT11 etc.)	10	1,00,000/-
23.	Bluetooth module HC05	10	3,500/-
24.	Display Screen	5	1,000/-
25.	Relay Module	5	5,000/-
26.	Wi-fi Module	10	5,000/-
27.	Development Boards (Micro Controller) PIC/AVR/8051	10	20,000/-
28.	ATMEGA Project Trainer Kit	20	20,000/-
29.	Mini ARM-7 Development Kit	10	40,000/-
30.	TopWin Universal IC Programmer	10	30,000/-
31.	VLSI Kit Xilinx with cable and power adapter	10	45,000/-
32.	Assorted Components (Active & Passive)	10 Set	40,000/-
33.	Assorted microcontrollers/processors (set)	10 Set	40,000/-
34.	Connectivity Radios (GPS, GSM,125 Khz RFID Reader, USB to Serial FTDI, Finger Print Reader , Wifi, Bluetooth, MIFARE RFID Writer/Reader with	10 set	1,25,000/-

	cards, NRF module, RF Module 434 Mhz Pair, Zigbee Module)		
35.	Gear DC Motor with wheels	10	2,500/-
36.	16*2 -Alpha numeric display	10	3,000/-
37.	Wireless AV Camera	05	12,500/-
38.	USB AV Tuner	05	15,000/-
39.	8 Relay Radio Control Module	05	15,000/-
40.	9 volt Battery	100	2,000/-
41.	DC Power Supply	10	2,000/-
42.	Tools and Supplies (Tools, connecting wires, solder wire(set))	10	20,000/-
43.	Miscellaneous- cables and connectors, computer stationery, printer consumables (inks), toner etc.	LS	30,000/-
	Total Approx. Price		71,87,500/-

DIGITAL ELECTRONICS AND MICROPROCESSORS LABORATORY			
1.	DC regulated low voltage variable power supply	6	15,000
2.	DC regulated multiple output power supply	3	9,000
3.	Digital IC power supply	8	10,000
4.	Electronic Digital Multimeter	6	9,000
5.	CRO Dual trace, 25 MHz	4	1,00,000
6.	Digital frequency meter/universal Counter timer	2	20,000
7.	Pulse Generator	2	10,000
8.	Logic probes (TTL and CMOS)	10	2,500
9.	Digital logic trainer (TTL)	4	20,000
10.	Logic Trainer Boards	10	10,000
11.	Microprocessor trainer Kits 8085	10	50,000
12.	Microprocessor Trainer Kits 8086	2	60,000
13.	Computer Trainer	1	30,000
14.	Interfacing Cards	5	2,50,000
15.	Micro-controller Kit 8051 based	10	1,00,000
16.	Digital IC Tester	1 No.	50,000
17	Universal Programmer	2No.	7,000
18	Digital Multimeter	10 No.	60,000
19.	EPROM Programme	2	10,000
20.	EPROM Eraser	2	1,500
21	Additional cards	LS	50,000
22	Ink jet Printers	2	6,000
23.	Laser Printers	2	12000
24	Scanners	2	5000

25	Copier	1	3000
26	Scanner cum Copier cum Printer, Fax	1	4500

NOTE: In addition to above laboratories, computer centre will be required for effective implementation of the course.

10.1.3 Furniture Requirement

Norms and standards laid down by AICTE be followed for working out furniture requirement for this course.

- Furniture for laboratories/Computer Centre 15 lacs

10.2 Human Resources

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, work load norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE. The website www.aicte.ernet.in may be referred for downloading current norms and standards pertaining to technician courses.

11. EVALUATION STRATEGY

11.1 INTRODUCTION

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learning endeavour is to ensure the quality of the product which can be accessed through learner‟s evaluation.

The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative (Internal and External Evaluation)

Formative Evaluation

It is an on-going evaluation process. Its purpose is to provide continuous and comprehensive feedback to students and teachers concerning teaching-learning process. It provides corrective steps to be taken to account for curricular as well as co-curricular aspects.

Summative Evaluation

It is carried out at the end of a unit of instruction like topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and systematic manner since any mistake or lacuna is likely to affect the future of students.

