THIRD YEAR
COURSE BOOKLET

B. Tech (Information Technology)

Affiliated to Maulana Abul Kalam Azad University of Technology
(erstwhile WBUT) and Approved by AICTE

Department of Information Technology

RCC Institute of Information Technology
(Unit of an Autonomous Society of Department of Higher Education, Government of West Bengal)

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This revised version of Course booklet is being published in accordance with Outcome Based Technical Education (OBTE) policy approved by Departmental Advisory Board (DAB), Department of IT

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All faculty members associated with Department of Information Technology, concerned faculty members of Basic Science and Humanities and the honorable members of DAB, Department of Information Technology of RCCIIT are acknowledged for their timely support and relevant inputs towards the preparation of this booklet.

Contents

Preface

The Department of Information Technology of RCC Institute of Information Technology, Kolkata is one of the oldest departments of the institute. It boasts of a pool of well versed faculty members supported by some efficient technical and administrative staff members.

The department is all set to implement the Outcome Based Technical Education (OBTE) from the current semester in the undergraduate discipline for the 2nd, 3rd and 4th year students. This course booklet is a repository of the different facets of OBTE which includes the undergraduate course curriculum, detailed University syllabus, course structure and assessment rubrics.

OBTE is the need of the hour in this rapidly evolving era of technical education in the nation. It is targeted to achieve the objectives of complete professional development of students taking Bachelors in Technology. This implies that the students while graduating after their Bachelors fulfill certain prerequisites which are commensurable to the internationally acclaimed standards. These prerequisites include the aspects of values and ethics of professionalism apart from the technical knowledge and skill achieved during the graduate program.

OBTE is characterized by Program Educational Objectives (PEOs) and their corresponding Program Outcomes (POs). Similar to any other premier department delivering technical education, the department of Information Technology of RCC Institute of Information Technology, Kolkata has laid down its well directed PEOs and POs in line with its well defined mission and vision to fulfill the aspirations of the future graduates. These are well documented in the course booklet.

OBTE is primarily adjudged by a set of assessment rubrics pertaining to each and every course subject undertaken in the graduate study by the student. These rubrics are qualitative assessment tools for computing the degree of attainment of the POs by the graduates. Typical examples of assessment components include (i) class attendance, (ii) assignments, (iii) classroom demonstration, (iv) micro project, (v) employer survey to name a few.

All the components of OBTE viz., mission, vision, PEOs, POs and assessment rubrics have been approved by the Departmental Advisory Board (DAB) [the highest academic body of the department]. The aspiring graduates and other stakeholders are requested to peruse through the course booklet to grasp the essence of OBTE. Any suggestions or feedback may please be forwarded to the respective mentors in the department.

Dr. Siddhartha Bhattacharyya

Head, Department of IT

Vision of the Department

To empower students to become global leaders in the IT based sector that would cater the needs of the local and global community.

Mission of the Department

To create a global ambience that fosters excellence in teaching-learning, research and development aided by state-of-the-art infrastructure, a dedicated pool of faculty and staff members and an inspired group of alumni that would help the department in facilitating the students to excel in IT and ITES.

Program Educational Objectives (PEOs)

PEO1. **Excellence in IT and Allied Services:** To enable graduates to contribute with excellence in IT-Enabled and Allied Services.

PEO2. **Problem Solving Ability:** To imbibe into the graduates, the ability to apply Engineering principles creatively in solving problems of the community & society.

PEO3. **Spirit of Teamwork:** To infuse into the students a spirit of collaboration, leadership and team-work.

PEO4. **Communicational Skill:** To develop their communication and managerial skills to handle challenges in projects and works in multidisciplinary teams by understanding societal and professional responsibility and initiate lifelong learning opportunities.

PEO5. **Research and Development:** To undertake research, design and developmental projects in the frontier areas of technology.

PEO6. **Versatility:** To prosper in a multinational, multilingual and multicultural atmosphere.

Program Outcomes (POs)

PO1. Apply the elementary concepts of mathematics, engineering sciences and core engineering in smart deployment of IT skills for development and derivation of contemporary methods and systems.

PO2. Analyze various correlated domains through extensive survey of literature to identify possible directives for new development.

PO3. Design a one shot and prototyped solution to solve different problems specific to the need of client or the society/economy.

PO4. Alter the design and architecture by investigating the pitfalls of the legacy system.

PO5. Use modern IT tools and adapt to new tools to deliver best possible applications/solutions.

PO6. Encompass IT for the betterment and societal need of public health services, different legal and cultural issues without truncating safety and security of the mass.

PO7. Realize the impact of ITES solutions in environmental contexts and reveal knowledge of and need for sustainable development.

PO8. Demonstrate professional, social, and ethical responsibilities.

PO9. Work under diverse multidisciplinary, multicultural, multinational environments and teams.

PO10. Communicate effectively in terms of technical documents, reports (verbal/written), presentations to a diverse client portfolio and general public.

PO11. Deliver quality work through cozy and high end researches as a part of project dissertation.

PO12. Demonstrate efficient and adaptable self-learning of ever changing technologies and practices of life-long learning.

B. Tech (IT) Curriculum

Year	Odd Semester Courses	Even Semester Courses
1st	HU101: English Language & Technical Communication HU181: Language Laboratory PH101: Physics – 1(Gr-A) PH191: Physics – 1(Gr-A) Lab CH101: Chemistry -1(Gr-B) CH191: Chemistry -1(Gr-B) Lab M101: Mathematics-1 ME101: Engg. Mechanics ME191: Engg.Drawing & Computer Graphics(Gr-B) ME192: Workshop Practice (Gr-A) ES101: Basic Electrical & Electronic Engineering-I (Gr-A +Gr-B) ES191: Basic Electrical & Electronic Engineering-I(Gr-A +Gr-B)Lab	PH201: Physics – 1(Gr-B) PH291: Physics – 1(Gr-B) Lab CH201: Chemistry -1(Gr-A) CH291: Chemistry -1(Gr-A) Lab M201: Mathematics-2 ES201: Basic Electrical & Electronic Engineering-II ES291: Basic Electrical & Electronic Engineering-II Lab CS201: Basic Computation & Principles of Computer Programming CS291: Basic Computation & Principles of Computer Programming Lab
2nd	HU301: Values & Ethics in Profession PH301: Physics- 2 PH391:Physics-2 Lab CH301: Basic Environmental Engineering & Elementary Biology. CS301: Analog & Digital Electronics CS391: Analog & Digital Electronics Lab CS302: Data Structure & Algorithm CS392:Data Structure & Algorithm Lab CS303 :Computer Organization CS393: Computer Organization Lab	HU481:Technical Report Writing & Language Lab Practice M401: Mathematics-3 CS401:Communication Engg& Coding Theory CS491:Communication Engg& Coding Theory Lab CS402: Formal Language & Automata Theory CS492:Software Tools MCS401: Numerical Methods MCS491: Numerical Methods Lab IT401:Object Oriented Programming & UML IT491: Object Oriented Programming & UML Lab
3rd	HU501: Economics for Engineers IT501: Design & Analysis of Algorithm IT591: Design & Analysis of Algorithm Lab IT502: Computer Architecture IT592:Computer Architecture Lab IT503: Operating System IT593: Operating System Lab IT504A: Circuit Theory & Network(EE) IT504B: Data Communication(ECE) IT504C: Digital Signal Processing(ECE) IT504D: Operation Research(M) IT504E: Microprocessors & Microcontrollers(CSE) IT504F: Programming Practices using C++. IT594A: Circuit Theory & Network(EE) Lab IT594B: Data Communication (ECE) Lab. IT594C: Digital Signal Processing(ECE) Lab IT594D: Operation Research(M) Lab IT594E: Microprocessors & Microcontrollers (CSE) Lab IT594F: Programming Practices using C++ Lab	HU601: Principals of Management IT601: Database Management System IT691: Database Management System Lab IT602: Computer Networking IT692: Computer Networking Lab IT603 : Software Engineering IT693: Software Engineering Lab IT604A : Information Theory & Coding IT604B : Computer Graphics IT604C: Pattern Recognition IT604D: ERP IT605A: Discrete Mathematics(M) IT605B: Human Resource Management(HSS) IT605C: Compiler Design(CSE) IT605D: Artificial Intelligence(CSE) IT681: Seminar
4th	HU781:Group Discussion IT701: Internet Technology IT791: Internet Technology Lab IT703A: E-Commerce IT703B: Soft Computing	HU801A:OrganizationalBehaviour HU801B: Project Management. IT801A: Advance computer architecture IT801B: Parallel Computing IT801C: Natural Language Processing

	IT703C: Image Processing IT704A: Distributed Operating System IT704B : Cloud Computing IT704C: Data Warehousing & Data Mining IT704D: Sensor Networks IT704E : Mobile Computing IT705A: Bio Informatics(BI) IT705B: Control System(EE) IT705C: Modeling & Simulation(M) IT705D: Microelectronics & VLSI Design(ECE) IT705E: Advance Data Communication & Coding IT793A: E-Commerce Lab IT793B: Soft Computing Lab IT793C: Image Processing Lab IT794: Industrial training. IT795: Project – I.	IT801D: Cryptography & Network Security IT802A: Technology Management(HSS) IT802B : Cyber Law & Security Policy(HSS) IT802C: Optical Networking(ECE) IT802D: Low Power Circuits & Systems(ECE) IT802E: Business Analytics(CSE) IT802F: Robotics(EE & ME) IT891: Design Lab/ Industrial problem related practical training IT892: Project -2. IT893: Grand Viva.

Curricular Distribution B. Tech (IT)

Module	Course Code	Total no of contact hours			Total hours	Credit
		L	T	P		
Humanities & Social Sc.	HU101, HU301,HU481,HU781, HU801, HU181, HU501, HU601	7	0	6	13	10
Basic Sc.	PH101,PH191,PH201,PH291,PH301,PH391, CH101,CH191,CH201,CH291, CH301M101,M201,M401	21	6	9	36	28.5
Engg Sc.	ME101,ME191,ME192, ES101,ES191,ES201,ES291	10	3	9	22	16
Professional Core	CS201,CS291,CS301, CS391,CS302, CS392, CS303,CS393,CS401,CS491, CS402,CS492,MCS401,MCS491 IT401,IT491,IT501,IT591,IT502,IT592,IT503,IT593,IT601,IT691,IT602,IT692,IT603,IT693,IT701,IT791	46	8	44	98	72
Professional Electives	IT604A,IT604B,IT604C, IT604D IT703A, IT703B,IT703C IT704A,IT704B,IT704C,IT704D,IT704E IT705A,IT705B,IT705C, IT705D,IT705EIT793A, IT793B,IT793C IT801A,IT801B,IT801C,IT801D IT802A,IT802B,IT802C,IT802D,IT802E,IT802F	18	0	3	21	19.5
Open Electives	IT504A,IT504B,IT504C,IT504D, IT504E, IT504F,IT594A,IT594B, IT594C,IT594D, IT594E, IT594F,IT605A,IT605B,IT605C, IT605D	6	2	3	11	8.5
Project	IT681, IT794, IT795, IT891, IT892, IT893	0	0	35	35	17.5
	Total	**108**	**19**	**109**	**236**	**172**

Third Year First Semester

Syllabus of B. Tech (IT)

Third Year - Fifth Semester

A. THEORY							
Sl.No	**Field**	**Theory**	**Contact Hours/Week**				**Cr. Pts**
			L	**T**	**P**	**Total**	
1	**HU501**	Economics for Engineers	3	0	0	3	3
2	**IT501**	Design & Analysis of Algorithm	3	**1**	0	4	4
3	**IT502**	Computer Architecture	3	**1**	0	4	4
4	**IT503**	Operating System	3	0	0	3	3
5	**F. E.**		3	0/1	0	3/4	3/4
	IT504A	Circuit Theory & Network (EE)					
	IT504B	Data Communication (ECE)					
	IT504C	Digital Signal Processing (ECE)					
	IT504D	Operation Research (M)					
	IT504E	Microprocessors & Microcontrollers(CSE)					
	IT504F	Programming Practices using C++					
Total of Theory						**17/18**	**17/18**
B. PRACTICAL							
6	**IT591**	Algorithm Lab	0	0	3	3	2
7	**IT592**	Computer Architecture	0	0	3	3	2
8	**IT593**	Operating System Lab	0	0	3	3	2
9	**F.E.**		0	0	3	3	2
	IT594A	A. Circuit Theory & Network (EE)					
	IT594B	B. Data Communication (ECE)					
	IT594C	C. Digital Signal Processing (ECE)					
	IT594D	D. Operation Research (M)					
	IT594E	Microprocessors & E. Microcontrollers(CSE)					
	IT594F	F. Programming Practices using C++					
		Total of Practical				**12**	**8**
Total of Semester						**29/30**	**25/26**

SEMESTER – V

Theory

Economics for Engineers
HU-501
Contracts: 3L
Credits- 3

Module-I

1. Economic Decisions Making – Overview, Problems, Role, Decision making process.
2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.

Module-II

3. Cash Flow, Interest and Equivalence: Cash Flow – D iagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest.
4. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.

Module-III

5. Inflation And Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.
6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.
7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.

Module-IV

8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.
9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.
10. Accounting – Function, Balance Sheet, Income Sta tement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.

Text Books

1. James L.Riggs,David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
3. John A. White, Kenneth E.Case,David B.Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Sullivan and Wicks: Engineering Economy, Pearson
5. R.Paneer Seelvan: Engineering Economics, PHI
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

Design & Analysis of Algorithm
Code: IT501
Contact: 3L + 1T
Credits: 4

Complexity Analysis:

Time and Space Complexity, Different Asymptotic notations – their mathematical significance

Algortihm Design Techniques:

Divide and Conquer:

Basic method, use, Examples – Binary Search, Merg e Sort, Quick Sort and their complexity Heap Sort and its complexity

Dynamic Programming:

Basic method, use, Examples – Matrix Chain Manipu lation, All pair shortest paths, single source shortest path. Backtracking

Basic method, use, Examples – 8 queens problem, Graph coloring problem. Greedy Method]

Basic method, use, Examples – Knapsack problem, Job sequencing with deadlines, Minimum cost spanning tree by Prim's and Kruskal's algorithm.

Lower Bound Theory:

O(nlgn) bound for comparison sort

Disjoint set manipulation:

Set manipulation algorithm like UNION-FIND, union by rank.

Graph traversal algorithm: Recapitulation:

Breadth First Search(BFS) and Depth First Search(DFS) – Classification of edges - tree, forward, back and cross edges – complexity and comparison

String matching problem:

Different techniques – Naive algorithm, string matching using finite automata, and Knuth, Morris, Pratt (KMP) algorithm with their complexities.

Amortized Analysis:

Aggregate, Accounting, and Potential Method.

Network Flow:

Ford Fulkerson algorithm, Max-Flow Min-Cut theorem (Statement and Illustration)

Matrix Manipulation Algorithm:

Strassen's matrix manipulation algorithm; application of matrix multiplication to solution of simultaneous linear equations using LUP decomposition, Inversion of matrix and Boolean matrix multiplication

Notion of NP-completeness:

P class, NP class, NP hard class, NP complete class – their interrelationship, Satisfiability prob lem, Cook's theorem (Statement only), Clique decision problem

Approximation Algorithms:

Necessity of approximation scheme, performance guarantee, polynomial time approximation schemes, vertex cover problem, travelling salesman problem.

Text Books

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, "Introduction to Algorithms"
2. A. Aho, J.Hopcroft and J.Ullman "The Design and Ana lysis of Algorithms" D.E.Knuth "The Art of Computer Programming", Vol. 3
3. Jon Kleiberg and Eva Tardos, "Algorithm Design"

Reference Books

1. K.Mehlhorn , "Data Structures and Algorithms" - Vol . I & Vol. 2.
2. S.Baase "Computer Algorithms"
3. E.Horowitz and Shani "Fundamentals of Computer Algor ithms"
4. E.M.Reingold, J.Nievergelt and N.Deo- "Combinational Algorithms- Theory and Practice", Prentice Hall, 1997

Computer Architecture
Code: IT502
Contact: 3L + 1T
Credits: 4

Pre-requisite: Basic Electronics in First year, Introduction to Computing in second semester, Analog & Digital Electronics and Computer Organisation in Third semester.

Module – 1

Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance.
Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance.

Module – 2
Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies.

Module – 3
Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, superpipelined and VLIW processor architectures. Array and vector processors.

Module – 4
Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Cluster computers.

Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures.

Learning Outcome:
This course is a formidable prerequisite for the course Operating System to be offered in the subsequent semester.

Operating System
Code: IT502
Contact: 3L
Credits: 3

Introduction
Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed, time-sharing, real-time, distributed, parallel.

System Structure
Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

Process Management

Processes Concept of processes, process scheduling, operations on processes, co-operating processes, inter-process communication.

Threads overview, benefits of threads, user and kernel threads.

CPU scheduling scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.

Process Synchronization background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.
Deadlocks system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Storage Management

Memory Management background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.

Virtual Memory background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.

File Systems file concept, access methods, directory structure, file system structure, allocation methods

(contiguous, linked, indexed), free space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.

I/O Management I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and nonblocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Disk Management disk structure, disk scheduling (FCFS, SSTF, SCAN,C-SCAN) , disk reliability, disk formatting, boot block, bad blocks.

Protection & Security

Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threat monitoring, encryption.

Text Books

1. Milenkovie M., "Operating System : Concept & Design" , McGraw Hill.
2. Tanenbaum A.S., "Operating System Design & Implemen tation", Practice Hall NJ.
3. Silbersehatz A. and Peterson J. L., "Operating Syst em Concepts", Wiley.
4. Dhamdhere: Operating System TMH
5. Stalling, William, "Operating Systems", Maxwell McM illan International Editions, 1992.
6. Dietel H. N., "An Introduction to Operating Systems ", Addison Wesley.

Free Elective

Circuit Theory & Network
Code: IT504A
Contact: 3L+1T
Credits: 4

a) Resonant Circuits: Series and Parallel resonance. (*) Impedance and Admittance Characteristics, Quality Factor, Half Power Points, Bandwidth . Phasor diagrams, Transform diagrams, Practical resonant and series circuits, Solution of Problems.
b) Mesh Current Network Analysis: Kirchoff's Voltage law, Formulation of mesh equations, Solution of mesh equations by Cramer's rule and matrix method, Driving point impedance, Transfer Impedance, Solution of problems with DC and AC sources.
a) Node Voltage Network Analysis: Kirchoff's Current law, Formulation of Node equations and solutions, driving point admittance, transfer Admittance, Solution of problems with DC and AC sources.
b) Network Theorems: Definition and Implication of Superposition Theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Compensation theorem, maximum Power Transfer Theorem, Millman's theorem, Star delta transformations, Solutions and problems with DC and AC sources.
Graph of Network: Concept of Tree and Branch, tree link, junctions, (*) Incident matrix, Tie set matrix [2L], Determination of loop current and node voltages.
Coupled Circuits: Magnetic coupling, polarity of coils, polarity of induced voltage, concept of Self and mutual inductance, Coefficient of coupling, Solution of Problems.
Circuit transients: DC transients in R-L and R-C Circuits with and without initial charge, (*) R-L-C Circuits, AC Transients in sinusoidal R-L, R-C and R-L-C Circuits, Solution of Problems
Laplace transform: Concept of Complex frequency, transform of f(t) into F(s), transform of step, exponential, over damped surge, critically damped surge, damped and un-damped sine functions, properties of Laplace transform, linearity, real differentiation, real integration, initial value theorem and final value theorem, inverse Laplace transform, application in circuit analysis, Partial fraction expansion, Heaviside's expansion theorem, Solution of problems .
(*) Laplace transform and Inverse Laplace transform.
Two Port Networks: Relationship of Two port network variables, short circuit admittance parameters, open circuit impedance parameters, transmission parameters, relationship between parameter sets, network functions for ladder network and general network.

Problems for Module 1a:

Ex. 1. A parallel RLC Circuit has R= 100 K Ohms, L= 10 mH, C= 10 nF. Find resonant frequency, bandwidth and Quality factor.

Ex. 2. Two coils one of R= 0.51 Ohms,L= 32 mH, other of R= 1.3 Ohms, L= 15 mH, and two capacitors of 25 micro F and 62 micro F are in series with a resistance of 0.24 Ohms. Determine resonance frequency and Q of each coil.

Ex. 3. In a series circuit with R= 50 Ohms, l= 0.05 Ohms and C= 20 micro F, frequency of the source is varied till the voltage across the capacitor is maximum. If the applied voltage is 100 V, find the maximum voltage across the capacitor and the frequency at which this occurs. Repeat the problem with R= 10 Ohms.

Problems for Module 1b and 2:
Examples for mesh current in networks like T, π, bridged T and combination of T and π.

See Annexure-1 for the figures

Problems for Module- 2a:
Ex.1. The network of Fig.1 – Mod.4 is in the zero stat e until t= 0when switch is closed. Find the current i1(t) in the resistor R3.
Hints: the Fig.1 – Mod.4 shows the same network in terms of transform impedance with the Thevenin equivalent network.

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Ex.2. Find the Norton's equivalent circuit for the circuit Fig.2 – Mod.4.
Hints: As a 1st. step, short the terminals ab. This results in the Circuit of Fig.2.(a). By applying KCL at node a, we have, (0-24)/4+ isc = 0; i.e isc= 9 A. To find out the equivalent Norton's impedance RN, deactivate all the independent sources, resulting in a circuit of Fig.2.(b), RN= (4x12)/(4+12) = 3 Ohms. Thus we obtain Norton equivalent circuit of Fig.2 (c).

Problems for Module – 2b:
Ex.1. Draw the graph, one tree and its co tree for the circuit shown in Fig.1 – mod.5.
Hints: In the circuit there are four nodes (N= 4) and seven branches (B= 7). The graph is so drawn and appears as in Fig. 1
(a). Fig.1(b) shows one tree of graph shown in Fig. 1(a). The tree is made up of branches 2, 5 and 6. The co tree for the tree of Fig.1 (b) is shown in Fig. 1(c). The co tree has L= B-N+1 = 7-4+1 = 4 Links.
Ex.2. (a). For the circuit shown in Fig.2- Mod.5, construct a tree so that i1 is a link current. Assign a complete set of link currents and find i1 (t).
(b). Construct another tree in which v1 is a tree branch voltage. Assign a complete set of tree branch voltages and v1 (t). Take i(t) = 25 sin 1000t A, v(t)= 15 cos 1000t.

Text Books

1. Valkenburg M. E. Van, "Network Analysis", Prenti ce Hall./Pearson Education
2. Hayt "Engg Circuit Analysis" 6/e Tata McGraw-Hill
3. D.A.Bell- Electrical Circuits- Oxford

Reference Books

1. A.B.Carlson-Circuits- Cenage Learning
2. John Bird- Electrical Circuit Theory and Technology- 3/e- Elsevier (Indian Reprint)
3. Skilling H.H.: "Electrical Engineering Circuits", John Wiley & Sons.
4. Edminister J.A.: "Theory & Problems of Electric Circuits", McGraw-Hill Co.
5. Kuo F. F., "Network Analysis & Synthesis", John Wiley & Sons.
6. R.A.DeCarlo & P.M.Lin- Linear Circuit Analysis- Oxford
7. P.Ramesh Babu- Electrical Circuit Analysis- Scitech
8. Sudhakar: "Circuits & Networks:Analysis & Synthes is" 2/e TMH
9. M.S.Sukhija & T.K.NagSarkar- Circuits and Networks-Oxford
10. Sivandam- "Electric Circuits and Analysis", Vika s
11. V.K. Chandna, "A Text Book of Network Theory & Cir cuit Analysis",Cyber Tech
12. Reza F. M. and Seely S., "Modern Network Analysi s", Mc.Graw Hill .
13. M. H. Rashid: "Introduction to PSpice using OrCAD for circuits and electronics", Pearson/PHI
14. Roy Choudhury D., "Networks and Systems", New Ag e International Publishers.
15. D.Chattopadhyay and P.C.Rakshit: "Electrical Circui ts" New Age

Data Communication

Code: IT504B
Contact: 3L + 1T
Credits: 4

Module I
Data Communication Fundamentals: Layered Network Architecture; Mode of communication, topology, Data and Signal; Transmission Media: Guided, Unguided; Transmission Impairments and Channel Capacity; Transmission of Digital Data: Interfaces-DTE-DCE, MODEM, Cable MODEM; The telephone network system and DSL technology;
Module II
Data Link Control: Interfacing to the media and synchronization; Error Control: Error Detection and Correction (Single bit, Multi bit); Flow control: Stop-and-Wait ARQ, Go-Back-N ARQ, Selective-Repeat ARQ
Data Link Protocols: Synchronous, Asynchronous Protocols, Point-to-Point Protocol(PPP).

Module III
Switching Communication Networks: Circuit switching; Packet switching; Routing in packet switched networks; X.25; Frame Relay; ATM, SONET.
Module IV
Communication Network: Topology; Medium Access Control Techniques; IEEE CSMA/CD based LANs; IEEE Ring LANs; High Speed LANs – Token Ring Bas ed(FDDI); High Speed LANs – CSMA/CD based; Wireless LANs: Bluetooth;
Network Security: Introduction to Cryptography; User Authentication; Firewalls.

Text Books

1. Data Communications and Networking, Behrouz A. Forouzan, TMH
2. Data and Computer Communications, William Stallings, PHI
3. Computer Networks, Andrew S. Tanenbaum, PHI

Digital Signal Processing
Code: IT504C
Contact: 3L + 1T
Credits: 4

MODULE – I
Discrete-time signals:
Concept of discrete-time signal, basic idea of sampling and reconstruction of signal, sampling theorem, sequences – periodic, energy, power, unit-sample, unit-step, unit-ramp, real & complex exponentials, arithmetic operations on sequences.
LTI Systems
Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and exercises, properties of convolution, interconnections of LTI systems with physical interpretations, stability and causality conditions, recursive and
non-recursive systems.
MODULE –II
Z-Transform
Definition, mapping between s-plane and z-plane, unit circle, convergence and ROC, properties of Z-transform, Z-transform on sequences with examples and exercises, characteristic families of signals along with ROCs, convolution, correlation and multiplication using Z-transform, initial value theorem, Perseval's relation, inverse Z-transform by contour integration,
power series & partial-fraction expansions with examples and

exercises.

Discrete Fourier Transform:

Concept and relations for DFT/IDFT, Twiddle factors and their properties, computational burden on direct DFT, DFT/IDFT as linear transformations, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circular convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequences – Overlap-Save and Overlap-Add methods with exam ples and exercises.

Fast Fourier Transform:

Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithms, signal flow graphs, Butterflies, computations in one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises.

MODULE – III

Filter Design

Basic concepts of IIR and FIR filters, difference equations, design of Butterworth IIR analog filter using impulse invariant and bilinear transforms, design of linear phase FIR filters, no. of taps, rectangular, Hamming and Blackman windows.

MODULE – IV

Digital Signal Processor

Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small
programs in Assembly Language.

FPGA

Architecture, different sub-systems, design flow for DSP system design, mapping of DSP algorithms onto FPGA.

Text Books

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis & D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach , S.K.Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.
4. VLSI Digital Signal Processing Systems Design and Implementation, Wiley International Publication.
5. Digital Signal Processing with Field Programmable Gate Arrays, U.Meyer-Baese, Springer.

Reference Books

1. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
3. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH Publishing Co.
4. Digital Signal Processing; A Hands on Approach, C. Schuler & M.Chugani, TMH Publishing Co.
6. Digital Signal Processing, A. Nagoor Kani, TMH Education
7. Digital Signal Processing S. Poornachandra & B. Sasikala, MH Education
8. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press
9. Texas Instruments DSP Processor user manuals and application notes.
10. Digital Signal Processing – A practical Approach (s econd Edition) – Emmanuel C. Ifeacher & Barrie W. Je rvis, Pearson Education
11. Xilinx FPGA user manuals and application notes.

Operation Research
Code: IT504D
Contact: 3L + 1T

Credits: 4

Module I
Linear Programming Problems (LPP):

Basic LPP and Applications; Various Components of LP Problem Formulation.

Solution of Linear Programming Problems:
Solution of LPP: Using Simultaneous Equations and Graphical Method;
Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate
Solution, Convex set and explanation with
examples.
Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory. Transportation Problems and Assignment
Problems.

Module II
Network Analysis:
Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource
Allocation excluded).

Inventory Control:
Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock.

Module III
Game Theory:
Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.

Module IV
Queuing Theory:
Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.

Text Books

1. H. A. Taha, "Operations Research", Pearson
2. P. M. Karak – "Linear Programming and Theory of Ga mes", ABS Publishing House
3. Ghosh and Chakraborty, "Linear Programming and The ory of Games", Central Book Agency
4. Ravindran, Philips and Solberg - "Operatio ns Research", WILEY INDIA

Microprocessors & Microcontrollers
Code: IT504E
Contact: 3L + 1T
Credits: 4

Module -1
Introduction to Microcomputer based system. History of evolution of Microprocessor and Microcontrollers and their
Advantages and disadvantages.
Architecture of 8085 Microprocessor, Pin description of 8085.
Address/data bus Demultiplexing , Status Signals and the control signals.
Instruction set of 8085 microprocessor, Addressing modes,

Timing diagram of the instructions (a few examples).

Module -2
Assembly language programming with examples, Counter and Time Delays,
Stack and Subroutine,
Interrupts of 8085 processor(software and hardware), I/O Device Interfacing-I/O Mapped I/O and Memory Mapped I/O , Serial (using SID and SOD pins and RIM, SIM Instructions) and Parallel data transfer,

Module 3:
The 8086 microprocessor- Architecture, Addressing modes, Interrupts
Introduction to 8051 Microcontroller –Architecture, Pin Details.
Addressing modes, Instruction set, Examples of Simple Assembly Language.

Module -4:
Memory interfacing with 8085, 8086 Support IC chips- 8255 ,8251,8237/8257,8259 Interfacing of PPI with 8085 and Microcontroller 8051. Brief introduction to PIC microcontroller (16F877)

Text Books

1. Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan (Oxford university press)
2. 8051 Microcontroller – K. Ayala (Cengage learning)
3. MICROPROCESSOR architecture, programming and Application with 8085 - R.Gaonkar (Penram international Publishing LTD.)
4. Microcontrollers:Principles&Applications , Ajit Pal, PHI 2011.
5. Naresh Grover, "Microprocessor comprehensive stud ies Architecture, Programming and Interfacing"Dhanp at Rai, 2003
6. 8051 Microprocessor –V. Udayashankara and M.S Ma llikarjunaswami (TMH).
7. Microprocessor 8085 and its Interfacing—S Mathur (PHI)
8. An Introduction to Microprocessor and Applications –Krishna Kant (Macmillan)

Reference Books

1. 8086 Microprocessor –K Ayala (Cengage learning)
2. The 8085 Microprocessor, Architecture, Programming and Interfacing- K Uday Kumar, B .S Umashankar (Pearson)
3. The X-86 PC Assembly language, Design and Interfacing - Mazidi, Mazidi and Causey (PEARSON)
4. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley (PEARSON)
5. Microprocessors – The 8086/8088, 80186/80386/804 86 and the Pentium family – N. B. Bahadure (PHI).
6. The 8051 microcontrollers – Uma Rao and Andhe Pal lavi (PEARSON).

Programming Practices using C++
Code: IT504F
Contact: 3L + 1T
Credits: 4

Introduction
Programming paradigms,Language translator, **B**asics of OOP, Structure of C++ program, Class and object, Abstraction and encapsulation, Polymorphism, Inheritance, Static and dynamic binding.

Declaration, Expression and statements
Data types, Variables, Constants, Operator and expression, Operator precedence and associativity. Statements: Labelled, Expression, Compound, Control, Jump, Declaration, Try-throw-catch.

Array, pointer and function
Array,Addresses, Pointer. Function: Declaration, Definition and call, Inline function, Main function argument, Reference variable, Function overloading, Default argument, Parameter passing, Recursion, Scope of variable, Return-by-value and Return-by-reference, Pointer to function

Data abstraction through classes and user defined data types
Class, Members, Constructor and destructor, Copy constructor.
Dynamic memory management: Operators new and delete, Malloc and free, Static member, Scope of class names, Scope of variables.

