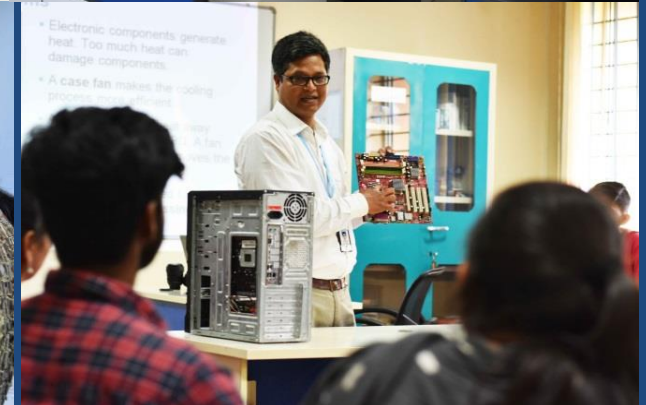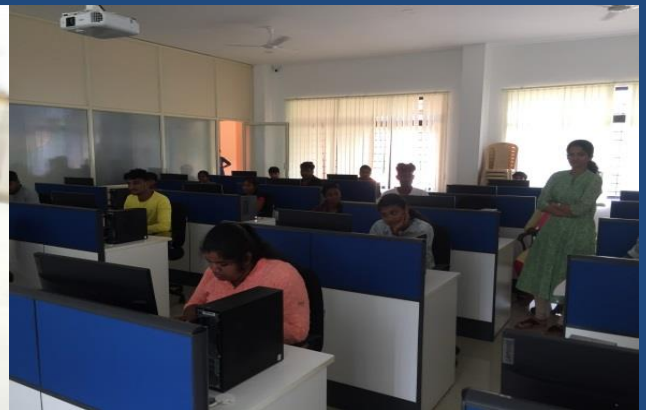# Karnataka German Multi Skill Development Center
KGMSDC Bangalore

Detailed Curriculum for One-year
'Post Graduate Certificate Program' in IT NETWORKING AT KGTTIs

Contents

- **Proposed Model Curriculum 'Post Graduate Certificate Program' for IT Network Engineering for approval**

Societyfor

KARNATAKAGERMANMULTISKILLDEVELOPMENTCENTER
(A Government of Karnataka Undertaking)

KARNATAKA GERMAN TECHNICAL TRAINING INSTITUTE
POST GRADUATE CERTIFICATE PROGRAM
IN IT NETWORK ENGINEERING
(PGCPNE)
CURRICULUM

AlignedTo
VTU & AICTE

1. **Curriculum of 'Post Graduate Certificate PrograminIT and Networking Engineering':**

   a) KGTTI under KGMSDC (Karnataka German Multi Skill Development center) formed bythe Government of Karnataka and Central Government under Technical guidance fromthe GIZ Germany has created many Multi Skill Development centers in Karnataka offerhigh technology industry oriented short-term courses and also offers 'Post Graduate Certificate Program in IT and Networking Engineering'withitsowndevelopedCourseCurriculum as per model curriculum of VTU/AICTE.

   b) Detailed Guidelines related to all the Post Graduate Certificate Programs are separately documented and referred in addition to this exclusive curriculum of 'Post Graduate Certificate Program in IT and Networking Engineering'

2. Contents

3. First Semester Curriculum Structure

Sl. No.	Category of Course	Code No.	Course Title	Hours per week			Total contact hours /week	Credits
				L	T	P		
1.	Mandatory course at the beginning of the first semester	IP101	Induction Program Two weeks	8 days intensive			40	0
2.	Program Core courses	PC101	Computer System Infrastructure	2	1	0	3	3
3.	Program Core courses	PC102	Computer Networking	3	1	0	4	4
4.	Program Core courses	PC103	Network programming languages	1	1	0	2	2
5.	Program Core courses	PC104	Computer System Infrastructure Practicals	0	0	4	4	2
6.	Program Core courses	PC105	Computer Networking Practicals	0	0	4	4	2
7.	Program Core courses	PC106	Network programming languages Practicals	0	0	4	4	2
8.	Summer Internship – I	SI101	Summer Internship – I(2 weeks)after ISemester	0	0	2	2	1
9.	Major Project:	PR101	Major Project: Network Design and Establishment of network	0	0	8	8	4
10	Audit	AU102	EnvironmentalScience	2	0	0	I	0
11	Audit	AU102	Essence of Indian Knowledge andTradition	2	0	0	I	0
	TotalCredits							20

4. First Semester Detailed Curriculum Contents

4.1. Induction program (AICTE curriculum)

CourseCode	:	PGCPNE IP101
CourseTitle	:	InductionProgram
NumberofCredits	:	3(L:2,T:1,P:0)
Prerequisites	;	NIL
CourseCategory	:	BS

A mandatory induction program is planned as part of Certificate Program Programme Curriculum at thestart ofthefirstsemester.Theduration oftheinduction programwillbeoftwoweekswherein students will undergo a wide variety of activities without actually starting with their usualclasses.

The Induction Program will help the new students in building holistic education, socialcharacter,leadershipqualities,self-confidence,creativityandappreciationformankindandnatureat large

- Totaldurationofthe InductionProgramisplannedfor12to15workingdays.
- Sundays can be utilized for screening some Patriotic / Socially SignificantMovies.
- Faculty mentors would be required to obtain the feedback cum suggestions ofthestudentsoftheirrespective groupsabout theInductionprogrammeonthe lastday.

Listofactivities forinductionprogram

- PhysicalActivity
- CreativeArtsandCulture
- Mentoring&UniversalHumanValues
- Familiarizationwiththe institution,Dept./Branch
- LiteraryActivity
- ProficiencyModules
- Lectures&WorkshopsbyEminentPeople
- VisitsinLocalArea/village
- Extra-CurricularActivitiesintheinstitution
- FeedbackandReportontheProgram

Time	Activity	Venue
Day-1 Students arrival and registration.		
9.30am–10.45am	Inauguration andwelcome function withparents.	Suitable Venue as per number of mentor-men-teegroups
11.00am – 12.15pm	ScreeningofInstituteDocumentaryMovie; video clips of variousfunctions andevents	Conference/SeminarHall
3.30pm–5.30pm	Institutevisit	Aroundthe Campus
5.30pm–9.30pm	RestandDinner	RespectiveHostels

Time	Activity	Venue
Day -2		
6:00am	Wakeup call	RespectiveHostels
6:30am -7:20am	Physicalactivity(mildexercise/yoga)	Sports GroundHealth run
7.30am -9.20am	Bath, Breakfastetc.	RespectiveHostels
9.30am– 12.30pm	Presentation cum Interactive SessionPlanned well in advance withImportant Institution Functionarieslike Principal, HODs Mentor-mentee groups - Introductionwith- ingroup. Warden etc. Explain rules andregulations	Conference/SeminarHall

	andacademicprocedures.	
12.30pm – 2.30pm	Lunch	RespectiveHostels
2.30pm– 5.30pm	VisittoRespectiveDepartments	RespectiveDepartments
5.30pm– 6.30pm	Filmson–course andfacilities	Conference/SeminarHall
6.30pm– 9.30pm	RestandDinner	RespectiveHostels

Day -3		
6:00am	Wakeup call	RespectiveHostels
6:30am -7:20am	Physicalactivity(mildexercise/yoga)	Sports GroundHealth run
7.30am -9.20am	Bath, Breakfastetc.	RespectiveHostels
9.30am– 12.30pm	Explain rules andregulations andacademicprocedures.	Conference/SeminarHall
12.30pm – 2.30pm	Lunch	RespectiveHostels
2.30pm– 5.30pm	VisittoRespectiveDepartments	RespectiveDepartments
5.30pm– 6.30pm	Filmson–course andfacilities	Conference/SeminarHall
6.30pm– 9.30pm	RestandDinner	RespectiveHostels

DAY4today7(3visits planned)		
6:00 am	Wakeup call	RespectiveHostels
6:30 am- 7:20 am	Physicalactivity(mildexercise/yoga)	Sports GroundHealth runExercise Yoga Marchingwithdrums
7.30 am- 9.20 am	Bath, Breakfastetc.	RespectiveHostels
9.30 am– 10.30 am	UniversalHumanValues Helpsstudentsin the rightdevelopmentof theirworld-view,mindset,perspective and values.	Suitablevenue
10.30 am– 11.00 am	Break	
11.00 am– 12.00 pm	CreativeArts/TechnicalWorkshops/ ProficiencyModules	
12.30 pm– 2.30 pm	Lunch Break	RespectiveHostels
2.30 pm– 7.00 pm	Local technicalvisitsplannedatleast3visits	places in and around the area, Computer networking installations, in industry, hotel. Offices, Banks
7.00 pm– 9.30	RestandDinner	RespectiveHostels

DAY8		
6:00 am	Wakeup call	RespectiveHostels
6:30 am -7:20 am	Physicalactivity(mildexercise/yoga)	SportsGround

7.30 am -9.20 am	Bath, Breakfastetc.	RespectiveHostels
9.30 am– 10.30 am	UniversalHumanValues	Suitable venue
10.30 am– 11.00 am	Break	
11.00 am– 12.00 pm	TalentShowandValedictoryFunction preparations	Suitablevenue
12.30 pm– 2.30 pm	Lunch Break	RespectiveHostels
2.30 pm 5.00 pm	TalentShowandValedictoryFunction preparations	Suitablevenue(indoor/ outdoor)
6.00 pm– 8.00 pm	TalentShowandValedictoryFunction, Parentsmeeting Principal'sAddress	Suitablevenue(indoor/ outdoor)
8.00 pm– 9.30 pm	RestandDinner	RespectiveHostels

Coordinatorscanbeassignedforvariousactivitiesduringtheinductionprogramme.

