Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology (RUET)
Institute of Information and Communication Technology (IICT)

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

1. Academic Requirements and Regulations

1.1 The minimum duration of the PGD in ICT will normally is three (3) semesters. A candidate for the PGD in ICT must complete all the requirements for the diploma within three academic years from the date of his/her first admission in the program. In an academic year there will be normally two semesters.

1.2 Academic progress will be measured in terms of credits earned by a student. One credit subject will normally require 14 hours of lecture for one semester; while one credit for project/ laboratory should normally require 42 hours of work for one semester. The number of credits for each subject will be specified in the syllabus of the institute.

1.3 For the PGD in ICT a student must earn a minimum of 36 credits including 6 credits in project.

1.4 There shall be two categories of students, namely, full-time students and part-time students. A student may be enrolled as a part-time student directly. Students, serving in different organizations, may also be admitted as a part-time student with a written consent of the employer.

(a) In the case of PGD in ICT, a part-time student may be assigned a maximum of 9 credits of course work in any semester.

(b) In the case of PGD in ICT, a full-time student must register a minimum of 15 credits and a maximum of 18 credits per semester. A full time student shall not be allowed to be in the employment of any organization (even as a part time employee). However, they may be employed as Teaching/ Research assistant at the university. If a full-time student becomes an employee (full time or part time) of any other organization in the middle of a semester, he/she may, with the approval of the Director of the Institute and his/her Employer, be allowed to continue as a full time student for that semester.

(c) Student may be allowed to switch from part-time to full-time or vice versa on the recommendation of the RAC before the commencement of a semester.

Summary of the Courses:

First Semester

Sl. No.	Course Code	Course Title	Credit	Hours/Week Lecture+Lab
1	DICT 5000	Project	3.00	0+3
2	DICT 5101	Programming Concepts	3.00	2+2
3	DICT 5102	Data Structure and Algorithm	3.00	2+2
4	DICT 5103	Database Design and Management	3.00	2+2
5	DICT 5104	Communication Technology	3.00	3+0
6	DICT 5105	Computer Networks	3.00	2+2
7	DICT 5106	Information System Analysis and Design	3.00	2+2
		Total	21.00	13+13

Second Semester

Sl. No.	Course Code	Course Title	Credit	Hours/Week Lecture+Lab
1	DICT 5000	Project	3.00	0+3
2	DICT 52**	Optional I	3.00	2+2
3	DICT 52**	Optional II	3.00	2+2
4	DICT 52**	Optional III	3.00	2+2
5	DICT 52**	Optional IV	3.00	3+0
		Total	15.00	9+9

Optional Courses:

Sl. No.	Course Code	Course Title	Credit	Hours/Week Lecture+Lab
1	DICT 5201	Operating System	3.00	2+2
2	DICT 5202	Web Technologies	3.00	2+2
3	DICT 5203	Multimedia Technology and Applications	3.00	2+2
4	DICT 5204	Digital Logic Design	3.00	2+2
5	DICT 5205	Data Mining	3.00	2+2

6	DICT 5206	Machine Learning	3.00	2+2
7	DICT 5207	Software Engineering	3.00	2+2
8	DICT 5208	Embedded System	3.00	2+2
9	DICT 5209	Advanced Internet Technologies	3.00	2+2
10	DICT 5210	Internet of Things	3.00	2+2
11	DICT 5211	Network Security	3.00	2+2
12	DICT 5212	Digital Communications	3.00	2+2
13	DICT 5213	Optical Communication	3.00	2+2
14	DICT 5214	Radar & Satellite Communication	3.00	2+2
15	DICT 5215	Mobile Communications	3.00	2+2
16	DICT 5216	Digital Signal Processing	3.00	2+2
17	DICT 5217	Digital Image Processing	3.00	2+2
18	DICT 5218	Computer Aided Design	3.00	2+2
19	DICT 5219	E-Commerce	3.00	2+2
20	DICT 5220	Cyber Law and Ethics	3.00	2+2

Detail Course Contents

DICT 5101: Programming Concepts

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

Introduction to programming and logic flow, procedural versus object oriented programming, data types, variables, constants, operators, expressions, input-output, control structures, arrays, functions, pointers, file access, structures, dynamic memory allocation, classes, objects, constructor and destructor, inheritance, polymorphism, files, exception handling.

DICT 5102: Data Structure and Algorithm

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

Elementary data structures: Arrays, Record, Linked Lists, Stacks, Queues, and 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.