In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative evaluation with a view to bring validity and reliability in the end-term examination system for achieving objectivity and efficiency in evaluation.

11.2 STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

- Theory
- Practical Work (Laboratory, Workshop, Field Exercises)
- Project Work
- Professional Industrial Training

A. Theory

Evaluation in theory aims at assessing students‟ understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve problems. The formative evaluation for theory subjects may be caused

through sessional /class-tests, home-assignments, tutorial-work, seminars, and group discussions etc. For end-term evaluation of theory, the question paper may comprise of three sections.

Section-I

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-1 should be of the order of 20 percent of the total marks and no choice should be given in this section. The objective type items should be used to evaluate students‟ performance in knowledge, comprehension and at the most application domains only.

Section-II

It should contain short answer/completion items. The weightage to this section should be of the order of 40 percent of the total marks. Again, no choice should be given in section-II

Section-III

It may contain two to three essay type questions. Total weightage to this section should be of the order of 40 percent of the total marks. Some built-in, internal choice of about 50 percent of the questions set, can be given in this section

Table II : Suggested Weightage to be given to different ability levels

Abilities	Weightage to be assigned
Knowledge	10-30 percent
Comprehension	40-60 percent
Application	20-30 percent
Higher than application i.e. Analysis, Synthesis and Evaluation	Upto 10 percent

B. Practical Work

Evaluation of students performance in practical work (Laboratory experiments, Workshop practicals/field exercises) aims at assessing students ability to apply or practice learnt concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related attitudes. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behaviour and it should be followed by viva-voce.

C. Project

The purpose of evaluation of project work is to assess students ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The formative and summative evaluation may comprise of weightage to nature of

project, quality of product, quality of report and quality of presentation followed by viva-voce.

D. Professional Industrial Training

Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students‟ understanding of materials, industrial processes, practices in the industry/field and their ability to engage in activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. The formative and summative evaluation may comprise of weightages to performance in testing, general behaviour, quality of report and presentation during viva-voce.

11.3 ASPECTS OF QUESTION PAPER SETTING

Validity and reliability are the most important considerations in the selection and construction of evaluation procedures. First and foremost are the evaluation tools to measure the specific outcomes for which they are intended to measure. Next in importance is reliability, and following that is a host of practical features that can be classified under the heading of usability.

For weightage of marks assigned to formative (internal) and summative (external) evaluation and duration of evaluation has been given in the study and evaluation scheme of the curriculum document. Teachers/Paper-setters/Examiners may use Manual for Students‟ Evaluation developed by Institute of Research Development & Training, U.P. Kanpur to bring objectivity in the evaluation system. The working group found it very difficult to detail out precisely the contents of subject on languages and therefore teachers may send guidelines to respective examiners for paper setting to maintain objectivity in evaluation.

12. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION

This curriculum document is a Plan of Action (POA) and has been prepared based on exhaustive exercise of curriculum planning and design. The representative sample comprising selected senior personnel (lecturers and HODs) from various institutions and experts from industry/field have been involved in curriculum design process.

The document is now ready for its implementation. It is the faculty of polytechnics who have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated students behaviour as in the curriculum document. It is important for the teachers to understand curriculum document holistically and further be aware of intricacies of teaching-learning process (T-L) for achieving curriculum objectives. Given below are certain suggestions which may help the teachers in planning and designing learning experiences effectively. These are indicative in nature and teachers using their creativity can further develop/refine them. The designers of the programme suggest every course teacher to read them carefully, comprehend and start using them.

(A) Broad Suggestions:

1. Curriculum implementation takes place at programme, course and class-room level respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.

2. Uttar Pradesh State Board of Technical Education (BTE U.P.) may make the academic plan available to all polytechnics well in advance. The Principals have a great role to play in its dissemination and, percolation upto grass-root level. Polytechnics in turn are supposed to prepare institutional academic plan by referring state level BTE plan.

3. HOD of every Programme Department along with HODs and incharges of other departments are required to prepare academic plan at department level referring institutional academic plan.

4. All lecturers/Senior lecturers are required to prepare course level and class level lesson plans referring departmental academic plan.