Sl. No.	Name of the activity	Coordinators
1.	Visitstodifferentdepartmentsand aroundthecampus	HODs
2.	Physical/Sports activities in the SportsGround(Morningaswellas Evening)	Incharge ofPhysicalEducation/Sports
3.	• CreativeArts/TechnicalWorkshops. • Lecture Sessions or Films on UniversalHuman Values / Cultural / Talent huntActivities / Performances by Classicalorfolkartists. • TalentShowandValedictoryFunction.	In charge of Technical / Culturalactivities
4.	Presentation cum Interactive SessionwithEminentAlumni/EminentSp eaker	Training&PlacementIncharge
5.	UniversalHumanValues	SuitableFacultymembers
6.	ProficiencyModule(English)	FacultyofEnglishlanguage
7.	LocalVisits	Hostel Wardens / Discipline incharge
8.	Wakeupcall/Hostelrelatedactivities ArrangementsatValedictoryFunction	ChiefWardens(Boys/Girls)

Schedule of local visits		
PlannedDates	Proposedvisit	Planned visit
	Historical placesinand around thearea,	
	Museums,	
	Industries	
	Village	

Note:

- The faculty mentors of the respective mentor - mentee groups / sections will accompany the students on local visits.
- The Institute buses, if there, may be made available for the purpose each day or some other arrangements may be made.
- Parents' consent is to be taken before departure.

• Attendanceofthe studentstobetakenat thetimeofdeparture andreturn.

4.2.   Computer System Infrastructure

CourseCode	:	PGCPNE PC101
CourseTitle	:	Computer System Infrastructure
NumberofCredits	:	3
Prerequisites	:	0
CourseCategory	:	Program Core courses

CourseObjectives:

• Develop critical thinking and problem-solving skills using computer systems equipment and virtual Packet Tracer.
• Learn and apply skills and procedures to install, configure, operating systems and application software.
• Learn and apply skills and procedures to troubleshoot and reinstall install software and configure, computers, mobile devices, to the peripherals
• Learn and apply skills and procedures to trouble shoot and optimize computer IT and software
• Identify common security threats and install the preventive methods
• Learn Network Components and Types, Networking Protocols, Standards, and Services, Network Devices and IT.
• The course will help the students to apply the concepts and principles of connecting computers to solve broad based problems and to understand different computer systems.

Teaching Approach:

• Teachers should give examples from daily routine as well as, latest IT and software applications on various concepts and principles in each topic so that students are able to understand and grasp these concepts and principles.
• Teaching and Learning experiences with interactive content such as practice labs, interactive activities and videos
• Use of demonstration can make the subject interesting and develop scientific temper in the students. Student activities should be planned on all the topics.
• Activity- Theory - Demonstrate/practice approach may be followed throughout the course
• Hands-on experience should be provided to individual candidates for installations, connections, IT and software configuration. Trouble shooting skills should be imparted
• Continuous assessment and reviews

Course Content:

Unit 1: Working knowledge and functions of how computers and mobile devices operate. Introduction to the Personal Computer IT , PC Assembly, learn roles and responsibilities of the IT Professional. Starting of computer system, Configure BIOS and UEFI settings, upgrade a computer to meet requirements

Unit 2: Windows Installation, Disk Management, Windows Configuration, Mobile, Linux, and mac OS Operating Systems, Create a partition in Windows using the Disk Management Utility, Configure Windows using Control Panels. Windows tools and utilities to manage Windows systems, Windows command line tools.

Unit 3: Laptops and Other Mobile Devices, Laptop Configuration, Printers peripherals. Apply skills and procedures to install, configure, and troubleshoot computers, mobile devices, and software. Maintenance of Laptops and other Mobile Devices. Purpose and characteristics of different types of printers. Install and Configure printer sharing

Unit 4: Develop critical thinking and problem solving skills using both real equipment and Cisco Packet Tracer, a network configuration simulation tool.

Unit 5: Security, Identify common security threats and vulnerabilities like malware, phishing, spoofing and social engineering, Configure basic security settings and policies for end devices, Configure wireless security, troubleshoot basic security problems

Unit 6: Preventive Maintenance and Troubleshooting, Troubleshoot problems with PC and peripheral devices.

Unit 7: Networking Concepts, Networking Protocols, Standards, and Services , Devises, Configure devices for wired and wireless networks , Troubleshooting Process for Networks , Virtualization and Cloud Computing, Compare cloud computing concepts

Learning Outcome:

Afterundergoingthissubject,thestudentwillbeableto:

- Select the appropriate computer components to build, repair, or upgrade personal computers
- Install components, to build, repair, or upgrade personal computers.
- Install the operating system and connect the computer IT at board level involving the defined assembly sequence.
- Identify physically computer makes, types of processors specifications and computer peripherals
- Trouble shoot the computer systems for various IT and software issues and solve the problems tominimizedowntime
- Compare performance of computers and set the parameters to the optimum level relate physical properties associated with linear motion and rotationalmotion
- Connect printers and other networking peripherals Explain how computers communicate on a network, virtualization and cloud computing.
- Explain the roles and responsibilities of the IT Professional.

References:

 CISCO IT Essentials.

4.3.   Computer Networking Technology

CourseCode	:	PGCPNE PC102
CourseTitle	:	Computer Networking Technology
NumberofCredits	:	3
Prerequisites	:	
CourseCategory	:	Program Core courses

Course Objectives:
- Study of Networking Basic Switch and End Device Configuration, Protocols and Models
- Physical Layer, Number Systems,
- Data Link Layer, Ethernet Switching, Network Layer, Address Resolution, Basic Router Configuration, IPv4 Addressing, IPv6 Addressing, ICMP
- Transport Layer, Application Layer
- Network Security Fundamentals, Build a Small Network
- Single-Area OSPFv2 Concepts, Single-Area OSPFv2 Configuration
- Network Security Concepts
- ACL Concepts, ACLs for IPv4 Configuration, NAT for IPv4
- WAN Concepts, VPN and IPsec Concepts, QoS Concepts
- Network Management, Network Design, Network Troubleshooting, Network, Virtualization, Network Automation
- Classify the various types of network attacks, network monitoring tools to identify attacks against network protocols and services, Prevent malicious access to computer networks, hosts, and data, impacts of cryptography on network security monitoring, investigate endpoint vulnerabilities and attacks and Evaluate network security alerts.

Teaching Approach:

- Teachers should give examples from daily routine as well as, latest IT and software applications on various concepts and principles in each topic so that students are able to understand and grasp these concepts and principles.
- Teaching and Learning experiences with interactive content such as practice labs, interactive activities and videos
- Use of demonstration can make the subject interesting and develop scientific temper in the students. Student activities should be planned on all the topics.
- Activity- Theory - Demonstrate/practice approach may be followed throughout the course
- Hands-on experience should be provided to individual candidates for installations, connections, IT and software configuration. Trouble shooting skills should be imparted
- Continuous assessment and reviews

Course Content:

Unit1:

- Explain the advances in modern network technologies
- Implement initial settings including passwords, IP addressing, and default gateway parameters on a network switch and end devices. Explain how network protocols enable devices to access local and remote network resources
- Explain how physical layer protocols, services, and network media support communications across data networks.

Unit2:

- Calculate numbers between decimal, binary, and hexadecimal systems. Explain how Ethernet operates in a switched network, Explain how routers use network layer protocols and services to enable end-to-end connectivity
- Explain how ARP and ND enable communication on a network. Implement initial settings on a router and end devices, Calculate an IPv4 sub netting scheme to efficiently segment a network, Implement an IPv6 addressing scheme

Unit3:

- Use various tools to test network connectivity, Compare the operations of transport layer protocols in supporting end-to-end communication, Explain the operation of application layer protocols in providing support to end-user applications, Configure switches and routers with device hardening features to enhance security.
- Build a Small Network, Implement a network design for a small network to include a router, a switch, and end devices

Unit4:

- Configure single-area OSPFv2 in both point-to-point and multi access networks.
- Explain how to mitigate threats and enhance network security using access control lists and security best practices.

Unit5:

- Implement standard IPv4 ACLs to filter traffic and secure administrative access.
- Configure NAT services on the edge router to provide IPv4 address scalability. Explain techniques to provide address scalability and secure remote access for WANs

Unit6:

- Explain how to optimize, monitor, and troubleshoot scalable network architectures.
- Explain how networking devices implement QoS.
- Implement protocols to manage the network.

Unit 7:

- Explain how technologies such as virtualization, software defined networking, and automation affect evolving networks

Unit 8:

- Principles of Network Security
- Network Services
- Network communication devises and Security Infrastructure
- Attackers and Their Tool, Common Threats and Attacks, Observing Network Operation
- Understanding Defense, Access Control, Threat Intelligence
- Cryptography and Endpoint Protection&Vulnerability Assessment
- Working with Network Security Data
- Digital Forensics and Incident Analysis and Response

Learning Outcome:

Afterundergoingthissubject,thestudentwillbeableto:

- Configure switches and end devices to provide access to local and remote network resources.
- Explain how physical and data link layer protocols support the operation of Ethernet in a switched network.
- Configure routers to enable end-to-end connectivity between devices.
- Create IPv4 and IPv6 addressing schemes and verifies network connectivity between devices.
- Explain how the upper layers of the OSI model support network applications.
- Configure a small network. Troubleshoot connectivity in a network.
- Configure single-area OSPFv2 in both point-to-point and multiaccess networks.
- Explain how to mitigate threats and enhance network security
- Implement standard IPv4 ACLs.
- Configure NAT services on the edge router to provide IPv4 address scalability.
- Explain techniques to provide address scalability and secure remote access for WANs.
- Explain how to optimize, monitor, and troubleshoot scalable network architectures.
- Explain how networking devices implement QoS. Implement protocols to manage the network.
- Explain how technologies such as virtualization, software defined networking, and automation affect evolving networks.