DICT 5103: Database Design and Management

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

Database Concepts: Database, Data Models, Entity-relationship model, Functional dependencies, Relational database design and normalization, Normal Forms, Relational Algebra and Calculus, Database storage and file structure, transaction management, concurrency control recovery management, object database and database administration.

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.

DICT 5104: Communication Technology

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

Introduction to data communication and networks; transmission media, signals, noises, modulation and demodulation, synchronous and asynchronous transmission, line encoding, error detection and correction, RS 232 interface, HDLC, flow control and error control; Channel multiplexing; Data network: point to point connections, circuit-switched, message switched and packed switched networks, WANs, ISPs and LANs, differences in ownership, speed and cost; Types of communication: client server communication, broadcast, unicast and multi-cast modes, simplex, duplex and half duplex information flow; Bandwidth: distribution of bandwidth, discrete bandwidth requirements, implications of other factors; Internet, OSI reference model, TCP/IP reference model, TCP/IP architecture.

DICT 5105: Computer Networks

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

Introduction to Computer Network: Definition, Network topology, Network media, Network devices, LAN, MAN, WAN, Network code, Network access and physical media, ISPs and internet backbones,

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 Addressing (IPv4 and IPv6), Upper layers in OSI model, Transport, Session, Presentation and Application Layer, Ethernet, wireless LANs and Bluetooth, Classification of IP addressing, subnet mask, CIDR, private IP Address, public IP address, sub netting, VLSM etc.

DICT 5106: Information System Analysis and Design

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

Introduction: 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.

DICT 5201: Operating System
(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)

Overview of operating system and its role in computer systems, Process: process model, inter-process communication, thread model, CPU scheduling, Memory management, virtual memory, address translation, File systems: files, directories, protection and security; Input, output; Deadlock; 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; LINUX: user management, privilege, using rpm, using configuration files.

DICT 5202: Web Technologies
(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.). 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). Server Controls, Data Access, Security, Prototyping/design tools, JS frameworks, React, Vue.Js, Laravel, RESTful web services, JSON Data, REST API and OAuth token.

DICT 5203: Multimedia Technology 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, merits and demerits, conversions between different formats and their combinations; Multimedia authoring, introduction to web and HTML, basic HTML tags design principles; Drawing: basic image properties, image manipulation, layers, colors, text, texture, brightness, contrast, filters and effects; Interactive application development using multimedia tools.

DICT 5204: Digital Logic Design
(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)

Module I: Boolean Functions Analog & digital signals, AND, OR, NOT, NAND, NOR & XOR gates, Boolean algebra, Standard representation of logical functions, K-map representation and simplification of logical function, don‟t care conditions, XOR & XNOR simplifications of K-maps, Tabulation method.
Module II: Combinational Circuits Adders, Subtractors, Multiplexer, de-multiplexer, decoder & encoder, code converters, Comparators, decoder / driver for display devices, Implementation of logic functions using multiplexer / demultiplexer,.

Module III: Sequential Circuits Flip-flops: SR, JK, D & T flip flops – Truth table, Excitation table, Conversion of flip-flops, race around condition, Master Slave flip flop, Shift registers: SIPO, PISO, PIPO, SIPO, Bi-directional; Counters: ripple & synchronous counters – up / down; Synchronous Sequential circuit: design procedure.

Module IV: Logic families Logic families: RTL, DTL, TTL, ECL Module V: Data Converters Data converters: ADC – successive approximation, linear ramp, dual slope; DAC – Binary Weighted, R-2R ladder type.

DICT 5205: Data Mining

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

Data Preprocessing: Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.
Data Mining: Basic concept of data mining, issues and techniques, Data warehouse and OLTP technologies for data mining, Classification of data mining techniques and models, Data pre-processing, Data mining primitives, Characterization and Discrimination, Mining Frequent Patterns, Associations, Correlations, Classification and Prediction, Cluster Analysis, Outlier Analysis, Evolution Analysis, Query languages and system architecture, Characterization and comparison, Mining association rules in large database, Data mining applications and future research issues, Relational Databases, Data Warehouses, Transactional Databases, Advanced Data and Information Systems.

