

Course Title	Virtual Systems and Services
Course Code	DI-421
Credit Hours	3+1
Category	Domain Core
Prerequisite	CC-112: Programming Fundamentals
Co-Requisite	None
Follow-up	None
Course Description	<p>Introduction: Virtualization in computing systems. Virtualization: Hardware and Software virtualization, hypervisor configurations, Vmware, Zen and Hyper-V, Docker, Para-virtualized software components, VM architecture, virtualization structures, virtualization of CPU, memory and I/O devices, virtual clusters, VM migration, virtualization for data center automation, data center networking structure, VPN, network virtualization, configuration, management and limitations of virtual environments, future of virtualization. Cloud Computing: Definition, essential characteristics, history, benefits, risks and challenges, privacy, security and trust issues, introduction to Cluster and Grid computing, difference between Cluster, Grid and Cloud computing, Migrating to the Cloud, Service Models, SaaS, PaaS and IaaS, Deployment Models, Data Storage in Clouds, Delivery Models, Cost Metrics and Pricing Models, Service Quality Metrics, CloudSim, Cloud Management, Advanced Cloud Architectures, Inter Cloud Resource Management, Cloud Security Threats and Mechanisms, Disaster Recovery, Open Issues in Cloud computing. Designing Cloud Based Solution: Cloud Application Scalability, Cloud Resource Scheduling, Mobile Cloud Computing, Big Data Processing in Clouds, Characteristics of Big Data, Multimedia Cloud Computing, SDN, Fog Computing, and Cloud Gaming.</p>
Text Book(s)	<ol style="list-style-type: none"> 1. Handbook of Virtual Environments: Design, Implementation, and Applications (Human Factors and Ergonomics), Edited by Kay M Stanney, Lawrence Erlbaum Associates Virtual Reality Technology by GRIGORE 2. Cloud Computing: Concepts, Technology & Architecture by Ricardo Puttini, Thomas Erl, and Zaigham Mahmood 3. NIST Cloud Computing Reference Architecture: Recommendations of the National Institute of Standards and Technology (Special Publication 500-292)
Reference Material	

Course Title	Virtual Systems and Services Lab
Course Code	DI-421L
Credit Hours	1
Category	Domain Core
Prerequisite	CC-112: Programming Fundamentals
Co-Requisite	None
Follow-up	None
Course Description	<p>Virtualbox/VMware: Installation and configuration with different flavors of Linux and Microsoft Windows OS on the top of Microsoft Windows. C Compiler: Installation and configuration in the virtual machine created using virtual box and execution of C Programs. Google App Engine: Installation and configuration. Creation of a “Hello World” app and other simple web applications using python/java. Use of GAE launcher to launch the web applications. CloudSim: Simulation of a cloud scenario and running of a scheduling algorithm that is not present in CloudSim. Transfer of files from one virtual machine to another virtual machine. Launch of a virtual machine using trystack (Online Openstack Demo Version). Hadoop: Installation and configuration of Hadoop node cluster and running a simple applications like word count. Experimentation: containers and virtual machines enabled cloud computing, DevOps, and cloud-native development. Container technology including concepts such as containers, Docker, and Kubernetes. Service deployment & usage over cloud. Management of cloud resources. Using existing cloud characteristics & service models. Cloud security management and performance evaluation of services over cloud.</p>
Text Book(s)	<ol style="list-style-type: none"> 1. Graham Charters, Sebastian Daschner, Pratik Patel, Steve Poole, Developing Open Cloud Native Microservices: Your Java Code in Action, 1st Edition, 2019. 2. Peter Späth, Beginning Java MVC 1.0: Model View Controller Development to Build Web, Cloud, and Microservices Applications, 1st Edition, 2021. 3. Rekha Kodali, Dr Gopala Krishna Behara, Sankara Narayanan Govindarajulu, Developing Cloud Native Applications in Azure using .NET Core: A Practitioner’s Guide to Design, Develop and Deploy App, 2020.
Reference Material	

Course Title	Software Quality Assurance
Course Code	EI-337
Credit Hours	3
Category	Technical Elective
Prerequisite	CMP-290: Software Engineering
Co-Requisite	None
Follow Up	None
Course Description	Introduction to Software Quality Assurance; Software Quality in Business Context; QA, QC and QE; Product Quality and Process Quality; Software Quality Measurement and Metrics; Personal Software Process; Walkthroughs and Inspections; Software Configuration Management; Quality System Documentation; Software Testing Techniques; Software Testing Strategies; Automated Testing; Capability Maturity Model; CMM-Integration, People-CMM; ISO; Six Sigma; Testing Tools, Trends and Perspectives.
Text Book/s	1. Daniel Galin, Software Quality Assurance From theory to implementation, 1 st Edition, Pearson, 2003, ISBN: 0201709457.
Reference Material	1. Roger S. Pressman, B. Maxim, Software Engineering: A Practitioner's Approach, 8 th Edition, McGraw-Hill, 2014, ISBN: 0078022126.