References:

- CISCO Introduction to Networks (ITN) ITN v7 Release Notes, ITN v7 Scope and Sequence
- CISCO Enterprise Networking, Security, and Automation (ENSA)

4.4.   Network programming languages

CourseCode	:	PGCPNE PC103
CourseTitle	:	Network programming languages
NumberofCredits	:	2
Prerequisites	:	
CourseCategory	:	Program Core courses

Course Objectives:

- Operational level programming skill in Network programming languages like

- C, C++,
- Perl, Jawa Object oriented programming language,
- Python Open Source Programming language,
- Ruby and Google go.
- Web development, XML Extensible Markup Language, Perl general purpose programming language,
- Unix based command like Bash command line interface tool, Linux networking ,
- Cloud networking, DevOps automation processes practices,
- IaC Infrastructure as code, application Programming interfaces APIs
- Programmable network, software defined networking 5G connectivity, Internet of things IoT applications ,

Teaching Approach:

- Teachers should give examples from daily routine as well as, latest IT and software applications on various concepts and principles in each topic so that students are able to understand and grasp these concepts and principles.
- Teaching and Learning experiences with interactive content such as practice labs, interactive activities and videos
- Use of demonstration can make the subject interesting and develop scientific temper in the students. Student activities should be planned on all the topics.
- Activity- Theory - Demonstrate/practice approach may be followed throughout the course
- Hands on experience should be provided to individual candidates for installations, connections, IT and software configuration. Trouble shooting skills should be imparted
- Continuous assessment and reviews
-

Course Content:

Unit 1:
- Operational level programming on universal programming languages C, C++,
- Perl, Jawa Object oriented programming language,
- concept of "objects", which can contain data and code that manipulates that data. In OOP, objects creation from templates "classes",

Unit2:
- Object oriented programming language like Perl, Jawa Object oriented programming language,
- Seven object-oriented principles (abstraction, encapsulation, polymorphism, inheritance, association, aggregation, and composition}

Unit3:
- Open Source Programming language like Python
- Principles or the four pillars of object-oriented programming (OOP). Study of four pillars Inheritance, Polymorphism, Encapsulation and Abstraction.

Unit 4:
- Ruby and Google go, create and deploy simple Go apps Go programs structure of following parts:- Package Declaration, Import Packages, Variables, Statements and Expressions, Functions, Comments

Unit 5:
- Web development, XML Extensible Markup Language, Perl general purpose programming language, Development of websites using HTML/CSS, PHP, Python, JavaScript, Java, Ruby, and Swift

Unit6:
- Cloud networking, DevOps automation processes practices,
- IaC Infrastructure as code, application Programming interfaces APIs
-

Unit 7:
- Programmable network, software defined networking 5G connectivity, Internet of things IoT applications ,

Learning Outcome:

Afterundergoingthissubject,thestudentwillbeableto:

Work on networking and programming using various software options. Write simple program in Network programming languages like
- C, C++,
- Perl, Jawa Object oriented programming language,
- Python Open Source Programming language,
- Ruby and Google go.
- Web development, XML Extensible Markup Language, Perl general purpose programming language,
- Unix based command like Bash command line interface tool, Linux networking ,
- Cloud networking, DevOps automation processes practices,
- IaC Infrastructure as code, application Programming interfaces APIs
- Programmable network, software defined networking 5G connectivity, Internet of things IoT applications.

4.5. Computer System Infrastructure Practical

CourseCode	:	PGCPNE PC104
CourseTitle	:	Computer System Infrastructure Practical
NumberofCredits	:	2
Prerequisites	:	PC101
CourseCategory	:	Program Core courses

Course Objectives:
- Assemble the computer system, Develop critical thinking and problem-solving skills using computer systems equipment and virtual Packet Tracer.
- To install, configure, operating systems and application software.
- Troubleshoot and reinstall install software and configure, computers, mobile devices, to

the peripherals, To trouble shoot and optimize computer IT and software
- Install the software for security threats as preventive methods
- Connecting computers in a network to solve broad based netwowrk problems

Teaching Practical Approach:

- Teachers should give examples and demonstrate good practices
- All computer systems should be in good condition and loaded with the required software, application software and programmable languages
- Students should operate on individual basis for acquiring good skills and speed of operation
- Continuous evaluation system should be followed in the practical sessions.
- Time factor should be measured as one of the performance factor for evaluation
- Teaching and Learning experiences with interactive content such as practice labs, interactive activities and videos
- Use of demonstration can make the subject interesting
- Activity- Description- Demonstrate/practice approach may be followed throughout the course
- Hands on experience should be provided to individual candidates for installations, connections and IT and software configuration. Trouble shooting skills should be imparted
- Continuous assessment and reviews

Course Content

Sl. No.	PracticalExercises
1	Assemble the computer system, Develop critical thinking and problem-solving skills using computer systems equipment and virtual Packet Tracer.
2	Install, configure, operating systems and application software, Optimization and maintenance of Windows operating systems
3	Troubleshoot and reinstall install software and configure, computers, mobile devices, to the peripherals, To trouble shoot and optimize computer IT and software
4	Install the software for security threats as preventive methods
5	Connecting computers in a network to solve broad based netwowrk problems
6	Configure, secure, and troubleshoot mobile, MacOS, and Linux operating systems. Implement host, data, and network security
7	Conduct the experiments of Cloud computing.

Learning Outcome:

AfterundergoingthisLab,thestudentwillbeableto:
- Using   the appropriate computer components to build, repair, or upgrade personal

computers
- Install Windows operating systems.
- Install IT and software to build, repair, or upgrade personal computers.
- Install a printer to meet requirements.
- Select the appropriate computer components to match system requirements and to adhere to environmental disposal methods.
- Perform troubleshooting on personal computers.
- Configure devices to communicate on a network.
- Explain how to troubleshoot laptops and other mobile devices.
- Perform management and maintenance of Windows operating systems.
- Explain how to configure, secure, and troubleshoot mobile, MacOS, and Linux operating systems.
- Implement host, data, and network security.
- Explain the roles and responsibilities of the IT Professional.
- Explain virtualization and cloud computing.

4.6. Computer Networking Technology Practicals

CourseCode	:	PGCPNE PC105
CourseTitle	:	Computer Networking Technology Practicals
NumberofCredits	:	2
Prerequisites	:	
CourseCategory	:	Program Core courses

Course Objectives:

- Conduct experiments on Networking Basic Switch and End Device Configuration, Protocols and Models, Physical Layer, Number Systems, Data Link Layer, Ethernet Switching, Network Layer, Address Resolution, Basic Router Configuration, IPv4 Addressing, IPv6 Addressing, ICMP, Transport Layer,   Application Layer
- Experiments on Network Security Fundamentals, Build a Small Network
- Experiments on Single-Area OSPFv2 Concepts, Single-Area OSPFv2 Configuration
- Experiments on Network Security Concepts
- Experiments on ACL Concepts, ACLs for IPv4 Configuration, NAT for IPv4
- Experiments on WAN Concepts, VPN and IPsec Concepts, QoS Concepts
- Experiments on Network Management, Network Design, Network Troubleshooting, Network, Virtualization, Network Automation

Teaching Practical Approach:

- Teachers should give examples and demonstrate good practices
- All computer systems should be in good condition and loaded with the required software, application software and programmable languages
- Students should operate on individual basis for acquiring good skills and speed of operation
- Continuous evaluation system should be followed in the practical sessions.
- Time factor should be measured as one of the performance factor for evaluation

- Teaching and Learning experiences with interactive content such as practice labs, interactive activities and videos
- Use of demonstration can make the subject interesting
- Activity- Description- Demonstrate/practice approach may be followed throughout the course
- Hands-on experience should be provided to individual candidates for installations, connections and ITand software configuration. Trouble shooting skills should be imparted
- Continuous assessment and reviews

Course Content:

Sl.No.	PracticalExercises
1	• Setup network and implement initial settings including passwords, IP addressing, and default gateway parameters on a network switch and end devices. enable devices to access local and remote network resources, physical layer protocols, services, and network media support communications across data networks.
2	• Calculate numbers between decimal, binary, and hexadecimal systems. Ethernet operations in a switched network, routers use network layer protocols and services to enable end-to-end connectivity. • Use ARP and ND to enable communication on a network. Implement initial settings on a router and end devices, Calculate an IPv4 sub netting scheme to efficiently segment a network, Implement an IPv6 addressing scheme
3	• Use various tools to test network connectivity, connect and compare the operations of transport layer protocols in supporting end-to-end communication, apply operation of application layer protocols in providing support to end-user applications, configure switches and routers with device hardening features to enhance security. • Build a Small Network, implement a network design for a small network to include a router, a switch, and end devices
4	• Connect and configure single-area OSPFv2 in both point-to-point and multi access networks. Mitigate threats and enhance network security using access control lists and security best practices
5	• Connect using standard IPv4 ACLs to filter traffic and secure administrative access. • Configure NAT services on the edge router to provide IPv4 address scalability. Provide address scalability and secure remote access for WANs
6	• Connect and optimize, monitor, and troubleshoot scalable network architectures. • Implement QoS. networking devices • Implement protocols to manage the network.
7	• Use virtualization, software defined networking, and automation affect evolving networks.

Teachersshouldusethefollowingstrategiestoachievethevariousoutcomesofthecourse.

- Different methods of teaching and media to be used to attain classroom attention.
- Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- 15-20% of the topics which are relatively simpler of descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations.
- Micro-projects may be given to group of students for hand-on experiences.

SuggestedStudentActivities&Strategies

Apart from classroom and laboratory learning suggest student related activities which can be undertaken to accelerate the attainment of various outcomes of thecourse.