Operator Overloading
Overloading unary and binary operator, Overloaded function calls, Subscripting, class member access, Non-member operator, New and delete, Cast operator.

Class relationships
Introduction, Polymorphism, Coercion, Overloading, Parametric and inclusion polymorphism
Inheritance: direct and indirect superclasses, Multiple inheritance, Virtual base class,Friend, Virtual function, Abstract class, Overriding and hiding, Dynamic binding of functions, Virtual destructor and operators.

Template and Exception Handling
Class template, Member function inclusion, Function template, Specialization,Inheritance, Namespace.
Concept of exception handling, Catch block, Nested try-catch block, Condition expression in throw expression, Constructor & destructor, Runtime standard exception

Standard Library in C++
Standard library function, Input and output, Iostream class hierarchy, Class ios, Other stream classes.

Object oriented design and modelling
Software development, Qualities of software system, Software architecture, Process life cycle, phases, Modularity, OO methodology, Modeling, UML overview, Object oriented design patterns.

Text Books

1. Schildt, H., The Complete Reference C++, McGraw – Hill.
2. C++ object oriented programming paradigm, Debasish Jana, PHI
3. Pooley, R and P. Stevens, Using UML , Addison-Wesley.
4. Programming In C++, Y.I. Shah and M.H. Thaker, ISTE/EXCEL BOOKS
5. Rambaugh, James Michael, Blaha – "Obj ect Oriented Modelling and Design" – Prentice Hall, India
6. Rajaram: Object Oriented Programming and C++, New Age International

Practical

Design & Analysis Algorithm Lab
Code: IT591
Contact: 3P
Credits: 2

Programming Language used :C
Lab :1 : Divide and Conquer :

> Implement Binary Search using Divide and Conquer approach
> Implement Merge Sort using Divide and Conquer approach

Lab :2 : Divide and Conquer :

> Implement Quick Sort using Divide and Conquer approach
> Find Maximum and Minimum element from a array of integer using Divide and Conquer approach

Lab :3 : Dynamic Programming :

> Find the minimum number of scalar multiplication needed for chain of matrix

Lab :4 : Dynamic Programming :

> Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm)
> Implement Traveling Salesman Problem

Lab :5 : Dynamic Programming :

> Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm)

Lab :6 : Brunch and Bound :

> Implement 15 Puzzle Problem

Lab :7 : Backtracking :

> Implement 8 Queen problem

Lab :8 : Backtracking (implement any one of the following problem):

>Graph Coloring Problem >Hamiltonian Problem

Lab :9 : Greedy method(implement any one of the following problem) :

>Knapsack Problem
>Job sequencing with deadlines

Lab :10 : Greedy method (implement any one of the following problem) :

>Minimum Cost Spanning Tree by Prim's Algorithm
>Minimum Cost Spanning Tree by Kruskal's Algorithm

Lab :11 : Graph Traversal Algorithm :

>Implement Breadth First Search (BFS)
>Implement Depth First Search (DFS)

Computer Architecture Lab
Code: IT592
Contact: 3P
Credits: 2

All laboratory assignments are based on Hardware Description Language (VHDL or Verilog) Simulation. [Pre-requisite: The hardware based design has been done in the Analog & Digital Electronics laboratory and Computer Organisation laboratory]
HDL introduction
Basic digital logic base programming with HDL 8-bit Addition, Multiplication, Division
8-bit Register design
Memory unit design and perform memory operatons. 8-bit simple ALU design
8-bit simple CPU design Interfacing of CPU and Memory

Operating System Lab
Code: IT593
Contact: 3P
Credits: 2

1. **Managing Unix/Linux Operating System:**
Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control

structures, functions, commands). Partitions, Swap space, Device files, Raw and Block files, Formatting disks, Making file systems, Superblock, I-nodes, File system checker, Mounting file systems, Logical Volumes, Network File systems, Backup schedules and methods Kernel loading, init and the inittab file, Run-levels, Run level scripts. Password file management, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users & user groups.

2. **Process**: starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.

3. **Signal**: signal handling, sending signals, signal interface, signal sets.

4. **Semaphore**: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).

5. **POSIX Threads**: programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)

6. **Inter-process communication**: pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO), message passing & shared memory(IPC version V).

Circuits and Networks Lab
Code: IT594A
Contacts: 3P
Credits: 2

1. Characteristics of Series & Parallel Resonant circuits
2. Verification of Network Theorems
3. Transient Response in R-L & R-C Networks ; simulation / hardware
4. Transient Response in RLC Series & Parallel Circuits & Networks ; simulation / hardware
5. Determination of Impedance (Z), and Admittance (Y) parameters of Two-port networks
6. Generation of periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, and ramp signals using MATLAB
7. Representation of Poles and Zeros in s-plane, determination of partial fraction expansion in s-domain

and cascade connection of second-order systems using MATLAB

21. Determination of Laplace Transform, different time domain functions, and Inverse Laplace
22. Transformation using MATLAB

Note: An Institution / college may opt for some other hardware or software simulation wherever possible in place of MATLAB

Data Communication Lab
Code:IT594B
Contact: 3P
Credits: 2

List of Experiments

1. To study different types of transmission media
2. Familiarization with Networking cables (CAT5, UTP), Connectors (RJ45, T-connector), Hubs, Switches. Configuration of a HUB/Switch.
3. PC-to-PC Communication with the Data Communication Trainers for File Transfer.

Error detection codes, Data Encryption etc.

4. Experiments using LAN Trainer kit for
   Point-to-Point Communication Multicast/Broadcast Communication Data Encryption and security protocols

5. To make inter-connections in cables for data communication in LAN and install LAN using (a) Tree topology (b) STAR topology (c) Bus topology (d) Token-Ring topology
6. Study of MODEMs: (a) configure the modem of a computer (b) Study Serial Interface RS-232 and its applications
(c) Study the Parallel Interface and its applications

DSP Lab
Code: IT594C
Contact: 3P
Credits: 2

Simulation Laboratory using standard Simulator:

1. Sampled sinusoidal signal, various sequences and different arithmetic operations.
2. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.
3. Z-transform of various sequences – verification of the properties of Z-transform.
4. Twiddle factors – verification of the properties.
5. DFTs / IDFTs using matrix multiplication and also using commands.
6. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.
7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods.
8. Butterworth filter design with different set of parameters.
9. FIR filter design using rectangular, Hamming and Blackman windows.

Hardware Laboratory using either 5416 or 6713 Processor and Xilinx FPGA:

10. Writing & execution of small programs related to arithmetic operations and convolution using Assembly Language of TMS320C 5416/6713 Processor, study of MAC instruction.
11. Writing of small programs in VHDL and downloading onto Xilinx FPGA.
12. Mapping of some DSP algorithms onto FPGA.

OR Lab
Code: IT594D
Contact: 3P
Credits: 2

Software based lab using C/C++

1. Assignment on Tranportation problem.

2. Assignment on Assignment problem

3. Assignment on Duality

4. Assignment on Simplex method (Including Charns' Big- M Method)

5. Assignment on Shortest Path by using Dijkstra's or Floyd's Algorithm

6. Assignment on Maximal Flow Problem (Ford-Fulkerson Method).

7. Assignment on PERT/CPM

8. Familiarization with O.R package: TORA

Microprocessor & Microcontroller Lab
Code: IT594E
Contact: 3P
Credits: 2

Experiment Name

Study of Prewritten programs on 8085 trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical).

Familiarization with 8085 simulator on PC. Programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator.
Programming using kit or Simulator for:
Table look up
Copying a block of memory
Shifting a block of memory
Packing and unpacking of BCD numbers
Addition of BCD numbers
Binary to ASCII conversion and vice-versa (Using Subroutine Call)
BCD to Binary Conversion and vice-versa
String Matching, Multiplication
Program using IN/OUT instructions and 8255 PPI on the trainer kit e.g. subroutine for delay, Glowing all the LEDs one by one with particular delay
Reading switch state and glowing LEDs accordingly.

Serial communication between two trainer kits
Study of Prewritten programs on 8051 Microcontroller Kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical).

Familiarization with 8051 Simulator on PC. Study of prewritten programs using basic instruction set

Programming Practice using C++
Code: IT594E
Contact: 3P
Credits: 2
Introduction of UNIX/Linux Operating System which includes preliminary commands, start-up & shutdown methodology, file handling as well as introduction to editors like Vi editor, introduction to GNU C & C++ compiler, as well as introduction to GNU & GDB script.

Introduction to C++, basic loop control, executing programs, writing functions, selection statements, review of functions and parameters, command line arguments, recursion, I/O streams, arrays and string manipulation, pointers, structures & unions**.**

Object-Oriented Programming in C++, fundamentals of classes, constructors-destructors.
Dealing with member functions, operator overloading and polymorphism (both static & dynamic).

Dealing with inheritance, derived class handling, abstract class, virtual class, overriding, template class, name-space & exception handling.

Dynamic memory allocation, implementation of Linked Lists, using C++.
Note: GNU C++ can be used for the programming, since it is free and has no licensing anomaly

Department of Information Technology
RCC Institute of Information Technology, Kolkata
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Course Structure – HU 501, Economics for Engineers

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **HU 501**, **Economics for Engineers.** 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Ms.Jhuma Ray.MBA.MPhil, Assist. Prof.Dept of SC & HU • Moderator: Dr. Siddhartha Bhattacharyya , PhD, Associate Professor,Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Ms.Jhuma Ray (10+ years exp in teaching) • Dr. Siddhartha Bhattacharyya (15 years exp in teaching.)
Designation as a Compulsory or Elective course (Module)	Compulsory
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 3-0-0 Credit – 3.0 Theory 3 hours Lecture One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives. 2. Perform and evaluate payback period and capitalized cost on one or more economic alternatives. 3. Carry out and evaluate benefit/cost, life cycle. 4. Calculate breakeven analyses on one or more economic alternatives.

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Day 1	2L	Economic Decision making – Overview, Problems, Role, Decision making process.	Describe the accounting for various investment securities including the equity method
Day 2	2L	Engineering Costs & Estimation – Fixed, Variable, Marginal and Average Costs, Sunk Costs, Opportunity Costs, Recurring and Nonrecurring Costs, Incremental costs, Cash Cost Vs. Book costs, Life-Cycle Cost.	Assignment on calculation of different types of costs.
Day 3	2L	Types of Estimate, Estimating	

			models – Per Unit Model, Segmenting Model, Costs Indexes, Power- Sizing, Model, Improvement & Learning Curve, Benefits.	
	Day 4	2L	Cash Flow, Interest and Equivalence: Cash Flow-Diagrams, Categories and computation.	Prepare and interpret a statement of cash flows
	Day 5	2L	Time value of Money, Debt repayment, Nominal & Effective Interest.	
	Day 6	2L	Present worth Analysis: End-Of-Year Convention, View point of Economic Analysis Studies, Borrowed Money Viewpoint, Effect of Inflation and Deflation, Taxes, Economic Criteria, Applying present Worth Techniques, Multiple Alternatives.	Assignment on problems based on NPV and IRR method.
	Day 7	2L	Cash Flow & Rate of return Analysis – Calculations, Treatment of Salvage value, Annual Cash Flow Analysis – Quantifying and Valuing Benefits & drawbacks.	Assignment on preparation of Cash flow and fund Flow Statement.
	Day 8	2L	Analysis Periods: Internal Rate of Return, Calculating Rate of return, Incremental Analysis: Best Choosing An Analysis Method, Future Worth Analysis, Benefit- Cost ratio Analysis, Sensitivity and Breakeven Analysis, Economic Analysis in the Public sector.	Assignment on Break Even Analysis,
	Day 9	2L	Uncertainty in future events, - Estimates and their use in Economic Analysis, Range of estimates, Probability, Joint Probability Distributions, Expected value, economic Decision Trees, Risk, Risk Vs Return,Simulation,Real options.	Discuss the liability, and shareholders' equity sections of the balance sheet to include a detailed analysis of current liabilities, contingencies, bonds payable, long-term notes payable, paid-in capital, and retained earnings
	Day 10	2L	Depreciation – Basic Aspects, Depreciation & Obsolescence, Depreciation and Expenses, Types of property, Depreciation Calculation Fundamentals.	Assignment on calculation of Depreciation based on different methods,
	Day 11	2L	Depreciation and Capital Methods, Straight- line depreciation Declining Balance Depreciation, Common Elements of Tax Regulations for Depreciation and capital Allowances.	Assignment on calculation of Depreciation based on different methods
	Day 12	2L	Replacement analysis- Replacement Analysis Decision map, Minimum Cost life of a new Asset, Marginal Cost, Minimum Cost Life	

			Problems.	
	Day 13	2L	Functions, Balance Sheets, Income Statement.	Assignment on preparation of final accounts.
	Day 14	2L	Financial Ratios, Capital Transactions, Cost accounting, Direct costs, and indirect costs, Indirect Costs allocation.	Assignment on calculation of different types of financial ratios.
	Day 15	2L	Inflation and Price change – Definition,, Effects, Causes, Price change with indexes, Composite Vs, Commodity, Indexes, Use of Price indexes in Engineering Economic Analysis, Cash Flows that inflate at different rates.	
Hints for Learning-Teaching Approach (Course Delivery)	• Lectures to relate theories with assignments. • Case study. • Assignment solving on each covered modules. • Interactive problem solving and doubt-clearing session . • Outside the class interaction with individual students having problems.			
Course Assessment Policy	Assessment will be done in following two methods: 1. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester 2. Indirect Assessment – Opinion Survey Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows: • Attendance (Cont. Assmt. by Teacher): 5% • Average of Quiz + Assignments: (Cont. Assmt. by Teacher): 10% • Best of two 45-mins Class Tests (Cont. Assmt. by Teacher): 15% • One 3-hours Term-end Exam (Terminal Assmt. by Univ.): 70% Points will be awarded by the Department upon assessing attainment of Pos related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course related PO is then found from the % of weighted average score w.r.t maximum score (4).			
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • 3 categories of questions in Class Tests • Library Assignment • Viva • Student Semester Exit Survey • Employer Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics (Table 1). The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics (Table 2).			
Text Books and/or Reference Material	**Text Books:** 1.James L.Riggs,David D.Bedworth,Sabah U.Randhawa : Economics for Engineers $e,Tata Mc.Graw –Hill 2.Donald Newman,Ted eschembach,Jerome lavelle: Engineering economics Analysis,OUP 3.John A.White, Kenneth E. Case, David B.Pratt : Principle Of engineering Economic Analysis, John Wiley 4.Sullivan and wicks : Engineering Economy,Pearson 5.R.Paneer Seelvan: Engineering Economics, PHI 6.Michael R lindeburg : Engineering Economics analysis , Professional Pub.			

Mapping of Course Outcome with Program Outcome

S. No.	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Economics for Engineers (HU501) - *Theory*	1. Perform and evaluate present worth, future worth and annual worth analysis on one of more economic alternatives.		S										
		2. Perform and evaluate payback period and capitalized cost on one or more economic alternatives.		S										
		3. Carry out and evaluate benefit/cost, life cycle.				S	S							
		4. Calculate breakeven analysis on one or more economic alternatives.				S	S							

Selection of Assessment Components and Tools

HU – 501 (Economics for Engineers)									
Assessment Tools						**Score (1 –4)**	**Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)**		
Component	**Ast - #**	**Method/Element**	**PO 2**	**PO 4**	**PO 5**		**PO 2**	**PO 4**	**PO 5**
Class Performance	1.1.1	Multiple Choice Question/ Quiz	*S*	-	-		0.5 × Score	-	-
	1.1.2	Short Answer type Questions (Class Test)	*S*	-	-		0.5 × Score	-	-
	1.1.3	Problem based Questions (Class Test)	*S*	-	-		0.5 × Score	-	-
	1.1.5	Open Ended Realistic Questions (Class Test)	*S*	*S*	-		0.5 × Score	0.5 × Score	-
	1.1.6	Assignments (Library/ Home Assignment)	-	-	-		-	-	-
	1.1.7	Viva	-	-	-			-	-
Terminal Test	1.2.1	Written Semester Exams	*M*	*W*	-		0.3 × Score	0.2 × Score	-
Indirect Method	2.2.1	Employer Survey	*M*	*M*	*S*		0.3 × Score	0.3 × Score	0.5 × Score
	2.2.2	Student Semester Exit Survey	*S*	-	*S*		0.5 × Score	-	0.5 × Score
						Weighted Score (WS)	**Total / 3.1**	**Total / 1.0**	**Total / 1.0**
						% of PO attained	**WS * 100/4**	**WS * 100/4**	**WS * 100/4**

Assessment Rubrics

HU - 501 (Economics for Engineers)					
Assessment Tools		**Grading Criteria**			
Assessment Method	**Ast - #**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions / Quiz	1.1.1	≤40%	>40% - 60%	>60% - 80%	>80%
Short Answer type Questions (Class Test)	1.1.2	<40%	>40% - <60%	>60% - <80%	>80%
Problem based Questions (Class Test)	1.1.3	<40%	>40% - <60%	>60% - <80%	>80%
Open Ended Realistic Questions (Class Test)	1.1.5	<40%	>40% - <60%	>60% - <80%	>80%
Assignment (Library/ Home Assignments)	1.1.6	Irregular	Regular but often search helps from instructor	Regular and solve all problems of its own	Regularly solves all problems and in addition to that is capable to generate new ideas
Viva	1.1.7	Seldom interacts	Interacts but wayward	Fairly Interactive	Takes the leadership role in answering questions
Written Semester exams	1.2.1	<40%	>40% - <60%	>60% - <80%	>80%
Employer survey	2.2.1	Can't answer anything	Try to answer basic questions	Good in both theory and programming, however weak skilled question	Promptly responses to any question, programming approach is efficient and confidently manages any program
Student Semester Exit survey	2.2.4	Poor understanding of any related questions	Try to response queries if initial hints are given	Also attempts to answer conceptual questions	Can manage any types of questions at any difficulty level with utmost confidence

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Course Structure of IT501, Design and Analysis of Algorithm

Format	Course Curriculum	
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT501**, Design and Analysis of Algorithm, 3rd Year	
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Abantika Choudhury, M.Tech., Asst. Prof., Dept of IT • Moderator: Dr. Dipankar Majumdar, Associate Professor, PhD.	
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Abantika Choudhury (9 years, M.Tech. in Software Engineering) • Dr. Dipankar Majumdar (11 years, PhD)	
Designation as a Compulsory or Elective course (Module)	Compulsory	
Pre-requisites Courses	Knowlwdge of C programming and data structure.	
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 3-1-0 Credit – 4 Theory 3 hours Lecture/ 1 Tutorial One Semester	
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Analyze the asymptotic performance of algorithm. 2. Write rigorous correctness proofs for algorithms. 3. Demonstrate a familiarity with major algorithms and data structure 4. Acquire knowledge in NP hard and complete problem.	
Topics covered based on syllabus of affiliating University MAKAUT	Day 1	Time and Space Complexity, Different asymptotic notations
	Day 2	Divide and conquer method (Basic methods, Divide and conquer: use, example and there complexity)
	Day 3	Heap sort and its complexity,
	Day 4	Dynamic programming (Basic method , use, Matrix chain multiplication)
	Day-5	Backtracking(Basic methods ,Use, 8 queens problem,
	Day 6	Graph coloring problem
	Day-7	Greedy Method: Basic Method, Use, Knapsack Problem,
	Day 8	Job sequencing with deadline

	Day-6	Minimum cost spanning tree by Prim's algorithm
	Day 9	Kruskal's algorithm

Topics covered based on syllabus of affiliating University MAKAUT	Day-10	Lower bounded theory (O(nlogn) bounded for comparison set)
	Day-11	Disjoint set manipulation(set manipulation algorithm like UNION-FIND, union by rank)
	Day-12	Graph traversal algorithm- Graph traversal algorithm (BFS, ,
	Day 13	DFS
	Day 14	Classification of Graph traversal algorithm (BFS ,DFS ,
	Day-15	Classification of edges and cross edge., complexity and comparison
	Day-16	Stassen's manipulation algorithm,
	Day 17	Application of matrix manipulation to solution of simultaneous linear equations using LUP decomposition.
	Day-18	String Matching Problem: Different techniques with their complexity
	Day 19	String Matching Problem contd.
	Day-20	String Matching Problem: contd. , Notion of NP Completeness: P class, NP class, NP hard class- their inter relationship
	Day-21	Inversion of matrix and Boolean matrix manipulation
	Day-22	Amortized analysis(Aggregate, Accounting and potential Method)
	Day-23	Network Flow(Ford Fulkerson Algorithm, Max Flow Min cut theorem)
	Day-24	Necessity of approximation scheme, Performance guarantee, polynomial time approximation scheme, vertex cover problem.
	Day-25	Travelling salesman problem.

Additional Topics, Activities and Assignments	• Different Techniques of algorithm.
Activities of students and Assignments	• Take part in Classroom Demonstration (group activity) • Take part in Quiz (individual activity) • Prepare Home Assignments • Prepare Library Assignments
Hints for Learning-Teaching Approach (Course Delivery)	• Chalk-Board Lectures • Class room Demonstration • Quiz, Interaction • Interactive problem solving and doubt-clearing session • Outside the class interaction with individual students having problems
Course Assessment Policy	Assessment will be done in following two methods: 1. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester 2. Indirect Assessment – Opinion Survey Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows: • Attendance (Cont. Assmt. by Teacher): 5% • Average of Quiz + Assignments: (Cont. Assmt. by Teacher): 10% • Best of two 45-mins Class Tests (Cont. Assmt. by Teacher): 15% • One 3-hours Term-end Exam (Terminal Assmt. by Univ.): 70% Points will be awarded by the Department upon assessing attainment of Pos related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course related PO is then found from the % of weighted average score w.r.t maximum score (4).
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • 4 categories of questions in Class Tests • Classroom Demonstration • Micro Project • Library Assignment • Viva • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey • Employer Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics (Table 1). The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics (Table 2).
Text Books and/or Reference Material	• **Text Books:** 1. T. H. coremen, C. E. Leiserson, Introduction to algorithms 2. A. Aho, J. Hopcroft, J. Ullman, Design and analysis of algorithm.

Department of Information Technology
RCC Institute of Information Technology, Kolkata
Canal South Road, Kolkata - 700015

Course Structure of IT591, Design and Analysis of Algorithm Lab

Format	Course Curriculum	
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT591**, **Design and Analysis of Algorithm Lab**, 3rd Year	
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Abantika Choudhury, M.Tech., Asst. Prof., Dept of IT • Moderator: Dr. Dipankar Majumdar, Associate Professor, PhD.	
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Abantika Choudhury (9 years, M.Tech in Software Engineering) • Prof. P.N.Basu (11 years, PhD)	
Designation as a Compulsory or Elective course (Module)	Compulsory	
Pre-requisites Courses	Knowledge of C programming, Data Structure.	
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 0-0-3 Credit – 2 Practical 3 hours Laboratory One Semester	
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Analyse the running time of asymptotic notation. 2. Develop algorithms for sorting, searching, insertion and matching. 3. Identify and apply the concept of computational intractability 4. Acquire knowledge in NP Hard and complete problem	
Topics covered based on syllabus of affiliating University MAKAUT	Day-1	Implement Binary search, Merge sort using Divider and conquer approach.
	Day-2	Find the minimum number of scalar multiplication needed for chain of matrix.
	Day-3	Implement all pair of shortest path for a graph, Implement travelling sales problem.
	Day-4	Implement Quick sort using Divider and conquer approach. Find maximum and minimum element from a array of integer using Divider and conquer approach
	Day-5	Implement single source shortest path for a graph.
	Day-6	Implementation of Backtracking method.

<table>
<tr><td rowspan="5">0Topics covered based on syllabus of affiliating University MAKAUT</td><td>Day-7</td><td>Implement 15 puzzle problem.</td></tr>
<tr><td>Day-8</td><td>Knapsack problem, Job sequencing with deadline.</td></tr>
<tr><td>Day-9</td><td>Minimum cost spanning tree by prim’s algorithm /Kruskal Algorithm</td></tr>
<tr><td>Day-10</td><td>Video: Analogue and Digital Video, Recording Formats and Standards.</td></tr>
<tr><td>Day-11</td><td>Graph Travel Algorithm(BFS ,DFS)</td></tr>
<tr><td>Additional Topics (Lab)</td><td colspan="2">• NIL</td></tr>
<tr><td>Activities and Assignments</td><td colspan="2">• Take part in Lab Experiment (individual activity)
• Prepare Home Assignments
• Prepare Lab Reports
• Complete Micro Project and submit Report (group activity)</td></tr>
<tr><td>Hints for Learning-Teaching Approach (Course Delivery)</td><td colspan="2">• Regular Lab Demonstrations (learner-centric) –
✓Involve students in discussion/expression of views
✓Ask students to explain on board
✓Ask questions to students on previously discussed /ongoing topic
• Home Assignment on topics not delivered in Lab
• Outside the Lab interaction with individual students having difficulty</td></tr>
<tr><td>Course Assessment Policy</td><td colspan="2">Assessment will be done in following two methods:
1. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester
2. Indirect Assessment – Opinion Survey
Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows:
• Attendance (Cont. Assmt. by Teacher): 10%
• Lab Performance (Cont. Assmt. by Teacher): 10%
• Lab Reports (Cont. Assmt. by Teacher): 20%
• Lab Viva (Terminal Assmt. by Teacher/External Examiner): 20%
• One 3-hours Term-end Lab Exam (Terminal Assmt. by University appointed External Examiner): 40%
Points will be awarded by the Department upon assessing attainment of POs related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course-related PO is then found from the % of weighted average score w.r.t maximum avg score (4).</td></tr>
<tr><td>Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)</td><td colspan="2">In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome.
• Micro Project
• Student Semester Exit Survey
• Faculty & Staff Satisfaction Survey
• Employer Survey
• The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics. The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics.</td></tr>
<tr><td>Text Books and/or Reference Material</td><td colspan="2">Text Books:
1. T. H. coremen, C. E. Leiserson, Introduction to algorithms
2. A. Aho, J. Hopcroft, J. Ullman, Design and analysis of algorithm.</td></tr>
</table>

Mapping of Course Outcomes with Program Outcomes

S. No.	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Design and Analysis of Algorithm (IT501) - ***Theory***	1. Analyze the asymptotic performance of algorithm.	S											
		2. Write rigorous correctness proofs for algorithms.	M	S										
		3. Demonstrate a familiarity with major algorithms and data structure			S									
		4. Acquire knowledge in NP hard and complete problem	M	S	S									
2	Design and Analysis of Algorithm (IT591) - ***Practical***	1. Analyse the running time of asymptotic notation.		S										
		2. Develop algorithms for sorting, searching, insertion and matching.	M	S										
		3. Identify and apply the concept of computational intractability	M		S									
		4. Acquire knowledge in NP Hard and complete problem	S	M										

Selection of Assessment Components and Tools

IT – 501 (Design and Analysis of Algorithm)							Weighted Evaluation of POs (W_S – 0.5 | | W_M = 0.3 | | W_W = 0.2)		
Assessment Tools			PO1	PO 2	PO3	Score (1 – 4)			
Component	Ast - #	Method/Element					PO1	PO 2	PO3
Class Performance	1.1.1	Multiple Choice Questions (Quiz)	*S*	-	-		0.5 × Score	-	-
	1.1.2	Short Answer type Questions (Class Test)	*S*	-	-		0.5 × Score	-	-
	1.1.3	Problem based Questions (Class Test)	*S*	*S*	-		0.5 × Score	0.5 × Score	-
	1.1.4	Design oriented Questions (Class Test)	*M*	*M*	*S*		0.3 × Score	0.3 × Score	0.5 × Score
	1.1.5	Open Ended Realistic Questions (Class Test)	*M*	*S*	-		0.3 × Score	0.5 × Score	-
	1.1.6	Library/ Home Assignment	*S*	-	-		0.5 × Score	-	-
	1.1.7	Viva	*S*	-	-		0.5 × Score	-	-
	1.1.9	Tutorial	*S*	*M*	-		0.5 × Score	0.3 × Score	-
	1.1.9	Attendance	*M*	-	-		0.3 × Score	-	-
Class Demonstration	1.1.8	Quality of Technical Content, Planning & Adherence to Context	*M*	-	-		0.3 × Score	-	-
		Study & Understanding of the Topic	*S*	-	-		0.5 × Score	-	-
		Basic Knowledge in the related Science & Technology	*S*	-	-		0.5 × Score	-	-
		Effective Use of Context Specific Examples, Test Cases and References	*S*	-	-		0.5 × Score	-	-
		Q&A and interaction	*S*	-	-		0.5 × Score	-	-
Micro Project	1.1.11	Research and gather information	*S*	-	-		0.5 × Score	-	-
		Analysis of Problem, Requirement Analysis	*M*	*S*	*M*		0.3 × Score	0.5 × Score	0.3 × Score
		Planning & Designing	*S*	*S*	*S*		0.5 × Score	0.5 × Score	0.5 × Score
		Application of Subject Knowledge	*S*	-	-		0.5 × Score	-	-
		Application of Related other Concept and Techniques - Integrated Approach	*S*	*M*	*M*		0.5 × Score	0.3 × Score	0.3 × Score
		Developing Solution/System using IT skill	*S*	-	*S*		0.5 × Score	-	0.5 × Score
Terminal Test	1.2.1	Written Semester Exams	*S*	*S*	-		0.5 × Score	0.5 × Score	-
		Viva	*S*	-	-		0.5 × Score	-	-
Indirect Method	2.2.2	Student Semester Exit Survey	*S*	*S*	*S*		0.5 × Score	0.5 × Score	0.5 × Score
	2.2.5	Faculty and Staff Satisfaction Survey	*M*	*M*	*M*		0.3 × Score	0.3 × Score	0.3 × Score
	2.2.5	Employer Survey	*M*	*M*	*S*		0.3 × Score	0.3 × Score	0.5 × Score
						Weighted Score for each PO			
						%PO attained			

Selection of Assessment Components and Tools

IT – 591 (Design and Analysis of Algorithm Lab)						Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 | | W_M = 0.3 | | W_W = 0.2)		
Assessment Tools			PO1	PO 2	PO3		PO1	PO 2	PO3
Component	Ast - #	Method/Element							
	1.1.9	Attendance	*M*	-	-		0.3 × Score	-	-
	1.1.10	Laboratory Experiments/ Assignments (incl. conducting physical tests using tools and preparing lab reports)	*M*	*M*	-		0.3 × Score	0.3 × Score	
Micro Project	1.1.11	Research and gather information	*S*	-	-		0.5 × Score	-	-
		Analysis of Problem, Requirement Analysis	*M*	*S*	*M*		0.5 × Score	-	-
		Planning & Designing	*S*	*S*	*S*		0.3 × Score	0.5 × Score	0.3 × Score
		Application of Subject Knowledge	*S*	-	-		0.5 × Score	0.5 × Score	0.5 × Score
		Application of Related other Concept and Techniques - Integrated Approach	*S*	*M*	*M*		0.5 × Score	-	-
		Developing Solution/System using IT skill	*S*	-	*S*		0.5 × Score	0.3 × Score	0.3 × Score
Terminal Test	1.2.2	Laboratory Exams (to conduct certain experiments, tool based assignments and report the procedure, results etc.)	*M*	*M*	*S*		0.3 × Score	0.3 × Score	0.5 × Score
Indirect Method	2.2.2	Student Semester Exit Survey	*S*	*S*	*S*		0.5 × Score	0.5 × Score	0.5 × Score
	2.2.5	Faculty and Staff Satisfaction Survey	*M*	*M*	*M*		0.3 × Score	0.3 × Score	0.3 × Score
	2.2.1	Employer Survey	*M*	*M*	*S*		0.3 × Score	0.3 × Score	0.5 × Score
						Weighted Score for each PO	**Total / 4.8**	**Total / 3.0**	**Total / 2.9**
						%PO attained	**WS/3 * 100**	**WS/3 * 100**	**WS/3 * 100**

