

**Khulna University of Engineering & Technology (KUET)**  
**Institute of Information and Communication Technology (IICT)**

**Course Structure and Outline for**  
**Postgraduate Diploma in Information and Communication Technology**

**Summary of the Courses:**

Sl. No.	Course No.	Course Title	Credit	Hours/Week Lecture + Lab.
1.	ICT 5000	Project	6.00	0 + 6
2.	ICT 5101	Programming Concepts	3.00	2 + 2
3.	ICT 5102	Data Structures and Algorithms	3.00	2 + 2
4.	ICT 5103	Database Design and Management	3.00	2 + 2
5.	ICT 5104	Web Programming	3.00	2 + 2
6.	ICT 5105	Information System Analysis and Design	3.00	2 + 2
7.	ICT 5106	Data Communication and Computer Networks	3.00	2 + 2
8.	ICT 5107	Communication Technology	3.00	3 + 0
9.	ICT 52**	Optional I	3.00	
10.	ICT 52**	Optional II	3.00	
11.	ICT 52**	Optional III	3.00	
Total Credit			36.00	

**Optional courses will be selected from the courses below.**

Sl. No.	Course No.	Course Title	Credit	Hours/Week Lecture + Lab.
1.	ICT 5201	Computer Organization and Architecture	3.00	3 + 0
2.	ICT 5202	Operating Systems	3.00	2 + 2
3.	ICT 5203	Digital Logic and Design	3.00	2 + 2
4.	ICT 5204	Software Engineering	3.00	2 + 2
5.	ICT 5205	Business System Engineering	3.00	2 + 2
6.	ICT 5206	e-Commerce	3.00	3 + 0
7.	ICT 5207	Web Applications and Protocols	3.00	2 + 2
8.	ICT 5208	Multimedia Technologies and Applications	3.00	2 + 2
9.	ICT 5209	Client Server Technologies and Distributed Database	3.00	2 + 2
10.	ICT 5210	Data Mining	3.00	2 + 2
11.	ICT 5211	Network Management and Security	3.00	2 + 2
12.	ICT 5212	Embedded System	3.00	2 + 2
13.	ICT 5213	VLSI System Design	3.00	2 + 2
14.	ICT 5214	Digital Communication	3.00	2 + 2
15.	ICT 5215	Optical Communication	3.00	2 + 2
16.	ICT 5216	Digital Image Processing	3.00	2 + 2
17.	ICT 5217	Digital Signal Processing	3.00	2 + 2
18.	ICT 5218	Computer Aided Design	3.00	2 + 2

**Outline of the Courses:**

**ICT 5000: Project**

A student must complete a Project study under the guidance of a supervisor.

**ICT 5101: Programming Concepts**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Computer Basics:** Basic Organization and Functional Units, Number Systems, Application and System Software, Internet and Intranet. **Programming Concepts:** Introduction to Programming, Algorithm and Flow Chart. **Programming Paradigms:** Types of Programming, Procedural Programming and Object Oriented Programming. **Programming Language C/C++:** Constants, Variables, Data Types, Operators, Expressions, Input and Output Operation, Branching, Looping, Array, Pointer, Function, Structure, Union, File Handling, Dynamic Memory Allocation. **Object Oriented Programming:** Concepts of Object Oriented Programming, Classes and Objects, Constructors and Destructors, Inheritances, Function Overloading and Polymorphism, and Exception Handling.

### **ICT 5102: Data Structures and Algorithms**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Elementary data structures:** Arrays, Record, Linked Lists, Stacks, Queues, Trees. **Techniques for analysis of algorithms:** Basic search and traversal techniques, Sorting algorithms. **Methods for the design of efficient algorithms:** Recursion, Divide and conquer, Greedy method, Dynamic programming, Graph algorithms.

### **ICT 5103: Database Design and Management**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Database System Concepts:** Introduction to Database, Data Models and ER Models, Functional dependencies, Normalization and Normal Forms, Relational Algebra and Calculus, relational model, Database Design and implementations, Database Development using SQL Server. **SQL:** DDL, DML, DCL, Indexing. **Query Development:** Basic SELECT, Functions, Sub-queries and Joins, Procedural Language Extensions of SQL, Data Integrity, Transaction Concurrency Control and Recovery management.