Course outcomes:

Attheendofthecourse,thestudentwillbeableto:

CO1	• Design, connect and Configure switches and end devices to provide access to local and remote network resources. Explain how physical and data link layer protocols support the operation of Ethernet in a switched network. • Connect and Configure routers to enable end-to-end connectivity between devices.
CO2	• Create IPv4 and IPv6 addressing schemes and verifies network connectivity between devices. • Explain upper layers of the OSI model support network applications.
CO3	• Troubleshoot and configure a small network. Configure single-area OSPFv2 in both point-to-point and multiaccess networks. • Mitigate threats and enhance network security, Implement standard IPv4 ACLs. • Configure NAT services on the edge router to provide IPv4 address scalability. Explain techniques to provide address scalability and secure remote access for WANs.
CO4	• Optimize, monitor, and troubleshoot scalable network architectures. Implement QoS. Implement protocols to manage the network. • Use technologies such as virtualization, software defined networking, and automation affect evolving networks

4.7. Network programming languages Practicals

CourseCode	:	PGCPNE PC106
CourseTitle	:	Network programming languages Practicals
NumberofCredits	:	2
Prerequisites	:	
CourseCategory	:	Program Core courses

CourseObjectives:

Operational level programming and conduct various exercises In management of the Network using programming languages like
- C, C++,
- Perl, Jawa Object oriented programming language,
- Python Open Source Programming language,
- Ruby and Google go.
- Web development, XML Extensible Markup Language, Perl general purpose programming language,
- Unix based command like Bash command line interface tool, Linux networking ,
- Cloud networking, DevOps automation processes practices,
- IaC Infrastructure as code, application Programming interfaces APIs
- Programmable network, software defined networking 5G connectivity, Internet of things IoT applications ,
-

Teaching Practical Approach:

- Teachers should give examples and demonstrate good practices
- All computer systems should be in good condition and loaded with the required software, application software and programmable languages
- Students should operate on individual basis for acquiring good skills and speed of operation
- Continuous evaluation system should be followed in the practical sessions.
- Time factor should be measured as one of the performance factor for evaluation
- Teaching and Learning experiences with interactive content such as practice labs, interactive activities and videos
- Use of demonstration can make the subject interesting
- Activity- Description- Demonstrate/practice approach may be followed throughout the course
- Hands-on experience should be provided to individual candidates for installations, connections and IT and software configuration. Trouble shooting skills should be imparted
- Continuous assessment and reviews

Course Content:

Sl.No.	DetailsOf programmable languages on which the Practical exercises are to be conducted
I	• Operational level programming on universal programming languages C, C++, • Perl, Jawa Object oriented programming language, • Concept of "objects", which can contain data and code that manipulates that data. In OOP, objects creation from templates "classes".
II	• Object oriented programming language like Perl, Jawa Object oriented programming language, • Seven object-oriented principles (abstraction, encapsulation, polymorphism, inheritance, association, aggregation, and composition}
III	• Open Source Programming language like Python Principles or the four pillars of object-oriented programming (OOP). Study of four pillars Inheritance, Polymorphism, Encapsulation and Abstraction
IV	• Ruby and Google go, create and deploy simple Go apps Go programs structure of following parts:- Package Declaration, Import Packages, Variables, Statements and Expressions, Functions, Comments
V	• Web development, XML Extensible Markup Language, Perl general purpose programming language, Development of websites using HTML/CSS, PHP, Python, JavaScript, Java, Ruby, and Swift
VI	• Cloud networking, DevOps automation processes practices, • IaC Infrastructure as code, application Programming interfaces APIs
VII	• Programmable network, software defined networking 5G connectivity, Internet of things IoT applications.

Teachersshouldusethefollowingstrategiestoachievethevariousoutcomesofthecourse.

- Different methods of teaching and media to be used to attain classroom attention.
- Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- 15-20% of the topics which are relatively simpler of descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations.
- Micro-projects may be given to group of students for hand-on experiences.

SuggestedStudentActivities&Strategies

Apart from classroom and laboratory learning following are the suggested student relatedactivities which can be undertaken to accelerate the attainment of various outcomes of thecourse

Course outcomes:

Attheendofthecourse,thestudentwillbeableto:

CO1	Can work on programmable languages and conduct Practical applications are conducted
CO2	Manage the network by applying changes in the program codes for better functionality
CO3	Troubles shoot the programs and fine tune the network properties.
CO4	Automate network management by various tools and programmable codes in appropriate programmable languages.

4.8. Summer Internship

CourseCode	:	PGCPNE SI201
CourseTitle	:	SUMMERINTERNSHIP-1
NumberofCredits	:	2 (4 weeksdurationafterIISemester)
Prerequisites	:	nil
CourseCategory	:	SI

Should be undertaken in an industry preferably related to tool and die making, Skill Centers,Institutes.

Internship Objectives:

- Understand industrial culture
- Understand the processes in the IT / Network application industry/Organization
- Understand the IT and software
- Understand the installation planning
- Understand the quality of Network application

Internship Content:

Sl.No.	Areasoforientationin the internship
I	Observeworkcultureandindustrialcultureoftheemployees
II	Observehowdifferentmanufacturingprocessesarefollowedinthe industry
III	Observetheoperationsand capabilitiesof the IT and software
IV	Observe how network planning is done inadvance and howthe entire network is functioning.

V	Observehowthequalityandtheproductivityismanagedinthe IT networking industry

Course outcomes:

Attheendoftheinternship,thestudentwillbeableto:

CO1	Appreciateworkcultureand IT industrialculture
CO2	Practicehowdifferentprocessesarefollowedinthe IT Network application industry
CO3	Highlightthecapabilitiesofthe IT and software
CO4	Practicehowtheplanningisdoneinadvance and installation of IT Network application is established
CO5	Appreciatehow the quality and the productivity is managed in theNetwork application industry

5. SecondSemesterCurriculumStructure

Sl. No	Category ofCourse	CodeNo. PGCPNE	CourseTitle	Hours perweek			Totalcontacthours/ week	Credits
				L	T	P		
1	Program Core courses	PC201	Linux System administration	2	1	0	3	3
2	Program Core courses	PC202	Computer Wireless Networking Technology	2	1	0	3	3
3	Program Core courses	PC203	Cloud Computing Technology	2	1	0	3	3
4	Program Core courses	PC204	Linux System administration Practicals	0	0	4	4	2
5	Program Core courses	PC205	Computer Wireless Networking Technology Practicals	0	0	4	4	2
6	Program Core courses	PC206	Cloud Computing Technology Practicals	0	0	4	4	2
7	Major Project:	PR201	Major Project: Design andEstablishment of Network	0	0	10	10	5
8	Seminar II	SE201	Seminar II	0	0	2	2	1
9	Audit	AU20I	Indian Constitution	2	0	0	2	0
	Audit	AU202	EntrepreneurshipandStart-ups	3	1	0	4	0
				TotalCredits				21

6. Second Semester Detailed Curriculum Contents

6.1. Linux System administration

CourseCode	:	PGCPNE PC201
CourseTitle	:	Linux System administration
NumberofCredits	:	3
Prerequisites	:	
CourseCategory	:	Program Core courses

Course Objectives:

- Get started with Red Hat Enterprise Linux, Access the command line, Manage files from the command line, Get help in Red Hat Enterprise Linux
- Create, view, and edit text files. Manage local users and groups,   Control access to files
- Monitor and manage Linux processes, Control services and daemons. Configure and secure SSH
- Manage networking, Install and update software,   Access Linux files systems
- Analyze servers and get support, Comprehensive review
- Improve command line productivity, Schedule future tasks, Analyze and store logs, Archive and Transfer Files, Tune system performance
- Manage SE Linux security. Manage basic storage, Manage storage stack, Access network-attached storage, Control the boot process, Manage network security
- Install Red Hat Enterprise Linux, Run Containers
- Install Ansible / Red Hat Ansible Engine on control nodes. Create and update inventories of managed hosts and manage connections to them.
- Automate administration tasks with Ansible Playbooks, Write effective playbooks at scale. Protect sensitive data used by Ansible with Ansible Vault.
- Reuse code and simplify playbook development with Ansible roles.

Teaching Approach:

- Teachers should give examples from daily routine as well as, latest IT and software applications on various concepts and principles in each topic so that students are able to understand and grasp these concepts and principles.
- Teaching and Learning experiences with interactive content such as practice labs, interactive activities and videos
- Use of demonstration can make the subject interesting and develop scientific temper in the students. Student activities should be planned on all the topics.
- Activity- Theory - Demonstrate/practice approach may be followed throughout the course
- Hands on experience should be provided to individual candidates for installations, connections, IT and software configuration. Trouble shooting skills should be imparted
- Continuous assessment and reviews
-

Course Content:

Unit1:
- Copy, move, create, delete, and organize files while working from the bash shell.
- Resolve problems by using local help systems.
- Manage text files from command output or in a text editor.
- Create, manage, and delete local users and groups, as well as administer local password policies.
- Set Linux file system permissions on files and interpret the security effects of different permission settings.
- Evaluate and control processes running on a Red Hat Enterprise Linux system.

Unit2:
- Control and monitor network services and system daemons using systemd.
- Configure secure command line service on remote systems, using OpenSSH
- Configure network interfaces and settings on Red Hat Enterprise Linux servers.
- Download, install, update, and manage software packages from Red Hat and yum package repositories.
- Access, inspect, and use existing file systems on storage attached to a Linux server.
- Investigate and resolve issues in the web-based management interface, getting support from Red Hat to help solve problems.
- Review the content covered in this course by completing hands-on exercises

Unit3:
- Run commands more efficiently by using advanced features of the Bash shell, shell scripts, and various utilities provided by Red Hat Enterprise Linux.
- Schedule commands to run in the future, either one time or on a repeating schedule.
- Locate and accurately interpret logs of system events for troubleshooting purposes.
- Archive and copy files from one system to another.