Assessment Rubrics

IT 501 (Design and Analysis of Algorithm) & IT 591 (Design and Analysis of Algorithm Lab)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Ast#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions (Quiz)	1.1.1	≤40%	>40% - 60%	>60% - 80%	>80%
Short Answer type Questions (Class Test)	1.1.2	≤40%	>40% - 60%	>60% - 80%	>80%
Problem based Questions (Class Test)	1.1.3	≤40%	>40% - 60%	>60% - 80%	>80%
Design oriented Questions (Class Test)	1.1.4	≤40%	>40% - 60%	>60% - 80%	>80%
Open Ended Realistic Questions (Class Test)	1.1.5	≤40%	>40% - 60%	>60% - 80%	>80%
Assignment (Library/ Home)	1.1.6	Irregular, mostly copies from peers	Regular but often search help from instructor, Collects info - not always relevant	Regular and solves most problems by its own, Collects only basic relevant info	Regularly solves all problems, capable to generate new ideas, Collects great deal of relevant info
Tutorial	1.1.9	Hardly questions the teacher, does not try to solve assignments in class, does not discuss with peers	Does only what is asked to do in the class; seldom questions to clear doubts, interacts with peers	Comes prepared, asks questions, solves assignments in class, not that good in solving critical questions /problems	Asks interesting questions, guides the peers in solving critical questions /problems, explains on board if asked
Attendance	1.1.9	≤50%	>50% - 60%	>60% - 80%	>80%
Laboratory Experiments	1.1.10	Neither able to solve the known problem nor able to done the experiment.	Able to solve the problem but not able to complete the experiment.	Able to solve the problem and able to complete the experiment with few errors.	Able to solve the problem and able to complete the experiment with time.
Written Exams	1.2.1	≤40%	>40% - 60%	>60% - 80%	>80%
Laboratory Exams	1.2.2	≤40%	>40% - 60%	>60% - 80%	>80%
Student Semester Exit Survey	2.2.2	Got poor marks in sem; no confidence on subject	Got fair marks in sem; unwilling to pursue further studies on subject	Got good marks in sem; confident that learnt something new and useful	Got excellent marks in sem, highly confident about the subject and willing to pursue projects or learn more on it
Faculty and Staff Satisfaction Survey	2.2.5	Poor understanding of any related questions	Tries to response queries if initial hints are given	Also attempts to answer conceptual questions	Can manage any types of questions at any difficulty level with utmost confidence
Employer Survey	2.2.1	Can't answer anything	Attempts to answer basic questions	Good in both theory and programming, however weak in skill -related question	Promptly responses to any question, programming approach is efficient and confidently manages any program

Classroom Demonstration	Quality of Technical Content, Planning & Adherence to Context	1.1.8	Sketchy and incoherent, mostly irrelevant and out of context	Moderate coverage of topic, sometimes out of context	Informative but not to the point always	Smart, comprehensive, very relevant and effective
	Study & Understanding of the Topic		Minimal or no use of examples/cases; hardly any reference used	Very few meaningful examples used, no reference used	Examples and test cases used but not explained properly; References used but not following norms	Optimal use of well-chosen examples to clearly explain the topic
	Basic Knowledge in the related Science & Technology		Wrong response or explanation, least awareness	sketchy explanation, skipping complicated parts	Good explanation at some places, lack of thorough study	Clear understanding, thorough preparation
	Effective Use of Context Specific Examples, Test Cases and References		Cannot connect and explain the scientific reason behind or related technology	Can connect but cannot explain properly relevant theory or technology	Explains but not convincing and clear; lacks good knowledge of related technology	Demonstrates sound knowledge of related theory and technology; appears aware of latest related developments
	Q&A and interaction		Hardly invites questions and monotonous delivery	Accepts limited questions and makes minimal interaction	Interacts only at the end of demonstration	Interactive demonstration involving the audience
Micro Project	Research and gather information	1.1.11	Does not collect any information on the topic	Collects very limited info; some related to the topic	Collects some basic info; most refer to the topic	Collects a great deal of relevant information; all refer to the topic
	Analysis of Problem, Requirement Analysis		Asks every other person to explain the problem without any thinking	Understands the problem, cannot do requirement analysis correctly – requires guidance	Understands the problem and requirement; good attempt but incomplete documentation	Pinpoints the salient requirements, conceives additional features; prepares standard documentation
	Planning & Designing		Copies plan/design from peers	Cannot decide a plan – discusses with everybody to create a plan and design	Can plan and make a workable design by own	Plans the solution effectively with innovative ideas and effective design
	Application of Subject Knowledge		Poor subject knowledge; requires support of others; can't even use templates	Lack of knowledge forces copy-paste with not much understanding	Applies subject knowledge partly	Effectively applies subject knowledge
	Application of Related other Concept and Techniques - Integrated Approach		No real application of any engg. techniques; waits for others to do his part	Conceptually weak, aware of some techniques but cannot integrate; requires guidance	Theoretically strong; encouraging approach without much help –lacks optimization	Makes integrated approach and effective use of techniques /concept; guides others
	Developing a Solution/System		Poor IT skill - cannot implement	Can implement partly	Mostly implements but complexity higher	Implements fully with all requirements satisfied – effective and less complex soln

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Course Structure of IT502, Computer Architecture

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT502**, **Computer Architecture**, 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Mr. Soumyadip Dhar, M.E., Asst. Prof., Dept of IT • Moderator: Dr. Pramathanath Basu, Professor, PhD.
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Mr. Soumyadip Dhar (8 years, M.E. in Computer Science and engineering) • Dr. Pramathanath Basu (41 years, PhD)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Basic Electronics in First year, Introduction to computing in second semester, Analog & Digital electronics and Computer organization in Third semester.
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 3-1-0 Credit – 4 Theory 3 hours Lecture/ 1 Tutorial One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Describe working of computer systems and its basic principles 2. Analyze the system performance. 3. Relate the interconnections between various components of a modern computer 4. Visualize the design of different components of a computer

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Day 1	1L	Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance.	
Day 2	2L	Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards,	
Day 3	1T	Control hazards and structural hazards, techniques for handling hazards. Exception handling.	-
Day 4	2L	Pipeline optimization techniques; Compiler techniques for improving performance.	Selected Problems as Home Assignment

	Day 5	1L	Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance(Continued from previous class)	Selected Problems as Home Assignment
	Day 6	1T	Hierarchical memory technology: Inclusion, Coherence and locality properties;	Selected Problems as Home Assignment
	Day 7	2L	Cache memory organizations,	Selected Problems as Home Assignment
	Day 8	1T	Techniques for reducing cache misses	Selected Problems as Home Assignment
	Day 9	2L	Virtual memory organization, mapping and management techniques,	Selected Problems as Home Assignment
	Day 10	1T	Virtual memory organization, mapping and management techniques, (Continued from previous class)	Selected Problems as Home Assignment
	Day 11	2L	Memory replacement policies.	Selected Problems as Home Assignment
	Day 12	1T	Techniques for reducing cache misses	Selected Problems as Home Assignment
	Day 13	2L	Instruction-level parallelism: basic concepts,	Selected Problems as Home Assignment
	Day 14	2L	Techniques for increasing ILP, superscalar, superpipelined and VLIW processor architectures.	Selected Problems as Home Assignment
	Day 15	2L	Array and vector processors.	Selected Problems as Home Assignment
	Day 16	1T	Multiprocessor architecture: taxonomy of parallel architectures;	Selected Problems as Home Assignment
	Day 17	2L	Centralized shared- memory architecture: synchronization,	Selected Problems as Home Assignment
	Day 18	1T	Memory consistency, interconnection networks. (Continued from previous class)	Selected Problems as Home Assignment
	Day 19	1L	Distributed shared-memory architecture. Cluster computers.	Selected Problems as Home Assignment
	Day 20	1T	Non von Neumann architectures: data flow computers,	Selected Problems as Home Assignment
	Day 21	1L	Reduction computer architectures, systolic architectures.	Selected Problems as Home Assignment
	Day 22	1T	Problem solving Pipelining, Collision reduction and	

			performance of computer based problem	
	Day 23	1L	Revision of important topics and Doubt clear class	-
Additional Topics (Class + Tutorial)	• Introduction to Xilinx • Different problem on Collision detection, Reservation table, collision vector, state diagram. • Different type of cache miss reduction technique			
Activities of Students and Assignments	• Take part in Classroom Demonstration (group activity) • Take part in Quiz (individual activity) • Prepare Home Assignments • Prepare Library Assignments			
Hints for Learning-Teaching Approach (Course Delivery)	• Regular Class Lectures (learner-centric) – ✓ Involve students in discussion/expression of views ✓ Ask students to explain on board ✓ Ask questions to students on previously discussed /ongoing topic • Tutorial for interactive problem solving and doubt-clearing • Class room Demonstration (on selected topics) by students in groups • Home/Library Assignment and Notes/Study Material on topics not delivered in Class/Tutorial • Outside the class interaction with individual students having difficulty			
Course Assessment Policy	Assessment will be done in following two methods: 1. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester 2. Indirect Assessment – Opinion Survey Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows: • Attendance (Cont. Assmt. by Teacher): 5% • Average of Quiz + Assignments: (Cont. Assmt. by Teacher): 10% • Best of two 45 minutes Class Tests (Cont. Assmt. by Teacher): 15% • One 3-hours Term-end Exam (Terminal Assmt. by Univ.): 70% Points will be awarded by the Department upon assessing attainment of POs related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course-related PO is then found from the % of weighted average score w.r.t maximum avg score (4).			
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • 3 categories of questions in Class Tests • Library Assignment • Viva • Student Semester Exit Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics. The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics.			
Text Books and/or Reference Material	• **Text Books:** 1. Computer Architecture and Organization. John. P.Hayes Magraw- Hill. 2. Computrt system Architecture. M.Moris Mano. Pearson			

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Course Structure - IT 592, Computer Architecture

	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT592**, **Computer architecture Lab**, 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Mr. Soumyadip Dhar, M.E., Asst. Prof., Dept of IT • Moderator: Dr. Pramathanath Basu, Professor, PhD.
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Mr. Soumyadip Dhar (8 years, M.E. in Computer Science and engineering) • Dr. Pramathanath Basu (41 years, PhD)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Basic Electronics design in first year, Analog & Digital electronics and Computer organization in Third semester.
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 0-0-3 Credit – 2.0 Practical 3 hours Laboratory One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Implement compound circuit to achieve complex logical results 2. Create design for new circuit that may be effective for complex computation 3. Design the basic components of a machine using VHDL 4. Test the hardware components and analyze the performance of compound circuits using software tools
Topics covered based on syllabus of affiliating University MAKAUT	**Day** / **Duration** / **Topics** Week 1 / 3 Lab / VHDL introduction Week 2 / 3 Lab / Basic digital logic base programming with VHDL Week 3 / 3 Lab / 8-bit Addition, Multiplication, Division Week 4 / 3 Lab / 8-bit Register design Week 5 / 3 Lab / Memory unit design and perform memory operations Week 6 / 3 Lab / 8-bit simple ALU design Week 7 / 3 Lab / 8-bit simple CPU design Week 8 / 3 Lab / Interfacing of CPU and Memory
Additional Topics (Class + Tutorial)	Minor project using Xiling
Hints for Learning-Teaching Approach (Course Delivery)	• Program demonstration through projector. • Assignments on different modules as per syllabus. • Interactive problem solving and doubt-clearing session. • Outside the class interaction with individual students having problems.

Course Assessment Policy	• Attendance (Direct Assessment Method): 10% (University certification) • Assignments: (Direct Assessment Method): 20% • 1 viva voce at term end (Direct Assessment Method): 10% • 1 Final Term-end Lab. Exam (Direct Assessment Method): 60% • Students Feedback and Employer Survey (Indirect Assessment Methods) • Classroom Demonstration and Class Performance (Direct Assessment Method (Institute certification)
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of Pos related to the course outcome. • Additional Lab Assignments • Micro Project • Student Semester Exit Survey • Program & Dept. Evaluation Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Tool Table. The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics Table.
Text Books and/or Reference Material	• **Text Books**: 1. Computer Architecture and Organization. John. P.Hayes McGraw- Hill. 2. Computrt system Architecture. M.Moris Mano. Pearson

Mapping of Course Outcome with Program Outcome

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S. No.	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Computer Architecture. **IT(502) -Theory**	Describe working of computer systems and its basic principles	S											
		Analyze the system performance		S										
		Relate the interconnections between various components of a modern computer	S	M										
		Visualize the design of different components of a computer	S											

Selection of Assessment Components and Tools

IT-502 (Computer Architecture)					**Score (1 – 4)**	**Weighted Evaluation of Pos (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)**	
Component	**Ast - #**		**PO 1**	**PO 2**		**PO 1**	**PO 2**
Class Performance	1.1.1	Multiple Choice Questions (Quiz)	*S*			0.5 × Score	
	1.1.2	Short Answer type Questions (Class Test)	*S*	*S*		0.5 × Score	0.5 × Score
	1.1.3	Problem based Questions (Class Test)	*S*	*S*		0.5 × Score	0.5 × Score
	1.1.5	Open Ended Realistic Questions (Class Test)	*S*	*S*		0.5 × Score	0.5 × Score
	1.1.6	Assignments (Library/ Home Assignment)	*M*			0.3 × Score	
	1.1.7	Viva	*S*			0.5 × Score	
	1.1.9	Attendance	*S*			0.5 × Score	
Terminal Test	1.2.1	Written Semester Exams	*S*	*M*		0.5 × Score	0.3 × Score
Indirect Method	2.2.2	Student Semester Exit Survey	*W*	*S*		0.2 x Score	0.5 × Score
					Weighted Score (WS)	**Total / 4.0**	**Total / 2.3**
					% of PO attained	**WS * 100/4**	**WS * 100/4**

Assessment Rubrics

IT-502 (Computer Architecture)					
Assessment Tools		**Assessment Techniques**			
Assessment Method	**Ast - #**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions (Quiz)	1.1.1	<40%	>40% - <60%	>60% - <80%	>80%
Short Answer type Questions (Class Test)	1.1.2	<40%	>40% - <60%	>60% - <80%	>80%
Problem based Questions (Class Test)	1.1.3	<40%	>40% - <60%	>60% - <80%	>80%
Open Ended Realistic Questions (Class Test)	1.1.5	<40%	>40% - <60%	>60% - <80%	>80%
Assignment (Library/ Home)	1.1.6	Irregular	Regular but often search helps from instructor	Regular and solve all problems of its own	Regularly solves all problems and in addition to that is capable to generate new ideas
Viva	1.1.7	<40%	>40% - <60%	>60% - <80%	>80%
Attendance	1.1.9	≤50%	>50% - 60%	>60% - 80%	>80%
Written exams	1.2.1	<40%	>40% - <60%	>60% - <80%	>80%
Student Semester Exit Survey	2.2.2	Can't answer adequately on overall course	Know the basics of every module but less confident to write program for new problem	Can identify and confident to apply techniques	Efficient in selection of approach, can reason out how to do and what to do

Mapping of Course Outcome with Program Outcome

S. No.	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Computer Architecture. Lab IT592 ***-Practical***	Implement compound circuit to achieve complex logical results	M		S									
		Create design for new circuit that may be effective for complex computation			S									
		Design the basic components of a machine using VHDL			S		S							
		Test the hardware components and analyze the performance of compound circuits using software tools			S									

Selection of Assessment Components and Tools

IT-592 (Computer Architecture Lab)						**Score (1 – 4)**	**Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)**		
Component	**Ast - #**		**PO1**	**PO3**	**PO 5**		**PO1**	**PO3**	**PO 5**
Class Performance	1.1.9	Attendance	*S*				0.5 × Score		
	1.1.10	Laboratory Experiments/Assignments (incl. conducting physical tests using tools and preparing lab reports)	*M*				0.3 × Score		
	1.1.11	Micro Project (in labs) (to conduct experiments, integrate result, analyse result and report)	*M*	*M*			0.3 × Score	0.3 × Score	
Terminal Test	1.2.2	Laboratory Exams (to conduct certain experiments, tool based assignments and report the procedure, results etc. followed by Viva Voce)	*M*	*S*	*M*		0.3 × Score	0.5 × Score	0.3 × Score
Indirect Method	2.2.2	Student Semester Exit Survey	*W*		*S*		0.2 × Score		0.5 × Score
	2.2.4	Program & Dept. Evaluation Survey		*S*	*M*			0.5 × Score	0.3 × Score
						Weighted Score (WS)	**Total / 1.6**	**Total / 1.3**	**Total / 1.1**
						% of PO attained	**WS * 100/4**	**WS * 100/4**	**WS * 100/4**

Assessment Rubrics

IT-592 (Computer Architecture Lab)					
Assessment Tools		**Assessment Techniques**			
Assessment Method	**Ast - #**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Attendance	1.1.9	≤50%	>50% - 60%	>60% - 80%	>80%
Lab. Experiments & Assignment	1.1.10	Irregular	Regular but often search helps from instructor	Regular and solve all problems of its own	Regularly solves all problems and in addition to that is capable to generate new ideas
Micro project (in Labs)	1.1.11	No Performance	Can design basic modules but poor in integration	Can integrate and execute the project but organization of code is very poor and hard to reuse	Develops the project with structured coding and proper comments. Reusability is high and proper documentation is done
Laboratory Exams	1.2.2	<40%	>40% - <60%	>60% - <80%	>80%
Student semester exit survey	2.2.2	Can't answer adequately on overall course	Know the basics of every module but less confident to write program for new problem	Can identify and confident to apply techniques	Efficient in selection of approach, can reason out how to do and what to do
Prog. & Dept. evaluation survey	2.2.4	Can't solve many of the programming assignments	Can write previously seen programs but application to new program is poor	Can analysis a given problem very well but adopts complex strategy for programming	Efficient programming approach towards any problem

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Course Structure of IT-503, Operating System

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT-503**, **Operating System**, 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Mr. Moumita Deb, Assistant Professor Dept. of IT, M.Tech. • Moderator: Dr. P.N.Basu, Professor, PhD.
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Mr. Moumita Deb (10 years, M.Tech in Software Engineering) • Dr. P.N.Basu (41 yrs, PhD)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Computer organization and Basic programming concept.
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 3-0-0 Credit – 3 Theory 3 hours Lecture One Semester
Course Outcomes	Upon successful completion of this Theory course, students should be able : 1. Describe the services provided by and the design of an operating system 2. Explain the structure and organization of the file system 3. Interpret a process and how processes are synchronized and scheduled 4. Classify different approaches to memory management 5. Use system calls for managing processes, memory and the file system

Topics covered based on syllabus of affiliating University MAKAUT	Day	Duration	Topics	Assignment
	Day-1	2L	Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed, timesharing.	
	Day-2	1L	Introduction to OS. (Continue) real-time, distributed, parallel. Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections.	
	Day-3	2L	Operating system structure (simple, layered, virtual machine), O/S services, and system calls.	
	Day-4	1L	Concept of processes, process	

			scheduling, operations on processes.	
	Day-5	2L	Co-operating processes, interprocess communication.	Assignment-1
	Day-6	1L	Threads overview, benefits of threads, user and kernel threads.	
	Day-7	2L	Scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms FCFS.	Assignment-2
	Day-8	1L	Scheduling algorithms (SJF, RR, priority), algorithm evaluation, multi-processor scheduling.	
	Day-9	2L	Critical section problem, critical region, synchronization hardware.	
	Day-10	1L	Semaphores, classical problems of synchronization.	
	Day-11	2L	Deadlock characterization, methods for handling deadlocks,	
	Day-12	1L	Deadlock prevention, deadlock avoidance.	
	Day-13	2L	Deadlock detection, recovery from deadlock.	Assignment-3
	Day-14	1L	Logical vs. physical address space, swapping, contiguous memory allocation, paging.	
	Day-15	2L	Segmentation, segmentation with paging.	
	Day-16	1L	Demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.	Assignment-4
	Day-17	2L	File concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed).	
	Day-18	1L	Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance. Disk structure, disk scheduling (FCFS, SSTF).design patterns	
	Day-19	2L	Disk scheduling (SCAN,C-SCAN) , disk reliability, disk formatting, boot block, bad blocks.	
	Day-20	1L	I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and non-blocking I/O).	
	Day-21	2L	Kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.	

<table>
<tr><td rowspan="4"></td><td>Day-22</td><td>1L</td><td>Goals of protection, domain of protection, security problem.</td><td></td></tr>
<tr><td>Day-23</td><td>2L</td><td>Authentication, one time password, program threats, system threats, threat monitoring, encryption.</td><td></td></tr>
<tr><td>Day-24</td><td>2L</td><td>Revision of important topics</td><td></td></tr>
<tr><td>Day-25</td><td>1L</td><td>MAKAUT previous years question paper solve.</td><td></td></tr>
<tr><td>Additional Topics (Class + Tutorial) Activities and Assignments</td><td colspan="4">• Basic ideas of Distributed and Real Time Operating System</td></tr>
<tr><td>Activities of students and Assignments</td><td colspan="4">• Chalk-Board Lectures
• Class room Demonstration
• Quiz, Interaction
• Interactive problem solving and doubt-clearing session
• Outside the class interaction with individual students having problems</td></tr>
<tr><td>Hints for Learning-Teaching Approach (Course Delivery)</td><td colspan="4">• Regular Class Lectures (learner-centric) –
✓Involve students in discussion/expression of views
✓Ask students to explain on board
✓Ask questions to students on previously discussed /ongoing topic
• Class room Demonstration (on selected topics) by students in groups
• Home/Library Assignment and Notes/Study Material on topics not delivered in Class
• Outside the class interaction with individual students having difficulty</td></tr>
<tr><td>Course Assessment Policy</td><td colspan="4">Assessment will be done in following two methods:
1. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester
2. Indirect Assessment – Opinion Survey
Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows:
• Attendance (Cont. Assmt. by Teacher): 5%
• Average of Quiz + Assignments: (Cont. Assmt. by Teacher): 10%
• Best of two 45 mins Class Tests (Cont. Assmt. by Teacher): 15%
• One 3-hours Term-end Exam (Terminal Assmt. by Univ.): 70%
Points will be awarded by the Department upon assessing attainment of POs related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course-related PO is then found from the % of weighted average score w.r.t maximum avg score (4).</td></tr>
<tr><td>Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)</td><td colspan="4">In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome.
• 4 categories of questions in Class Tests
• Library Assignment
• Classroom Demonstration
• Micro Project
• Viva
• Student Semester Exit Survey
• Faculty & Staff Satisfaction Survey
• Alumni Survey
• Employer Survey
The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics</td></tr>
</table>

Text Books and/or Reference Material	**Text Books:** Abraham Silberschatz , Greg Gagne , Peter B. Galvin, "Operating System Concepts" **Reference Books:** 1. Milenkovie M., "Operating System : Concept & Design", McGraw Hill. 2. Tanenbaum A.S., "Operating System Design & Implementation", Practice Hall NJ. 3. Silbersehatz A. and Peterson J. L., "Operating System Concepts", Wiley. 4. Dhamdhere: Operating System TMH 5. Dietel H. N., "An Introduction to Operating Systems", Addison Wesley.

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Course Structure - IT 593, Operating System Lab

	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT593**, **Operating System Lab**, 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Ms. Moumita Deb, M.Tech., Asst. Prof., Dept of IT • Moderator: Dr. Pramathanath Basu, Professor, PhD.
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Ms. Moumita Deb (10 years, M.Tech. in Software Engineering) • Dr. Pramathanath Basu (41 years, PhD)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Introduction to computing in first year, Data structure and Computer organization in Third semester.
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 0-0-3 Credit – 2.0 Practical 3 hours Laboratory One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Grasp history, purpose and components of a UNIX shell 2. Create a user account, logon and get information using commands on a UNIX system 3. Use a UNIX text editor to create a shell script and run scripts effectively from the command line 4. Incorporate essential UNIX utilities such as eval, exec, exit and sleep in a program 5. Handle processes 6. Use shell flow control and conditional branching constructs, declare and initialize an array, access and sort the array elements

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics
Week 1	3 Lab	To learn about basic unix commands. Ex: who, cat, cd, ls. cp, rm, mv.
Week 2	3 Lab	To learn about basic unix command. Ex: chmod, grep, sort, gzip, gunzip,
Week 3	3 Lab	To learn about basic unix command.Ex: sleep, Ps, df, zcat, ls-l.
Week 4	3 Lab	To learn about basic vi editors.Ex::x,:w,:wq,:q,db,dw,:nd,:n mo p,m co P, :m, n w.
Week 5	3 Lab	To learn about basic shell script programme.
Week 6	3 Lab	To learn about shell script loop, conditional statement.
Week 7	3 Lab	To learn about shell script switch-case programme.
Week 8	3 Lab	To learn how to create process, replacing a process image, duplicating a process image, waiting for a process, Zombie

			Proc.
Additional Topics (Lab)	• Advanced Bash Scripting		
Activities and Assignments	• Take part in Lab Experiment (individual activity) • Prepare Home Assignments • Prepare Lab Reports • Complete Micro Project and submit Report (group activity)		
Hints for Learning-Teaching Approach (Course Delivery)	• Regular Lab Demonstrations (learner-centric) – ✓Involve students in discussion/expression of views ✓Ask students to explain on board ✓Ask questions to students on previously discussed /ongoing topic • Home Assignment on topics not delivered in Lab • Outside the Lab interaction with individual students having difficulty		
Course Assessment Policy	Assessment will be done in following two methods: 1. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester 2. Indirect Assessment – Opinion Survey Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows: • Attendance (Cont. Assmt. by Teacher): 10% • Lab Performance (Cont. Assmt. by Teacher): 10% • Lab Reports (Cont. Assmt. by Teacher): 20% • Lab Viva (Terminal Assmt. by Teacher/External Examiner): 20% • One 3-hours Term-end Lab Exam (Terminal Assmt. by University appointed External Examiner): 40% Points will be awarded by the Department upon assessing attainment of POs related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course-related PO is then found from the % of weighted average score w.r.t maximum avg score (4).		
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • 2 categories of questions in Class Tests • Micro Project • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey • Employer Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics. The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics.		
Text Books and/or Reference Material	• **Text Books:** 1. Unix Shell Programming, Yashwant P. Kanetkar. 2. Unix and Shell Programming, Sumitabha Das.		

Mapping of Course Outcomes with Program Outcomes

S. No.	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Operating System IT503 *- Theory*	1. Describe the services provided by and the design of an operating system	S											
		2. Explain the structure and organization of the file system	S											
		3. Interpret a process and how processes are synchronized and scheduled	S	S										
		4. Classify different approaches to memory management	S	M										
		5. Use system calls for managing processes, memory and the file system	M	S										
2	Unix & Shell Prog. Lab. **IT593** *- Practical*	1. Grasp history, purpose and components of a UNIX shell	S											
		2. Create a user account, logon and get information using commands on a UNIX system	M	S			S							
		3. Use a UNIX text editor to create a shell script and run scripts effectively from the command line	M	S			S							
		4. Incorporate essential UNIX utilities such as eval, exec, exit and sleep in a program	M				S							
		5. Process Handling	M	S			M							
		6. Use shell flow control and conditional branching constructs, declare and initialize an array, access and sort the array elements	S	M										

Selection of Assessment Components and Tools

IT – 503(Operating System)						Score (1 – 4)	Weighted Evaluation of Pos(W_S – 0.5 || W_M = 0.3 || W_W = 0.2)		
Assessment Tools			PO 1	PO 2	PO 5		PO 1	PO 2	PO5
Component	Ast #	Method/Element							
Class Performance	1.1.1	Multiple Choice Questions (Quiz)	*S*	-			0.5 × Score	-	
	1.1.2	Short Answer type Questions (Class Test)	*S*	-			0.5 × Score	-	
	1.1.3	Problem based Questions (Class Test)	*S*	*S*			0.5 × Score	0.5 × Score	
	1.1.4	Design oriented Questions (Class Test)	*M*	*M*	M		0.3 × Score	0.3 × Score	0.3 × Score
	1.1.5	Open Ended Realistic Questions (Class Test)	*M*	*S*			0.3 × Score	0.5 × Score	
	1.1.6	Library/ Home Assignment	*S*	-			0.5 × Score	-	
	1.1.7	Viva	*S*	-			0.5 × Score	-	
	1.1.9	Attendance	*M*	-			0.3 × Score	-	
Class Demonstration	1.1.8	Quality of Technical Content, Planning & Adherence to Context	*M*	-			0.3 × Score	-	-
		Study & Understanding of the Topic	*S*	-	-		0.5 × Score	-	-
		Basic Knowledge in the related Science & Technology	*S*	-	S		0.5 × Score	-	0.5 × Score
		Effective Use of Context Specific Examples, Test Cases and References	*S*	-	M		0.5 × Score	-	0.3 × Score
		Q&A and interaction	*S*	-	-		0.5 × Score	-	-
Minor Project	1.1.12	Research and gather information	*S*	-	-		0.5 × Score	-	
		Analysis of Problem, Requirement Analysis	*M*	*S*	M		0.3 × Score	0.5 × Score	0.3 × Score
		Planning & Designing	*S*	*S*			0.5 × Score	0.5 × Score	
		Application of Subject Knowledge	*S*	-			0.5 × Score	-	
		Application of Related other Concept and Techniques - Integrated Approach	*S*	*M*	S		0.5 × Score	0.3 × Score	0.5 × Score
		Developing Solution/System using modern IT skill	*S*	-	S		0.5 × Score	-	0.5 × Score
Terminal Test	1.2.1	Written Semester Exams	*S*	*S*	-		0.5 × Score	0.5 × Score	-
Indirect Method	2.2.2	Student Semester Exit Survey	*W*	*S*	S		0.2 × Score	0.5 × Score	0.5 × Score
	2.2.5	Faculty and Staff Satisfaction Survey	*W*	-	S		0.2 × Score	-	0.5 × Score
	2.2.1	Employer Survey	*S*	*M*	S		0.5 × Score	0.3 × Score	0.5 × Score
	2.2.6	Alumni Survey	*S*	-	S		0.5 × Score	-	0.5 × Score
Weighted Score for each PO							**Total/10.4**	**Total / 3.9**	**Total / 4.1**
					%PO attained		**WS/3 * 100**	**WS/3 * 100**	**WS/3 * 100**

Selection of Assessment Components and Tools

IT - 593 (Unix and Shell Programming Lab)							**Weighted Evaluation of POs(W_S – 0.5 || W_M = 0.3 || W_W = 0.2)**		
Assessment Tools			**PO1**	**PO 2**	**PO5**	**Score (1 – 4)**			
Component	**Ast - #**	**Method/Element**					**PO1**	**PO 2**	**PO5**
Lab Performance	1.1.3	Problem based Questions (Class Test)	*S*	*S*			0.5 × Score	0.5 × Score	
	1.1.4	Design oriented Questions (Class Test)	*M*	*S*	M		0.3 × Score	0.5 × Score	0.3 × Score
	1.1.9	Attendance	*M*	-			0.3 × Score	-	
	1.1.10	Laboratory Experiments/Assignments (incl. conducting physical tests using tools and preparing lab reports)	*M*	*M*	M		0.3 × Score	0.3 × Score	0.3 × Score
Minor Project	1.1.12	Research and gather information	*S*	-	-		0.5 × Score	-	-
		Analysis of Problem, Requirement Analysis	*M*	*S*	-		0.5 × Score	0.5 × Score	-
		Planning & Designing	*S*	*S*	-		0.5 × Score	0.5 × Score	-
		Application of Subject Knowledge	*S*	-	-		0.5 × Score	-	-
		Application of Related other Concept and Techniques - Integrated Approach	*S*	*M*	S		0.5 × Score	0.3 × Score	0.5 × Score
		Developing Solution/System using IT skill	*S*	-	S		0.5 × Score	-	0.5 × Score
Terminal Test	1.2.2	Laboratory Exams (to conduct certain experiments, tool based assignments and report the procedure, results etc.)	*M*	*M*	S		0.3 × Score	0.3 × Score	0.5 × Score
		Viva Voce	*S*	-	-		0.5 × Score	-	-
Indirect Method	2.2.2	Student Semester Exit Survey	*W*	*S*	S		0.2 × Score	0.5 × Score	0.5 × Score
	2.2.5	Faculty and Staff Satisfaction Survey	*W*	-	S		0.2 × Score	-	0.5 × Score
	2.2.1	Employer Survey	*S*	*M*	S		0.5 × Score	0.3 × Score	0.5 × Score
Weighted Score for each PO							**Total / 6.1**	**Total / 4.2**	**Total / 3.6**
						%PO attained	**WS/3 * 100**	**WS/3 * 100**	**WS/3 * 100**