### **ICT 5104: Web Programming**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Introduction Web Programming:** Concepts of Web Programming, Data Types, Variables and Expressions, Control structures, Classes and Objects, Constructors, Inheritance, Interfaces, Exception Handling. **Collection Classes:** Array, Threads. **GUI development:** Forms, Building Web pages, Server Controls, Data Access, Security, Client-Side Programming, Server side development technologies such as ASP.net, PHP, Perl, Java Servlets, JSP and JSP.net.

### **ICT 5105: Information System Analysis and Design**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Introduction:** Different Types of Information, Attributes of Information, Roles, Tasks and Attributes of a System Analyst, Sources of Information, Information gathering Techniques, Handling of Missing information. **Analysis and Design:** Steps of System Analysis, Cost-Benefit Analysis, Design of an Information System, Networks Models for Project time Estimation, Estimation of Confidence Levels, Simplex Method for Minimization of Project Time, Project Effort Analysis, Designing of Inputs and Outputs, Project Team Organization, Database and Files Design, Project Management and Documentation, Analysis of System maintenance and Upgrading, Ethics and Privacy, Control and Security.

### **ICT 5106: Data Communication and Computer Networks**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Introduction to Data Communication:** Transmission Media, Signal, Noises, Modulation and Demodulation. **Digital Transmission:** digital-to-digital conversion, analog-to-digital conversion, pulse code modulation, delta modulation. **Transmission modes:** parallel and serial transmission. **Analog Transmission:** Digital-to-Analog Conversion, ASK, FSK, PSK, QAM, Analog-to-Analog conversion, amplitude modulation, frequency modulation, phase modulation, Signal and Multi-channel Data Communication, Data network, Circuit Switching and Packet Switching. **Multiplexing:** frequency-division multiplexing, wave-division multiplexing, synchronous time-division multiplexing. **Telephone Networks for Data Transmission:** Telephone networks, dial-up modems, and digital subscriber line: ADSL, HDSL, SDSL, VDSL, cable TV networks, HDLC, flow control and error control.

**Introduction to Computer Network:** Network code, Network access and physical media, ISPs and internet backbones, Delay and loss in packet-switched networks. **Network Architecture:** Layering and Protocols, OSI Architecture, Encapsulation, TCP/IP, LAN Concepts. **Technologies and Protocols:** Address Resolution Protocols (ARP), Carrier sense multiple access with collision detection (CSMA/CD), Local Talk, Token Ring, Fiber Distributed Data Interface (FDDI). **Internetworking:** Routing, IP Address: IPv4 and IPv6, Upper layers in OSI model, Transport, Session, Presentation and Application Layer. **Security in Computer Networks:** Definition, Principles of cryptography, Authentication, Integrity, Key distribution and certification. **Access control:** Firewalls, Attacks and countermeasures.

### **ICT 5107: Communication Technology**

*(Theory: 3 Hours/Week, Credit: 3.0)*

**Overview of telecommunication:** history, evolution, convergence of telecommunication and data networks, standards; **Basics of communication systems:** modulation, multiplexing; Switching system: circuit switching, packet switching; Voice over Internet Protocol (VoIP), Fax over IP network, voice over frame relay, and ATM; **Telephony:** operating principles, telephone apparatus, description of the modern phone; Telephone switching systems: PBX, Centrex, ACDs, call centers, computer integration; **Data communication equipment:** introduction to terminals, modems, RS-232 and other interfaces, modem types; Tele-Traffic analysis; **Cellular telephony:** Frequency reuse, frequency management, channel alignment, handoffs strategies, FDMA, TDMA, CDMA and GSM, Introduction to satellite communication, Optical fiber communication, Submarine cables, Digital Radio Microwave, etc.