Course Title	Professional Practices
Course Code	GE-166
Credit Hours	3
Category	General Education
Prerequisite	None
Co-Requisite	None
Follow-up	None
Course Description	Professional Ethics: Philosophy of Ethics, Computing Profession, Computing Ethics. Computing Professions and Laws: The Structure of Organizations, Finance and Accounting, Anatomy of a Software House, Computer Contracts, Intellectual Property Rights, The Framework of Employee Relations Law and Changing Management Practices, Human Resource Management and IT, Health and Safety at Work, Software Liability, Liability and Practice, Computer Misuse and the Criminal Law, Regulation and Control of Personal Information. Code of Conduct and Ethics: Overview of the British Computer Society Code of Conduct, IEEE Code of Ethics, ACM Code of Ethics and Professional Conduct, ACM/IEEE Software Engineering Code of Ethics and Professional Practice. Accountability and Auditing, Social Application of Ethics.
Text Book(s)	<ol style="list-style-type: none"> 1. Michael J. Quinn, Ethics for the Information Age, 7th Edition, Pearson Education, 2017, ISBN: 978-0134296548 2. Sara Baase, A Gift of Fire: Social, Legal, and Ethical Issues in Computing, 5th Edition, Pearson, 2018, ISBN: 978-0132492676
Reference Material	<ol style="list-style-type: none"> 1. J. Kizza, Ethical and Social Issues in the Information Age, 6th Edition, Springer, 2017, ISBN: 978-3319707112

Course Title	Technical and Business Writing
Course Code	GE-261
Credit Hours	3
Category	General Education
Prerequisite	
Co-Requisite	None
Follow-up	None
Course Description	Overview of technical reporting, use of library and information gathering, administering questionnaires, reviewing the gathered information; Technical exposition; topical arrangement, exemplification, definition, classification and division, causal analysis, effective exposition, technical narration, description and argumentation, persuasive strategy, Organizing information and generation solution: brainstorming, organizing material, construction of the formal outline, outlining conventions, electronic communication, generation solutions. Polishing style: paragraphs, listening sentence structure, clarity, length and order, pomposity, empty words, pompous vocabulary, document design: document structure, preamble, summaries, abstracts, table of contents, footnotes, glossaries, cross-referencing, plagiarism, citation and bibliography, glossaries, index, appendices, typesetting systems, creating the professional report; elements, mechanical elements and graphical elements. Reports: Proposals, progress reports, Leaflets, brochures, handbooks, magazines articles, research papers, feasibility reports, project reports, technical research reports, manuals and documentation, thesis. Electronic documents, Linear versus hierarchical structure documents, Business Letters; Proposals and Business Plans; Writing Proposals and Reports; Short Reports; Long Formal Reports; Specification Documents; Review of Language; Writing Technical Research Reports; Documentation and Research Citation; Job Application and Resumes.
Text Book(s)	<ol style="list-style-type: none"> 1. D. O'Hair, J. S. O'Rourke, M.J. O'Hair, Business Communication: A Framework for Success, 1st Edition, Cengage Learning, 2000, ISBN-13: 978-0324073508. 2. Herta A. Murphy, Herbert W. Hildebrandt and Jane P. Thomas, Effective Business Communication, 7th Edition, McGraw Hill India, 2008, ISBN-13: 978-0070187757. 3. Courtland L. Bovee, John V. Thill, Business Communication Today, 12th Edition, Prentice Hall, 2013, ISBN-13: 978-0132971294.
Reference Material	<ol style="list-style-type: none"> 1. J. M. Penrose, R. W. Rasberry, R. J. Myers, Advance Business Communication, 4th Edition, South-Western Publishers, 2000, ISBN-13: 978-0324037395. 2. Kitty O. Locker, Business and Administrative Communication, 11th Edition, McGraw-Hill Education, 2014, ISBN-13: 978-0073403250.

Course Title	Social Services
Code	UE-371
Credit Hours	1
Category	Social Science Related University Elective
Prerequisite	None
Co-Requisite	None
Follow-up	None
Course Description	<p>The objective of this course is to acquaint and familiarize students with the basic concepts and, scope of Social work. Social Service: Philosophical base, generic principles, Islamic concept, policy, primary and secondary methods, professional and voluntary. Important fields of practice including, health, education, poverty, minorities etc. Social Institutions: Structure and types including family, religious, political, educational, economic, recreational, non-governmental organizations (NGOs) etc. Social Problems: Impact on development, role of social worker. Types of social problems including crime, over population, juvenile delinquency, illiteracy, poverty, social inequality, beggary, unemployment and under employment, child labor, addiction, gender-based violence, corruption, terrorism, urbanization etc. Social Welfare in Pakistan: Development of social welfare, social legislation, services and welfare initiatives for family, children, youth, labor, women, senior citizens, and disabled persons. National & regional organizations including All Pakistan Women Association (APWA), Edhi Foundation, Ansaar Burni Trust, Akhuwat, Rural Support Program (NRSP, AKRSP, PRSP, SRSP, BRSP), Orangi Pilot Project (OPP). Global Social Services: Global social problems including human trafficking, illegal drug sales and abuse, environmental disasters, racial inequalities, inter-ethnic strife, immigrant and migration rights. International organizations including United Nations International Children Emergency Fund (UNICEF), International Labor Organization (ILO), World Health Organization (WHO), United Nations Education, Scientific & Cultural Organization (UNESCO), United Nations High Commissioner for Refugee (UNHCR), United Nations Development Program (UNDP), World Food Program, Red Crescent. ICT for Social Work: Organizing people and ideas, sharing of norms and values, transparency and access to public information, greater access to knowledge and education, efficient collaborations, global village etc.</p>
Text Book(s)	1. Khalid, Muhammad. Social Work: Theory & Practice. Karachi: Kifayat Academy, 2020. ISBN-13: 978-969859719-1.
Reference Material	1. Rehmatullah, S. (2003). Social Welfare in Pakistan. Oxford University Press. ISBN-13: 978-019579632-2. 2. Kirst-Ashman, K. (2012). Introduction to Social Work & Social Welfare: Critical Thinking Perspectives, 4th ed. Brooks/Cole. ISBN-13: 978-084002866-2.