Assessment Rubrics

IT 503 (Operating System) &**IT 691** (Unix and Shell Programming Lab)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Ast#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions (Quiz)	1.1.1	≤40%	>40% - 60%	>60% - 80%	>80%
Short Answer type Questions (Class Test)	1.1.2	≤40%	>40% - 60%	>60% - 80%	>80%
Problem based Questions (Class Test)	1.1.3	≤40%	>40% - 60%	>60% - 80%	>80%
Design oriented Questions (Class Test)	1.1.4	≤40%	>40% - 60%	>60% - 80%	>80%
Open Ended Realistic Questions (Class Test)	1.1.5	≤40%	>40% - 60%	>60% - 80%	>80%
Assignment (Library/ Home)	1.1.6	Irregular, mostly copies from peers	Regular but often search help from instructor, Collects info - not always relevant	Regular and solves most problems by its own, Collects only basic relevant info	Regularly solves all problems, capable to generate new ideas, Collects great deal of relevant info
Viva	1.1.7	Seldom responses	Often responses – few are correct	Regularly responses – mostly correct, fails to answer incisive questions	Seldom gives wrong answers; also gives to the point answers, correctly answers incisive questions
Tutorial	1.1.9	Hardly questions the teacher, does not try to solve assignments in class, does not discuss with peers	Does only what is asked to do in the class; seldom questions to clear doubts, interacts with peers	Comes prepared, asks questions, solves assignments in class, not that good in solving critical questions /problems	Asks interesting questions, guides the peers in solving critical questions /problems, explains on board if asked
Attendance	1.1.9	≤50%	>50%-60%	>60% - 80%	>80%
Laboratory Experiments	1.1.10	Neither able to solve the known problem nor able to done the experiment.	Able to solve the problem but not able to complete the experiment.	Able to solve the problem and able to complete the experiment with few errors.	Able to solve the problem and able to complete the experiment with time.
Written Semester Exam	1.2.1	≤40%	>40% - 60%	>60% - 80%	>80%
Laboratory Exams	1.2.2	≤40%	>40% - 60%	>60% - 80%	>80%
Student Semester Exit Survey	2.2.2	Got poor marks in sem; no confidence on subject	Got fair marks in sem; unwilling to pursue further studies on subject	Got good marks in sem; confident that learnt something new and useful	Got excellent marks in sem, highly confident about the subject and willing to pursue projects or learn more on it

Faculty and Staff Satisfaction Survey		2.2.5	Poor understanding of any related questions	Tries to response queries if initial hints are given	Also attempts to answer conceptual questions	Can manage any types of questions at any difficulty level with utmost confidence
Employer Survey		2.2.1	Can't answer anything	Attempts to answer basic questions	Good in both theory and programming, however weak in skill -related question	Promptly responses to any question, programming approach is efficient and confidently manages any program
Alumni Survey		2.2.6	Poor knowledge of any subject	Tries to answer but not specific	Attempts to answer conceptual questions	Can manage any types of questions at any difficulty level with utmost confidence
Classroom Demonstration	Quality of Technical Content, Planning & Adherence to Context	1.1.8	Sketchy and incoherent, mostly irrelevant and out of context	Moderate coverage of topic, sometimes out of context	Informative but not to the point always	Smart, comprehensive, very relevant and effective
	Study & Understanding of the Topic		Minimal or no use of examples/cases; hardly any reference used	Very few meaningful examples used, no reference used	Examples and test cases used but not explained properly; References used but not following norms	Optimal use of well-chosen examples to clearly explain the topic
	Basic Knowledge in the related Science & Technology		Wrong response or explanation, least awareness	sketchy explanation, skipping complicated parts	Good explanation at some places, lack of thorough study	Clear understanding, thorough preparation
	Effective Use of Context Specific Examples, Test Cases and References		Cannot connect and explain the scientific reason behind or related technology	Can connect but cannot explain properly relevant theory or technology	Explains but not convincing and clear; lacks good knowledge of related technology	Demonstrates sound knowledge of related theory and technology; appears aware of latest related developments
	Q&A and interaction		Hardly invites questions and monotonous delivery	Accepts limited questions and makes minimal interaction	Interacts only at the end of demonstration	Interactive demonstration involving the audience
Minor Project	Research and gather information	1.1.12	Does not collect any information on the topic	Collects very limited info; some related to the topic	Collects some basic info; most refer to the topic	Collects a great deal of relevant information; all refer to the topic
	Analysis of Problem, Requirement Analysis		Asks every other person to explain the problem without any thinking	Understands the problem, cannot do requirement analysis correctly – requires guidance	Understands the problem and requirement; good attempt but incomplete documentation	Pinpoints the salient requirements, conceives additional features; prepares standard documentation
	Planning & Designing		Copies plan/design from peers	Cannot decide a plan – discusses with everybody to create a plan and design	Can plan and make a workable design by own	Plans the solution effectively with innovative ideas and effective design
	Application of		Poor subject knowledge;	Lack of knowledge forces	Applies subject knowledge	Effectively applies subject knowledge

	Subject Knowledge		requires support of others; can't even use templates	copy-paste with not much understanding	partly	
	Application of Related other Concept and Techniques - Integrated Approach		No real application of any engg. techniques; waits for others to do his part	Conceptually weak, aware of some techniques but cannot integrate; requires guidance	Theoretically strong; encouraging approach without much help –lacks optimization	Makes integrated approach and effective use of techniques /concept; guides others
	Developing a Solution/System		Poor IT skill - cannot implement	Can implement partly	Mostly implements but complexity higher	Implements fully with all requirements satisfied – effective and less complex soln

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Course Structure of - IT504D, Operations Research

Format	Course Mapping
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT504D**, **Operations Research**, 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Dr. A Mukherjee, PhD, Assist. Prof., Dept of IT • Moderator: Dr. S Bhattacharyya, PhD, Assoc. Prof., Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Dr. Dr. A Mukherjee (15 years exp in teaching OR, Graphics, SAD,SE etc.) • Dr. S Bhattacharyya (13 years exp in teaching Programming, Multimedia, etc.)
Designation as a Compulsory or Elective course (Module)	Open Elective (Mathematics)
Pre-requisites Courses	Mathematics in 1st Yr., System Analysis & Design in 2nd Yr.
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 3-1-0 Credit – 4 Theory 3 hours Lecture and 1 hour Tutorial One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Determine the importance of different OR models in supporting managerial decisions 2. Formulate real-life and project management problems as Linear or Non-Linear OR problems 3. Solve different optimization problems applying OR models and methods

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Day 1	1L	Basic LPP and Applications	Study Material on 'Origin and Application of OR'
Day 2	2L	Solution of LPP using Simultaneous Equations and Graphical Method; Important definitions: Basic and non-Basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set	Selected problems on 'Graphical solution' as Home Assignment 1A
Day 3	1L+ 1T	Graphical Method (contd.)	Tutorial: Solving problems of all types (Max, Min, Infeasible, Multiple, Unbalanced,

				Degenerate)
	Day 4	2L	Solution of LPP by Simplex method;	Selected problems on 'Simplex' as Home Assignment 1B
	Day 5	1L+ 1T	Simplex method (contd.); Charles' Big-M Method	Tutorial: Duality Theory & example problems
	Day 6	2L	Transportation Problem: 3 methods for finding Basic Feasible Solution	Selected problems on 'Transportation' as Home Assignment 2A
	Day 7	1L+ 1T	Transportation Problem: Methods for finding final solution	Tutorial: Alternative methods for finding final solution
	Day 8	2L	Assignment Problems: Hungarian method	Selected problems on 'Assignment' as Home Assignment 2B
	Day 9	1L+ 1T	Special cases of Transportation & Assignment problems: Infeasible and Multiple solution and Unbalanced problem	Tutorial: Solving problems of different types
	Day 10	2L	Introduction to Game Theory; 2-Person Zero-sum Game, Saddle Point; Mini-Max and Maxi-Min Theorems	Study Material on 'Graphical Method of solving Game Theory problem'
	Day 11	1L	Games without Saddle Point; Principle of Dominance	Selected problems on 'Game Theory' as Home Assignment 3A
	Day 12	2L	Network: Shortest Path; Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); How to draw activity/event network diagram for projects	Library Assignment 1 on 'Network Problems & Solutions'
	Day 13	1L+ 1T	Critical Path Method (CPM)	-
	Day 14	2L	PERT	Selected problems on 'CPM, PERT' as Home Assignment 3B
	Day 15	1L+ 1T	Revision of Simplex, Graphical method	-
	Day 16	2L	Revision of Assignment, Transportation	-
	Day 17	1L+ 1T	Revision of CPM, PERT	-
	Day 18	2L	Introduction to Inventory problems; Definitions and EOQ Models.	Study Material on 'Inventory'

	Day 19	1L+ 1T	Deterministic Inventory problem	Tutorial: Problem solving
	Day 20	2L	Probabilistic Inventory problem	Selected problems on 'Inventory' as Home Assignment 3C
	Day 21	1L+ 1T	Queuing: Basic definitions and notations	Library Assignment 2 on 'Queuing Applications in Real Life'
	Day 22	2L	Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.	Notes with worked out problem on 'Axiomatic Derivation of the Arrival & Departure (Poisson Queue)'
	Day 23	1L+ 1T	Revision on Inventory and Queuing	-
	Day 24	2L	Doubt clearing and practice problems	Problem sheet
Additional Topics (Class + Tutorial)	• Application of LPP in real life situations • Special cases of Transportation & Assignment problems – Balanced, Unbalanced, Degenerate, Infeasible, Multiple solution problems • Inventory: VED, ABC & XYZ Analysis			
Activities of Students and Assignments	• Take part in Quiz (individual activity) • Prepare Home Assignments • Prepare Library Assignments			
Hints for Learning-Teaching Approach (Course Delivery)	• Regular Class Lectures (learner-centric) – ✓ Involve students in discussion/expression of views ✓ Ask students to explain on board ✓ Ask questions to students on previously discussed /ongoing topic • Tutorial for interactive problem solving and doubt-clearing • Home/Library Assignment and Notes/Study Material on topics not delivered in Class/Tutorial • Outside the class interaction with individual students having difficulty			
Course Assessment Policy	Assessment will be done in following two methods: 3. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester 4. Indirect Assessment – Opinion Survey Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows: • Attendance (Cont. Assmt. by Teacher): 5% • Average of Quiz + 3 Assignments: (Cont. Assmt. by Teacher): 10% • Best of two 1-hour Class Tests (Cont. Assmt. by Teacher): 15% • One 3-hours Term-end Exam (Terminal Assmt. by Univ.): 70% Points will be awarded by the Department upon assessing attainment of POs related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course-related PO is then found from the % of weighted average score w.r.t maximum avg score (4).			
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • 5 categories of questions in Class Tests • 2 Library Assignments • Tutorial			

	• Viva • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics. The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics.
Text Books and/or Reference Material	• **Text Books:** 1. H. A. Taha, "Operations Research", Pearson 2. P. M. Karak, "Linear Programming and Theory of Games", ABS Publishing House 3. Ghosh and Chakraborty, "Linear Programming and Theory of Games", Central Book Agency 4. Ravindran, Philips and Solberg, "Operations Research", WILEY INDIA • **Reference Books:** 1. Kanti Swaroop, "Operations Research", Sultan Chand & Sons 2. Rathindra P. Sen, "Operations Research: Algorithms and Applications", PHI 3. R. Panneerselvam, "Operations Research", PHI 4. A.M. Natarajan, P. Balasubramani and A. Tamilarasi, "Operations Research", Pearson 5. M. V. Durga Prasad, "Operations Research", CENGAGE Learning 6. J. K. Sharma, "Operations Research", Macmillan Publishing Company

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Course Structure – IT 594D, Operations Research Lab.

	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT594D**, **Operations Research Lab** , 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Dr. A Mukherjee, PhD, Assist. Prof., Dept of IT • Moderator: Dr. S Bhattacharyya, PhD, Assoc. Prof., Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Dr. Dr. A Mukherjee (15 years exp in teaching OR, Graphics, SAD,SE etc.) • Dr. S Bhattacharyya (13 years exp in teaching Programming, Multimedia, etc.)
Designation as a Compulsory or Elective course (Module)	Open Elective (Mathematics)
Pre-requisites Courses	Mathematics in 1st Yr., C -language in 1st Yr. , IT504D (Operations Research) in 3rd Yr.
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 0-0-3 Credit – 2 Practical 3 hours Laboratory One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Solve simple Linear problems applying the OR models and using C/C++ programming language Design for new project that may be effective for complex computation. 2. Develop user friendly applications for modelling and solving small scale project management problems using C/C++ 3. Use OR package TORA in solving standard OR problems

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics
Week 1	3 P	Generate a m*n matrix - input and display the elements using C/C++ and a suitable tool (e.g. MATLAB/TORA)
Week 2	3 P	
Week 3	3 P	Find the maximum/minimum element of a row/column of a m*n matrix and the element at intersection of a row/column using C/C++ and and a suitable tool (e.g. MATLAB/TORA)
Week 4	3 P	
Week 5	3 P	Add a new row/column to a m*n matrix, add/subtract elements of two row/column and multiply a given row/column with a number using C/C++ and a suitable tool (e.g. MATLAB/TORA)
Week 6	3 P	
Week 7	3 P	Find Basic Feasible solution of a Transportation Problem using Matrix-Minimum method / North West Corner Method / VAM using C/C++ and a suitable tool (e.g. TORA)
Week 8	3 P	
Week 9	3 P	Find value and saddle point of a 2 person 0 sum Game using C/C++ and a suitable tool (e.g. TORA)
Week 10	3 P	Find optimal solution of an Assignment problem using

	Week 11	3 P	Hungarian method using C/C++ and a suitable tool (e.g. TORA)
Additional Topics	• Standard operations on a 2*2 matrix • Use of OR package TORA		
Activities of Students and Assignments	• Do weekly laboratory experiments using C/C++ and a suitable tool (e.g. MATLAB /TORA) and document the results • Prepare and submit Lab Report • Complete Micro Project and submit Report		
Hints for Learning-Teaching Approach (Course Delivery)	• Small assignments (on matrix) to familiarize students before introducing matrix-based solution for most OR problems • Explanation of program logic for the lab assignments • Demonstration of tools like MATLAB /TORA • On-the-machine programming guidance and doubt-clearing at individual level • Outside the class interaction with students having problems • Additional assignments to practice beyond the laboratory hours		
Course Assessment Policy	Assessment will be done in following two methods: 1. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester 2. Indirect Assessment – Opinion Survey Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows: • Attendance + weekly lab experiments + report + quizzes/assignment (Cont. Assmt. by Teacher): **40%** • One 3-hours Term-end Lab Exam incl. experiment, viva-voce and report (Assmt. by Univ. Expert): **60%** Points will be awarded by the Department upon assessing attainment of POs related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course-related PO is found from the % of weighted average score w.r.t maximum avg score (4)		
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	Continuous Assessment (40%) • Attendance: 5% • Performance/ Laboratory practice and problem solving: 15% • Lab Report: 15% • Interaction & Homework, Quizzes and Assignments: 5% Terminal Assessment (60%) • Final Exam (Practical test) - Experiment Report: 20%, - Experiment performance: 20%, - Comprehensive viva voce on the allotted work: 20% In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • Additional Lab Assignments • Micro Project • Employer Survey • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics (Table 1). The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics (Table 2).		
Text Books and/or Reference Material	• **Text Books:** 1. H. A. Taha, "Operations Research", Pearson **2.** Ravindran, Philips and Solberg, "Operations Research", WILEY INDIA **3.** Lab Manual-OR		

Mapping of Course Outcome with Program Outcome

S. No	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Operations Research (IT 504D)	1. Determine the importance of different OR models in supporting managerial decisions	S	S										
		2. Formulate real-life and project management problems as Linear or Non-Linear OR problems	S	S									M	
		3. Solve different optimization problems applying OR models and methods	S	M	S								S	

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Selection of Assessment Components and Tools

IT – 504D (Operations Research)							Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)			
Assessment Tools			PO 1	PO 2	PO 3	PO 11		PO 1	PO 2	PO 3	PO 11
Component	Ast #	Method/Element									
Class Performance	1.1.1	Multiple Choice Questions (Quiz)	*S*	-	-	-		0.5 × Score	-	-	-
	1.1.2	Short Answer type Questions (Class Test 1)	*S*	-	-	-		0.5 × Score	-	-	-
	1.1.3	Problem based Questions (Class Test 1)	*S*	*S*	-	*M*		0.5 × Score	0.5 × Score	-	0.3 × Score
	1.1.4	Design oriented Questions (Class Test 2)	*M*	*M*	*S*	*S*		0.3 × Score	0.3 × Score	0.5 × Score	0.5 × Score
	1.1.5	Open Ended Realistic Questions (Class Test 2)	*M*	*S*	-	*S*		0.3 × Score	0.5 × Score	-	0.5 × Score
	1.1.6	Library/ Home Assignment	*S*	-	-	*M*		0.5 × Score	-	-	0.3 × Score
	1.1.7	Viva	*S*	-	-	-		0.5 × Score	-	-	-
	1.1.9	Tutorial	*S*	*M*	-	*S*		0.5 × Score	0.3 × Score	-	0.5 × Score
	1.1.9	Attendance	*M*	-	-	-		0.3 × Score	-	-	-
Micro Project	1.1.11	Research and gather information	*S*	-	-	*M*		0.5 × Score	-	-	0.3 × Score
		Analysis of Problem, Requirement Analysis	*M*	*S*	*M*	*S*		0.3 × Score	0.5 × Score	0.3 × Score	0.5 × Score
		Planning & Designing	*M*	*S*	*S*	*S*		0.3 × Score	0.5 × Score	0.5 × Score	0.5 × Score
		Application of Subject Knowledge	*S*	-	-	*M*		0.5 × Score	-	-	0.3 × Score
		Application of Related other Concept and Techniques - Integrated Approach	*S*	*M*	*M*	*S*		0.5 × Score	0.3 × Score	0.3 × Score	0.5 × Score
		Developing Solution/System using IT skill	*S*	-	*S*	*S*		0.5 × Score	-	0.5 × Score	0.5 × Score
Terminal Test	1.2.1	Written Semester Exams	*S*	*S*	-	-		0.5 × Score	0.5 × Score	-	-
		Viva	*S*	-	-	*W*		0.5 × Score	-	-	0.2 × Score
Indirect Method	2.2.2	Student Semester Exit Survey	*S*	*S*	*S*	*M*		0.5 × Score	0.5 × Score	0.5 × Score	0.3 × Score
	2.2.5	Faculty and Staff Satisfaction Survey	*M*	*M*	*M*	*M*		0.3 × Score	0.3 × Score	0.3 × Score	0.3 × Score
						Weighted Score (WS)		**Total/8.3**	**Total / 4.2**	**Total / 2.9**	**Total / 5.5**
						%PO attained		**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

Assessment Rubrics

IT 504D (Operations Research)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Ast#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions (Quiz)	1.1.1	≤40%	>40% - 60%	>60% - 80%	>80%
Short Answer type Questions (Class Test)	1.1.2	≤40%	>40% - 60%	>60% - 80%	>80%
Problem based Questions (Class Test)	1.1.3	≤40%	>40% - 60%	>60% - 80%	>80%
Design oriented Questions (Class Test)	1.1.4	≤40%	>40% - 60%	>60% - 80%	>80%
Open Ended Realistic Questions (Class Test)	1.1.5	≤40%	>40% - 60%	>60% - 80%	>80%
Assignment (Library/ Home)	1.1.6	Irregular, mostly copies from peers	Regular but often search help from instructor, Collects info - not always relevant	Regular and solves most problems by its own, Collects only basic relevant info	Regularly solves all problems, capable to generate new ideas, Collects great deal of relevant info
Viva	1.1.7	Seldom responses	Often responses – few are correct	Regularly responses – mostly correct, fails to answer incisive questions	Seldom gives wrong answers; also gives to the point answers, correctly answers incisive questions
Tutorial	1.1.9	Hardly questions the teacher, does not try to solve assignments in class, does not discuss with peers	Does only what is asked to do in the class; seldom questions to clear doubts, interacts with peers	Comes prepared, asks questions, solves assignments in class, not that good in solving critical questions / problems	Asks interesting questions, guides the peers in solving critical questions / problems, explains on board if asked
Attendance	1.1.9	≤50%	>50% - 60%	>60% - 80%	>80%
Written exams	1.2.1	≤40%	>40% - 60%	>60% - 80%	>80%
Student Semester Exit Survey	2.2.2	Got poor marks in sem; no confidence on subject	Got fair marks in sem; unwilling to pursue further studies on subject	Got good marks in sem; confident that learnt something new and useful	Got excellent marks in sem, highly confident about the subject and willing to pursue projects or learn more on it
Faculty and Staff Satisfaction Survey	2.2.5	Poor understanding of any related questions	Tries to response queries if initial hints are given	Also attempts to answer conceptual questions	Can manage any types of questions at any difficulty level with utmost confidence

`IT 504D (Operations Research)						
Assessment Tools			**Grading Criteria**			
Method/Element		**#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Micro Project	Research and gather information	1.1.11	Does not collect any information on the topic	Collects very limited info; some related to the topic	Collects some basic info; most refer to the topic	Collects a great deal of relevant information; all refer to the topic
	Analysis of Problem, Requirement Analysis		Asks every other person to explain the problem without any thinking	Understands the problem, cannot do requirement analysis correctly – requires guidance	Understands the problem and requirement; good attempt but incomplete documentation	Pinpoints the salient requirements, conceives additional features; prepares standard documentation
	Planning & Designing		Copies plan/design from peers	Cannot decide a plan – discusses with everybody to create a plan and design	Can plan and make a workable design by own	Plans the solution effectively with innovative ideas and effective design
	Application of Subject Knowledge		Poor subject knowledge; requires support of others; can't even use templates	Lack of knowledge forces copy-paste with not much understanding	Applies subject knowledge partly	Effectively applies subject knowledge
	Application of Related other Concept and Techniques - Integrated Approach		No real application of any engg. techniques; waits for others to do his part	Conceptually weak, aware of some techniques but cannot integrate; requires guidance	Theoretically strong; encouraging approach without much help –lacks optimization	Makes integrated approach and effective use of techniques /concept; guides others
	Developing a Solution/System		Poor IT skill - cannot implement	Can implement partly	Mostly implements but complexity higher	Implements fully with all requirements satisfied – effective and less complex soln

Mapping of Course Outcome with Program Outcome

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Operations Research Lab IT-594D	1.Solve simple Linear problems applying the OR models and using C/C++ programming language	S	S										
	2.Develop user friendly applications for modelling and solving small scale project management problems using C/C++	M	S	S									
	3.Use OR package TORA in solving standard OR problems	M	M			S							

Selection of Assessment Components and Tools

IT 594D (Operations Research Lab)							Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)			
Assessment Tools			PO 1	PO 2	PO 3	PO 5					
Component	Ast #	Method/Element						PO 1	PO 2	PO 3	PO 5
Class Performance	1.1.9	Attendance	*M*	-	-	-		0.3 × Score	-	-	-
	1.1.10	Laboratory Experiments/Assignments (incl. conducting physical tests using tools and preparing lab reports)	*S*	*S*	*M*	*S*		0.5 × Score	0.5 × Score	0.3 × Score	0.3 × Score
Micro Project	1.1.11	Research and gather information	*S*	-	-	-		0.5 × Score	-	-	-
		Analysis of Problem, Requirement Analysis	*M*	*S*	*M*	-		0.3 × Score	0.5 × Score	0.3 × Score	-
		Planning & Designing	*M*	*S*	*S*	-		0.3 × Score	0.5 × Score	0.5 × Score	-
		Application of Subject Knowledge	*S*	-	-	*M*		0.5 × Score	-	-	0.3 × Score
		Application of Related other Concept and Techniques - Integrated Approach	*S*	*M*	*M*	*M*		0.5 × Score	0.3 × Score	0.3 × Score	0.3 × Score
		Developing Solution/System using IT skill	*S*	-	*S*	*S*		0.5 × Score	-	0.5 × Score	0.5 × Score
Terminal Test	1.2.2	Laboratory Exams (to conduct certain experiments, tool based assignments and report the procedure, results etc. followed by Viva Voce)	*S*	*S*	*M*	-		0.5 × Score	0.5 × Score	0.3 × Score	-
Indirect Method	2.2.1	Employer Survey	*M*	*S*	*S*	*S*		0.3 × Score	0.5 × Score	0.5 × Score	0.5 × Score
	2.2.2	Student Semester Exit Survey	*S*	-	*S*	*M*		0.5 × Score	-	0.5 × Score	0.3 × Score
	2.2.5	Faculty & Staff Satisfaction Survey	*S*	*S*	*M*	*M*		0.5 × Score	0.5 × Score	0.3 × Score	0.3 × Score
						Weighted Score (WS)		**Total / 5.2**	**Total / 3.3**	**Total / 3.5**	**Total / 2.5**
						% of PO attained		**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

Assessment Rubrics

IT 594D (Operations Research Lab)						
Assessment Tools			**Grading Criteria**			
Method/Element		**Ast#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Attendance		1.1.9	≤50%	>50% - 60%	>60% - 80%	>80%
Lab. Experiments & Assignment		1.1.10	Irregular	Regular but often searches help from instructor	Regular and does experiments and assignments by its own	Regular and self sufficient; results are accurate and reports are neat
Laboratory Exams		1.2.2	<40%	>40% - <60%	>60% - <80%	>80%
Employer Survey		2.2.1	Can't answer anything	Try to answer basic questions	Good in both theory and programming, however weak at skill related question	Promptly responses to any question, programming approach is efficient and confidently manages any program
Student semester exit survey		2.2.2	Can't answer adequately on overall course	Know the basics of every module but less confident to write program for new problem	Can identify and confident to apply techniques	Efficient in selection of approach, can reason out how to do and what to do
Faculty & Staff Satisfaction Survey		2.2.5	Can't solve many of the programming assignments	Can write previously seen programs but application to new program is poor	Can analysis a given problem very well but adopts complex strategy for programming	Efficient programming approach towards any problem
Micro Project	Research and gather information	1.1.11	Does not collect any information on the topic	Collects very limited info; some related to the topic	Collects some basic info; most refer to the topic	Collects a great deal of relevant information; all refer to the topic
	Analysis of Problem, Requirement Analysis		Asks every other person to explain the problem without any thinking	Understands the problem, cannot do requirement analysis correctly – requires guidance	Understands the problem and requirement; good attempt but incomplete documentation	Pinpoints the salient requirements, conceives additional features; prepares standard documentation
	Planning & Designing		Copies plan/design from peers	Cannot decide a plan – discusses with everybody to create a plan and design	Can plan and make a workable design by own	Plans the solution effectively with innovative ideas and effective design
	Application of Subject Knowledge		Poor subject knowledge; requires support of others; can't even use templates	Lack of knowledge forces copy-paste with not much understanding	Applies subject knowledge partly	Effectively applies subject knowledge
	Application of Related other Concept and Techniques - Integrated Approach		No real application of any engg. techniques; waits for others to do his part	Conceptually weak, aware of some techniques but cannot integrate; requires guidance	Theoretically strong; encouraging approach without much help –lacks optimization	Makes integrated approach and effective use of techniques /concept; guides others
	Developing a Solution/System		Poor IT skill - cannot implement	Can implement partly	Mostly implements but complexity higher	Implements fully with all requirements satisfied – effective and less complex soln

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Course Structure of IT-504F, Programming Practices using C++

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT-504F**, **Programming Practices using C++**, 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Mr. Hiranmoy Roy, Assistant Professor Dept. of IT, M.Tech. • Moderator: Mrs. Moumita Deb, Assistant Professor, M.Tech.
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Mr. Hiranmoy Roy (10 years, M.Tech in Computer Technology) • Mrs. Moumita Deb (8 years, M.Tech)
Designation as a Compulsory or Elective course (Module)	Free Elective (FE)
Pre-requisites Courses	Programming concepts using C.
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 3-1-0 Credit – 3/4 Theory 3 hours Lecture , 1 hour Tutorial One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Co-relate the basic features available in C++ with other programming languages. 2. Apply the features of C++ to solve small problems. 3. Develop object oriented models for given scenarios using Unified Modeling Language. 4. Apply the object oriented features of C++ Programming Language to translate object oriented models to object oriented programs.

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment
Day-1	2L	Programming paradigms, Language translator, Basics of OOP, Structure of C++ program, Class and object, Abstraction and encapsulation, Polymorphism.	
Day-2	1L	Inheritance, Static and dynamic binding. Data types, Variables, Constants, Operator and expression, Operator precedence and associativity.	Assignment-1
Day-3	1T	Discussion and Problem Solving	
Day-4	2L	Statements: Labelled, Expression, Compound, Control, Jump, Declaration, Try-throw-catch.	