**Introduction to wireless technology:** History, Web services, Wireless networks, Modes, Cordless, Application of wireless communications; **Mobile Communications:** History, Features; **Wi-Fi:** Uses, Advantages, Limitations, Hardware Devices, Safety; **Bluetooth technology:** Uses, Implementation, Computer requirements, Mobile phone requirements, Specifications and features, Technology, Security.

### **ICT 5201: Computer Organization and Architecture**

*(Theory: 3 Hours/Week, Credit: 3.0)*

**Introduction:** Organization and Architecture, Structure and Function, Importance of studying Computer Architecture and Organization, Designing for Performance, Pentium and PowerPC Evolution. **A top-level view of computer function and interconnection:** Computer function, interconnection structure, bus interconnection. **Cache Memory:** Cache memory principle, elements of cache design. **Internal Memory:** Semiconductor main memory, error correction. **External Memory:** Magnetic disk, RAID, optical memory. **Input/output:** I/O modules, programmed I/O, Interrupt-Driven I/O, Direct memory access, Input/output Processor. **Introduction to Microprocessors:** Architecture, Addressing modes, Instruction set, Interrupts, Memory interface, Bus interface, **Peripheral chips and their application:** Arithmetic Logic Unit design, **Control Unit design:** Hardwired and Micro-programmed, Memory organizational, Direct Memory Access, Pipelined architecture and pipeline control, Multi processors and relevant issues.

### **ICT 5202: Operating Systems**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Operating System:** Its Role in Computer Systems, Process, Model and Implementation, Inter Process Communication, CPU Scheduling, Memory Management, Virtual Memory, File System, Protection and Security, **Introduction to UNIX:** UNIX Kernel, UNIX Commands, Services, Device Structure, Memory Structure, Process and Jobs, File System and File Management, vi and emacs editors, Shell Programming.

### **ICT 5203: Digital Logic and Design**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Introduction Boolean Algebra:** Boolean functions, Canonical forms, Minimization of Boolean functions, Combinational Logic Circuit Design, Adder, Subtractors, Code Conversion, Arithmetic and data handling logic circuits. Decoders, Encoders, Multiplexers, and Demultiplexers, Binary Parallel Adder, ROM, EPROM and PLA, PAL design, Hazards in combinational circuit. **Sequential Logic:** Flip flops, State diagram, Mealy and Moor machines. State minimization and assignments, Design of Counters, Register, and the Memory Unit, Asynchronous counters and synchronous counters and their applications, Synchronous and asynchronous logic circuit design. **Combinational Logic:** Combinational Logic with MSI and LSI, Race around problems, and Races in sequential circuits.

### **ICT 5204: Software Engineering**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Introduction:** Software Engineering paradigms, Different Software Design Methodologies, Requirement Engineering. **Software Models:** Different Software Complexity Models, Graphical Analysis of Complexity Measures, Memory Requirement Analysis, Processing Time Analysis, Testing Philosophy and Methods, Software Reliability and Availability. **Quality Control and Measure:** Quality Measure and Assurance, Software Maintenance, Development of an Application Using Software Engineering Concepts.

### **ICT 5205: Business System Engineering**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Systems Support:** Definition, Systems Approach, General system model, Organizational and Natural Environments. **Elements of business Systems Engineering:** Business System Engineering model and a generic enterprise model. **Planning and Development:** Management of business functions, Organizational structures, Financial Planning. **Project Management:** PERT and CPM. **Information and Communications:** MIS, Information for management and control, Uses of financial information. **Strategic systems:** Strategic planning, strategic information systems, business process re-engineering. **Business system in society:** Ecology, Environment and Business, Business and the consumer, Business and World market, Emergence of modern concept of quality, Total Quality management (TQM), Quality standards and their compliance, ISO 9000 and ISO 14000. **Applications of Business Systems Engineering:** Importance of effective business communication, Case studies, Project conceptualization and modeling, Report Writing, Presentation.