Unit 4:
- Improve system performance by setting tuning parameters and adjusting scheduling priority of processes. Protect and manage the security of a server by using SELinux
- Create and manage storage devices, partitions, file systems, and swap spaces from the command line.
- Create and manage logical volumes containing file systems and swap spaces from the command line.

Unit5:
- Use the NFS protocol to administer network-attached storage.
- Manage the boot process to control services offered and to troubleshoot and repair problems.
- Control network connections to services using the system firewall and SELinux rules.
- Install Red Hat Enterprise Linux on servers and virtual machines.
- Obtain, run, and manage simple, lightweight services as containers on a single Red Hat Enterprise Linux server.

Unit6:
- **Introduce Ansible**

Describe Ansible concepts and install Red Hat Ansible Engine.

- **Implementing an Ansible Playbook**
  Write a simple Ansible Playbook and run it to automate tasks on multiple managed hosts.
- **Managing Variables and Facts**
  Write playbooks that use variables to simplify management of the playbook and facts to reference information about managed hosts.
- **Implementing task control**
  Manage task control, handlers, and task errors in Ansible Playbooks.

Unit7:

- **Deploying files to managed hosts**
  Deploy, manage, and adjust files on hosts managed by Ansible.
- **Managing complex Plays and Playbooks**
  Write playbooks that are optimized for larger, more complex projects.
- **Simplifying Playbooks with Roles and Ansible Content Collections**
  Use Ansible Roles and Ansible Content Collection to develop playbooks more quickly and to reuse Ansible code.
- **Troubleshooting Ansible**
  Troubleshoot playbooks and managed hosts.
- **Automating Linux Administration Tasks**
  Automate common Linux system administration tasks with Ansible.

Learning Outcome:

Afterundergoingthissubject,thestudentwillbeableto:

- Get help in Red Hat Enterprise Linux
- Create, view, and edit text files. Manage local users and groups,   Monitor and manage Linux processes,
- Manage networking
- Analyze servers and get support,
- Schedule future tasks, Archive and Transfer Files, Tune system performance
- Manage SE Linux security.
- Install Red Hat Enterprise Linux,
- Install Ansible / Red Hat Ansible Engine and manage
- Automate administration tasks with Ansible Playbooks

References:
- Red Hat System Administration I – RH124
- Red Hat System Administration II – RH134
- Red Hat System Administration III: Linux Automation (RH294)

6.2.   Computer Wireless Networking Technology

CourseCode	:	PGCPNE PC202
CourseTitle	:	Computer Wireless Networking Technology
NumberofCredits	:	3
Prerequisites	:	
CourseCategory	:	Program Core courses

Course Objectives:
- Switching, Routing and Wireless Essentials
- Basic Device Configuration, Switching Concepts, VLANs, Inter-VLAN Routing, STP, Ether Channel, DHCPv4, SLAAC and DHCPv6 Concepts, FHRP Concepts
- LAN Security Concepts
- Switch Security Configuration
- WLAN Concepts, WLAN Configuration
- Routing Concepts, IP Static Routing Troubleshoot Static and Default Routes

Teaching Approach:
- Teachers should give examples from daily routine as well as, latest IT and software applications on various concepts and principles in each topic so that students are able to understand and grasp these concepts and principles.
- Teaching and Learning experiences with interactive content such as practice labs, interactive activities and videos
- Use of demonstration can make the subject interesting and develop scientific temper in the students. Student activities should be planned on all the topics.
- Activity- Theory - Demonstrate/practice approach may be followed throughout the course
- Hands-on experience should be provided to individual candidates for installations, connections, IT and software configuration. Trouble shooting skills should be imparted
- Continuous assessment and reviews

Course Content:
Unit1:
- Configure devices by using security best practices, Layer 2 switches forward data, VLANs in a switched network,

Unit2:
- Troubleshoot inter-VLAN routing on Layer 3 devices, STP enables redundancy in a Layer 2 network., Troubleshoot EtherChannel on switched links

Unit3:
- Implement DHCPv4 to operate across multiple LANs, Configure dynamic address allocation in IPv6
- Networks, FHRPs provide default gateway services in a redundant network

Unit5:
- Explain how vulnerabilities compromise LAN security, Implement switch security to mitigate LAN attacks

Unit6:
- Explain how WLANs enable network connectivity. Implement a WLAN using a wireless router and WLC.

Unit 7:

- Explain how routers use information in packets to make forwarding decisions, Configure IPv4 and IPv6 static routes, Troubleshoot static and default route configurations

Learning Outcome:

Afterundergoingthissubject,thestudentwillbeableto:

- Configuration of the various wireless devices Basic Device Configuration, Switching Concepts, VLANs, Inter-VLAN Routing, STP, Ether Channel, DHCPv4, SLAAC and DHCPv6 Concepts, FHRP Concepts
- Design and configure LAN Security Concepts
- Connecting, mounting, troubleshooting and maintenance Switch Security Configuration
- Undertake WLAN Configuration independently
- Configure and IP Static Routing Troubleshoot Static and Default Routes

References:: CCNAv7 Switching, Routing and Wireless Essentials

6.3.   Cloud Computing Technology

CourseCode	:	PGCPNE PC203
CourseTitle	:	Cloud Computing Technology
NumberofCredits	:	3
Prerequisites	:	
CourseCategory	:	Program Core courses

Course Objectives:

- Understand and use the AWS Cloud, Explain the AWS pricing philosophy
- Identify the global infrastructure components of AWS
- Study security and compliance measures of the AWS Cloud, including AWS Identity and Access Management (IAM)
- Creation of a virtual private cloud (VPC) by using Amazon Virtual Private Cloud (Amazon VPC)
- Use Amazon Elastic Compute Cloud (Amazon EC2), AWS Lambda, and AWS Elastic Beanstalk
- Differentiate between Amazon Simple Storage Service (Amazon S3), Amazon Elastic Block Store (Amazon EBS), Amazon Elastic File System (Amazon EFS), and Amazon Simple Storage Service Glacier (Amazon S3 Glacier)
- Use of AWS database services, including Amazon Relational Database Service (Amazon RDS), Amazon DynamoDB, Amazon Redshift, and Amazon Aurora
- Explore the architectural principles of the AWS Cloud
- Explore key concepts related to Elastic Load Balancing, Amazon Cloud Watch, and Amazon EC2 Auto Scaling
- Make architectural decisions based on AWS architectural principles and best practices
- AWS services to make infrastructure scalable, reliable, and highly available
- AWS managed services to enable greater flexibility and resiliency in an infrastructure
- Increase performance and reduce cost of a cloud infrastructure built on AWS
- AWS Well-Architected Framework to improve architectures that use AWS solutions

Teaching Approach:

- Teachers should give examples from daily routine as well as, latest IT and software applications on various concepts and principles in each topic so that students are able to understand and grasp these concepts and principles.
- Teaching and Learning experiences with interactive content such as practice labs, interactive activities and videos
- Use of demonstration can make the subject interesting and develop scientific temper in the students. Student activities should be planned on all the topics.
- Activity- Theory - Demonstrate/practice approach may be followed throughout the course
- Hands-on experience should be provided to individual candidates for installations, connections, IT and software configuration. Trouble shooting skills should be imparted
- Continuous assessment and reviews

Course Content:

Unit1:
- Introduction to cloud computing, Advantages of the cloud, Introduction to AWS, Moving to the AWS Cloud
- Activity: Sample Exam , AWS global infrastructure, AWS services and service categories
- Cloud Security
- AWS shared responsibility model, Activity: AWS Shared Responsibility Model, AWS IAM, Demo: AWS IAM Console, Securing a new AWS account Securing data
- Networking and Content Delivery, Networking basics, Amazon VPC , PC networking, VPC security, Activity: Design a VPC , Lab: Build a VPC and Launch a Web Server • Route 53 , Cloud Front

Unit2:

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- Compute services overview • Amazon EC2 part 1 • Amazon EC2 part 2 • Amazon EC2 part 3 Introduction to AWS Elastic Beanstalk , Activity: AWS Elastic Beanstalk
- AWS EBS , Amazon Elastic Block Store Console , Working with EBS • AWS S3 Console
- Storage , AWS EFS , Demo: AWS EFS Console , AWS S3 Glacier
- Databases , Amazon RDS, Amazon Dynamo DB
- Amazon Aurora, Amazon Redshift, Cloud Architecture , AWS Well-Architected Framework design principles
- Operational excellence , Security , Reliability , Performance efficiency , Cost optimization , Reliability & high availability , Automatic Scaling and Monitoring
- Elastic Load Balancing, Activity: Elastic Load Balancing, Amazon CloudWatch,

Unit 3:
- Amazon EC2 auto scaling, What is cloud architecting?, AWS Well-Architected Framework, Best practices for building solutions on AWS, AWS global infrastructure, Course capstone project, The simplest architecture , Amazon S3 Versioning , Hosting a Static Website, Storing data in Amazon S3 , Moving data to and from Amazon S3 , Amazon S3 Transfer Acceleration , Choosing Regions for your architecture ,
  - Challenge Lab: Creating a Static Website for the Café
- Database layer considerations ,Amazon Relational Database Service (Amazon RDS) , Guided Lab: Creating an Amazon RDS database , Demonstration: Amazon RDS Automated Backup and Read Replicas , Amazon DynamoDB , Which database should the café use? Database security controls , Migrating data into AWS databases
- Creating an AWS networking environment, Connecting your AWS networking environment to the internet, Creating a Virtual Private Cloud Using the AWS Console