	Day-5	1L	Array, Addresses, Pointer. Function: Declaration, Definition and call, Inline function, Main function argument, Reference-variable	Assignment-2
	Day-6	1T	Discussion and Problem Solving	
	Day-7	2L	Function overloading, Default argument, Parameter passing, Recursion, Scope of variable, Return-by-value and Return-by-reference, Pointer to function.	
	Day-8	1L	Class, Members, Constructor and destructor, Copy constructor.	Assignment-3
	Day-9	1T	Discussion and Problem Solving	
	Day-10	2L	Dynamic memory management: Operators new and delete, Malloc and free.	
	Day-11	1L	Static member, Scope of class names, Scope of variables	
	Day-12	1T	Discussion and Problem Solving	
	Day-13	2L	Overloading unary and binary operator, Overloaded function calls	
	Day-14	1L	Subscripting, class member access, Non-member-operator, New and delete, Cast operator	Assignment-4
	Day-3	1T	Discussion and Problem Solving	
	Day-15	2L	Polymorphism, Coercion, Overloading, Parametric and inclusion polymorphism	
	Day-16	1L	Inheritance: direct and indirect super classes, Multiple inheritance, Virtual base class, Friend, Virtual function	
	Day-3	1T	Discussion and Problem Solving	
	Day-17	2L	Abstract class, Overriding and hiding, Dynamic binding of functions, Virtual destructor and operators.	
	Day-18	1L	Class template, Member function inclusion, Function template, Specialization, Inheritance, Namespace.	Assignment-5
	Day-19	1T	Discussion and Problem Solving	
	Day-20	2L	Concept of exception handling, Catch block, Nested try-catch block, Condition expression in throw expression, Constructor & destructor, Runtime standard exception.	
	Day-21	1L	Standard library function, Input and output, Iostream class hierarchy, Class ios, Other stream classes	
	Day-22	1T	Discussion and Problem Solving	
	Day-23	2L	Software development, Qualities of software system, Software	

<table>
<tr><td rowspan="3"></td><td></td><td></td><td>architecture, Process life cycle, phases, Modularity,</td><td></td></tr>
<tr><td>Day-24</td><td>1L</td><td>OO methodology, Modeling, UML overview, Object oriented design patterns</td><td></td></tr>
<tr><td>Day-25</td><td>1T</td><td>Discussion and Problem Solving</td><td></td></tr>
<tr><td>Additional Topics (Class + Tutorial) Activities and Assignments</td><td colspan="4">• Singleton class and its use
• Memory leakage and how to stop it</td></tr>
<tr><td>Activities of students and Assignments</td><td colspan="4">• Take part in Classroom Demonstration (group activity)
• Take part in Quiz (individual activity)
• Prepare Home Assignments
• Prepare Library Assignments</td></tr>
<tr><td>Hints for Learning-Teaching Approach (Course Delivery)</td><td colspan="4">• Regular Class Lectures (learner-centric) –
✓Involve students in discussion/expression of views
✓Ask students to explain on board
✓Ask questions to students on previously discussed /ongoing topic
• Tutorial for interactive problem solving and doubt-clearing
• Class room Demonstration (on selected topics) by students in groups
• Home/Library Assignment and Notes/Study Material on topics not delivered in Class/Tutorial
• Outside the class interaction with individual students having difficulty</td></tr>
<tr><td>Course Assessment Policy</td><td colspan="4">Assessment will be done in following two methods:
1. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester
2. Indirect Assessment – Opinion Survey
Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows:
• Attendance (Cont. Assmt. by Teacher): 5%
• Average of Quiz + Assignments: (Cont. Assmt. by Teacher): 10%
• Best of two 1-hour Class Tests (Cont. Assmt. by Teacher): 15%
• One 3-hours Term-end Exam (Terminal Assmt. by Univ.): 70%
Points will be awarded by the Department upon assessing attainment of POs related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course-related PO is then found from the % of weighted average score w.r.t maximum avg score (4).</td></tr>
<tr><td>Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)</td><td colspan="4">In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome.
• 4 categories of questions in Class Tests
• Library Assignment
• Classroom Demonstration
• Viva
• Student Semester Exit Survey
• Faculty & Staff Satisfaction Survey
• Employer Survey
The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics. The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics.</td></tr>
<tr><td>Text Books and/or Reference Material</td><td colspan="4">Text Books:
1. C++ object oriented programming paradigm, Debasish Jana, PHI
2. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
Reference Books:
1. Schildt, H., The Complete Reference C++, McGraw – Hill.
2. Rajaram: Object Oriented Programming and C++, New Age International</td></tr>
</table>

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Course Structure of IT-594F, Programming Practices using C++ Lab

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT-594F**, **Programming Practices using C++ Lab**, 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Mr. Hiranmoy Roy, Assistant Professor Dept. of IT, M.Tech. • Moderator: Mrs. Moumita Deb, Assistant Professor, M.Tech.
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Mr. Hiranmoy Roy (10 years, M.Tech in Computer Technology) • Mrs. Moumita Deb (8 years, M.Tech)
Designation as a Compulsory or Elective course (Module)	Free Elective (FE)
Pre-requisites Courses	Programming concepts using C and Java.
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 0-0-3 Credit – 2 Practical 3 hours Laboratory One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Solve simple problems applying the basic concepts of C++. 2. Apply all the available object oriented features of C++ Programming Language. 3. Develop user friendly object oriented applications for small scale real life problems using C++.
Topics covered based on syllabus of affiliating University MAKAUT	**Day** / **Topics**
	Day-1: Introduction of UNIX/Linux Operating System. Vi-editor, introduction to GNU C & C++ compiler. How to execute C++ program.
	Day-2: **Introduction to C++:** Basic loop control, writing functions, selection statements, review of functions and parameters, command line arguments, recursion. **Assignment:** Pascal's Triangle using ${}^{n}C_{r}$ formulae.
	Day-3: **I/O streams, arrays and string manipulation, pointers, structures & unions.** **Assignment:** Create student information having name, roll and marks and print the name of the student who got highest marks.
	Day-4: **Fundamentals of classes**, constructors-destructors. Dealing

		with member functions. **Assignment:** Create a Fraction class and add two fraction object using member function.
	Day-5	**Operator overloading** and polymorphism. **Assignment:** Overload the following operators: pre++, ++post, >>, <<, >=.
	Day-6	**Dealing with inheritance**, derived class handling, abstract class, virtual class, overriding. **Assignment:** Banking accounts.
	Day-7	**Assignment:** Inherit array class into stack class and queue class and then again inherit the queue into circular queue and linear queue.
	Day-8	**Template:** Class template and function template. **Assignment:** Create a array template class and bubble sort template function for int, float and char data.
	Day-9	**Exception handling**. **Assignment:** Handling Divided by zero, Array index out of bound.
	Day-10	**Dynamic memory allocation**. **Assignment:** Linked list creation.
Additional Topics (Lab) Activities and Assignments	• **Singleton class** • **Virtual Destructor**	
Activities and Assignments	• Take part in Lab Experiment (individual activity) • Prepare Home Assignments • Prepare Lab Reports • Complete Micro Project and submit Report (group activity)	
Hints for Learning-Teaching Approach (Course Delivery)	• Regular Lab Demonstrations (learner-centric) – ✓ Involve students in discussion/expression of views ✓ Ask students to explain on board ✓ Ask questions to students on previously discussed /ongoing topic • Home Assignment on topics not delivered in Lab • Outside the Lab interaction with individual students having difficulty	
Course Assessment Policy	Assessment will be done in following two methods: 1. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester 2. Indirect Assessment – Opinion Survey Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows: • Attendance (Cont. Assmt. by Teacher): 10% • Lab Performance (Cont. Assmt. by Teacher): 10% • Lab Reports (Cont. Assmt. by Teacher): 20% • Lab Viva (Terminal Assmt. by Teacher/External Examiner): 20% • One 3-hours Term-end Lab Exam (Terminal Assmt. by University appointed External Examiner): 40% Points will be awarded by the Department upon assessing attainment of POs related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course-related PO is then found from the % of weighted average score w.r.t maximum avg score (4).	
Hints for Course Assessment instruments & processes (both continuous and semester-end	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome.	

assessment)	• Micro Project • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey • Employer Survey • The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics. The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics.
Text Books and/or Reference Material	**Text Books:** 1. C++ object oriented programming paradigm, Debasish Jana, PHI 2. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India **Reference Books:** 1. Schildt, H., The Complete Reference C++, McGraw – Hill. 2. Rajaram: Object Oriented Programming and C++, New Age International

Mapping of Course Outcome with Program Outcome

S. No.	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Programming Practices using C++ (IT504F) - *Theory*	1. Co-relate the basic features available in C++ with other programming languages.	S											
		2. Apply the features of C++ to solve small problems.	M	S										
		3. Develop object oriented models for given scenarios using Unified Modeling Language.			S		S							
		4. Apply the object oriented features of C++ Programming Language to translate object oriented models to object oriented programs.	M	S	S									
2	Programming Practices using C++ Lab (IT594F)- *Practical*	1. Solve simple problems applying the basic concepts of C++.		S										
		2. Apply all the available object oriented features of C++ Programming Language.		M	S									
		3. Develop user friendly object oriented applications for small scale real life problems using C++.			S									

Selection of Assessment Components and Tools

IT – 504F (Programming Practices using C++)							Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)			
Assessment Tools			PO 1	PO 2	PO 3	PO 5		PO 1	PO 2	PO 3	PO 5
Component	Ast #	Method/Element									
Class Performance	1.1.1	Multiple Choice Questions (Quiz)	*S*	-	-	-		0.5 × Score	-	-	-
	1.1.2	Short Answer type Questions (Class Test 1)	*S*	-	-	-		0.5 × Score	-	-	-
	1.1.3	Problem based Questions (Class Test 1)	*S*	*S*	-	*S*		0.5 × Score	0.5 × Score	-	0.5 × Score
	1.1.4	Design oriented Questions (Class Test 2)	*M*	*M*	*S*	-		0.3 × Score	0.3 × Score	0.5 × Score	-
	1.1.5	Open Ended Realistic Questions (Class Test 2)	*M*	*S*	-	-		0.3 × Score	0.5 × Score	-	-
	1.1.6	Library/ Home Assignment	*S*	-	-	*M*		0.5 × Score	-	-	0.3 × Score
	1.1.7	Viva	*S*	-	-	*S*		0.5 × Score	-	-	0.5 × Score
	1.1.9	Tutorial	*S*	*M*	-	*S*		0.5 × Score	0.3 × Score	-	0.5 × Score
	1.1.9	Attendance	*M*	-	-	-		0.3 × Score	-	-	-
Class Demonstration	1.1.8	Quality of Technical Content, Planning & Adherence to Context	*M*	-	-	-		0.3 × Score	-	-	-
		Study & Understanding of the Topic	*S*	-	-	-		0.5 × Score	-	-	-
		Basic Knowledge in the related Science & Technology	*S*	-	-	-		0.5 × Score	-	-	-
		Effective Use of Context Specific Examples, Test Cases and References	*S*	-	-	-		0.5 × Score	-	-	-
		Q&A and interaction	*S*	-	-	-		0.5 × Score	-	-	-
Micro Project	1.1.11	Research and gather information	*S*	-	-	-		0.5 × Score	-	-	-
		Analysis of Problem, Requirement Analysis	*M*	*S*	*M*	-		0.3 × Score	0.5 × Score	0.3 × Score	-
		Planning & Designing	*S*	*S*	*S*	-		0.5 × Score	0.5 × Score	0.5 × Score	-
		Application of Subject Knowledge	*S*	-	-	-		0.5 × Score	-	-	-
		Application of Related other Concept and Techniques - Integrated Approach	*S*	*M*	*M*	*M*		0.5 × Score	0.3 × Score	0.3 × Score	0.3 × Score
		Developing Solution/System using IT skill	*S*	-	*S*	*S*		0.5 × Score	-	0.5 × Score	0.5 × Score
Terminal Test	1.2.1	Written Semester Exams	*S*	*S*	-	-		0.5 × Score	0.5 × Score	-	-
		Viva	*S*	-	-	*W*		0.5 × Score	-	-	0.2 × Score
Indirect Method	2.2.2	Student Semester Exit Survey	*S*	*S*	*S*	*S*		0.5 × Score	0.5 × Score	0.5 × Score	0.5 × Score
	2.2.5	Faculty and Staff Satisfaction Survey	*M*	*M*	*M*	*S*		0.3 × Score	0.3 × Score	0.3 × Score	0.5 × Score
	2.2.5	Employer Survey	*M*	*M*	*S*	*S*		0.3 × Score	0.3 × Score	0.5 × Score	0.5 × Score
						Weighted Score (WS)		Total/11.1	Total / 4.5	Total / 3.4	Total / 4.3
						%PO attained		WS/4 * 100	WS/4 * 100	WS/4 * 100	WS/4 * 100

Selection of Assessment Components and Tools

IT – 594F (Programming Practices using C++ Lab)							Weighted Evaluation of POs (W_S – 0.5 | | W_M = 0.3 | | W_W = 0.2)		
Assessment Tools			PO1	PO 2	PO3	Score (1 – 4)			
Component	Ast - #	Method/Element					PO1	PO 2	PO3
Lab Performance	1.1.3	Problem based Questions (Class Test)	*S*	*S*	-		0.5 × Score	0.5 × Score	-
	1.1.4	Design oriented Questions (Class Test)	*M*	*S*	*S*		0.3 × Score	0.5 × Score	0.5 × Score
	1.1.9	Attendance	*M*	-	-		0.3 × Score	-	-
	1.1.10	Laboratory Experiments/ Assignments (incl. conducting physical tests using tools and preparing lab reports)	*M*	*M*	-		0.3 × Score	0.3 × Score	
Micro Project	1.1.11	Research and gather information	*S*	-	-		0.5 × Score	-	-
		Analysis of Problem, Requirement Analysis	*M*	*S*	*M*		0.5 × Score	-	-
		Planning & Designing	*S*	*S*	*S*		0.3 × Score	0.5 × Score	0.3 × Score
		Application of Subject Knowledge	*S*	-	-		0.5 × Score	0.5 × Score	0.5 × Score
		Application of Related other Concept and Techniques - Integrated Approach	*S*	*M*	*M*		0.5 × Score	-	-
		Developing Solution/System using IT skill	*S*	-	*S*		0.5 × Score	0.3 × Score	0.3 × Score
Terminal Test	1.2.2	Laboratory Exams (to conduct certain experiments, tool based assignments and report the procedure, results etc.)	*M*	*M*	*S*		0.3 × Score	0.3 × Score	0.5 × Score
		Viva Voce	*S*	-	-			0.5 × Score	-
Indirect Method	2.2.2	Student Semester Exit Survey	*S*	*S*	*S*		0.5 × Score	0.5 × Score	0.5 × Score
	2.2.5	Faculty and Staff Satisfaction Survey	*M*	*M*	*M*		0.3 × Score	0.3 × Score	0.3 × Score
	2.2.1	Employer Survey	*M*	*M*	*S*		0.3 × Score	0.3 × Score	0.5 × Score
					Weighted Score for each PO		**Total / 5.6**	**Total / 4.5**	**Total / 3.4**
					%PO attained		**WS/3 * 100**	**WS/3 * 100**	**WS/3 * 100**

Assessment Rubrics

IT 504F (Programming Practices using C++) & IT 594F (Programming Practices using C++ Lab)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Ast#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions (Quiz))	1.1.1	≤40%	>40% - 60%	>60% - 80%	>80%
Short Answer type Questions (Class Test)	1.1.2	≤40%	>40% - 60%	>60% - 80%	>80%
Problem based Questions (Class Test)	1.1.3	≤40%	>40% - 60%	>60% - 80%	>80%
Design oriented Questions (Class Test)	1.1.4	≤40%	>40% - 60%	>60% - 80%	>80%
Open Ended Realistic Questions (Class Test)	1.1.5	≤40%	>40% - 60%	>60% - 80%	>80%
Assignment (Library/ Home)	1.1.6	Irregular, mostly copies from peers	Regular but often search help from instructor, Collects info - not always relevant	Regular and solves most problems by its own, Collects only basic relevant info	Regularly solves all problems, capable to generate new ideas, Collects great deal of relevant info
Viva	1.1.7	Seldom responses	Often responses – few are correct	Regularly responses – mostly correct, fails to answer incisive questions	Seldom gives wrong answers; also gives to the point answers, correctly answers incisive questions
Tutorial	1.1.9	Hardly questions the teacher, does not try to solve assignments in class, does not discuss with peers	Does only what is asked to do in the class; seldom questions to clear doubts, interacts with peers	Comes prepared, asks questions, solves assignments in class, not that good in solving critical questions /problems	Asks interesting questions, guides the peers in solving critical questions /problems, explains on board if asked
Attendance	1.1.9	≤50%	>50% - 60%	>60% - 80%	>80%
Laboratory Experiments	1.1.10	Neither able to solve the known problem nor able to done the experiment.	Able to solve the problem but not able to complete the experiment.	Able to solve the problem and able to complete the experiment with few errors.	Able to solve the problem and able to complete the experiment with time.
Written Exams	1.2.1	≤40%	>40% - 60%	>60% - 80%	>80%
Laboratory Exams	1.2.2	≤40%	>40% - 60%	>60% - 80%	>80%
Student Semester Exit Survey	2.2.2	Got poor marks in sem; no confidence on subject	Got fair marks in sem; unwilling to pursue further studies on subject	Got good marks in sem; confident that learnt something new and useful	Got excellent marks in sem, highly confident about the subject and willing to pursue projects or learn

						more on it
Faculty and Staff Satisfaction Survey		2.2.5	Poor understanding of any related questions	Tries to response queries if initial hints are given	Also attempts to answer conceptual questions	Can manage any types of questions at any difficulty level with utmost confidence
Employer Survey		2.2.1	Can't answer anything	Attempts to answer basic questions	Good in both theory and programming, however weak in skill -related question	Promptly responses to any question, programming approach is efficient and confidently manages any program
Classroom Demonstration	Quality of Technical Content, Planning & Adherence to Context	1.1.8	Sketchy and incoherent, mostly irrelevant and out of context	Moderate coverage of topic, sometimes out of context	Informative but not to the point always	Smart, comprehensive, very relevant and effective
	Study & Understanding of the Topic		Minimal or no use of examples/cases; hardly any reference used	Very few meaningful examples used, no reference used	Examples and test cases used but not explained properly; References used but not following norms	Optimal use of well-chosen examples to clearly explain the topic
	Basic Knowledge in the related Science & Technology		Wrong response or explanation, least awareness	sketchy explanation, skipping complicated parts	Good explanation at some places, lack of thorough study	Clear understanding, thorough preparation
	Effective Use of Context Specific Examples, Test Cases and References		Cannot connect and explain the scientific reason behind or related technology	Can connect but cannot explain properly relevant theory or technology	Explains but not convincing and clear; lacks good knowledge of related technology	Demonstrates sound knowledge of related theory and technology; appears aware of latest related developments
	Q&A and interaction		Hardly invites questions and monotonous delivery	Accepts limited questions and makes minimal interaction	Interacts only at the end of demonstration	Interactive demonstration involving the audience
Micro Project	Research and gather information	1.1.11	Does not collect any information on the topic	Collects very limited info; some related to the topic	Collects some basic info; most refer to the topic	Collects a great deal of relevant information; all refer to the topic
	Analysis of Problem, Requirement Analysis		Asks every other person to explain the problem without any thinking	Understands the problem, cannot do requirement analysis correctly – requires guidance	Understands the problem and requirement; good attempt but incomplete documentation	Pinpoints the salient requirements, conceives additional features; prepares standard documentation
	Planning & Designing		Copies plan/design from peers	Cannot decide a plan – discusses with everybody to create a plan and design	Can plan and make a workable design by own	Plans the solution effectively with innovative ideas and effective design
	Application of Subject Knowledge		Poor subject knowledge; requires support of others; can't even use templates	Lack of knowledge forces copy-paste with not much understanding	Applies subject knowledge partly	Effectively applies subject knowledge
	Application of Related other Concept and Techniques -		No real application of any engg. techniques; waits for others to do his part	Conceptually weak, aware of some techniques but cannot integrate; requires guidance	Theoretically strong; encouraging approach without much help –lacks optimization	Makes integrated approach and effective use of techniques /concept; guides others

	Integrated Approach					
	Developing a Solution/System		Poor IT skill - cannot implement	Can implement partly	Mostly implements but complexity higher	Implements fully with all requirements satisfied – effective and less complex soln

Third Year Second Semester

Syllabus of B. Tech (IT)

Third Year - Sixth Semester

A. THEORY							
Sl.No.	**Field**	**Theory**	**Contact Hours/Week**				**Cr. Pts**
			L	**T**	**P**	**Total**	
1	**HU601**	Principles of Management	2	0	0	2	2
2	**IT.601**	Data Base Management System	3	0	0	3	3
3	**IT602**	Computer Networking	3	0	0	3	3
4	**IT603**	Software Engg	3	0	0	3	3
5	**P.E.**		3	0	0	3	3
	IT604A	Information Theory & Coding					
	IT604B	Computer Graphics					
	IT604C	Pattern Recognition					
	IT604D	ERP					
6	**F. E.**		3	0/1	0	3/4	3/4
	IT605A	Discrete Mathematics (M)					
	IT605B	Human Resource Management (HSS)					
	IT605C	Compiler Design (CSE)					
	IT605D	Artificial Intelligence (CSE)					
		Total of Theory				**17/18**	**17/18**
B. PRACTICAL							
7	**IT691**	Data Base Management System Lab	0	0	3	3	2
8	**IT692**	Computer Networking	0	0	3	3	2
9	**IT693**	Software Engineering	0	0	3	3	2
10	**IT681**	Seminar	0	0	3	3	2
Total of Practical						**12**	**8**
Total of Semester						**29/30**	**25/26**

SEMESTER – VI

Theory

Principles of Management
HU-601
Contracts: 2L
Credits- 2

Module-I

1. Basic concepts of management: Definition – Ess ence, Functions, Roles, Level.

2. Functions of Management: Planning – Concept, N ature, Types, Analysis, Management by objectives; Organisation Structure – Concept, Structure, Principles, Centrali zation, Decentralization, Span of Management; Organisational Effectiveness.

Module-II

3. Management and Society – Concept, External Env ironment, CSR, Corporate Governance, Ethical Standards.

4. People Management – Overview, Job design, Recr uitment & Selection, Training & Development, Stress Management.

5. Managerial Competencies – Communication, Motiva tion, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship.

Module-III

6. Leadership: Concept, Nature, Styles.
7. Decision making: Concept, Nature, Process, Tools & techniques.

8. Economic, Financial & Quantitative Analysis – Production, Markets, National Income Accounting, Financial Function

& Goals, Financial Statement & Ratio Analysis, Quantitative Methods – Statistical Interference, Forecas ting, Regression Analysis, Statistical Quality Control.

Module-IV

9. Customer Management – Market Planning & Researc h, Marketing Mix, Advertising & Brand Management.

10. Operations & Technology Management – Productio n & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.

Text Books

1. Management: Principles, Processes & Practices – Bhat, A & Kumar, A (OUP).
2. Essentials for Management – Koontz, Revised edit ion, Tata McGraw Hill (TMH)
3. Management – Stoner, James A. F. (Pearson)
4. Management - Ghuman, Tata McGraw Hill(TMH)

Database Management System
IT-601
Contracts: 3L
Credits- 3

Introduction

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Entity-Relationship Model

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

Relational Model

Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

SQL and Integrity Constraints

Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Relational Database Design

Functional Dependency, Different anamolies in designing a Database., Normalization using funtional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Nomalization using multi-valued depedencies, 4NF, 5NF

Internals of RDBMS

Physical data structures, Query optimization : join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management : transaction model properties, state serializability, lock base protocols, two phase locking.

File Organization & Index Structures

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree .

Text Books

1. Henry F. Korth and Silberschatz Abraham, “Database System Concepts”, Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, “Fundamentals of Database Systems”, Benjamin Cummings Publishing. Company.
3. Ramakrishnan: Database Management System , McGraw-Hill
4. Gray Jim and Reuter Address, “Transaction Processing : Concepts and Techniques”, Moragan Kauffman Publishers.
5. Jain: Advanced Database Management System CyberTech
6. Date C. J., “Introduction to Database Management”, V ol. I, II, III, Addison Wesley.
7. Ullman JD., “Principles of Database Systems”, Galgo ttia Publication.

Reference Books

1. James Martin, “Principles of Database Management S ystems”, 1985, Prentice Hall of India, New Delhi
2. “Fundamentals of Database Systems”, Ramez Elmasri, S hamkant B.Navathe, Addison Wesley Publishing Edition
3. “Database Management Systems”, Arun K.Majumdar, Pr itimay Bhattacharya, Tata McGraw Hill

Computer Networking
IT-602
Contracts: 3L
Credits- 3

Module I
Overview of Data Communication and Networking:

Introduction; Data communications: components, data representation (ASCII,ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN,WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Physical Level:
Overview of data(analog & digital), signal(analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;

Module II
Data link Layer

Types of errors, framing(character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC;

Medium Access sub layer:

Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet(in brief);

Module III
Network layer:

Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : IP addressing, subnetting; Routing : techniques, static vs. dynamic routing , Unicast Routing Protocols: RIP, OSPF, BGP; Other Procols: ARP, IP, ICMP, IPV6;.

Transport layer

Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm,

Module IV
Application Layer

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls.

Modern topics:

ISDN services & ATM, DSL technology, Cable Modem: Architecture & Operation in brief Wireless LAN: IEEE 802.11, Introduction to blue-tooth.

Text Books

1. B. A. Forouzan – "Data Communications and Networki ng (3rd Ed.) " – TMH
2. A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
3. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas
7. Miller, Digital & Data Communication, Jaico
8. Shay, Understanding Data Communication & Network, Vikas

Reference Books

1. Kurose and Rose – " Computer Networking -A top dow n approach featuring the internet" – Pearson Educat ion
2. Leon, Garica, Widjaja – "Communication Networks" – TMH
3. Walrand – "Communication Networks" – TMH.
4. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3 (4th Ed.)" – Pearson Education/PHI

Software Engineering
IT-603
Contracts: 3L
Credits- 3

Module I
Overview of System Analysis & Design , Business System Concept, System Development Life Cycle, Waterfall Model , Spiral Model, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model.

Module II
System Design – Context diagram and DFD, Problem Par titioning, Top-Down And Bottom-Up design; Decision tree, decision table and structured English; Functional vs. Object- Oriented approach.

Module III
Coding & Documentation – Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation. Testing – Levels of Testing, Integration Testing, T est case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control.

Module IV
Software Project Management – Project Scheduling, S taffing, Software Configuration Management, Quality Assurance, Project Monitoring.

Module V
Fundamentals of Object Oriented design in UML
Static and dynamic models, why modeling, UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram.

Some Justifications about the changes made in the above syllabus Note:
1. "UML extensibility- model constraints and comments, Note, Stereotype" is omitted to fit the syllabus in 10L.
2. There are 44 lectures in the current syllabus and the proposed syllabus is also spans 44 lectures.
3. To my opinion, "Coding & Documentation – Structur ed Programming, OO Programming, Information Hiding, Reuse, System Documentation. [4L]" from Module III may be removed and then total lectures get reduced to 40.

Professional Elective

Information Theory & Coding
IT-604A
Contracts: 3L
Credits- 3

Source Coding
Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes.

Channel Capacity And Coding
Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit.

Linear And Block Codes For Error Correction
Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes.

Cyclic Codes
Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes.

BCH Codes
Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.

Convolutional Codes

Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding.

Text Books

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.
3. Introduction to Information Theory - M Mansurpur; McGraw Hill.
4. Information Theory - R B Ash; Prentice Hall.
5. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

Computer Graphics
IT-604B
Contracts: 3L
Credits- 3

Module I:
Introduction to computer graphics & graphics systems: Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.

Scan conversion: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

Module II:
2D transformation & viewing: Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse. Cohen and Sutherland line clipping,

Sutherland-Hodgeman Polygon clipping, Cyrus-beck clipping method

3D transformation & viewing: 3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, view port clipping, 3D viewing.

Module III:

Curves: Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves.

Hidden surfaces: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal - geometry.

Color & shading models: Light & color model; interpolative shading model; Texture.

Introduction to Ray-tracing:
Human vision and color, Lighting, Reflection and transmission models.

Text Books

1. Hearn, Baker – "Computer Graphics (C version 2nd Ed .)" – Pearson education
2. Z. Xiang, R. Plastock – " Schaum's outlines Comput er Graphics (2nd Ed.)" – TMH
3. D. F. Rogers, J. A. Adams – "Mathematical Eleme nts for Computer Graphics (2nd Ed.)" – TMH

Pattern Recognition
IT-604C
Contracts: 3L
Credits- 3

1. Basics of pattern recognition
2. Bayesian decision theory
   - 2.1. Classifiers, Discriminant functions, Decision surfaces
   - 2.2. Normal density and discriminant functions
   - 2.3. Discrete features
3. Parameter estimation methods
   - 3.1. Maximum-Likelihood estimation
   - 3.2. Gaussian mixture models
   - 3.3. Expectation-maximization method
   - 3.4. Bayesian estimation
4. Hidden Markov models for sequential pattern classification
   - 4.1. Discrete hidden Markov models
   - 4.2. Continuous density hidden Markov models
5. Dimension reduction methods
   - 5.1. Fisher discriminant analysis
   - 5.2. Principal component analysis
   - 5.3. Parzen-window method
   - 5.4. K-Nearest Neighbour method
6. Non-parametric techniques for density estimation
7. Linear discriminant function based classifier

7.1. Perceptron
7.2. Support vector machines

8. Non-metric methods for pattern classification
   - 8.1. Non-numeric data or nominal data
   - 8.2. Decision trees
9. Unsupervised learning and clustering

9.1. Criterion functions for clustering
9.2. Algorithms for clustering: K-means, Hierarchical and other methods

Text Books

1. R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification, John Wiley, 2001.
2. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

ERP
IT-604D
Contracts: 3L
Credits- 3

Module 1: Overview of ERP

1. The evolution of ERP systems: A historical perspective

Evolution through Payroll system, Inventory Control system, Materials Requirement Planning (MRP I) system, Manufacturing Resource Planning (MRP II) system, Their advantages and disadvantages. Definition and Concept of ERP, Business reasons for rise and popularity of ERP system - Benefits of an ERP system

2. Business processes supported by ERP systems

Various business functions in an Organization – Pur chasing, Materials Management, Manufacturing, Sales & Distribution, Plant Maintenance, Quality Management, Finance & Accounting including Costing, Human Resources etc.

ERP market place – SAP, Oracle, PeopleSoft, JD Edw ards, Baan, Microsoft's suit of products etc.

Business modules in these ERP packages – a brief comparative description of business function modules and sub-modules.

Overview of key end-to-end business processes supported in two major ERP systems (preferably SAP and Oracle)

– Order to Cash, Procure to Pay, Plan to Produce and Despatch.

Module 2 : Information Technology and ERP systems

1. The evolution of Information Technology (IT): A historical perspective

Evolution of computer generations (hardware and software) – Operating systems, File systems to Databa se Management systems, Communication Networks. Enabling of ERP systems by IT evolution.

2. The evolution of ERP systems architecture

Client-Server based architecture, Multi-Tier architecture – Presentation layer, Application layer, and Database layer (On-line Transaction Processing – OLTP). Brief discussion on Extended ERP systems - Web-enabled ERP architecture, Service-Oriented Architecture and Cloud Computing. Open Source ERP.

3. Related technology concepts

ERP and Supply Chain Management (SCM), and Customer Relationship Management (CRM), ERP and Business Intelligence (some of the popular tools like Cognos, Business Objects should be mentioned), ERP and Data warehousing (Data Mart, Data Mining and On-line Analytical Processing - OLAP), ERP and E-business.

Module 3: Implementation of ERP system
Types of services required in implementation – Consu lting, Configuration, Customization and Support

1. ERP implementation approach

Single vendor versus Best-of Breed ERP implementation, Big Bang versus

Phased (by module/ site) implementation, Using ERP of Application Service Provider (ASP).

2. ERP implementation life cycle

Planning different aspects (Economic viability, Senior Management commitment, Resource requirements, Change management etc.), Understanding requirements and Process preparation – Gap analysis and Business Proces s Engineering, User Acceptance criteria, Design, Configuration, Customization (difference between Configuration and Customization, advantages and disadvantages), Extensions, Data migration, End-user training, User Acceptance, Going live, Roll-out. Differences between ERP implementation life cycle and Custom Software development phases. Drawbacks of ERP system.

3. Organizing implementation

Interaction with Vendors, Consultants, and Users. Contracts with Vendors, Consultants, and Employees. Project Management and Monitoring. ERP Project Organization

– Formation of Steering Committee and different Use r Groups. Top Management Commitment and Steering Committee meetings. Change Management, Risks and Challenges in ERP implementation.

4. Post-implementation Support, Review, Maintenance and Security of ERP systems

A typical Support Cycle (Planning, Stabilization, Ongoing and Upgrade phases). Post-implementation Review of ERP systems – measures of review (Efficiency, Effect iveness, and Competitive Advantage), and approaches for review (User attitude survey, Cost/benefit analysis, Compliance audit, Budget performance review, Service level monitoring, Technical review, Product review, Integration review etc.). System maintenance and ERP system maintenance. Software upgrade (patch, release, version). Security and Access control of ERP systems.

Module 4 : Emerging Trends and Future of ERP systems

1. Emerging Technologies and ERP

Service-oriented Architecture (SOA): Enterprise SOA layers – Business processes, Business services, Components and Integration services, Advantages and Drawbacks of
SOA, When to use SOA, Difference between multi-layered Client-server architecture and SOA, basic awareness of NetWeaver from SAP, Websphere from Oracle and .Net from Microsoft.

Enterprise Application Integration (EAI): Basic understanding of the concept, Types of EAI (levels) – User Interface, Method (logic), Application Interface, Data.

EAI architecture – Typical framework (Business Proce sses, Components &Services, Messaging service, and Transport service. Mention of some of the leading EAI vendors – IBM, Microsoft, Oracle, SAP, TIBCO. Radio Frequency Identification (RFID) and ERP: awareness of RFID technology, Benefits of RFID integrated with ERPs.

M-Commerce: basic concept and applications, difference with E-Commerce, benefits of integration with ERPs.

2. Future of ERP

Technology transformation to SOA, more E-Commerce features, Growing mobile applications, Economical and Easy models of ERP deployment etc.

Text Books

1. Enterprise Resource Planning – A Managerial Perspect ive by D P Goyal, Tata McGraw Hill Education, 2011
2. Enterprise Resource Planning by Ashim Raj Singla, Cengage Learning, 2008

Reference Books

1. Enterprise Resource Planning, 2nd Edition by Alexis Leon, Tata McGraw Hill Education, 2008

Free Elective

Discrete Mathematics
IT-605A
Contracts: 3L
Credits- 3

Module I:
Introduction to Propositional Calculus: Propositions, Logical Connectives, Conjunction, Disjunction, Negation and their truth table. Conditional Connectives, Implication, Converse, Contrapositive, Inverse, Biconditional statements with truth table, Logical Equivalence, Tautology, Normal forms-CNF, DNF; Predicates and Logical Quantifications of propositions and related examples.