### **ICT 5206: e-Commerce**

*(Theory: 3 Hours/Week, Credit: 3.0)*

**Introduction to e-commerce:** Overview, Candidate Models, Web Resources. **Security and Encryption:** Computer and Network Security Risks, Digital Certificates, Encryption and PGP, Firewalls, Transaction Security. **Electronic Payment Systems:** Web based payment system based on credit cards, checking accounts and cash. **Business to consumer e-commerce:** e-commerce business models, On-line retailing, One-line publishing, on line customer and Support, On-line Banking. **Legal Issues:** Intellectual Property, Copyright, Trademark and Patents, Cyber Crime and Money Laundering.

### **ICT 5207: Web Applications and Protocols**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Web Architecture and HTTP:** History and architecture of the World Wide Web, Overview of the Hyper Text Transfer Protocol, Other related protocols. **Hyper Text Mark Language (HTML):** concept of markup, overview of HTML (table, form, frame, window, link etc.), CSS. **Client side scripting:** variables data types, control

structure, functions, Document Object Model (DOM), event handlers, properties methods, cookies. **Server side scripting:** concepts, variables, data types, control structure, functions, objects. **Database:** content generation, data exchange, Regular expressions, mails, cookies, sessions. **Middleware:** object management architecture, object request brokers (CORBA, OLE/COM), services (trading, naming, event, transaction, and security), interior protocols (e.g. the Internet Interior protocol).

### **ICT 5208: Multimedia Technologies and Applications**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Introduction to multimedia:** image, sound, video formats and their different properties, compression, playing and recording techniques, conversions between different formats and their combinations. **Multimedia authoring, HTML:** Introduction to web and HTML, basic HTML tags Essentials for good design, Uploading Web pages to the Web Server, Cascading Style sheets, Dynamic HTML. **Drawing:** Basic image properties, How to set/change them in Photo Shop, Concepts of layers, colors, text, texture, brightness, contrast, filters and effects, Photo Shop Print production, Photo Shop Web Production, Introduction to Macromedia Director, Illustrator and Premier, Animation creating software (Media studio/ Video studio etc ), its use, facts to concern while marketing.

### **ICT 5209: Client Server Technologies and Distributed Database**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Introduction:** Components of client server architecture, Middleware, Socket, Remote Procedure Call (RPC). **Distributed concept:** Distributed Computing Environment (DCE), Common Object Request Broker Architecture (CORBA), Java Remote Method Invocation (RMI), Enterprise Java Beans (EJB), distributed data management, Client-Server application development. **Storage and Performance:** Storage management, security and User management, Backup and recovery, Performance tuning.

### **ICT 5210: Data Mining**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Introduction:** Machine Learning and Data Mining, Machine Learning and Classification, Input: Concepts, instances, attributes, Output: Knowledge Representation, Classification - Basic methods. **Classification:** Decision Trees, Classification: C4.5. **Classification:** CART, **Classification:** more methods, Evaluation and Credibility, Evaluation - Lift and Costs, Data Preparation for Knowledge Discovery, Clustering, Associations, Visualization, Summarization and Deviation Detection. **Applications:** Targeted Marketing and Customer Modeling. **Applications:** Genomic Microarray Data Analysis, Data Mining and Society, Future Directions.

### **ICT 5211: Network Management and Security**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Concepts:** Network operating system, Streaming technology, Inter process communication (IPC) between application programs, Abstract Syntax Notation One (ASN.1), TELNET. **Protocols concept:** File Transfer Protocol (FTP), Simple mail transfer protocol (SMTP), Simple Network Management Protocol (SNMP), network programming, socket-level interface, algorithm and issues in client / server software design, Installation, Administration and management of commercial network software packages. **Network services:** Network information service (NIS) and network file system (NFS), State-of-the-art network management tools and systems, high speed LAN, MAN, network management and troubleshooting techniques.

### **ICT 5212: Embedded System**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Introduction:** Concepts, Classifications, Characteristics, Requirements, Introduction to embedded system design process, Unified Modeling Language (UML), Embedded micro-controller cores, Embedded memories, Technological aspects, Interfacing between analog and digital blocks, Signal conditioning, Digital signal processing, sub-system interfacing, Interfacing with external systems, user interfacing, Design trade-offs, Thermal considerations. **Networked embedded systems:** The I2C bus, the CAN bus, the Flex Ray, Example of applications.