Unit4:
- Securing your AWS networking environment, Architectural need, Connecting your remote network with AWS Site-to-Site VPN, Connecting your remote network with AWS Direct Connect, Connecting virtual private clouds (VPCs) in AWS with VPC peering, Creating a VPC Peering Connection, Scaling your VPC network with AWS Transit Gateway, Connecting your VPC to supported AWS services, Connecting Networks
- Account users and AWS Identity and Access Management (IAM), Examining IAM policies, Organizing users, Federating users, Multiple accounts, Controlling Account Access by Using IAM, User and Application Access
- Scaling your compute resources, Creating Scaling Policies for Amazon EC2 Auto Scaling, Scaling your databases, Designing an environment that's highly available, Creating a Highly Available Web Application, 30 min, Amazon Route 53, Creating a Highly Available

Environment, Monitoring, Creating a Scalable and Highly Available Environment for the Café, Elasticity, High Availability and Monitoring

Unit5:
- Reasons to automate, Automating your infrastructure, Analyzing AWS Cloud Formation Template Structure and Creating a Stack, Automating Infrastructure Deployment with AWS Cloud Formation, Automating deployments, AWS Elastic Beanstalk, Automating Infrastructure Deployment
- Overview of caching, Edge caching, Streaming Dynamic Content Using Amazon, CloudFront, Caching web sessions, Caching databases, Caching Content

Unit6:
- Decoupling your architecture, Decoupling with Amazon Simple Queue Service (Amazon SQS), Decoupling with Amazon Simple Notification Service (Amazon SNS), Sending messages between cloud applications and on-premises with Amazon MQ, Decoupled Architecture
- Introducing microservices, Building microservice applications with AWS container services, Guided Lab , Breaking a Monolithic Node.js Application into Microservices, Introducing serverless architectures, Building serverless architectures with AWS Lambda, Demonstration: Creating an AWS Lambda Function, Using AWS Lambda with Amazon S3, Implementing a Serverless Architecture on AWS, Extending serverless architectures with Amazon API Gateway, Orchestrating microservices with AWS Step Functions, Implementing a Serverless Architecture for the Café, Microservices and Serverless.

Unit7:
- Disaster planning strategies, Disaster recover patterns, Hybrid Storage and Data
- Migration with AWS Storage Gateway File Gateway, Disaster Planning,

Learning Outcome:

Afterundergoingthissubject,thestudentwillbeableto:

- Explain the AWS Cloud, Explain the AWS pricing philosophy, Identify the global infrastructure components of AWS
- Describe the security and compliance measures of the AWS Cloud, including AWS Identity and Access Management (IAM), Create a virtual private cloud (VPC) by using Amazon Virtual Private Cloud (Amazon VPC)
- Demonstrate when to use Amazon Elastic Compute Cloud (Amazon EC2), AWS Lambda, and AWS Elastic Beanstalk, Differentiate between Amazon Simple Storage Service (Amazon S3), Amazon Elastic Block Store (Amazon EBS), Amazon Elastic File System (Amazon EFS), and Amazon Simple Storage Service Glacier (Amazon S3 Glacier) , Demonstrate when to use AWS database services, including Amazon Relational Database Service (Amazon RDS), Amazon DynamoDB, Amazon Redshift, and Amazon Aurora
- Explain the architectural principles of the AWS Cloud, Use Elastic Load Balancing, Amazon Cloud Watch, and Amazon EC2 Auto Scaling
- Make architectural decisions based on AWS architectural principles and best practices
- Use AWS services to make infrastructure scalable, reliable, and highly available
- Use AWS managed services to enable greater flexibility and resiliency in an infrastructure
- Increase performance and reduce cost of a cloud infrastructure built on AWS
- Use the AWS Well-Architected Framework to improve architectures that use AWS solutions

References:
- AWS Academy Cloud Foundations
- AWS Academy Cloud Architecting

6.4.   Linux System administration Practicals

CourseCode	:	PGCPNE PC204
CourseTitle	:	Linux System administration Practicals
NumberofCredits	:	2
Prerequisites	:	
CourseCategory	:	Program Core courses

Course Objectives:

Conduct the Practical exercises designed for the following Red Hat Enterprise Linux,
- Access the command line, Manage files from the command line, Get help in Red Hat Enterprise Linux
- Create, view, and edit text files. Manage local users and groups
- Monitor and manage Linux processes,
- Manage networking, Install and update software,
- Improve command line productivity, Archive and Transfer Files,
- Manage SE Linux security. Manage basic storage, Manage storage stack, Manage network security
- Install Red Hat Enterprise Linux,
- Install Ansible / Red Hat Ansible Engine on control nodes. Create and update inventories of managed hosts and manage connections to them.
- Automate administration tasks with Ansible Playbooks
- Reuse code and simplify playbook development with Ansible roles.

Teaching Practical Approach:

- Teachers should give examples and demonstrate good practices.
- All computer systems should be in good condition and loaded with the required software, application software and programmable languages.
- Students should operate on individual basis for acquiring good skills and speed of operation.
- Continuous evaluation system should be followed in the practical sessions.
- Time factor should be measured as one of the performance factors for evaluation
- Teaching and Learning experiences with interactive content such as practice labs, interactive activities and videos
- Use of demonstration can make the subject interesting.
- Activity- Description- Demonstrate/practice approach may be followed throughout the course
- Hands-on experience should be provided to individual candidates for installations, connections and IT and software configuration. Trouble shooting skills should be imparted
- Continuous assessment and reviews

Course Content:

Sl.No.	PracticalExercises are conducted on the following technologies on Linux System
I	• Copy, move, create, delete, and organize files while working from the bash shell. • Resolve problems by using local help systems. • Manage text files from command output or in a text editor. • Create, manage, and delete local users and groups, as well as administer local password policies. • Set Linux file system permissions on files and interpret the security effects of different permission settings. • Evaluate and control processes running on a Red Hat Enterprise Linux system.
II	• Configure secure command line service on remote systems, using OpenSSH • Configure network interfaces and settings on Red Hat Enterprise Linux servers. • Download, install, update, and manage software packages from Red Hat and yum package repositories. • Investigate and resolve issues in the web-based management interface, getting support from Red Hat to help solve problems.
III	• Run commands more efficiently by using advanced features of the Bash shell, shell scripts, and various utilities provided by Red Hat Enterprise Linux. • Schedule commands to run in the future, • Locate and accurately interpret logs of system events for troubleshooting purposes.
IV	• Improve system performance by setting tuning parameters and adjusting scheduling priority of processes. • Protect and manage the security of a server by using SELinux • Create and manage storage devices, partitions, file systems, and swap spaces from the command line. • Create and manage logical volumes containing file systems and swap spaces from the command line.
V	• Use the NFS protocol to administer network-attached storage. • Manage the boot process to control services offered and to troubleshoot and repair problems. • Control network connections to services using the system firewall and SELinux rules. • Install Red Hat Enterprise Linux on servers and virtual machines. • Obtain, run, and manage simple, lightweight services as containers on a single Red Hat Enterprise Linux server.

VI	• **Introduce Ansible** Describe Ansible concepts and install Red Hat Ansible Engine. • **Implementing an Ansible Playbook** Write a simple Ansible Playbook and run it to automate tasks on multiple managed hosts. • **Managing Variables and Facts** Write playbooks that use variables to simplify management of the playbook and facts to reference information about managed hosts. • **Implementing task control** Manage task control, handlers, and task errors in Ansible Playbooks.
VII	• **Deploying files to managed hosts** Deploy, manage, and adjust files on hosts managed by Ansible. • **Managing complex Plays and Playbooks** Write playbooks that are optimized for larger, more complex projects. • **Simplifying Playbooks with Roles and Ansible Content Collections** Use Ansible Roles and Ansible Content Collection to develop playbooks more quickly and to reuse Ansible code. • **Troubleshooting Ansible** Troubleshoot playbooks and managed hosts. • **Automating Linux Administration Tasks** Automate common Linux system administration tasks with Ansible.

Teachers should use the following strategies to achieve the various outcomes of the course.

- Different methods of teaching and media to be used to attain classroom attention.
- Massive open online courses (MOOCs) may be used to teach various topics/subtopics.
- 15-20% of the topics which are relatively simpler of descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations.
- Micro-projects may be given to groups of students for hand-on experiences.

Suggested Student Activities & Strategies

Apart from classroom and laboratory learning, the following are the suggested student relatedactivities which can be undertaken to accelerate the attainment of various outcomes of thecourse.

References:

- Red Hat System Administration I – RH124
- Red Hat System Administration II – RH134
- Red Hat System Administration III: Linux Automation (RH294)

Course outcomes:

At the end of the course, the student will be able to:

CO1	• Manage files from the command line, Get help in Red Hat Enterprise Linux • Create, and edit text files. Manage local users and groups, Monitor and manage Linux processes, Install and update software.
CO2	• Improve command line productivity, • Archive and Transfer Files, • Manage SE Linux security. • Manage basic storage, Manage storage stack, • Manage network security.
CO3	• Install Red Hat Enterprise Linux, • Install Ansible / Red Hat Ansible Engine on control nodes. • Create and update inventories of managed hosts and manage connections to them.
CO4	• Automate administration tasks with Ansible Playbooks • Reuse code and simplify playbook development with Ansible roles.

6.5.   Computer Wireless Networking Technology Practicals

CourseCode	:	PGCPNE PC205
CourseTitle	:	Computer Wireless Networking Technology Practicles
NumberofCredits	:	2
Prerequisites	:	
CourseCategory	:	Program Core courses

Course Objectives:

Conduct the Practical exercises designed for the following networking technologies.