Module II:
Theory of Numbers: Well Ordering Principle, Divisibility theory and properties of divisibility; Fundamental theorem of Arithmetic; Euclidean Algorithm for finding G.C.D and some basic properties of G.C.D with simple examples; Congruences, Residue classes of integer modulo n (Zn) and its examples.
Order, Relation and Lattices: POSET, Hasse Diagram, Minimal , Maximal, Greatest and Least elements in a POSET, Lattices and its properties, Principle of Duality, Distributive and Complemented Lattices.

Module III:
Counting Techniques: Permutations, Combinations, Binomial coefficients, Pigeon- hole Principle, Principles of inclusion and exclusions; Recurrence relations: Formulation/Modelling of different counting problems in terms of recurrence relations, Solution of linear recurrence relations with constant coefficients (upto second order) by (i) The iterative method (ii) Characteristic roots method (iii) Generating functions method.

Module IV:
Graph Coloring: Chromatic Numbers and its bounds, Independence and Clique Numbers, Perfect Graphs-Definition and examples, Chromatic polynomial and its determination, Applications of Graph Coloring. Matchings: Definitions and Examples of Perfect Matching, Maximal and Maximum Matching, Hall's Marriage Theorem (Statement only) and related problems.

Text Books

1. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
2. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
3. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
4. Gary Chartrand and Ping Zhang – Introduction to Grap h Theory, TMH

Reference Books

1. J.K. Sharma, Discrete Mathematics, Macmillan
2. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.
3. S. K. Chakraborty and B. K. Sarkar, Discrete Mathematics, OXFORD University Press.
4. Douglas B. West, Introduction to graph Theory, PHI

Human Resource Management (HSS)
IT-605B
Contracts: 3L
Credits- 3

Introduction : HR Role and Functions, Concept and Significance of HR, Changing role of HR managers - HR functions and Global Environment, role of a HR Manager.

Human Resources Planning : HR Planning and Recruitment: Planning Process - planning at different levels - Job Analysis - Recruitment and selection processes - Restructuring strategies - Recruitment-Sources of Recruitment-Selection Process-Placement and Induction-Retention of Employees.

Training and Development : need for skill upgradation - Assessment of training needs - Retraining and Redeployment methods and techniques of training employees and executives - performance appraisal systems.

Performance Management System : Definition, Concepts and Ethics-Different methods of Performance Appraisal- Rating Errors-Competency management.

Industrial Relations : Factors influencing industrial relations - State Interventions and Legal Framework - Role of Trade unions - Collective Bargaining - Workers' participation in management.

Text Books

1. Gary Dessler, Human Resource Management - (8th ed.,) Pearson Education, Delhi
2. Decenzo & Robbins, Personnel / Human Resource Management, 3rd ed., John Wiley & Sons
3. Biswajeet Patanayak, Human Resource Management, PHI, New Delhi
4. Luis R. Gomez, Mejia, Balkin and Cardy, Managing Human Resources PHI, New Delhi.

Compiler Design
IT-605C
Contracts: 3L
Credits- 3

Introduction to Compiling
Compilers, Analysis of the source program, The phases of the compiler, Cousins of the compiler.
Lexical Analysis
The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).
Syntax Analysis

The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.

Syntax directed translation

Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

Type checking

Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions

Run time environments

Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

Intermediate code generation

Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

Code optimization

Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.

Code generations

Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Text books

1. Aho, Sethi, Ullman - “Compiler Principles, Techni ques and Tools” - Pearson Education.
2. Holub - “Compiler Design in C” - PHI.

Artificial Intelligence
IT-605D
Contracts: 3L
Credits- 3

Introduction

Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.

Intelligent Agents

Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

Problem Solving

Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

Search techniques

Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

Heuristic search strategies

Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Adversarial search

Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Knowledge & reasoning

Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Using predicate logic

Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

Representing knowledge using rules
Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Probabilistic reasoning
Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.

Planning
Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

Natural Language processing
Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.

Learning
Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Expert Systems
Representing and using domain knowledge, expert system shells, knowledge acquisition.

Basic knowledge of programming language like Prolog & Lisp

Text Books

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS

Practical

Database Management System Lab
Code: IT691
Contact: 3P
Credits: 2

Structured Query Language
1. Creating Database
Creating a Database Creating a Table
Specifying Relational Data Types Specifying Constraints
Creating Indexes

2. Table and Record Handling
INSERT statement
Using SELECT and INSERT together

3. DELETE, UPDATE, TRUNCATE statements DROP, ALTER statements
Retrieving Data from a Database
1. The SELECT statement
2. Using the WHERE clause
3. Using Logical Operators in the WHERE clause

4. Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING

Clause
5. Using Aggregate Functions

6. Combining Tables Using JOINS

7. Subqueries
4. Database Management
Creating Views

Creating Column Aliases Creating Database Users
Using GRANT and REVOKE

Cursors in Oracle PL / SQL
Writing Oracle PL / SQL Stored Procedures

Computer Networking Lab
Code: IT692
Contact: 3P
Credits: 2

NIC Installation & Configuration (Windows/Linux) 2) Understanding IP address, subnet etc, Familiarization with Networking cables (CAT5, UTP), Connectors (RJ45, T-connector), Hubs, Switches
TCP/UDP Socket Programming

- Simple, TCP based, UDP based

Multicast & Broadcast Sockets
Implementation of a Prototype Multithreaded Server
Implementation of

- Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
- Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
- Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

Server Setup/Configuration FTP, TelNet, NFS, DNS, Firewall

Software Engineering Lab
Code: IT693
Contact: 3P
Credits: 2

Pre-requisite: For Software Engineering Lab,design a project proposal which will be used throughout the lab for performing different experiments using CASE Tools.

1.Preparation of requirement document for proposed project in standard format.
2.Project Schedule preparation using tools like MSProject.Generation of Gnatt and PERT chart from schedule.Prepare Project Management Plan in standard format.
3.Draw Use Case diagram,Class diagram,Sequence diagram and prepare Software Design Document using tools like Rational Rose.
4.Estimate project size using Function Point(FP)/Use Case Point.Use Excel/Open Office template for calculation.
5.Design Test Script/Test Plan(both Black box and WhiteBox approach) for a small component of the proposed project.(Develop that component using programming languages like c/Java/VB etc.)
6.Generate Test Result and perform defect root cause analysis using Pareto or Fishbone diagram.
7.Compute Process and Product Metrics (e.g Defect Density,Defect Age,Productivity,Cost etc.)
8.Familiarization with any Version Control System like CVS/VSS/Pvcs etc.

(Following projects can be used as dummy projects: Library Management System, Railway Reservation System, Employee Payroll, Online Banking System, Online Shopping Cart, Online Examination)

Department of Information Technology
RCC Institute of Information Technology, Kolkata
Canal South Road, Kolkata - 700015

Course Structure – HU 601, Principles of Management

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **HU 601**, **Principles of Management.** 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Ms.Jhuma Ray.MBA.MPhil, Assist. Prof.Dept of SC & HU • Moderator: Dr. Siddhartha Bhattacharyya , PhD, Assoc. Prof.,Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Ms.Jhuma Ray (10+ years exp in teaching) • Dr. Siddhartha Bhattacharyya (15 years exp in teaching.)
Designation as a Compulsory or Elective course (Module)	Compulsory
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 2-0-0 Credit – 2.0 Theory 2 hours Lectures One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: • Understand and apply marketing concepts including the development of customer oriented strategies focusing on having the right product available, where and when the customer wants it. • Apply key aspects of managing a business, including Leadership; Management and Employee Empowerment. • Examine and reflect upon personal strengths and weaknesses as it relates to entrepreneurial tendencies. • Communicate effectively through written and oral presentation assignments.

Topics covered based on syllabus of affiliating University MAKAUT	**Day**	**Duration**	**Topics**	**Assignment/Notes**
	Day 1	2L	Basic Concepts of Management: Definition, Essence, Functions, Roles and Levels.	Group discussions on techniques to solve quantitative managerial hierarchical problems.

	Day 2	2L	Functions Of management: Planning- Concept, nature, Types, Analysis, Management by objectives.	
	Day 3	2L	Organization Structure: Concept, Structure, Principles, Centralization, Decentralization, Span Of Management, Organizational effectiveness.	Case Studies on Effectively managing the time, utilizing organization and decision making skills.
	Day 4	2L	Management and society: Concept, External environment, CSR, Corporate Governance, Ethical Standards.	Group discussions on Describing and discussing the various factors necessary for cultivating a business in a diverse global environment, including: The Free Enterprise System; Economics and Globalization; Ethics and Social Responsibility.
	Day 5	2L	People Management: Overview, Job Design, Recruitment & Selection, training & Development, stress management.	Assignment on Managing and/or describing conflict and conflict resolution strategies.
	Day 6	2L	Management Competencies: Communication, Motivation, Team Effectiveness.	Assignment on : Examining and developing a strategy for improving interpersonal job-oriented skills and how to Communicate effectively through both oral and written presentations.
	Day 7	2L	Conflict Management: Creativity, Entrepreneurship. Leadership: Concept, Nature, styles,	Group discussions on conflict and conflict resolution strategies.
	Day 8	2L	Decision making: Concept, Nature, Process, tools and techniques.	Case studies on Working effectively as a team member through group projects, case studies,

				and problem analysis.
	Day 9	2L	Economic, Financial and Quantitative Analysis: Production, markets, national Income and accounting.	
	Day 10	2L	Financial functions and goals.	
	Day 11	2L	Financial statements and Ratio Analysis: Overview.	Assignment on basic computational techniques to solve quantitative financial accounting problems.
	Day 12	2L	Quantitative Methods- Statistical Interference, Forecasting, Regression Analysis, and Statistical Quality control.	
	Day 13	2L	Customer Management: Market Planning, Market Research, Marketing Mix, Advertising and Brand Management.	Group discussions on effective Integrated Marketing Communications (IMC) strategies and materials.
	Day 14	2L	Operations and Technology Management: Production and Operation management.	
	Day 15	2L	Logistics and supply chain management: Total Quality management, Kaizen Theory, Six Sigma. MIs	Illustrating how partnerships and alliances can gain entry into new areas. Identify factors to consider in deciding whether to enter certain areas. Explain how the current exchange rate impacts the success of a company in another country .Develop a strategy for a company to enter a new country.
Hints for Learning-Teaching Approach (Course Delivery)	• Lectures to relate theories with assignments. • Case study. • Assignment solving on each covered modules. • Interactive problem solving and doubt-clearing session . • Outside the class interaction with individual students having problems.			
Course Assessment Policy	• Attendance (Direct Assessment Method): 5% (University certification) • Quiz and Assignments: (Direct Assessment Method): 10% • 2 Unit Tests Exams (Direct Assessment Method): 15% • 1 Final Term-end Exam (Direct Assessment Method): 70% • Students Feedback and Employer Survey (Indirect Assessment Methods) • Classroom Demonstration and Class Performance (Direct Assessment Method (Institute certification).			
Hints for Course Assessment	In addition to direct assessment tools as per University norms, following			

instruments & processes (both continuous and semester-end assessment)	direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • • 2 categories of questions in Class Tests • • Library Assignment • • Viva • • Classroom Demonstration • • Student Semester Exit Survey • • Employer Survey • The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics. The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics.
Text Books and/or Reference Material	**Text Books:** 1.Management: Principles,Processes & Practices – Bhat,A & Kumar,AQ9OUP). 2.Essentials Fopr Management- Koontz,Revised,Tata Mc Graw Hill (TMH) 3.Management-Stoner,James A.F.(Pearson) 4.Management- Ghuman,Tata mc Graw hill (TMH)

Mapping of Course Outcome with Program Outcome

S. No.	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
2	Principles of Management (HU601) - ***Theory***	1. Understand and apply marketing concepts including the development of customer oriented strategies focusing on having the right product available, where and when the customer wants it.			S		S							
		2. Apply key aspects of managing a business, including Leadership; Management and Employee Empowerment.									S			
		3. Examine and reflect upon personal strengths and weaknesses as it relates to entrepreneurial tendencies.							S					
		4. Communicate effectively through written and oral presentation assignments.										S		

Selection of Assessment Components and Tools

HU – 601 (Principles of Management)								**Score (1 – 4)**	**Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)**				
Assessment Tools													
Component	**Ast - #**	**Method/Element**	**PO 3**	**PO 5**	**PO 7**	**PO 9**	**PO 10**		**PO 3**	**PO 5**	**PO 7**	**PO 9**	**PO 10**
Class Performance	1.1.1	Multiple Choice Questions /Quiz			*M*						0.3 × Score		
	1.1.2	Short Answer type Questions (Class Test)			*M*						0.3 × Score		
	1.1.3	Problem based Questions (Class Test)			*M*						0.3 × Score		
	1.1.4	Design oriented Questions (Class Test)			*M*						0.3 × Score		
	1.1.5	Open Ended Realistic Questions (Class Test)			*M*						0.3 × Score		
	1.1.6	Assignments (Library/ Home Assignment)	-	-	-	*W*	*M*		-	-	-	0.2 × Score	-
	1.1.7	Viva	-	-	-	-	*M*		-	-	-		-
	1.1.8	Classroom Demonstration	-	-	-	*M*	*S*		-			0.3 × Score	-
	1.1.9	Attendance	-	-	-	*M*	-		-	-	-	0.3 × Score	-
	1.2.5	Group Discussion (on general or technical issues)	-	-	-	*S*	*S*		-	-	-	0.5 × Score	0.5 × Score
Terminal Test	1.2.1	Written Semester Exams	*M*	-	-	-	-		0.3 × Score	-	-	-	-
Indirect Method	2.1	Observation of Performance in Co-Curricular and Extra-Curricular activities	-	-	-	*S*	*M*		-			0.5 × Score	0.3 × Score
	2.2.1	Employer Survey	*S*	*S*	*W*	-	*S*		0.5 × Score	0.5 × Score	0.2 × Score	-	0.5 × Score
	2.2.2	Student Semester Exit Survey	-	*S*	-	-	-			0.5 × Score			
							Weighted Score (WS)		**Total / 0.8**	**Total /1.0**	**Total / 1.7**	**Total / 1.8**	**Total / 1.3**
							% of PO attained		**WS * 100/4**	**WS * 100/4**	**WS * 100/4**	**WS * 100/4**	**WS * 100/4**

Assessment Rubrics

HU - 601 (Principles of Management)					
Assessment Tools		**Grading Criteria**			
Assessment Method	**Ast - #**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions / Quiz	1.1.1	≤40%	>40% - 60%	>60% - 80%	>80%
Short Answer type Questions (Class Test)	1.1.2	≤40%	>40% - 60%	>60% - 80%	>80%
Problem based Questions (Class Test)	1.1.3	≤40%	>40% - 60%	>60% - 80%	>80%
Design oriented Questions (Class Test)	1.1.4	≤40%	>40% - 60%	>60% - 80%	>80%
Open Ended Realistic Questions (Class Test)	1.1.5	≤40%	>40% - 60%	>60% - 80%	>80%
Assignments (Library/ Home Assignment)	1.1.6	<40%	>40% - <60%	>60% - <80%	>80%
Viva	1.1.7	Seldom interacts	Interacts but wayward	Fairly Interactive	Takes the leadership role in answering questions
Classroom Demonstration / Seminar on pre-assigned subject topics / chosen topics	1.1.8	Unprepared for the presentation	Tries to explain the matter but not up to the mark	Fair demonstration of the topic	Good understanding and hold over the entire subject matter
Attendance	1.1.9	≤50%	>50% - 60%	>60% - 80%	>80%
Group Discussion (on general or technical issues)	1.2.5	Bears a very casual overall approach	Tries to get into the regular practices	Takes interest in the discussion effectively	Always takes a lead role in the discussion
Written exams	1.2.1	<40%	>40% - <60%	>60% - <80%	>80%
Observation of Performance in Co-Curricular and Extra-Curricular activities	2.1	Hardly participates or takes any interest	May be forced into relevant activities	Bears an acumen in such activities	Always takes the initiative
Employer survey	2.2.1	Can't answer anything	Try to answer basic questions	Good in both theory and programming, however weak skilled question	Promptly responses to any question, programming approach is efficient and confidently manages any program
Student Semester Exit survey	2.2.4	Poor understanding of any related questions	Try to response queries if initial hints are given	Also attempts to answer conceptual questions	Can manage any types of questions at any difficulty level with utmost confidence

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Course Structure of IT-601, Database Management System

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT-601, Database Management System**, 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Mr. Moumita Deb, Assistant Professor Dept. of IT, M.Tech. • Moderator: Dr. P.N.Basu, Professor, PhD.
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Mr. Moumita Deb (10 years, M.Tech in Software Engineering) • Dr. P.N.Basu (41 yrs, PhD)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Computer organization and Basic programming concept.
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 3-0-0 Credit – 3 Theory 3 hours Lecture One Semester
Course Outcomes	Upon successful completion of this Theory course, students should be able : 1. Explain the role of a database management system in an organization 2. Describe basic database concepts, including the structure and operation of the relational data model 3. Construct simple and moderately advanced database queries using (SQL) 4. Analyse and successfully apply logical database design principles, including E-R diagrams and database normalization 5. Implement the concept of database transaction and related database facilities, including concurrency control, backup and recovery, data object locking and protocols.

Topics covered based on syllabus of affiliating University MAKAUT	Day	Duration	Topics	Assignment
	Day-1	2L	Concept & Overview of DBMS, Difference between file processing system and DBMS	
	Day-2	1L	Data Models, Database Languages, Database Administrator,	
	Day-3	2L	Database Users, Three Schema architecture of DBMS. Data	

			Independence.	
	Day-4	1L	Entity-Relationship Model, Basic concepts, Design Issues,	
	Day-5	2L	Mapping Constraints, Keys, Entity-Relationship Diagram,	
	Day-6	1L	Weak Entity Sets, Extended E-R features.	Assignment-1
	Day-7	2L	Relational Model, Structure of relational Databases,	
	Day-8	1L	Relational Algebra,	
	Day-9	2L	Relational Calculus, Extended Relational Algebra Operations,	
	Day-10	1L	Views, Modifications of the Database.	Assignment-2
	Day-11	2L	Integrity Constraints in SQL, Concept of DDL, DML, DCL.	
	Day-12	1L	Basic Structure, Set operations, Aggregate Functions,	
	Day-13	2L	Null Values, Domain Constraints, Referential Integrity Constraints, assertions.	
	Day-14	1L	Nested Sub queries, Database security application development using SQL,	Assignment-3
	Day-15	2L	Stored procedures and triggers.	
	Day-16	1L	Relational Database Design, Functional Dependency, Different anomalies in designing a Database	
	Day-17	2L	Normalization using functional dependencies, why different normal form.	
	Day-18	1L	Decomposition, 1NF	
	Day-19	2L	2NF 3NF	
	Day-20	1L	BCNF, multi-valued dependencies,	
	Day-21	2L	Check for multivalued dependency,4NF, 5NF	Assignment-4
	Day-22	1L	Physical data structures, Query optimization : join algorithm,	
	Day-23	2L	Statistics and cost base optimization.	
	Day-24	1L	Transaction processing, ACID properties.	
	Day-25	2L	Concurrency control and serializability.	
	Day-26	1L	Recovery management, transaction model properties,	
	Day-27	2L	Revision of important topics	
	Day-28	1L	MAKAUT previous years question paper solve.	

Additional Topics (Class + Tutorial) Activities and Assignments	• Nested Transactions. • Multi-Dimensional Index Structures • Introduction to Data ware housing.
Activities of students and Assignments	• Chalk-Board Lectures • Class room Demonstration • Quiz, Interaction • Interactive problem solving and doubt-clearing session • Outside the class interaction with individual students having problems • Interactive lab sessions.
Hints for Learning-Teaching Approach (Course Delivery)	• Regular Class Lectures (learner-centric) – ✓Involve students in discussion/expression of views ✓Ask students to explain on board ✓Ask questions to students on previously discussed /ongoing topic • Tutorial for interactive problem solving and doubt-clearing • Class room Demonstration (on selected topics) by students in groups • Home/Library Assignment and Notes/Study Material on topics not delivered in Class • Outside the class interaction with individual students having difficulty
Course Assessment Policy	Assessment will be done in following two methods: 1. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester 2. Indirect Assessment – Opinion Survey Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows: • Attendance (Cont. Assmt. by Teacher): 5% • Average of Quiz + Assignments: (Cont. Assmt. by Teacher): 10% • Best of two 45 mins Class Tests (Cont. Assmt. by Teacher): 15% • One 3-hours Term-end Exam (Terminal Assmt. by Univ.): 70% Points will be awarded by the Department upon assessing attainment of POs related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course-related PO is then found from the % of weighted average score w.r.t maximum avg score (4).
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • 4categories of questions in Class Tests • Library Assignment • Micro Project • Classroom Demonstration • Viva • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey • Alumni Survey • Employer Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics. The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics.
Text Books and/or Reference Material	**Text Books:** 1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill. 2. Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company. 3. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley. **Reference Books:** 1. "Fundamentals of Database Systems", Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition

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Course Structure - IT 691, Database Management System Lab

	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT691**, **DBMS Lab**, 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Ms. Moumita Deb, M.Tech., Asst. Prof., Dept of IT • Moderator: Dr. Pramathanath Basu, Professor, PhD.
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Ms. Moumita Deb (10 years, M.Tech. in Software Engineering) • Dr. Pramathanath Basu (41 years, PhD)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Introduction to computing in first year, Data structure and Computer organization in Third semester.
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 0-0-3 Credit – 2.0 Practical 3 hours Laboratory One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Create a database schema after analyzing data 2. Handle data using basic query like insert, update, delete, and alter 3. Apply integrity constraints, restriction checking 4. Create and analyze view 5. Handle complex queries using join, nested query, sub query using PL/SQL

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics
Week 1	3 Lab	To learn about database creation, table creation and value insertion, fetch data from table with specific condition.
Week 2	3 Lab	To learn about key constraints, Aggregate functions, Numeric functions, Arithmetic Operator and Relational Operator.
Week 3	3 Lab	To learn about Order by, Group by and Having clause.
Week 4	3 Lab	To learn about Correlated queries.
Week 5	3 Lab	To learn about Joining.
Week 6	3 Lab	To learn about View, Index.
Week 7	3 Lab	To learn about PL/SQL.
Week 8	3 Lab	To learn about Triggers.
Week9	3Lab	To learn about Cursors.

Additional Topics (Lab)	• SQL Server Programming.
Activities and Assignments	• Take part in Lab Experiment (individual activity) • Prepare Home Assignments • Prepare Lab Reports • Complete Micro Project and submit Report (group activity)
Hints for Learning-Teaching Approach (Course Delivery)	• Regular Lab Demonstrations (learner-centric) – ✓Involve students in discussion/expression of views ✓Ask students to explain on board ✓Ask questions to students on previously discussed /ongoing topic • Home Assignment on topics not delivered in Lab • Outside the Lab interaction with individual students having difficulty
Course Assessment Policy	Assessment will be done in following two methods: 1. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester 2. Indirect Assessment – Opinion Survey Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows: • Attendance (Cont. Assmt. by Teacher): 10% • Lab Performance (Cont. Assmt. by Teacher): 10% • Lab Reports (Cont. Assmt. by Teacher): 20% • Lab Viva (Terminal Assmt. by Teacher/External Examiner): 20% • One 3-hours Term-end Lab Exam (Terminal Assmt. by University appointed External Examiner): 40% Points will be awarded by the Department upon assessing attainment of POs related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course-related PO is then found from the % of weighted average score w.r.t maximum avg score (4).
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • 2 categories of questions in Class Tests • Micro Project • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey • Employer Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics. The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics.
Text Books and/or Reference Material	• **Text Books:** 1. SQL,PL/SQL The programming language of ORACLE, I.Bayross, BPB Publication. 2. Oracle PL/SQL Programming, Steven Feuerstein, Bill Pribyl, O'Reilly.

Mapping of Course Outcome with Program Outcome

S. No.	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Database Mgmt. Sys. **IT601** **-Theory**	1. Explain the role of a database management system in an organization	S											
		2. Describe basic database concepts, including the structure and operation of the relational data model	S											
		3. Construct simple and moderately advanced database queries using (SQL)	S	S			M							
		4. Analyse and successfully apply logical database design principles, including E-R diagrams and database normalization	M	S	S									
		5. Implement the concept of database transaction and related database facilities, including concurrency control, backup and recovery, data object locking and protocols	M		S									
2	Database Mgmt. Sys. Lab IT691 ***-Practical***	1. Create a database schema after analysing data	M	S	S									
		2. Handle data using basic query like insert, update, delete, and alter		M	S									
		3. Apply integrity constraints, restriction checking		S	S		M							
		4. Create and analyse view		S	M		M							
		5. Handle complex queries using join, nested query, sub query using PL/SQL		M	S		M							

Selection of Assessment Components and Tools

IT – 601 (Database Management System)								Weighted Evaluation of Pos (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)			
Assessment Tools			PO 1	PO 2	PO 3	PO 5	Score (1 – 4)				
Component	Ast #	Method/Element						PO 1	PO 2	PO 3	PO5
Class Performance	1.1.1	Multiple Choice Questions / Quiz	*S*	-	-			0.5 × Score	-	-	
	1.1.2	Short Answer type Questions (Class Test)	*S*	-	-			0.5 × Score	-	-	
	1.1.5	Open Ended Realistic Questions (Class Test)	*M*	*S*	-			0.3 × Score	0.5 × Score	-	
	1.1.6	Library/ Home Assignment	*S*	-	-			0.5 × Score	-	-	
	1.1.7	Viva	*S*	-	-			0.5 × Score	-	-	
	1.1.9	Attendance	*M*	-	-			0.3 × Score	-	-	
Class Demonstration	1.1.8	Quality of Technical Content, Planning & Adherence to Context	*M*	-	-			0.3 × Score	-	-	-
		Study & Understanding of the Topic	*S*	-	-	-		0.5 × Score	-	-	-
		Basic Knowledge in the related Science & Technology	*S*	-	-	S		0.5 × Score	-	-	0.5 × Score
		Effective Use of Context Specific Examples, Test Cases and References	*S*	-	-	M		0.5 × Score	-	-	0.3 × Score
		Q&A and interaction	*S*	-	-	-		0.5 × Score	-	-	-
Micro Project	1.1.12	Research and gather information	*S*	-	-	-		0.5 × Score	-	-	
		Analysis of Problem, Requirement Analysis	*M*	*S*	*M*	M		0.3 × Score	0.5 × Score	0.3 × Score	0.3 × Score
		Planning & Designing	*S*	*S*	*S*			0.5 × Score	0.5 × Score	0.5 × Score	
		Application of Subject Knowledge	*S*	-	-			0.5 × Score	-	-	
		Application of Related other Concept and Techniques - Integrated Approach	*S*	*M*	*M*	S		0.5 × Score	0.3 × Score	0.3 × Score	0.5 × Score
		Developing Solution/System using modern IT skill	*S*	-	*S*	S		0.5 × Score	-	0.5 × Score	0.5 × Score
Terminal Test	1.2.1	Written Semester Exams	*S*	*S*	-	-		0.5 × Score	0.5 × Score	-	-
Indirect Method	2.2.2	Student Semester Exit Survey	*W*	*S*	-	S		0.2 × Score	0.5 × Score	-	0.5 × Score
	2.2.5	Faculty and Staff Satisfaction Survey	*W*	-	-	S		0.2 × Score	-	-	0.5 × Score
	2.2.1	Employer Survey	*S*	*M*	*S*	S		0.5 × Score	0.3 × Score	0.5 × Score	0.5 × Score
	2.2.6	Alumni Survey	*S*	-	*S*	S		0.5 × Score	-	0.5 × Score	0.5 × Score
						Weighted Score (WS)		**Total/9.6**	**Total / 3.1**	**Total / 2.6**	**Total / 3.8**
						%PO attained		**WS/3 * 100**	**WS/3 * 100**	**WS/3 * 100**	**WS/3 * 100**

Selection of Assessment Components and Tools

IT - 691 (Database Management System Lab)								**Weighted Evaluation of POs** (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)			
Assessment Tools			**PO1**	**PO 2**	**PO3**	**PO5**	**Score (1 – 4)**				
Component	**Ast - #**	**Method/Element**						**PO1**	**PO 2**	**PO3**	**PO5**
Lab Performance	1.1.3	Problem based Questions (Class Test)	*S*	*S*	-			0.5 × Score	0.5 × Score	-	
	1.1.4	Design oriented Questions (Class Test)	*M*	*S*	*S*	M		0.3 × Score	0.5 × Score	0.5 × Score	0.3 × Score
	1.1.9	Attendance	*M*	-	-			0.3 × Score	-	-	
	1.1.10	Laboratory Experiments/Assignments (incl. conducting physical tests using tools and preparing lab reports)	*M*	*M*	-	M		0.3 × Score	0.3 × Score	-	0.3 × Score
Minor Project	1.1.12	Research and gather information	*S*	-	-	-		0.5 × Score	-	-	-
		Analysis of Problem, Requirement Analysis	*M*	*S*	*M*	-		0.5 × Score	0.5 × Score	0.3 × Score	-
		Planning & Designing	*S*	*S*	*S*	-		0.5 × Score	0.5 × Score	0.5 × Score	-
		Application of Subject Knowledge	*S*	-	-	-		0.5 × Score	-	-	-
		Application of Related other Concept and Techniques - Integrated Approach	*S*	*M*	*M*	S		0.5 × Score	0.3 × Score	0.3 × Score	0.5 × Score
		Developing Solution/System using IT skill	*S*	-	*S*	S		0.5 × Score	-	0.5 × Score	0.5 × Score
Terminal Test	1.2.2	Laboratory Exams (to conduct certain experiments, tool based assignments and report the procedure, results etc.)	*M*	*M*	*S*	S		0.3 × Score	0.3 × Score	0.5 × Score	0.5 × Score
		Viva Voce	*S*	-	-	-		0.5 × Score	-	-	-
Indirect Method	2.2.2	Student Semester Exit Survey	*W*	*S*	-	S		0.2 × Score	0.5 × Score	-	0.5 × Score
	2.2.5	Faculty and Staff Satisfaction Survey	*W*	-	-	S		0.2 × Score	-	-	0.5 × Score
	2.2.1	Employer Survey	*S*	*M*	*S*	S		0.5 × Score	0.3 × Score	0.5 × Score	0.5 × Score
							Weighted Score for each PO	**Total / 6.1**	**Total / 4.2**	**Total / 3.1**	**Total / 3.6**
							%PO attained	**WS/3 * 100**	**WS/3 * 100**	**WS/3 * 100**	**WS/3 * 100**

Assessment Rubrics

IT 601 (Database Management System) &**IT 691** (Database Management System Lab)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Ast#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions/ Quiz	1.1.1	≤40%	>40% - 60%	>60% - 80%	>80%
Short Answer type Questions (Class Test)	1.1.2	≤40%	>40% - 60%	>60% - 80%	>80%
Problem based Questions (Class Test)	1.1.3	≤40%	>40% - 60%	>60% - 80%	>80%
Design oriented Questions (Class Test)	1.1.4	≤40%	>40% - 60%	>60% - 80%	>80%
Open Ended Realistic Questions (Class Test)	1.1.5	≤40%	>40% - 60%	>60% - 80%	>80%
Assignment (Library/ Home)	1.1.6	Irregular, mostly copies from peers	Regular but often search help from instructor, Collects info - not always relevant	Regular and solves most problems by its own, Collects only basic relevant info	Regularly solves all problems, capable to generate new ideas, Collects great deal of relevant info
Viva	1.1.7	Seldom responses	Often responses – few are correct	Regularly responses – mostly correct, fails to answer incisive questions	Seldom gives wrong answers; also gives to the point answers, correctly answers incisive questions
Attendance	1.1.9	≤50%	>50%-60%	>60% - 80%	>80%
Laboratory Experiments	1.1.10	Neither able to solve the known problem nor able to done the experiment.	Able to solve the problem but not able to complete the experiment.	Able to solve the problem and able to complete the experiment with few errors.	Able to solve the problem and able to complete the experiment with time.
Written Exams	1.2.1	≤40%	>40% - 60%	>60% - 80%	>80%
Laboratory Exams	1.2.2	≤40%	>40% - 60%	>60% - 80%	>80%
Student Semester Exit Survey	2.2.2	Got poor marks in sem; no confidence on subject	Got fair marks in sem; unwilling to pursue further studies on subject	Got good marks in sem; confident that learnt something new and useful	Got excellent marks in sem, highly confident about the subject and willing to pursue projects or learn more on it
Faculty and Staff Satisfaction Survey	2.2.5	Poor understanding of any related questions	Tries to response queries if initial hints are given	Also attempts to answer conceptual questions	Can manage any types of questions at any difficulty level with utmost confidence

Employer Survey		2.2.1	Can't answer anything	Attempts to answer basic questions	Good in both theory and programming, however weak in skill -related question	Promptly responses to any question, programming approach is efficient and confidently manages any program
Alumni Survey		2.2.6	Poor knowledge of any subject	Tries to answer but not specific	Attempts to answer conceptual questions	Can manage any types of questions at any difficulty level with utmost confidence
Classroom Demonstration	Quality of Technical Content, Planning & Adherence to Context	1.1.8	Sketchy and incoherent, mostly irrelevant and out of context	Moderate coverage of topic, sometimes out of context	Informative but not to the point always	Smart, comprehensive, very relevant and effective
	Study & Understanding of the Topic		Minimal or no use of examples/cases; hardly any reference used	Very few meaningful examples used, no reference used	Examples and test cases used but not explained properly; References used but not following norms	Optimal use of well-chosen examples to clearly explain the topic
	Basic Knowledge in the related Science & Technology		Wrong response or explanation, least awareness	sketchy explanation, skipping complicated parts	Good explanation at some places, lack of thorough study	Clear understanding, thorough preparation
	Effective Use of Context Specific Examples, Test Cases and References		Cannot connect and explain the scientific reason behind or related technology	Can connect but cannot explain properly relevant theory or technology	Explains but not convincing and clear; lacks good knowledge of related technology	Demonstrates sound knowledge of related theory and technology; appears aware of latest related developments
	Q&A and interaction		Hardly invites questions and monotonous delivery	Accepts limited questions and makes minimal interaction	Interacts only at the end of demonstration	Interactive demonstration involving the audience
Minor Project	Research and gather information	1.1.12	Does not collect any information on the topic	Collects very limited info; some related to the topic	Collects some basic info; most refer to the topic	Collects a great deal of relevant information; all refer to the topic
	Analysis of Problem, Requirement Analysis		Asks every other person to explain the problem without any thinking	Understands the problem, cannot do requirement analysis correctly – requires guidance	Understands the problem and requirement; good attempt but incomplete documentation	Pinpoints the salient requirements, conceives additional features; prepares standard documentation
	Planning & Designing		Copies plan/design from peers	Cannot decide a plan – discusses with everybody to create a plan and design	Can plan and make a workable design by own	Plans the solution effectively with innovative ideas and effective design
	Application of Subject Knowledge		Poor subject knowledge; requires support of others; can't even use templates	Lack of knowledge forces copy-paste with not much understanding	Applies subject knowledge partly	Effectively applies subject knowledge
	Application of Related other Concept and Techniques - Integrated Approach		No real application of any engg. techniques; waits for others to do his part	Conceptually weak, aware of some techniques but cannot integrate; requires guidance	Theoretically strong; encouraging approach without much help –lacks optimization	Makes integrated approach and effective use of techniques /concept; guides others

	Developing a Solution/System		Poor IT skill - cannot implement	Can implement partly	Mostly implements but complexity higher	Implements fully with all requirements satisfied – effective and less complex soln

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Course Structure of IT-602, Computer Networking

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT-602**, **Computer Networking**, 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Mr. Hiranmoy Roy, Assistant Professor Dept. of IT, M.Tech. • Moderator: Dr. P. N. Basu, Professor, PhD.
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Mr. Hiranmoy Roy (12 years, M.Tech in Computer Technology) • Dr. P.N.Basu (41 years, PhD.)
Designation as a Compulsory or Elective course (Module)	Professional Core (PC)
Pre-requisites Courses	Computer Architecture, Operating System
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 3-0-0 Credit – 3 Theory 3 hours Lecture One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Visualize a top-down approach of layered architecture in internet. 2. Describe how Data Communication works through different components and its limitations. 3. State the basic protocols and standards of computer networking.