DICT 5206: Machine Learning

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

Introduction, Prediction as regression and classification, Linear Regression, Linear Classification, Logistic Regression, Nonparametric Methods, Decision Trees, kNN & Decision Trees, Multi-class Classification, Probabilistic Classifiers, Naive Bayes and Gaussian Bayes Classifier, Neural Networks, Clustering, Mixture of Gaussians & EM, Dimensionality Reduction**,** PCA & Auto-encoders, Anomaly Detection, Kernels and Margins, Support Vector Machines, Unsupervised learning, Time series analysis and prediction Sequential models, hidden markov models, Semi supervised learning, Graphical models, Ensemble Methods, Bagging & Boosting, Reinforcement Learning.

DICT 5207: Software Engineering
(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)

Software engineering paradigms, process models, complexity models, requirement engineering, different models of effort, schedule and cost estimation, risk analysis and management, project management, different software design methodologies, verification and validation, testing philosophy and methods, software configuration management, software metrics, software reliability and availability, software maintenance and software reengineering, development of applications using software engineering concepts.

DICT 5208: Embedded System
(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)

Concepts, classifications; Characteristics; Requirements; Introduction to embedded system design process, Unified Modeling Language (UML); Embedded microcontroller 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 FlexRay; Example of applications.

DICT 5209: Advanced Internet Technologies
(Theory: 2 Hours/Week, Lab: 2 Hours/Week, Credit: 3.0)

Introduction to the Internet: Internet Address, Hyper Text Transfer Protocol, Other related protocols, Sockets, Application specific protocols and services: Authentication, Domain Name Services (DNS), Electronic mail, World Wide Web, Web caching, Network management, Internet control message protocol (ICMP), File transfer protocol (FTP), secured remote access, Voice over IP and its protocols, Next generation of internet, Revolutionary application of internet, Hyper Text Mark Language (HTML), Overview of HTML (table, form, frame, window, link etc.), Concepts of Web Programming, Data Types, Variables and Expressions, Control structures, Classes and Objects, Constructors, Inheritance, Interfaces, Exception Handling. Collection Classes, Array, Threads, Document Object Model (DOC), Client side scripting: HTML5, JavaScript, XML, CSS3, Jquery, SCSS, CGI, Cookies, Server side scripting: Web Forms, ASP.net, PHP, Perl, Java Servlets, JSP and JSP.net, GUI development: UI/UX Design, Forms, Building Web pages, Server Controls, Data Access, Security, Prototyping/design tools, JS frameworks, React, Vue.Js, Laravel, RESTful web services, JSON Data, REST API and OAuth token.

DICT 5210: Internet of Things

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

Module I: IOT - What is the IoT and why is it important? Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues.

Module II:IOT PROTOCOLS - Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFIDProtocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security

Module III: IOT ARCHITECTURE - IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity : An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.

Module IV: WEB OF THINGS - Web of Things versus Internet of Things – Two Pillars of the Web – Architecture StandardizationforWoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals andBusiness Intelligence.

Module V:IOT APPLICATIONS - IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.

DICT 5211: Network Security

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

Principles of cryptography, substitution cipher, transposition cipher, one time pads, public key cryptography, encryption and decryption, authentication protocol 1.0 to 5.0, digital signature, Key distribution and certification, Integrity, Access control, different symmetric key algorithm, certificate authority, Security standards: DES, RSA, DHA, Digital Signature Algorithm (DSA), SHA, AES; Security at Transport layer: Secure Socket Layer (SSL) and Transport Layer Security (TLS), DNS, electronic mail, world wide web, Firewalls, Attacks and countermeasures, IPSec, Network security applications, AAA standards, e-mail securities, PGP, S/MIME, PKI smart cards, Sandboxing, Firewalls and Proxy server.
Security for wireless network protocols: WEP, WPA, TKIP, EAP, LEAP; Security protocols for Ad-hoc network; Security protocols for Sensor network; Security for communication protocols; Security for operating system and mobile agents; Security for e-commerce; Security for LAN and WAN; Switching and routing security; Other state-of-the-art related topics.

DICT 5212: Digital Communications

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

Overview of 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.

DICT 5213: Optical Communication

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

Introduction; 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.