### **ICT 5213: VLSI System Design**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Introduction:** VLSI Design Methodology, Introduction to Microelectronics and CMOS technology, Brief overview of Fabrication process, Basic electrical properties of CMOS and BiCMOS circuits. **Hardware Modeling:** Hardware Modeling languages, logic networks, state diagrams, Data flow, behavioral optimization. Introduction to GaAs technology, Ultra-fast VLSI circuits and systems. **CMOS and BiCMOS Design Process:** Stick diagram and Lambda-based design rules, Subsystem Design processes. **Subsystem Design Layout:** Gate Logic, Combinational Design, Clocked Sequential circuits, Bus designs. **Design of Computational Elements:** ALU sub-system, Adder, Multipliers, Memory, Registers, and aspects of system timing. **Architectural Synthesis:** Circuit specification, Architectural optimization, Data-path synthesis, Control unit synthesis and synthesis of pipelined circuits. ASIC Design using FPGA and PLDs,

### **ICT 5214: Digital Communication**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Overview:** Different types of communication networks and their architecture, A/D conversion, GIF, JPEG, PNG, Audio coding for fixed telephone network and speech coding for mobile communications, Image and video coding: JPEG and MPEG. **Channel coding:** scrambling, convolution coding, cyclic redundancy checks, scrambling and interleaving, Modulation schemes: ASK, PSK, FSK, and GMSK. **Modulation for local access:** ADSL, DSL, Multiple access technologies, high speed PSTN access technology, Routing strategies, numbering schemes; **Switching techniques:** space switching, store and forward switching, Routing strategies, Numbering schemes, VSAT and satellite communication, Audio and video conferencing technique, Cable and satellite TV networks, HDTV transmission.

### **ICT 5215: Optical Communication**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Light propagation through optical fiber:** Ray optics theory and mode theory. **Optical fibers:** Structure, conditions of propagation, attenuation, pulse dispersion, fiber joint and fiber couplers. **Light sources and transmitters:** Principle of light emission, modulation bandwidth and spectral properties. **Photodiodes and receivers:** Operational principles, electrical bandwidth, noise and sensitivity. **Optical amplifiers:** Construction, amplification and noise. **Optical communication systems with analog and digital modulation formats:** performance and system budgets, Multichannel systems.

### **ICT 5216: Digital Image Processing**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Digital Image Fundamentals:** Elements of Visual Perception, Image sensing & acquisition, Image sampling & quantization. **Image Enhancement in the spatial and Frequency domain:** Image transformation, histogram processing, Spatial filtering, Frequency-Domain filters. **Image Restoration:** Noise models, Noise filtering and reduction. **Image Compression:** Image compression models, Different technique for image compression, Image Segmentation, Morphological Image Processing.

### **ICT 5217: Digital Signal Processing**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Signal Fundamentals:** Discrete time description of signals and systems, Fourier transform of discrete time signals, Discrete Fourier transform, DSP hardware and software development aids, Digital Hearing Aids, Z-transform, Digital filter structure, Infinite Impulse Response filter design techniques, Finite impulse response filter design techniques, finite precision effects, Inverse filtering.

### **ICT 5218: Computer Aided Design**

*(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)*

**Introduction to computer Graphics:** Definitions, Classification, Architecture of interactive computer Graphics, Applications Display & Interactive devices; **Basic concepts of CAD;** Graphics programming; mechanical drafting package; Advanced modeling techniques, Surface modeling, Solid modeling; CAD data base development and data base management systems; **2D:** Representation and Transformation of Points, Transformation of Lines, Rotation, Reflection, Scaling and combined transformations; **3D:** Scaling, Shearing, Rotation, Reflection, Translation, Projections parametric representation of Ellipse, Parabola, Hyperbola; Rendering, Animations, Multimedia, Picture, Sound, Video, Tools of Multimedia, CAM.