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment
Day-1	2L	Overview of Data Communications and Networking.	
Day-2	1L	Introduction, Network Models (OSI and TCP/IP), Addressing, IPv4, IPv6.	
Day-3	2L	Physical Layer: Signals, Transmission Media, Digital Transmission.	
Day-4	1L	Physical Layer: Analog Transmission, Multiplexing.	
Day-5	2L	Physical Layer: Circuit Switching and Telephone Network. Virtual Circuit Switching.	Assignment-1
Day-6	1L	Data Link Layer: Error Detection and Correction, Flow and Error Control.	
Day-7	2L	Data Link Layer: Data Link Control	

			and Protocol, Point to Point Access: PPP, Multiple Access: ALOHA, CSMA, CSMA/CD, Ethernet.	
	Day-8	1L	Data Link Layer: Multiple Access: CSMA/CA, Wireless LAN, Connecting LAN, Backbone Networks.	Assignment-2
	Day-9	2L	Network Layer: Internetworking.	
	Day-10	1L	Network Layer: Routing, Unicast and Multicast Routing: Routing Protocols.	Assignment-3
	Day-11	2L	Network Layer: IP.	
	Day-12	1L	Network Layer: ARP, ICMP, RARP.	
	Day-13	2L	Network Layer: ARP, ICMP, RARP.	Assignment-4
	Day-14	1L	Transport Layer: Congestion Control and Quality of Service.	
	Day-15	2L	Application Layer: Socket Interface, Domain Name System (DNS),	
	Day-16	1L	Application Layer: Electronic Mail (SMTP), File Transfer (FTP).	
	Day-17	2L	Application Layer: HTTP and WWW, Multimedia,	Assignment-5
	Day-18	1L	Security: Cryptography, Message Security,	
	Day-19	2L	Security: User Authentication, and Key Management, Security Protocols in the Internet, Firewall.	
	Day-20	1L	MAKAUT previous years question paper solve.	
Additional Topics (Class + Tutorial)	• CDMA • Bluetooth			
Activities of Students and Assignments	• Take part in Classroom Demonstration (group activity) • Take part in Quiz (individual activity) • Prepare Home Assignments • Prepare Library Assignments			
Hints for Learning-Teaching Approach (Course Delivery)	• Regular Class Lectures (learner-centric) – ✓Involve students in discussion/expression of views ✓Ask students to explain on board ✓Ask questions to students on previously discussed /ongoing topic • Class room Demonstration (on selected topics) by students in groups • Home/Library Assignment and Notes/Study Material on topics not delivered in Class/Tutorial • Outside the class interaction with individual students having difficulty			
Course Assessment Policy	Assessment will be done in following two methods: 1. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester 2. Indirect Assessment – Opinion Survey Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows: • Attendance (Cont. Assmt. by Teacher): 5% • Average of Quiz + Assignments: (Cont. Assmt. by Teacher): 10% • Best of two 45 mins Class Tests (Cont. Assmt. by Teacher): 15% • One 3-hours Term-end Exam (Terminal Assmt. by Univ.): 70% Points will be awarded by the Department upon assessing attainment of POs related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment			

	of each course-related PO is then found from the % of weighted average score w.r.t maximum avg score (4).
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • 4 categories of questions in Class Tests • Library Assignment • Tutorial • Classroom Demonstration • Viva • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey • Employer Survey • The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics . The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics.
Text Books and/or Reference Material	**Text Books:** 1. B A Forouzan : Data Communications and Networking, TMH, 2003. 2. A S Tanenbaum : Computer Networks, PHI, 2004. **Reference Books:** 1. W Stallings : Data and Computer Communications , PHI/Pearson.

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Course Structure of IT-692, Computer Networking Lab

Format	Course Curriculum	
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT-692**, **Computer Networking Lab**, 3rd Year	
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Mr. Hiranmoy Roy, Assistant Professor Dept. of IT, M.Tech. • Moderator: Dr. P. N. Basu, Professor, PhD.	
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Mr. Hiranmoy Roy (12 years, M.Tech in Computer Technology) • Dr. P.N.Basu (41 years, PhD.)	
Designation as a Compulsory or Elective course (Module)	Professional Core (PC)	
Pre-requisites Courses	Java Programming, Unix commands, C Programming.	
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : -0-3 Credit – 2 Practical 3 hours Laboratory One Semester	
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Analyse the problem of a network connected in star topology. 2. Demonstrate how CRC, Checksum and Hamming Code work for error detection and correction. 3. Develop user friendly client-server models using socket programming.	
Topics covered based on syllabus of affiliating University MAKAUT	**Day**	**Topics**
	Day-1	NIC Installation & Configuration (Windows/Linux) Understanding IP address, subnet mask. **Different LAN Topologies**: Mesh, Bus, Star and Tree etc. and their advantages and disadvantages. **Different networking commands**: ipconfig, ping, tracert, nslookup and netstat.
	Day-2	**Familiarization with** : 1. Networking cables (CAT5, UTP) 2. Connectors (RJ45, T-connector). 3. Hubs, Switches. **Hands on**: Straight cable and cross cable connection using clamping tools. Connect two pc's using cross cable and connect more than two pc's using straight cable and switch.

	Day-3	**Data Link Layer Error Detection Mechanism** (Cyclic Redundancy Check) using C program.
	Day-4	**Assignment**: Data Link Layer Error Correction Mechanism (Hamming Code) using C program.
	Day-5	**TCP/UDP Socket Programming Using Java** Multicast & Broadcast Sockets Basic Java methods and classes related with java.net package.
	Day-6	**Java Socket Programming**: ECHO CLIENT, ECHO SERVER for single client.
	Day-7	**Java Socket Programming**: ECHO CLIENT, ECHO SERVER for multiple client support using java Thread class.
	Day-8	**Assignment**: TIME CLIENT, TIME SERVER.
	Day-9	**Assignment**: Multiple client chat with single server.
	Day-10	**Data Link Layer Flow Control Mechanism** (Stop & Wait, Sliding Window) using c program.
	Day-11	**Assignment**: Data Link Layer Error Control Mechanism (Selective Repeat or Go Back N) using C program.
	Day-12	**Server Setup/Configuration**: FTP, TELNET, NFS, DNS, Firewall.
Additional Topics (Lab)	• **Client to Client chat using server**.	
Activities and Assignments	• Take part in Lab Experiment (individual activity) • Prepare Home Assignments • Prepare Lab Reports • Complete Micro Project and submit Report (group activity)	
Hints for Learning-Teaching Approach (Course Delivery)	• Regular Lab Demonstrations (learner-centric) – ✓Involve students in discussion/expression of views ✓Ask students to explain on board ✓Ask questions to students on previously discussed /ongoing topic • Home Assignment on topics not delivered in Lab • Outside the Lab interaction with individual students having difficulty	
Course Assessment Policy	Assessment will be done in following two methods: 1. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester 2. Indirect Assessment – Opinion Survey Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows: • Attendance (Cont. Assmt. by Teacher): 10% • Lab Performance (Cont. Assmt. by Teacher): 10% • Lab Reports (Cont. Assmt. by Teacher): 20% • Lab Viva (Terminal Assmt. by Teacher/External Examiner): 20% • One 3-hours Term-end Lab Exam (Terminal Assmt. by University appointed External Examiner): 40% Points will be awarded by the Department upon assessing attainment of POs related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course-related PO is then found from the % of weighted average score w.r.t maximum avg score (4).	
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • Micro Project • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey • Employer Survey • The correlation mapping of assessment tools/elements and POs related	

	to the course are depicted in the Assessment Rubrics (Table 1). The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics (Table 2).
Text Books and/or Reference Material	**Text Books:** 1. B A Forouzan : Data Communications and Networking, TMH, 2003. 2. W Richard Stevens; UNIX Network Programming (Vol-1), AWP, 2004. 3. H Schildt; Java: The Complete Reference, TMH, 2008.

Mapping of Course Outcome with Program Outcome

S. No.	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Computer Networking (IT602) - ***Theory***	1. Visualize a top-down approach of layered architecture in internet	S											
		2. Describe how Data Communication works through different components and its limitations	S	S										
		3. State the basic protocols and standards of computer networking	S											
2	Computer Networking Lab (IT692)- ***Practical***	1. Analyse the problem of a network connected in star topology	M	S										
		2. Demonstrate how CRC, Checksum and Hamming Code work for error detection and correction	M	S										
		3. Develop user friendly client-server models using socket programming			S									

Selection of Assessment Components and Tools

IT – 602 (Computer Networking)							Score (1 – 4)	Weighted Evaluation of Pos (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)		
Assessment Tools			PO 1	PO 2	PO 3					
Component	Ast #	Method/Element					PO 1	PO 2	PO 3
Class Performance	1.1.1	Multiple Choice Questions / Quiz	*S*	-	-		0.5 × Score	-	-
	1.1.2	Short Answer type Questions (Class Test)	*S*	-	-		0.5 × Score	-	-
	1.1.3	Problem based Questions (Class Test)	*S*	*S*	-		0.5 × Score	0.5 × Score	-
	1.1.4	Design oriented Questions (Class Test)	*M*	*M*	*S*		0.3 × Score	0.3 × Score	0.5 × Score
	1.1.5	Open Ended Realistic Questions (Class Test)	*M*	*S*	-		0.3 × Score	0.5 × Score	-
	1.1.6	Library/ Home Assignment	*S*	-	-		0.5 × Score	-	-
	1.1.7	Viva	*S*	-	-		0.5 × Score	-	-
	1.1.9	Attendance	*M*	-	-		0.3 × Score	-	-
Class Demonstration	1.1.8	Quality of Technical Content, Planning & Adherence to Context	*M*	-	-		0.3 × Score	-	-
		Study & Understanding of the Topic	*S*	-	-		0.5 × Score	-	-
		Basic Knowledge in the related Science & Technology	*S*	-	-		0.5 × Score	-	-
		Effective Use of Context Specific Examples, Test Cases and References	*S*	-	-		0.5 × Score	-	-
		Q&A and interaction	*S*	-	-		0.5 × Score	-	-
Micro Project	1.1.11	Research and gather information	*S*	-	-		0.5 × Score	-	-
		Analysis of Problem, Requirement Analysis	*M*	*S*	*M*		0.3 × Score	0.5 × Score	0.3 × Score
		Planning & Designing	*S*	*S*	*S*		0.5 × Score	0.5 × Score	0.5 × Score
		Application of Subject Knowledge	*S*	-	-		0.5 × Score	-	-
		Application of Related other Concept and Techniques - Integrated Approach	*S*	*M*	*M*		0.5 × Score	0.3 × Score	0.3 × Score
		Developing Solution/System using IT skill	*S*	-	*S*		0.5 × Score	-	0.5 × Score
Terminal Test	1.2.1	Written Semester Exams	*S*	*S*	-		0.5 × Score	0.5 × Score	-
Indirect Method	2.2.2	Student Semester Exit Survey	*S*	*S*	*S*		0.5 × Score	0.5 × Score	0.5 × Score
	2.2.4	Faculty and Staff Satisfaction Survey	*M*	*M*	*M*		0.3 × Score	0.3 × Score	0.3 × Score
						Weighted Score (WS)	**Total/9.8**	**Total / 3.9**	**Total / 2.9**
						%PO attained	**WS/3 * 100**	**WS/3 * 100**	**WS/3 * 100**

Selection of Assessment Components and Tools

IT - 692 (Computer Networking Lab)							**Weighted Evaluation of POs** (W_S – 0.5 | | W_M = 0.3 | | W_W = 0.2)		
Assessment Tools			**PO1**	**PO 2**	**PO3**	**Score (1 – 4)**			
Component	**Ast - #**	**Method/Element**					**PO1**	**PO 2**	**PO3**
	1.1.9	Attendance	*M*	-	-		0.3 × Score	-	-
	1.1.10	Laboratory Experiments/Assignments (incl. conducting physical tests using tools and preparing lab reports)	*M*	*M*	-		0.3 × Score	0.3 × Score	
Micro Project	1.1.11	Research and gather information	*S*	-	-		0.5 × Score	-	-
		Analysis of Problem, Requirement Analysis	*M*	*S*	*M*		0.5 × Score	-	-
		Planning & Designing	*S*	*S*	*S*		0.3 × Score	0.5 × Score	0.3 × Score
		Application of Subject Knowledge	*S*	-	-		0.5 × Score	0.5 × Score	0.5 × Score
		Application of Related other Concept and Techniques - Integrated Approach	*S*	*M*	*M*		0.5 × Score	-	-
		Developing Solution/System using IT skill	*S*	-	*S*		0.5 × Score	0.3 × Score	0.3 × Score
Terminal Test	1.2.2	Laboratory Exams (to conduct certain experiments, tool based assignments and report the procedure, results etc.)	*M*	*M*	*S*		0.3 × Score	0.3 × Score	0.5 × Score
		Viva Voce	*S*	-	-			0.5 × Score	-
Indirect Method	2.2.2	Student Semester Exit Survey	*S*	*S*	*S*		0.5 × Score	0.5 × Score	0.5 × Score
	2.2.5	Faculty and Staff Satisfaction Survey	*M*	*M*	*M*		0.3 × Score	0.3 × Score	0.3 × Score
					Weighted Score for each PO		**Total / 4.5**	**Total / 3.2**	**Total / 2.4**
					%PO attained		**WS/3 * 100**	**WS/3 * 100**	**WS/3 * 100**

Assessment Rubrics

IT 602 (Computer Networking) & **IT 692** (Computer Networking Lab)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Ast#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions (Class Test)	1.1.1	≤40%	>40% - 60%	>60% - 80%	>80%
Short Answer type Questions (Class Test)	1.1.2	≤40%	>40% - 60%	>60% - 80%	>80%
Problem based Questions (Class Test)	1.1.3	≤40%	>40% - 60%	>60% - 80%	>80%
Design oriented Questions (Class Test)	1.1.4	≤40%	>40% - 60%	>60% - 80%	>80%
Open Ended Realistic Questions (Class Test)	1.1.5	≤40%	>40% - 60%	>60% - 80%	>80%
Assignment (Library/ Home)	1.1.6	Irregular, mostly copies from peers	Regular but often search help from instructor, Collects info - not always relevant	Regular and solves most problems by its own, Collects only basic relevant info	Regularly solves all problems, capable to generate new ideas, Collects great deal of relevant info
Attendance	1.1.9	≤50%	>50% - 60%	>60% - 80%	>80%
Laboratory Experiments	1.1.10	Neither able to solve the known problem nor able to done the experiment.	Able to solve the problem but not able to complete the experiment.	Able to solve the problem and able to complete the experiment with few errors.	Able to solve the problem and able to complete the experiment with time.
Written Semester Exams	1.2.1	≤40%	>40% - 60%	>60% - 80%	>80%
Laboratory Exams	1.2.2	≤40%	>40% - 60%	>60% - 80%	>80%
Viva	2.2.4	Poor subject knowledge; can't understand simple questions	Moderate subject knowledge, some good explanation; unable to answer harder questions	Good subject knowledge, mostly good explanation; attempts some harder questions	Sound subject knowledge, precise explanations; correctly answers most of the harder questions
Student Semester Exit Survey	2.2.2	Got poor marks in sem; no confidence on subject	Got fair marks in sem; unwilling to pursue further studies on subject	Got good marks in sem; confident that learnt something new and useful	Got excellent marks in sem, highly confident about the subject and willing to pursue projects or learn more on it
Faculty and Staff Satisfaction Survey	2.2.5	Poor understanding of any related questions	Tries to response queries if initial hints are given	Also attempts to answer conceptual questions	Can manage any types of questions at any difficulty level with utmost confidence

Classroom Demonstration	Quality of Technical Content, Planning & Adherence to Context	1.1.8	Sketchy and incoherent, mostly irrelevant and out of context	Moderate coverage of topic, sometimes out of context	Informative but not to the point always	Smart, comprehensive, very relevant and effective
	Study & Understanding of the Topic		Minimal or no use of examples/cases; hardly any reference used	Very few meaningful examples used, no reference used	Examples and test cases used but not explained properly; References used but not following norms	Optimal use of well-chosen examples to clearly explain the topic
	Basic Knowledge in the related Science & Technology		Wrong response or explanation, least awareness	sketchy explanation, skipping complicated parts	Good explanation at some places, lack of thorough study	Clear understanding, thorough preparation
	Effective Use of Context Specific Examples, Test Cases and References		Cannot connect and explain the scientific reason behind or related technology	Can connect but cannot explain properly relevant theory or technology	Explains but not convincing and clear; lacks good knowledge of related technology	Demonstrates sound knowledge of related theory and technology; appears aware of latest related developments
	Q&A and interaction		Hardly invites questions and monotonous delivery	Accepts limited questions and makes minimal interaction	Interacts only at the end of demonstration	Interactive demonstration involving the audience
Micro Project	Research and gather information	1.1.11	Does not collect any information on the topic	Collects very limited info; some related to the topic	Collects some basic info; most refer to the topic	Collects a great deal of relevant information; all refer to the topic
	Analysis of Problem, Requirement Analysis		Asks every other person to explain the problem without any thinking	Understands the problem, cannot do requirement analysis correctly – requires guidance	Understands the problem and requirement; good attempt but incomplete documentation	Pinpoints the salient requirements, conceives additional features; prepares standard documentation
	Planning & Designing		Copies plan/design from peers	Cannot decide a plan – discusses with everybody to create a plan and design	Can plan and make a workable design by own	Plans the solution effectively with innovative ideas and effective design
	Application of Subject Knowledge		Poor subject knowledge; requires support of others; can't even use templates	Lack of knowledge forces copy-paste with not much understanding	Applies subject knowledge partly	Effectively applies subject knowledge
	Application of Related other Concept and Techniques - Integrated Approach		No real application of any engg. techniques; waits for others to do his part	Conceptually weak, aware of some techniques but cannot integrate; requires guidance	Theoretically strong; encouraging approach without much help –lacks optimization	Makes integrated approach and effective use of techniques /concept; guides others
	Developing a Solution/System		Poor IT skill - cannot implement	Can implement partly	Mostly implements but complexity higher	Implements fully with all requirements satisfied – effective and less complex soln

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RCC Institute of Information Technology, Kolkata
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Course Structure of IT603, Software Engineering

	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT603**, **Software Engineering**, 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Abhijit Das, Assist. Prof., Dept of IT • Moderator: Dr. A Mukherjee, PhD, Assist. Prof., Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Abhijit Das (11 years exp in teaching DSA, ST, INW, WT, SE, ECOMM etc.) • Dr. A Mukherjee (14 years exp in teaching Computer Graphics, OR etc.)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Programming concept in C, Algorithms
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 3-0-0 Credit – 3.0 Theory 3 hours Lecture One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Describe basic SW engineering methods and practices, and their appropriate applications 2. Illustrate software process models such as waterfall, spiral and evolutionary models 3. Discover the role of project management including planning, scheduling, risk management, etc.

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Day 1	2L	Overview of System Analysis & Design, Business System Concept, System Development Life Cycle concepts, overview of various SDLC models Waterfall Model	
Day 2	1L	Overview on Spiral Model	
Day 3	2L	Overview on Prototyping, Evolutionary model, V model etc.	Assignment on justification on selecting SDLC model for given project scenarios
Day 4	1L	Different types of Feasibility Analysis	
Day 5	2L	Various Cost- Benefit Analysis methodologies	

	Day 6	1L	Cost Analysis using COCOMO	Notes on COCOMO
	Day 7	2L	Top-Down And Bottom-Up design approach, ER Diagram concepts, Cardinalities	
	Day 8	1L	Overview on Context diagram and DFD	
	Day 9	2L	Ideas on Decision Tree, Decision Table and Structured English	Notes on DFD, ERD
	Day 10	1L	Problem Partitioning, Functional vs. Object- Oriented approach	
	Day 11	2L	Basic Documentation structure and its standards	Notes on Software Project Report standard
	Day 12	1L	Case Study1	
	Day 13	1L	Levels of Testing, Validation & Verification Metrics	
	Day 14	2L	Overview on various Testing methods	Notes on Software Testing in detail
	Day 15	1L	Overview on various Testing standards	
	Day 16	2L	Test case Specification and Test-Bed generation ideas	
	Day 17	1L	Reliability Assessment, Monitoring & Control	
	Day 18	2L	Project Scheduling, Gantt Chart, PERT, CPM	Assignment on PERT, CPM
	Day 19	1L	Staffing, Project Monitoring	
	Day 20	2L	Recent trends in Quality Assurance, Quality of good SRS	Notes on SRS standards
	Day 21	1L	Introduction to UML diagrams	
	Day 22	2L	Class diagram, Object diagram	
	Day 23	1L	Use Case diagram, concepts on Generalization, Aggregation, Specialization	
	Day 24	2L	Sequence Diagram, Collaboration diagram	Notes on overall UML design issues
	Day 25	1L	Case Study2	
Additional Topics, Activities and Assignments	• Software-hardware co relation • Information system pyramid • Software Quality standards • Assignments on UML design on given cases			
Hints for Learning-Teaching Approach (Course Delivery)	• Notes in most classes in lieu with discussion • Assignments are individually checked and corrected with relevant guidelines for improvements as and when needed • Special tip for weak areas identified through class performances in different assignments As per University norms, • 3 Quizzes/Assignments will be given and only the best 2 to be counted • Two 1-hour Class Tests and a 3-hours final exam will be taken			
Course Assessment Policy	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • 4 categories of questions in Class Tests • Library Assignment • Classroom Demonstration • Student Semester Exit Survey • Employer Survey •Course Entry & Exit Survey •Program & Dept. Evaluation Survey			

	•Faculty & Staff Satisfaction Survey •Alumni Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics. The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics.
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	• Attendance (Direct Assessment Method): 5% (University certification) • Quiz and Assignments: (Direct Assessment Method): 10% • 2 Unit Tests Exams (Direct Assessment Method): 15% • 1 Final Term-end Exam (Direct Assessment Method): 70% • Students' Feedback, Employer and Alumni Survey, Faculty & Staff Satisfaction Survey, Dept. Evaluation Survey (Indirect Assessment Methods) • Classroom Demonstration and Class Performance (Direct Assessment Method (Institute certification)
Text Books and/or Reference Material	• **Text Books:** 1. Roger Pressman – "Software Engineering: A Practitioner's Approach" – McGraw-Hill Higher Education 2. Rajib Mall – "Fundamentals of Software Engineering" (3rd Ed.) – PHI Learning Pvt. Ltd. 3. Pankaj Jalote – "An Integrated Approach to Software Engineering" (2nd Ed.) – Narosa • **Reference Books:** 1. Ian Sommerville – "Software Engineering" (9th Ed.) – Pearson

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Course Structure of IT693, Software Engineering Lab,

	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT693**, **Software Engineering Lab**, 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Abhijit Das, Assist. Prof., Dept of IT • Moderator: Dr. A Mukherjee, PhD, Assist. Prof., Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Abhijit Das (11 years exp in teaching DSA, ST, INW, WT, SE, ECOMM etc.) • Dr. A Mukherjee (14 years exp in teaching Computer Graphics, OR etc.)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Basic knowledge of Programming logic and DBMS, and MS Windows
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 0-0-3 Credit – 2.0 Practical 3 hours Laboratory One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Design and implement software solutions using software engineering techniques 2. Use UML, source control, and project management techniques 3. Work in different roles (e.g. analyst, designer, developer, tester, debugger etc.) in a software development team and deliver under tight deadline

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics
Week 1	3 Lab	To learn about a Software development life cycle and how to make Documentation
Week 2	3 Lab	To learn about Software Requirement Specifications (SRS)
Week 3	3 Lab	To learn about Project scheduling using various methods (Gantt chart)
Week 4	3 Lab	To learn about E-Draw software tool and its various interfaces
Week 5	3 Lab	To learn about drawing Entity-Relationship Diagrams (E-Draw)
Week 6	3 Lab	To learn about drawing Data Flow Diagrams (E-Draw)
Week 7	3 Lab	To learn about various UNIFIED MODELLING LANGUAGE (UML) diagrams
Week 8	3 Lab	To learn about drawing Use Case Diagram (E-Draw)

<table>
<tr><td></td><td>Week 9</td><td>3 Lab</td><td>To learn about drawing Sequence Diagram (E-Draw)</td></tr>
<tr><td></td><td>Week 10</td><td>3 Lab</td><td>To learn about drawing State Chart Diagram (E-Draw)</td></tr>
<tr><td></td><td>Week 11</td><td>3 Lab</td><td>To learn about implementing systems using MS Visual Basic 6.0 as front end and MS Access 2003 as back end</td></tr>
<tr><td>Additional Topics, Activities and Assignments</td><td colspan="3">• Micro Projects in team / individual</td></tr>
<tr><td>Hints for Learning-Teaching Approach (Course Delivery)</td><td colspan="3">• Assignments on different modules as per syllabus
• Real life case scenarios in different development sessions introduced
• Outside class interaction with individual students having doubts
• Samples / templates supplied showing industry standards</td></tr>
<tr><td>Course Assessment Policy</td><td colspan="3">• Notes in every class in lieu with discussion
• Role of individuals and team effort in the given Micro Projects
• Additional assignment to practice beyond the laboratory hours
• Library assignment to solve different questions involving Design and Testing issues related to Software Engineering from previous placements drives and entrance examinations for higher studies
As per University norms,
• Multiple Assignments for continuous evaluation
• One viva voce to evaluate overall understanding on common issues related to Software Engineering in Practice
• 3-hours final exam will be taken in laboratory</td></tr>
<tr><td>Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)</td><td colspan="3">• Attendance (Direct Assessment Method): 10% (University certification)
• Assignments: (Direct Assessment Method): 20%
• 1 viva voce at term end (Direct Assessment Method): 10%
• 1 Final Term-end Lab. Exam (Direct Assessment Method): 60%
• Students' Feedback, Employer and Alumni Survey, Faculty & Staff Satisfaction Survey, Dept. Evaluation Survey (Indirect Assessment Methods)
• Classroom Demonstration and Class Performance (Direct Assessment Method (Institute certification)</td></tr>
<tr><td>Text Books and/or Reference Material</td><td colspan="3">• Text Books:
1. Roger Pressman – "Software Engineering: A Practitioner's Approach" – McGraw-Hill Higher Education
2. Rajib Mall – "Fundamentals of Software Engineering" (3rd Ed.) – PHI Learning Pvt. Ltd.
• Reference Books:
1. Elias M. Awad – "System Analysis and Design" (2nd Ed.) – Galgotias
2. V. Rajaraman – "Analysis and Design of Information System" – PHI
3. Soma Dasgupta – "Visual Basic Projects" – BPB</td></tr>
</table>

Mapping of Course Outcome with Program Outcome

S. No.	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Software Engineering (IT603) (Theory)	1. Describe basic SW engineering methods and practices, and their appropriate applications	S											
		2. Illustrate software process models such as waterfall, spiral and evolutionary models	S											
		3. Discover the role of project management including planning, scheduling, risk management, etc.	M	S	M	S	W							
2	Software Engineering Lab (IT693) (Practical)	1. Design and implement software solutions using software engineering techniques			S	M	S							
		2. Use UML, source control, and project management techniques	M		W	M	M							
		3. Work in different roles (e.g. analyst, designer, developer, tester, debugger etc.) in a software development team and deliver under tight deadline			M	S						M		