DICT 5214: Radar & Satellite Communication

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

UNIT 1 RADAR SIGNAL MODELS: 12L Amplitude models, distributed target forms of range equation, radar cross section, statistical description of radar cross section, Swerling model, Clutter, signal to clutter ratio, temporal and spatial correlation of clutter, noise model and signal to noise ratio, frequency models, Doppler shift, simplifies approach to Doppler shift, stop and hop assumption, spatial model, variation with angle, variation with range, projections, multipath, spectral models. UNIT 2 RADAR WAVE FORMS: 8L Waveform matched filter of moving targets, ambiguity function, ambiguity function of the simple matched pulse filter for the pulse burst, pulse by pulse processing, range ambiguity, Doppler response and ambiguity function of the pulse burst. Introduction to Synthetic Aperture Radar (SAR)
Overview of Satellite system, Spacecraft, Telemetry, Tracking, Antennas in satellite communications, Frequency reuse. Propagation of radio waves. **Multiple Access Techniques:** Multiplexing and its techniques. Uplink and downlink. TDMA, FDMA, CDMA and SDMA.
Earth Station Technology: Earth station design and maintenance. Small and large earth stations and their antennas. **System Design:** Construction of Geostationary satellite, Overview of Bangobondhu satellite, Functions different parts of Geostationary satellite.

DICT 5215: Mobile Communications

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

An introduction to ubiquitous communication; Wireless transmission: frequencies for transmission, International Regulations and Regulatory Authorities, signals, antennas, signal propagation, multiplexing, modulation, spread spectrum; Medium access control: SDMA, FDMA, TDMA, CDMA; Radio network planning; Fundamentals of cellular telephony: concept of cellular communications, frequency reuse, cell splitting, registration, terminal authentication, handoff; GSM and GPRS: services, system architecture,

radio interface, protocols, handover, security; Next generation mobile telecommunications systems: 2.5G systems (EDGE, TETRA), 3G systems (UMTS, UTRAN), 4G and beyond; Wireless LANS and personal area networks: 802.11, IrDA, Bluetooth, data services: WAP, mobile IP.

DICT 5216: Digital Signal Processing

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

Discrete time description of signals and systems, Sampling of DCT signals, Fourier Analysis: The discrete Fourier transform (DFT) and series (DFS). The discrete-time Fourier transform (DTFT), Examples, The fast Fourier transform algorithm (FFT), Z- transform, Digital filter structure, Infinite Impulse Response filter design techniques, Linear time-invariant systems, convolution, ideal and realizable filters. Interpolation and Sampling: Continuous-time (CT) signals, interpolation, sampling, Finite impulse response filler design techniques, finite precision effects, Inverse filtering.

DICT 5217: Digital Image Processing

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

Digital Image Fundamentals: Different types of digital images, sampling and quantization, imaging geometry, image acquisition systems, Basic concepts of digital distances, distance transform, Binarization of Grey level images: Histogram of grey level images, optimal thresholding using Bayesian classification, multilevel thresholding, Detection of edges: First order and second order edge operators, multi-scale edge detection, Canny's edge detection algorithm, Hough transform for detecting lines and curves, edge linking. Images Enhancement: Point processing, Spatial Filtering, Frequency domain filtering, multi-spectral image enhancement, image restoration. Image Segmentation: Segmentation of grey level images, Water shade algorithm for segmenting grey level image, Image representation and description, recognition and interpretation, Image compression: Lossy and lossless compression schemes, prediction based compression schemes, vector quantization, sub-band encoding schemes, JPEG compression standard, Fractal compression scheme, Wavelet compression scheme, medial axis transform, component labeling, thinning, morphological processing, extension to grey scale morphology.

DICT 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.

DICT 5219: E-Commerce

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

Overview of electronic commerce, business models; E-commerce channels: portals, auctions, communities, marketplace; Managing the marketplace: Demographics and advertising; Customer relationship management, web services for B2B and B2C e- commerce, electronic payment systems; Network security, cryptography, digital certificates; Markup for e-commerce: ebXML, M-commerce, L-commerce, wireless and U-commerce, digital money and electronic banking; Ethical, legal, and regulatory environment: Intellectual property, copyright, trademark, patents.

DICT 5220: Cyber Law and Ethics

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

Computers in the workplace, Computer Crime, Rules of Communications, Privacy, Intellectual property, Impact on Employment, Professional responsibility, Globalization, Responsibilities of Computer Scientists, Responsibilities influences by growth in computer use and networks, Professional and Ethical Responsibilities, Intellectual Property, Piracy, Hacking, Viruses, Liability, Privacy, Crime and Civil Liabilities, Digital Rights Management, Cyber laws, ICT acts.

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(Prof. Dr. Md. Selim Hossain)
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