- Switching, Routing and Wireless Essentials
- Basic Device Configuration, Switching Concepts, VLANs, Inter-VLAN Routing, STP, Ether Channel, DHCPv4, SLAAC and DHCPv6 Concepts, FHRP Concepts
- LAN Security Concepts
- Switch Security Configuration
- WLAN Concepts, WLAN Configuration
- Routing Concepts, IP Static Routing Troubleshoot Static and Default Routes

Teaching Practical Approach:

- Teachers should give examples and demonstrate good practices.
- All computer systems should be in good condition and loaded with the required software, application software and programmable languages.
- Students should operate on an individual basis for acquiring good skills and speed of operation.
- Continuous evaluation system should be followed in the practical sessions.
- Time factor should be measured as one of the performance factors for evaluation
- Teaching and Learning experiences with interactive content such as practice labs, interactive activities and videos
- Use of demonstration can make the subject interesting.
- Activity- Description- Demonstrate/practice approach may be followed throughout the course.
- Hands-on experience should be provided to individual candidates for installations, connections and IT and software configuration. Trouble shooting skills should be imparted
- Continuous assessment and reviews

Course Content

Sl. No.	PracticalExercises are conducted on the following technologies on wireless networking
1	Configure devices by using security best practices, Layer 2 switches forward data, VLANs in a switched network,

2	Troubleshoot inter-VLAN routing on Layer 3 devices, STP enables redundancy in a Layer 2 network., Troubleshoot EtherChannel on switched links
3	Implement DHCPv4 to operate across multiple LANs, Configure dynamic address allocation in IPv6
4	Networks, FHRPs provide default gateway services in a redundant network.
5	Explain how vulnerabilities compromise LAN security, implement switch security to mitigate LAN attacks.
6	Explain how WLANs enable network connectivity. Implement a WLAN using a wireless router and WLC
7	Explain how routers use information in packets to make forwarding decisions, Configure IPv4 and IPv6 static routes, Troubleshoot static and default route configurations.

Suggested Learning Resources

CCNAv7 Switching, Routing and Wireless Essentials

After undergoing this subject, the student will be able to:
- Connect various wireless devices Basic Device and Configure, Switching devices, VLANs, Inter-VLAN Routing, STP, Ether Channel, DHCPv4, SLAAC and DHCPv6 Concepts, FHRP Concepts
- Design, connect and configure LAN Security Concepts
- Connecting, mounting, troubleshooting and maintenance Switch Security Configuration
- Undertake WLAN Configuration independently.
- Configure and IP Static Routing, Troubleshoot Static and Default Routes

6.6. Cloud Computing Technology Practical's

CourseCode	:	PGCPNE PC206
CourseTitle	:	Cloud Computing Technology Practicals
NumberofCredits	:	2
Prerequisites	:	
CourseCategory	:	Program Core courses

Course Objectives:

Conduct the Practical exercises designed for the following Cloud Computing technologies.

- Understand and use the AWS Cloud, Explain the AWS pricing philosophy.
- Identify the global infrastructure components of AWS.
- Study security and compliance measures of the AWS Cloud, including AWS Identity and

Access Management (IAM)

- Creation of a virtual private cloud (VPC) by using Amazon Virtual Private Cloud (Amazon VPC)
- Use Amazon Elastic Compute Cloud (Amazon EC2), AWS Lambda, and AWS Elastic Beanstalk
- Differentiate between Amazon Simple Storage Service (Amazon S3), Amazon Elastic Block Store (Amazon EBS), Amazon Elastic File System (Amazon EFS), and Amazon Simple Storage Service Glacier (Amazon S3 Glacier)
- Use of AWS database services, including Amazon Relational Database Service (Amazon RDS), Amazon DynamoDB, Amazon Redshift, and Amazon Aurora
- Explore the architectural principles of the AWS Cloud
- Explore key concepts related to Elastic Load Balancing, Amazon Cloud Watch, and Amazon EC2 Auto Scaling
- Make architectural decisions based on AWS architectural principles and best practices.
- AWS services to make infrastructure scalable, reliable, and highly available.
- AWS managed services to enable greater flexibility and resiliency in an infrastructure.
- Increase performance and reduce cost of a cloud infrastructure built on AWS.
- AWS Well-Architected Framework to improve architectures that use AWS solutions.

Teaching Practical Approach:

- Teachers should give examples and demonstrate good practices.
- All computer systems should be in good condition and loaded with the required software, application software and programmable languages.
- Students should operate on individual basis for acquiring good skills and speed of operation.
- Continuous evaluation system should be followed in the practical sessions.
- Time factor should be measured as one of the performance factor for evaluation
- Teaching and Learning experiences with interactive content such as practice labs, interactive activities and videos
- Use of demonstration can make the subject interesting
- Activity- Description- Demonstrate/practice approach may be followed throughout thecourse
- Hands on experience should be provided to individual candidates for installations, connections and IT and software configuration. Trouble shooting skills should be imparted.
- Continuous assessment and reviews

Course Content:

Sl.No.	PracticalExercises are conducted on the following technologies on cloud computing

I	• Introduction to cloud computing , Advantages of the cloud • Introduction to AWS , Moving to the AWS Cloud • Activity: Sample • Activity: Simple Monthly Calculator • Delaware North case study , AWS Organizations • Technical support models, Support Plan Scavenger Hunt • AWS services and service categories
II	• Activity: AWS Management Console , Cloud Security • AWS shared responsibility model • Activity: AWS Shared Responsibility Model , AWS IAM , AWS IAM Console , Securing a new AWS account • Lab: Introduction to AWS IAM , Securing accounts , Securing data • Networking and Content Delivery
III	• Networking basics , Amazon VPC , VPC networking , Activity: Label This diagram , Demo: Amazon VPC Console , VPC security , Activity: Design a VPC ., Lab: Build a VPC and Launch a Web Server • Route 53 CloudFront • Compute, Compute services overview • Amazon EC2 part 1 • Amazon EC2 part 2 • Amazon EC2 , Demo: Amazon EC2 • Lab: Introduction to Amazon EC2, • Activity: Amazon EC2 Versus Managed Services, Amazon EC2 Part Console ,Introduction to AWS Elastic Beanstalk , Activity: AWS Elastic Beanstalk
IV	• Storage , AWS EBS , Demo: Amazon Elastic Block Store Console , Lab: Working with EBS • AWS S3 , Demo: AWS S3 Console , AWS EFS , Demo: AWS EFS Console , AWS S3 Glacier , Databases, Amazon RDS, Demo: Amazon RDS Console. Lab: Build a Database Server, Amazon DynamoDB, Demo: Amazon DynamoDB, Amazon Redshift, Amazon Aurora
V	• Cloud Architecture , AWS Well-Architected Framework design principles , Activity: AWS Well-Architected Framework Design Principles , Operational excellence , Security , Reliability , Performance efficiency , Cost optimization , Reliability & high availability , Automatic Scaling and Monitoring, •, Elastic Load Balancing, Activity: Elastic Load Balancing, Amazon CloudWatch, Activity: Amazon CloudWatch, Amazon EC2 auto scaling, Lab: Scale & Load Balance your Architecture • Amazon EC2 auto scaling, What is cloud architecting?, AWS Well-Architected Framework, Best practices for building solutions on AWS, AWS global infrastructure, Course capstone project, The simplest architecture , Amazon S3 Versioning , Hosting a Static Website, Storing data in Amazon S3 , Moving data to and from Amazon S3 , Amazon S3 Transfer Acceleration , Choosing Regions for your architecture , Challenge Lab: Creating a Static Website for the Café • Database layer considerations ,Amazon Relational Database Service (Amazon RDS) , Guided Lab: Creating an Amazon RDS database , Demonstration: Amazon RDS Automated Backup and Read Replicas , Amazon DynamoDB , Which database should the café use? Database security controls , Migrating data into AWS databases • Creating an AWS networking environment, Connecting your AWS networking environment to the internet, Creating a Virtual Private Cloud Using the AWS Console.

VI	• Securing your AWS networking environment, Architectural need, Connecting your remote network with AWS Site-to-Site VPN, Connecting your remote network with AWS Direct Connect, Connecting virtual private clouds (VPCs) in AWS with VPC peering, Creating a VPC Peering Connection, Scaling your VPC network with AWS Transit Gateway, Connecting your VPC to supported AWS services, Connecting Networks • Account users and AWS Identity and Access Management (IAM), Examining IAM policies, Organizing users, Federating users, Multiple accounts, Controlling Account Access by Using IAM, User and Application Access • Scaling your compute resources, Creating Scaling Policies for Amazon EC2 Auto Scaling, Scaling your databases, Designing an environment that's highly available, Creating a Highly Available Web Application, 30 min, Amazon Route 53, Creating a Highly Available Environment, Monitoring, Creating a Scalable and Highly Available Environment for the Café, Elasticity, High Availability and Monitoring.
VII	• Decoupling your architecture, Decoupling with Amazon Simple Queue Service (Amazon SQS), Decoupling with Amazon Simple Notification Service (Amazon SNS), Sending messages between cloud applications and on-premises with Amazon MQ, Decoupled Architecture • Introducing microservices, Building microservice applications with AWS container services, Guided Lab , Breaking a Monolithic Node.js Application into Microservices, Introducing serverless architectures, Building serverless architectures with AWS Lambda, Demonstration: Creating an AWS Lambda Function, Using AWS Lambda with Amazon S3, Implementing a Serverless Architecture on AWS, Extending serverless architectures with Amazon API Gateway, Orchestrating microservices with AWS Step Functions, Implementing a Serverless Architecture for the Café, Microservices and Serverless • Disaster planning strategies, Disaster recover patterns, Hybrid Storage and Data Migration with AWS Storage Gateway File Gateway, Disaster Planning

Teachers should use the following strategies to achieve the various outcomes of the course.

- Different methods of teaching and media to be used to attain classroom attention.
- Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- 15-20% of the topics which are relatively simpler of descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations.
- Micro-projectsmaybegiventogroupofstudentsforhand-onexperiences.

Suggested Student Activities & Strategies

Apart from classroom and laboratory learning following are the suggested student relatedactivities which can be undertaken to accelerate the attainment of various outcomes of thecourse.