(B) Course Level Suggestions

Teachers are educational managers at class room level and their success in achieving course level objectives lies in using course plan and their judicious execution which is very important for the success of programme by achieving its objectives.

Polytechnic teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop, practicals, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practicals and field experiences. Teachers are also required to do all these activities within a stipulated period of 16 weeks which is made available to them in the academic plan

at BTE level. With the amount of time to their credit, it is essential for them to use it judiciously by planning all above activities properly and ensure execution of the plan effectively.

Following is the gist of suggestions for subject teachers to carry out T-L process effectively:

1. Teachers are required to prepare a course plan, taking into account departmental academic plan, number of weeks available, course to be taught, different learning experiences required to be developed etc.

2. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of content to be covered, learning material (transparencies, VCDs, Models etc.) for execution of a lesson plan. They may follow steps for preparing lesson plan e.g. drawing attention, state instructional objectives, help in recalling pre-requisite knowledge, deliver planned subject content, check desired learning outcome and reinforce learning etc.

3. Teachers are required to plan for expert lectures from field/industry. Necessary steps are to plan in advance, identify field experts, make correspondence to invite them, take necessary budgetary approval etc.

4. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The tutorial, assignment and seminar can be thought of as terminal outcome of library experiences.

5. Concept and content based field visits with appropriate releases (day-block) may be planned and executed for such content of course which otherwise is abstract in nature and no other requisite resources are readily available in institute to impart them effectively.

6. There is a dire need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem based learning/activity learning/ experiential learning approach effectively. The development of lab instruction sheets for the course is a good beginning to provide lab experiences effectively.

7. Planning of progressive assessment encompasses periodical assessment in semester, preparation of proper quality question paper, assessment of answer sheets immediately and giving constructive explicit feed back to every student. It has to be planned properly; otherwise very purpose of the same is lost.

8. The co-curricular activities like camp, social gathering, study tour, hobby club etc. may be used to develop generic skills like task management, problem solving, managing self, collaborating with others etc.

9. Where ever possible, it is essential to use activity based learning rather than relying on delivery based conventional teaching all the time.

10. While imparting instructions, emphasis may be laid on the development of cognitive, psychomotor, reactive and interactive skills in the students.

11. Teachers may take working drawings from the industry/field and provide practices in reading these drawings.

12. Considerable emphasis should be laid in discipline specific contracting and repair and maintenance of machines, tools and installations.

13. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

14. Case studies and assignments may be given to students for understanding of Enterprise Resource Management (ERM).

15. Students be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.

16. Students may be given relevant and well thought out minor and major project assignments, which are purposeful and develop practical skills. This will help students in developing creativity and confidence for their gainful employment (wage and self).

17. A Project bank may be developed by the concerned department of the polytechnics in consultation with related Industry, Research Institutes and other relevant field organizations in the state.

13. LIST OF PARTICIPANTS

The following experts have participated in workshop for Developing Curriculum Contents of PG diploma courses in Computer Hardware & Networking for UP State on 18th October 2019 at IRDT Kanpur and on 30th January 2020 at GP Ghaziabad.

1. Sh. Ashish Kanaujiya, Founder & Director, NXG Ventures, Ahemedabad.
2. Sh. Kural Srivastava, Sr. Scientist, CSIR-CDRI Lucknow.
3. Ms. Mugdha Tripathi, Team Lead, Accenture India, Noida.
4. Sh. Harsh Jaiswal, Sr. iOS Developer, Docquity PTE Ltd, New Delhi.
5. Sh. Brijesh Kushwaha, Sr. Software Engineer, S&P Global, Gurugram.
6. Sh. Ankit Kumar, Consultant, Genpact India Pvt Ltd, Noida.
7. Sh. L.S. Yadav, Principal, Government Girls Polytechnic, Jhansi.
8. Sh. Ashok Kushwaha, HOD Computer/ Text Book Officer, IRDT, U.P. Kanpur.
9. Sh. Neeraj Kumar, HOD IT /Assistant Director, Directorate of Technical Education, U.P. Kanpur.
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11. Sh. Sumit Babu, Lecturer, CS, Government Polytechnic, Kanpur.
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