References:

Course outcomes:

At the end of the course, the student will be able to:

CO1	• use the AWS Cloud, Explain the AWS pricing philosophy • Identify the global infrastructure components of AWS • use security and compliance measures of the AWS Cloud, including AWS Identity and Access Management (IAM) • Creation of a virtual private cloud (VPC) by using Amazon Virtual Private Cloud (Amazon VPC) • Use Amazon Elastic Compute Cloud (Amazon EC2), AWS Lambda, and AWS Elastic Beanstalk • Differentiate between Amazon Simple Storage Service (Amazon S3), Amazon Elastic Block Store (Amazon EBS), Amazon Elastic File System (Amazon EFS), and Amazon Simple Storage Service Glacier (Amazon S3 Glacier)
CO2	• Use of AWS database services, including Amazon Relational Database Service (Amazon RDS), Amazon DynamoDB, Amazon Redshift, and Amazon Aurora • architectural principles of the AWS Cloud • use concepts related to Elastic Load Balancing, Amazon Cloud Watch, and Amazon EC2 Auto Scaling • Make architectural decisions based on AWS architectural principles and best practices
CO3	• AWS services to make infrastructure scalable, reliable, and highly available. • AWS managed services to enable greater flexibility and resiliency in an infrastructure. • Increase performance and reduce cost of a cloud infrastructure built on AWS. • AWS Well-Architected Framework to improve architectures that use AWS solutions. • Make architectural decisions based on AWS architectural principles and best practices. • Use AWS services to make infrastructure scalable, reliable, and highly available
CO4	• Use AWS managed services to enable greater flexibility and resiliency in an infrastructure. • Increase performance and reduce cost of a cloud infrastructure built on AWS. • Use the AWS Well-Architected Framework to improve architectures that use AWS solutions

6.7.   Design of Network application Project

CourseCode	:	PGCPNE PR201
CourseTitle	:	Design of Network application project
NumberofCredits	:	4 (L:0,T:0,P:8)
Prerequisites	:	
CourseCategory		MajorProject

Objectives of Major project:

- To take up the project of design and implementation of Network application as per requirements for a given IT infrastructure. identify a project, do the estimation, planning, process plan, try out and inspect.
- To study the given drawings; interpret the requirements and design of the of Network application.
- To manufacture and assemble of Network application.
- To test and try out the of Network application.
- To check the quality of the of Network application prepare the inspection report.
- To prepare project report from the inception stage to the final stage
-

Proposed activities during project

Sl. No.	ProposedactivitiesforMajorProject
1	Shouldbeareal application of Network application
2	Designshouldbeofindustrystandardundertheguidance ofthe industry partners
3	of Network application shouldbepreparedwith proper useofmaterialsand processeswith goodqualitymanagement
4	Tryoutonthe real time andtaketrial and performancereports
5	Inspectthequality of Network applicationandprepare theinspectionreport.Rectifythe errorsfound andprepare finalreport.
6	prepareprojectreportfrom the inceptionstagetothefinal stage

Suggested projects:

Sl. No.	Network application ProposedforMajorProject
1	
2	

3	
4	
5	
6	
7	

Project outcomes:

At the end of the course, the student will be able to:

CO1	Designtheof Network application
CO2	Implementation of Network application
CO3	Connect theNetwork application andtakeperformance report
CO4	InspecttheNetwork application andpreparedetailedprojectreport.

6.8. Seminar-II

CourseCode	:	PGCPNE SE201
CourseTitle	:	SEMINAR-II
NumberofCredits	:	1
Prerequisites	:	
CourseCategory		SEMINAR.

Seminar Objectives:

- To Prepare and present one case study of the of Network application which is under service in an IT industry.
- Study the processes and of Network application.
- Andbe readyfordiscussions,questionandanswers foranygivenpurpose.

Suggested activities during Seminar preparation

Sl. No.	SuggestedactivitiesforSeminar
I	Collectallthe data,Studythehistoricalinformationofthe Network application
II	Collect/prepare the process adopted for of Network application
III	Collecttheof Network application detailswhere itis used.

IV	Preparethecostingoftheof Network application
V	Observationofallthe IT and software used in the Network application Highlightingtheoperations and security features.
VI	Prepareapresentationforone hourduration. Practicepresentation
VII	Finalpresentationtothe panelandevaluation

Seminar outcomes:

CO1	Prepare a presentation with all the data on a of Network application
CO2	Presentittotheaudience,examination,management,customer
CO3	Getfeedback

At the end of the seminar presentation, the student will be able to:

6.9. Indian Constitution

CourseCode	:	PGCPNE AU302
CourseTitle	:	IndianConstitution
NumberofCredits	:	0 (L:2, T:0;P: 0)
Prerequisites(Coursecode)	:	None
CourseCategory	:	AU

Course Objectives:

- UnderstandTheIndianConstitution
- Understanduniongovernmentformation
- UnderstandStategovernmentformation
- Understand operations ofDistrict Administration, Municipal Corporation, ZillaPanchayat
- Understandtheprocessofelectionsandelectioncommission

Course Content

Unit1TheConstitution–Introduction:

- The HistoryoftheMakingof theIndianConstitution
- Preambleandthe BasicStructure, anditsinterpretation
- Fundamental RightsandDutiesandtheirinterpretation

- State Policy Principles

Unit2 Union Government:

- Structure of the Indian Union
- President – Role and Power
- Prime Minister and Council of Ministers
- Lok Sabha and Rajya Sabha

Unit3 State Government:

- Governor – Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

Unit4 Local Administration:

- District Administration
- Municipal Corporation
- Zilla Panchayat

Unit5 Election Commission:

- Role and Functioning
- Chief Election Commissioner
- State Election Commission

Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
1.	Ethics and Politics of the Indian Constitution	Rajeev Bhargava	Oxford University Press, New Delhi, 2008
2.	The Constitution of India	B.L. Fadia	Sahitya Bhawan; New edition (2017)
3.	Introduction to the Constitution of India	DD Basu	Lexis Nexis; Twenty-Third 2018 edition

Suggested Software/Learning Websites:

- https://www.constitution.org/cons/india/const.html
- http://www.legislative.gov.in/constitution-of-india
- https://www.sci.gov.in/constitution
- https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/

Course outcomes:

At the end of the course, the student will be able to:

- AppreciatetheIndianConstitution
- Followuniongovernmentformalities.
- FollowStategovernmentformalities.
- Be a part ofoperations ofDistrict Administration, Municipal Corporation, ZillaPanchayat
- Involveintheprocessofelections.

6.10. Entrepreneurship and Start-Ups

CourseCode	:	PGCPNE HS302
CourseTitle	:	EntrepreneurshipandStart-ups
NumberofCredits	:	4 (L:3,T:1,P:0)
Prerequisites(Coursecode)	:	None
CourseCategory	:	HS

Course Learning Objectives:

- AcquiringEntrepreneurial spiritandresourcefulness.
- Familiarization with various uses of human resource for earning dignified meansof living.
- Understanding the concept and process of entrepreneurship I the area of Network application - its contributionandrole inthe growth anddevelopmentof individualandthenation.
- Acquiringentrepreneurialquality, competency,andmotivation in establishing of Network application.
- Learning the process and skills of creation and management of entrepreneurialventure in the area of IT Infrastructure management and in running large Network application.

Course Content:

Unit1IntroductiontoEntrepreneurshipandStartups:

- Definitions,Traitsofanentrepreneur,Entrepreneurship, Motivation
- TypesofBusinessStructures,Similarities/differencesbetweenentrepreneursandmanagers.

Unit2BusinessIdeasandtheirimplementation:

- Discoveringideasandvisualizingthebusiness
- Activitymap
- Business

PlanUnit3IdeatoStartup:

- MarketAnalysis –Identifyingthe targetmarket,
- CompetitionevaluationandStrategyDevelopment,

- Marketingandaccounting,
- Risk

analysisUnit4Management:

- Company'sOrganizationStructure,
- Recruitmentandmanagementoftalent.
- Financialorganizationandmanagement

Unit5FinancingandProtectionofIdeas:

- Financingmethodsavailable forstart-upsinIndia
- CommunicationofIdeastopotential investors– InvestorPitch
- PatentingandLicenses

Unit6Exitstrategiesforentrepreneurs:

- Bankruptcy, and succession and harvesting strategy

Suggested Learning Resources:

Sl. No.	TitleofBook	Author	Publication
1.	The Startup Owner's Manual: TheStep-by-Step Guide for Building aGreatCompany	SteveBlank andBob Dorf	K&SRanch ISBN–978-0984999392
2.	TheLeanStartup:HowToday'sEntrepreneurs Use ContinuousInnovationtoCreateRadically SuccessfulBusinesses	EricRies	Penguin UK ISBN–978-0670921607
3.	Demand: Creating What People LoveBefore TheyKnowTheyWant It	Adrian J. Slywotzkywith KarlWeber	HeadlineBookPublishing ISBN–978-0755388974
4.	The Innovator's Dilemma: TheRevolutionaryBookThatWillChangetheWayYouDoBusiness	Clayton M.Christensen	HarvardbusinessISBN:978-142219602
Sl. No.	TitleofBook	Author	Publication

Suggested Software/Learning Websites:

a.https://www.fundable.com/learn/resources/guides/startup
b.https://corporatefinanceinstitute.com/resources/knowledge/finance/corporatestructure/
c.https://www.finder.com/small-business-finance-tips
d.https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

Learning Outcome:

Upon completion of the course, the student will be able to demonstrate knowledge of thefollowingtopics:

- Understanding the dynamic role of entrepreneurship and small businesses
- Organizing and Managing a Small Business
- Financial Planning and Control
- Forms of Ownership for Small Business
- Strategic Marketing Planning
- New Product or Service Development
- Business Plan Creation

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