Selection of Assessment Components and Tools

IT – 603 (Software Engineering) Theory										Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 | | W_M = 0.3 | | W_W = 0.2)					
Assessment Tools			PO1	PO2	PO3	PO4	PO5	PO10		PO1	PO2	PO3	PO4	PO5	PO10
Component	#	Method/Element													
	1.1.1	Multiple Choice Questions /Quiz	*S*							0.5 × Score					
	1.1.2	Short Answer type Questions (Class Test)	*S*	*S*	-	-	-	-		0.5 × Score	0.5 × Score	-	-	-	-
	1.1.3	Problem based Questions (Class Test)	*S*	*S*	-	-	-	-		0.5 × Score	0.5 × Score	-	-	-	-
	1.1.4	Design oriented Questions (Class Test)	*M*	*S*	*S*	*M*	-	-		0.3 × Score	0.5 × Score	0.5 × Score	0.3 × Score	-	-
	1.1.5	Open Ended Realistic Questions (Class Test)	*S*	*S*	-	*S*	-	-		0.5 × Score	0.5 × Score	-	0.5 × Score	-	-
	1.1.6	Assignments (Library/ Home Assignment)	*M*	-	-	-	-	*M*		0.3 × Score	-	-	-	-	0.3 × Score
	1.1.7	Technical Quiz (Written/Verbal)	*S*	-	-	-	-	*M*		0.5 × Score	-	-	-	-	0.3 × Score
	1.1.8	Classroom Demonstration / Seminar on pre-assigned subject topics / chosen topics	*M*	-	-	-	-	*S*		0.3 × Score	-	-	-	-	0.5 × Score
	1.1.9	Attendance	*M*	-	-	-	-	-		0.3 × Score	-	-	-	-	-
	1.2.1	Written Exams (incl. MCQ, Short Answer type and Long Answer type Questions, Numerical & Design Problems)	*S*	*M*	*M*	*W*	-	*M*		0.5 × Score	0.3 × Score	0.3 × Score	0.2× Score	-	0.3 × Score
	2.2.1	Employer Survey	*S*	*M*	*S*	*M*	*S*	*S*		0.5 × Score	0.3 × Score	0.5 × Score	0.3 × Score	0.5 × Score	0.5 × Score
	2.2.2	Student Semester Exit Survey	*W*	*S*	-	-	*S*	*S*		0.2× Score	0.5 × Score	-	-	0.5 × Score	0.5 × Score
	2.2.3	Course Entry & Exit Survey (by the first year batch and outgoing batch of every year)	*W*	-	-	-	*S*	*S*		0.2× Score	-	-	-	0.5 × Score	0.5 × Score
	2.2.4	Program & Dept. Evaluation Survey	-	*S*	*S*	-	*M*	*S*			0.5 × Score	0.5 × Score	-	0.3 × Score	0.5 × Score
	2.2.5	Faculty & Staff Satisfaction Survey	*W*	-	-	-	*S*	*S*		0.2× Score	-	-	-	0.5 × Score	0.5 × Score
	2.2.6	Alumni Survey	*S*	-	*S*	-	*S*	*S*		0.5 × Score	-	0.5 × Score	-	0.5 × Score	0.5 × Score
									Weighted Score for each PO	**Total/ 5.8**	**Total/ 3.6**	**Total/ 2.3**	**Total/ 1.3**	**Total/ 2.8**	**Total/ 4.4**
									%PO attained			**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

IT – 693 (Software Engineering) Practical								Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 | | W_M = 0.3 | | W_W = 0.2)				
Assessment Tools			PO1	PO3	PO4	PO5	PO10		PO1	PO3	PO4	PO5	PO10
Component	#	Method/Element											
	1.1.10	Laboratory Experiments/Assignments (incl. conducting physical tests using tools and preparing lab reports	*M*	-	-	-	*M*		0.3 × Score	-	-	-	0.3 × Score
	1.1.11	Micro Project (in labs) (to conduct experiments, integrate result, analyse result and report)	*M*	*M*	-	-	*M*		0.3 × Score	0.3 × Score	-	-	0.3 × Score
	1.2.2	Laboratory Exams (to conduct certain experiments, tool based assignments and report the procedure, results etc. followed by Viva Voce)	*M*	*S*	-	*M*	-		0.3 × Score	0.5 × Score	-	0.3 × Score	-
	2.2.1	Employer Survey	*S*	*S*	*M*	*S*	*S*		0.5 × Score	0.5 × Score	0.3 × Score	0.5 × Score	0.5 × Score
	2.2.2	Student Semester Exit Survey	*W*	-	-	*S*	*S*		0.2× Score	-	-	0.5 × Score	0.5 × Score
	2.2.4	Program & Dept. Evaluation Survey	-	*S*	-	*M*	*S*		-	0.5 × Score	-	0.3 × Score	0.5 × Score
	2.2.5	Faculty & Staff Satisfaction Survey	*W*	-	-	*S*	*S*		0.2× Score	-	-	0.5 × Score	0.5 × Score
	2.2.6	Alumni Survey	*S*	*S*	-	*S*	*S*		0.5 × Score	0.5 × Score	-	0.5 × Score	0.5 × Score
								Weighted Score for each PO	**Total/ 2.3**	**Total/ 2.3**	**Total/ 0.3**	**Total/ 2.6**	**Total/ 3.1**
								%PO attained	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

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Course Structure of IT604B, Computer Graphics

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT604B**, **Computer Graphics**, 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Dr. A Mukherjee, PhD, Assist. Prof., Dept of IT • Moderator: Dr. S Bhattacharyya, PhD, Assoc. Prof., Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Dr. A Mukherjee (15 years exp in teaching OR, Graphics, SAD, SE etc.) • Dr. S Bhattacharyya (13 years exp in teaching Programming, Multimedia, etc.)
Designation as a Compulsory or Elective course (Module)	Professional Elective
Pre-requisites Courses	Class XII Mathematics, Algorithms
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 3-0-0 Credit – 3.0 Theory 3 hours Lecture One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Recognize and compare the working and efficiency of different graphics systems and devices and basic display technology 2. Correlate/Apply the fundamental mathematical and procedural elements of digital graphics with/in different scientific/ engg./ commercial applications of IT 3. Design and develop graphics utility by applying different graphics routines and models

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Day 1	1L	Overview of Computer Graphics	Study Material on 'Graphics Devices'
Day 2	2L	RGB Color Model, Random Scan Display, Raster Scan Display	Library Assignment 1 on 'Modern Display Devices'
Day 3	1L	Raster Scan Display (contd.), Look Up Table	-
Day 4	2L	Scan Conversion, DDA Algorithm for Line Drawing	Selected Problems as Home Assignment 1A
Day 5	1L	Bresenhams' Line Drawing Algorithm	Selected Problems as Home Assignment 1B
Day 6	2L	Midpoint Algorithm for Circle Drawing	Selected Problems as Home Assignment 1C
Day 7	1L	Ellipse Drawing Algorithm	-
Day 8	2L	Boundary Fill & Flood Fill Algorithm	Study Material on 'Scan Line Polygon Fill Algorithm'

	Day 9	1L	Concept of 2D Geometric Transformation, Matrix Representation – Translation, Scaling, Rotation, Reflection, Shear	Notes on Worked out Examples of 'Transformation of Coordinate Systems'
	Day 10	2L	Composite Transformation, Homogeneous Coordinates, Generalized 2D Transformations	Selected Problems (incl. 'Transformation of Parallel & Intersecting Lines') as Home Assignment 2A
	Day 11	1L	Curve Representation, Bezier Curves	-
	Day 12	2L	Conditions for Smooth Joining of Cubic Bezier B-Spline Curves	Study Material on 'End Conditions for Periodic B-Spline, Rational B-Spline' Selected Problems as Home Assignment 2B
	Day 13	1L	Viewing Pipeline, Window to Viewport Transformation	-
	Day 14	2L	Concept of 2D Clipping, Clipping of Points & Lines, Cohen-Sutherland Line Clipping Algorithm	Selected Problems as Home Assignment 3
	Day 15	1L	Sutherland –Hodgman Polygon Clipping Algorithm	Study Material on 'Cyrus-Beck Clipping Method'
	Day 16	2L	3D Transformations: Translation, Scaling, Reflection, Rotation	Library Assignment 2 on '3D Graphics Application'
	Day 17	1L	Rotation about an Arbitrary Axis in Space	Notes on Worked out Examples of 'Reflection through an Arbitrary Plane'
	Day 18	2L	Viewing Transformation – Parallel & Perspective Projection	Notes on Worked out Examples of different Cases of Parallel & Perspective Projection
	Day 19	1L	Hidden Surface Algorithm – Z Buffer Algorithm	Study Material on 'Hidden Line Elimination, Wireframe model, Fractals'
	Day 20	2L	Back Face Detection, BSP Tree Method, Painters Algorithm	
	Day 21	1L	Light & Color (illumination) Model – Interpolative Shading	-
	Day 22	2L	Phong Shading & Gouraud Shading Model	Notes on Worked out Examples of Phong & Gouraud shading
	Day 23	1L	Introduction to Graphics Applications, GUI	Study Material on 'Human Vision, Colour Models, Texture, Reflection and Transmission Models'
	Day 24	2L	Introduction to Multimedia	-
Additional Topics (Class)	• Graphics Mathematics • Introduction to Graphic Applications, GUI • Conditions for Smooth Joining of Cubic Bezier Curves • Phong Shading & Gouraud Shading Model • Introduction to Multimedia			
Activities of Students and Assignments	• Take part in Classroom Demonstration (group activity) • Take part in Quiz (individual activity) • Prepare Home Assignments • Prepare Library Assignments • Complete Micro Project and submit Report (The Micro Project will be: *Design of GUI for a 2D CAD software incl. design of input dialog boxes or*			

	command prompts for drawing and editing of graphic objects and for performing graphic procedures) (group activity)
Hints for Learning-Teaching Approach (Course Delivery)	• Regular Class Lectures (learner-centric) – ✓Involve students in discussion/expression of views ✓Ask students to explain on board ✓Ask questions to students on previously discussed /ongoing topic • Class room Demonstration (on selected topics) by students in groups • Home/Library Assignment and Notes/Study Material on topics not delivered in Class/Tutorial • Outside the class interaction with individual students having difficulty
Course Assessment Policy	Assessment will be done in following two methods: 1. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester 2. Indirect Assessment – Opinion Survey Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows: • Attendance (Cont. Assmt. by Teacher): 5% • Average of Quiz + Assignments: (Cont. Assmt. by Teacher): 10% • Best of two 1-hour Class Tests (Cont. Assmt. by Teacher): 15% • One 3-hours Term-end Exam (Terminal Assmt. by Univ.): 70% Points will be awarded by the Department upon assessing attainment of POs related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course-related PO is then found from the % of weighted average score w.r.t maximum avg score (4).
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • 5 categories of questions in Class Tests • Library Assignment • Tutorial • Classroom Demonstration • Micro Project • Viva • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey • Employer Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics (Table 1). The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics (Table 2).
Text Books and/or Reference Material	• **Text Books:** 1. Hearn, Baker – "Computer Graphics (C version 2nd Ed.)" – Pearson education 2. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH 3. Mukhopadhyay & Chattopadhyay – "Introduction to Computer Graphics and Multimedia" - VIKAS • **Reference Books:** 1. D. F. Rogers, J. A. Adams – "Mathematical Elements for Computer Graphics (2nd Ed.)" – TMH 2. D. F. Rogers – "Procedural Elements for Computer Graphics" – TMH

Mapping of Course Outcome with Program Outcome

S. No	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Computer Graphics (IT 604B)	1. Recognize and compare the working and efficiency of different graphics systems and devices and basic display technology	S	S										
		2. Correlate/Apply the fundamental mathematical and procedural elements of digital graphics with/in different scientific/engg./commercial applications of IT	S	S										
		3. Design and develop graphics utility by applying different graphics routines and models	M		S		M							

Selection of Assessment Components and Tools

IT – 604B (Computer Graphics)							Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)			
Assessment Tools			PO 1	PO 2	PO 3	PO 5					
Component	Ast #	Method/Element						PO 1	PO 2	PO 3	PO 5
Class Performance	1.1.1	Multiple Choice Questions /Quiz	*S*	-	-	-		0.5 × Score	-	-	-
	1.1.2	Short Answer type Questions (Class Test)	*S*	-	-	-		0.5 × Score	-	-	-
	1.1.3	Problem based Questions (Class Test)	*S*	*S*	-	*S*		0.5 × Score	0.5 × Score	-	0.5 × Score
	1.1.4	Design oriented Questions (Class Test)	*M*	*M*	*S*	-		0.3 × Score	0.3 × Score	0.5 × Score	-
	1.1.5	Open Ended Realistic Questions (Class Test)	*M*	*S*	-	-		0.3 × Score	0.5 × Score	-	-
	1.1.6	Library/ Home Assignment	*S*	-	-	*M*		0.5 × Score	-	-	0.3 × Score
	1.1.7	Viva	*S*	-	-	*S*		0.5 × Score	-	-	0.5 × Score
	1.1.9	Attendance	*M*	-	-	-		0.3 × Score	-	-	-
Class Demonstra-tion	1.1.8	Quality of Technical Content, Planning & Adherence to Context	*M*	-	-	-		0.3 × Score	-	-	-
		Study & Understanding of the Topic	*S*	-	-	-		0.5 × Score	-	-	-
		Basic Knowledge in the related Science & Technology	*S*	-	-	-		0.5 × Score	-	-	-
		Effective Use of Context Specific Examples, Test Cases and References	*S*	-	-	-		0.5 × Score	-	-	-
		Q&A and interaction	*S*	-	-	-		0.5 × Score	-	-	-
Micro Project	1.1.11	Research and gather information	*S*	-	-	-		0.5 × Score	-	-	-
		Analysis of Problem, Requirement Analysis	*M*	*S*	*M*	-		0.3 × Score	0.5 × Score	0.3 × Score	-
		Planning & Designing	*S*	*S*	*S*	-		0.5 × Score	0.5 × Score	0.5 × Score	-
		Application of Subject Knowledge	*S*	-	-	-		0.5 × Score	-	-	-
		Application of Related other Concept and Techniques - Integrated Approach	*S*	*M*	*M*	*M*		0.5 × Score	0.3 × Score	0.3 × Score	0.3 × Score
		Developing Solution/System using IT skill	*S*	-	*S*	*S*		0.5 × Score	-	0.5 × Score	0.5 × Score
Terminal Test	1.2.1	Written Semester Exams	*S*	*S*	-	-		0.5 × Score	0.5 × Score	-	-
		Viva	*S*	-	-	*W*		0.5 × Score	-	-	0.2 × Score
Indirect Method	2.2.2	Student Semester Exit Survey	*S*	*S*	*S*	*S*		0.5 × Score	0.5 × Score	0.5 × Score	0.5 × Score
	2.2.5	Faculty and Staff Satisfaction Survey	*M*	*M*	*M*	*S*		0.3 × Score	0.3 × Score	0.3 × Score	0.5 × Score
	2.2.5	Employer Survey	*M*	*M*	*S*	*S*		0.3 × Score	0.3 × Score	0.5 × Score	0.5 × Score
						Weighted Score (WS)		**Total/10.6**	**Total/ 4.2**	**Total/ 3.4**	**Total/ 3.8**
						%PO attained		**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

Assessment Rubrics

IT 604B (Computer Graphics)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Ast#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions / Quiz	1.1.1	≤40%	>40% - 60%	>60% - 80%	>80%
Short Answer type Questions (Class Test)	1.1.2	≤40%	>40% - 60%	>60% - 80%	>80%
Problem based Questions (Class Test)	1.1.3	≤40%	>40% - 60%	>60% - 80%	>80%
Design oriented Questions (Class Test)	1.1.4	≤40%	>40% - 60%	>60% - 80%	>80%
Open Ended Realistic Questions (Class Test)	1.1.5	≤40%	>40% - 60%	>60% - 80%	>80%
Assignment (Library/ Home)	1.1.6	Irregular, mostly copies from peers	Regular but often search help from instructor, Collects info - not always relevant	Regular and solves most problems by its own, Collects only basic relevant info	Regularly solves all problems, capable to generate new ideas, Collects great deal of relevant info
Technical Quiz	1.1.7	Seldom responses	Often responses – few are correct	Regularly responses – mostly correct, fails to answer incisive questions	Seldom gives wrong answers; also gives to the point answers, correctly answers incisive questions
Attendance	1.1.9	≤50%	>50% - 60%	>60% - 80%	>80%
Written exams	1.2.1	≤40%	>40% - 60%	>60% - 80%	>80%
Viva	2.2.4	Poor subject knowledge; can't understand simple questions	Moderate subject knowledge, some good explanation; unable to answer harder questions	Good subject knowledge, mostly good explanation; attempts some harder questions	Sound subject knowledge, precise explanations; correctly answers most of the harder questions
Student Semester Exit Survey	2.2.2	Got poor marks in sem; no confidence on subject	Got fair marks in sem; unwilling to pursue further studies on subject	Got good marks in sem; confident that learnt something new and useful	Got excellent marks in sem, highly confident about the subject and willing to pursue projects or learn more on it
Faculty and Staff Satisfaction Survey	2.2.5	Poor understanding of any related questions	Tries to response queries if initial hints are given	Also attempts to answer conceptual questions	Can manage any types of questions at any difficulty level with utmost confidence
Employer Survey	2.2.1	Can't answer anything	Attempts to answer basic questions	Good in both theory and programming, however weak in skill -related question	Promptly responses to any question, programming approach is efficient and confidently manages any program

`IT 604B (Computer Graphics)						
Assessment Tools			**Grading Criteria**			
Method/Element		**#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Classroom Demonstration	Quality of Technical Content, Planning & Adherence to Context	1.1.8	Sketchy and incoherent, mostly irrelevant and out of context	Moderate coverage of topic, sometimes out of context	Informative but not to the point always	Smart, comprehensive, very relevant and effective
	Study & Understanding of the Topic		Wrong response or explanation, least awareness	sketchy explanation, skipping complicated parts	Good explanation at some places, lack of thorough study	Clear understanding, thorough preparation
	Basic Knowledge in the related Science & Technology		Cannot connect and explain the scientific reason behind or related technology	Can connect but cannot explain properly relevant theory or technology	Explains but not convincing and clear; lacks good knowledge of related technology	Demonstrates sound knowledge of related theory and technology; appears aware of latest related developments
	Effective Use of Context Specific Examples, Test Cases and References		Minimal or no use of examples/cases; hardly any reference used	Very few meaningful examples used, no reference used	Examples and test cases used but not explained properly; References used but not following norms	Optimal use of well-chosen examples to clearly explain the topic
	Q&A and interaction		Hardly invites questions and monotonous delivery	Accepts limited questions and makes minimal interaction	Interacts only at the end of demonstration	Interactive demonstration involving the audience
Micro Project	Research and gather information	1.1.11	Does not collect any information on the topic	Collects very limited info; some related to the topic	Collects some basic info; most refer to the topic	Collects a great deal of relevant information; all refer to the topic
	Analysis of Problem, Requirement Analysis		Asks every other person to explain the problem without any thinking	Understands the problem, cannot do requirement analysis correctly – requires guidance	Understands the problem and requirement; good attempt but incomplete documentation	Pinpoints the salient requirements, conceives additional features; prepares standard documentation
	Planning & Designing		Copies plan/design from peers	Cannot decide a plan – discusses with everybody to create a plan and design	Can plan and make a workable design by own	Plans the solution effectively with innovative ideas and effective design
	Application of Subject Knowledge		Poor subject knowledge; requires support of others; can't even use templates	Lack of knowledge forces copy-paste with not much understanding	Applies subject knowledge partly	Effectively applies subject knowledge
	Application of Related other Concept and Techniques - Integrated Approach		No real application of any engg. techniques; waits for others to do his part	Conceptually weak, aware of some techniques but cannot integrate; requires guidance	Theoretically strong; encouraging approach without much help –lacks optimization	Makes integrated approach and effective use of techniques /concept; guides others
	Developing a Solution/System		Poor IT skill - cannot implement	Can implement partly	Mostly implements but complexity higher	Implements fully with all requirements satisfied – effective and less complex soln

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Course Structure of IT605C, Compiler Design

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT605C**, **Compiler Design** (Theory)
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Dr. P N Basu, PhD, Prof., Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Dr. P N Basu (40 years Computer Industry, 11 Years Academy. Ph.D. in Computer Technology)
Designation as a Compulsory or Elective course (Module)	Elective (Engineering Science)
Pre-requisites Courses	Pre-requisite: Concept of basic components of a digital computer, Basic concept of Fundamentals & Programme structures. Concept of Operating System, Basic knowledge of Automata theories.
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T -P 3-0-0 Credit – 3.0 Theory 3 hours Lecture One Semester
Course Outcomes	Upon successful completion of this course, learners will be able to: • Explain the different phases of a compiler design activities • Use the important tools for designing compilers including LEX and YACC • Solve problems on top down and bottom up parsing and build required parse tables • Apply the methods used in intermediate code generation and optimize a given source

Topics covered based on syllabus of affiliating University MAKAUT **(Lesson Plan)**

Day	Duration	Topics	Assignment/Notes
Day 1	**2L**	Introduction to Compiler	
Day 2	**1L**	Introduction to Compiler contd.	
Day 3	**2L**	**Lexical Analysis:** The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token,	**First home assignment**

	Day 4	**2L**	Recognition of a token, Finite automata, conversion from a regular expression to an NFA, conversion from a regular expression to DFA, Conversion algorithm from NFA to DFA	**Examples in class**
	Day 5	**2L**	Revision; Design of a lexical analyzer generator (Lex)	
	Day 6	**2L**	**Syntax Analysis**: The role of a parser, Context free grammars, Writing a grammar,	
	Day 7	**1L**	Top down Parsing, Non-recursive Predictive parsing(LL),	
	Day 8	**2L**	Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing,	
	Day 9	**1l**	LR parsers (SLR, LALR)	
	Day 10	**2L**	LR parsers (SLR, LALR), continued…	
	Day 11	**1L**	Parser generators (YACC). Error Recovery strategies for different parsing techniques.	**Second home assignment**
	Day 12	**2L**	**Syntax directed translation:** Syntax directed definitions, Construction of syntax trees,	
	Day 13	**1L**	Bottom-up evaluation of S attributed definitions,	
	Day 14	**2L**	L attributed definitions, Bottom-up evaluation of inherited attributes	
	Day 15	**1L**	Revisions	
	Day 16	**2L**	**Type checking** :Type systems, Specification of a simple type checker	
	Day 17	**2L**	Equivalence of type expressions, Type conversions	
	Day 18	**2L**	**Run time environments:** Source language issues (Activation trees, Control stack, scope of declaration, Binding of names),	**exercises**
	Day 19	**1L**	Storage organization (Subdivision of run-	**exercises**

			time memory, Activation records),	
	Day 20	**2L**	Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name),	**exercises**
	Day 21	**2L**	Symbol tables, dynamic storage allocation techniques	**exercises**
	Day 22	**2L**	Intermediate code generation, intermediate language, graphical representation	**exercises**
	Day 23	**2L**	Three address code, implementation of three address statements (Quadruplets, Indirect tripletsTriples),	**exercises**
	Day 24	**2L**	Code optimization, Introduction, Basic blocks, Flow Graphs	**exercises**
	Day 25	**2L**	Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization	**exercises**
	Day 26	**1L**	Loops in flow graph, Peephole optimization	
	Day 27	**2L**	**Code generations:** Issues in the design of code generator, a simple code generator,	
	Day 28	**2L**	Register allocation & assignment	**Discussions on assignments and projects**
			Revisions in remaining days	
Additional Topics, Activities and Assignments	• Practice problems • Assignments • Recapitulation of prerequisite			
Hints for Learning-Teaching Approach (Course Delivery)	Course notes, tutorial notes, tips of weekly study and class news are given through group_email/class representatives. Quizzes/Assignments are conducted/given to students as the course progresses, Selected assignments' answers are distributed personally accordingly. These are in addition to the weekly tutorial classes; As per University norms, • 3 Quizzes/Assignments are given and only the best 2 to be counted • Two 1-hour Class Tests and a 3-hours final exam will be taken Frequent question answer session in class are carried on regularly			
Course Assessment Policy	• Chalk-Board Lectures • PPTs for all lectures. Distributed to all students • Quiz, Interaction, Interactive problem solving and doubt-clearing session • Outside the class interaction with individual students having problems • Assignments and evaluation • Discussion on previous years questions. In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • Additional Lab Assignments • Micro Project			

	• Student Semester Exit Survey • Program & Dept. Evaluation Survey • Employer Survey • Course Entry & Exit Survey • Faculty & Staff Satisfaction Survey • Alumni Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Tool Table. The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics Table
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	• Attendance (Direct Assessment Method): 5% (University certification) • Quiz and Assignments: (Direct Assessment Method): 10% • 2 Unit Tests Exams (Direct Assessment Method): 15% • 1 Final Term-end Exam (Direct Assessment Method): 70% • Students Feedback and Employer Survey (Indirect Assessment Methods) • Classroom Demonstration and Class Performance (Direct Assessment Method (Institute certification)
Text Books and/or Reference Material	**Text books**: 1. Aho, Sethi, Ullman - "Compiler Principles, Techniques and Tools" - Pearson Education. 2. Holub - "Compiler Design in C" - PHI.

Mapping of Course Outcome with Program Outcome

S. No	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Compiler Design (IT 605C)	1. Explain the different phases of a compiler design activities	S											
		2. Use the important tools for designing compilers including LEX and YACC		M	S		S							
		3. Solve problems on top down and bottom up parsing and build required parse tables	S	S										
		4. Apply the methods used in intermediate code generation and optimize a given source	S	S										

Selection of Assessment Components and Tools

IT 605C (Compiler Design)								Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)			
Assessment Tools			PO 1	PO 2	PO 3	PO 5						
Component	Ast #	Method/Element						PO 1	PO 2	PO 3	PO 5
Class Performance	1.1.1	Multiple Choice Questions (Quiz)	*S*	-	-	-		0.5 × Score	-	-	-
	1.1.2	Short Answer type Questions (Class Test)	*S*	-	-	-		0.5 × Score	-	-	-
	1.1.3	Problem based Questions (Class Test)	*S*	*S*	-	*S*		0.5 × Score	0.5 × Score	-	0.5 × Score
	1.1.4	Design oriented Questions (Class Test)	*M*	*M*	*S*	-		0.3 × Score	0.3 × Score	0.5 × Score	-
	1.1.5	Open Ended Realistic Questions (Class Test)	*M*	*S*	-	-		0.3 × Score	0.5 × Score	-	-
	1.1.6	Library/ Home Assignment	*S*	-	-	*M*		0.5 × Score	-	-	0.3 × Score
	1.1.7	Viva	*S*	-	-	*S*		0.5 × Score	-	-	0.5 × Score
	1.1.9	Tutorial	*S*	*M*	-	*S*		0.5 × Score	0.3 × Score	-	0.5 × Score
	1.1.9	Attendance	*M*	-	-	-		0.3 × Score	-	-	-
Class Demonstra-tion	1.1.8	Quality of Technical Content, Planning & Adherence to Context	*M*	-	-	-		0.3 × Score	-	-	-
		Study & Understanding of the Topic	*S*	-	-	-		0.5 × Score	-	-	-
		Basic Knowledge in the related Science & Technology	*S*	-	-	-		0.5 × Score	-	-	-
		Effective Use of Context Specific Examples, Test Cases and References	*S*	-	-	-		0.5 × Score	-	-	-
		Q&A and interaction	*S*	-	-	-		0.5 × Score	-	-	-
Micro Project	1.1.11	Research and gather information	*S*	-	-	-		0.5 × Score	-	-	-
		Analysis of Problem, Requirement Analysis	*M*	*S*	*M*	-		0.3 × Score	0.5 × Score	0.3 × Score	-
		Planning & Designing	*S*	*S*	*S*	-		0.5 × Score	0.5 × Score	0.5 × Score	-
		Application of Subject Knowledge	*S*	-	-	-		0.5 × Score	-	-	-
		Application of Related other Concept and Techniques - Integrated Approach	*S*	*M*	*M*	*M*		0.5 × Score	0.3 × Score	0.3 × Score	0.3 × Score
		Developing Solution/System using IT skill	*S*	-	*S*	*S*		0.5 × Score	-	0.5 × Score	0.5 × Score
Terminal Test	1.2.1	Written Semester Exams	*S*	*S*	-	-		0.5 × Score	0.5 × Score	-	-
		Viva	*S*	-	-	*W*		0.5 × Score	-	-	0.2 × Score
Indirect Method	2.2.2	Student Semester Exit Survey	*S*	*S*	*S*	*S*		0.5 × Score	0.5 × Score	0.5 × Score	0.5 × Score
	2.2.5	Faculty and Staff Satisfaction Survey	*M*	*M*	*M*	*S*		0.3 × Score	0.3 × Score	0.3 × Score	0.5 × Score
	2.2.5	Employer Survey	*M*	*M*	*S*	*S*		0.3 × Score	0.3 × Score	0.5 × Score	0.5 × Score
							Weighted Score (WS)	**Total/11.1**	**Total / 4.5**	**Total / 3.4**	**Total / 4.3**
							%PO attained	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

Assessment Rubrics

IT 605C (Compiler Design)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Ast#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions (Quiz)	1.1.1	≤40%	>40% - 60%	>60% - 80%	>80%
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Open Ended Realistic Questions (Class Test)	1.1.5	≤40%	>40% - 60%	>60% - 80%	>80%
Assignment (Library/ Home)	1.1.6	Irregular, mostly copies from peers	Regular but often search help from instructor, Collects info - not always relevant	Regular and solves most problems by its own, Collects only basic relevant info	Regularly solves all problems, capable to generate new ideas, Collects great deal of relevant info
Viva	1.1.7	Seldom responses	Often responses – few are correct	Regularly responses – mostly correct, fails to answer incisive questions	Seldom gives wrong answers; also gives to the point answers, correctly answers incisive questions
Tutorial	1.1.9	Hardly questions the teacher, does not try to solve assignments in class, does not discuss with peers	Does only what is asked to do in the class; seldom questions to clear doubts, interacts with peers	Comes prepared, asks questions, solves assignments in class, not that good in solving critical questions / problems	Asks interesting questions, guides the peers in solving critical questions / problems, explains on board if asked
Attendance	1.1.9	≤50%	>50% - 60%	>60% - 80%	>80%
Written exams	1.2.1	≤40%	>40% - 60%	>60% - 80%	>80%
Viva	2.2.4	Poor subject knowledge; can't understand simple questions	Moderate subject knowledge, some good explanation; unable to answer harder questions	Good subject knowledge, mostly good explanation; attempts some harder questions	Sound subject knowledge, precise explanations; correctly answers most of the harder questions
Student Semester Exit Survey	2.2.2	Got poor marks in sem; no confidence on subject	Got fair marks in sem; unwilling to pursue further studies on subject	Got good marks in sem; confident that learnt something new and useful	Got excellent marks in sem, highly confident about the subject and willing to pursue projects or learn more on it
Faculty and Staff Satisfaction Survey	2.2.5	Poor understanding of any related questions	Tries to response queries if initial hints are given	Also attempts to answer conceptual questions	Can manage any types of questions at any difficulty level with utmost confidence
Employer Survey	2.2.1	Can't answer anything	Attempts to answer basic questions	Good in both theory and programming, however weak in skill -related question	Promptly responses to any question, programming approach is efficient and confidently manages any program

IT 605C (Compiler Design)						
Assessment Tools			**Grading Criteria**			
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Classroom Demonstration	Quality of Technical Content, Planning & Adherence to Context	1.1.8	Sketchy and incoherent, mostly irrelevant and out of context	Moderate coverage of topic, sometimes out of context	Informative but not to the point always	Smart, comprehensive, very relevant and effective
	Study & Understanding of the Topic		Minimal or no use of examples/cases; hardly any reference used	Very few meaningful examples used, no reference used	Examples and test cases used but not explained properly; References used but not following norms	Optimal use of well-chosen examples to clearly explain the topic
	Basic Knowledge in the related Science & Technology		Wrong response or explanation, least awareness	sketchy explanation, skipping complicated parts	Good explanation at some places, lack of thorough study	Clear understanding, thorough preparation
	Effective Use of Context Specific Examples, Test Cases and References		Cannot connect and explain the scientific reason behind or related technology	Can connect but cannot explain properly relevant theory or technology	Explains but not convincing and clear; lacks good knowledge of related technology	Demonstrates sound knowledge of related theory and technology; appears aware of latest related developments
	Q&A and interaction		Hardly invites questions and monotonous delivery	Accepts limited questions and makes minimal interaction	Interacts only at the end of demonstration	Interactive demonstration involving the audience
Micro Project	Research and gather information	1.1.11	Does not collect any information on the topic	Collects very limited info; some related to the topic	Collects some basic info; most refer to the topic	Collects a great deal of relevant information; all refer to the topic
	Analysis of Problem, Requirement Analysis		Asks every other person to explain the problem without any thinking	Understands the problem, cannot do requirement analysis correctly – requires guidance	Understands the problem and requirement; good attempt but incomplete documentation	Pinpoints the salient requirements, conceives additional features; prepares standard documentation
	Planning & Designing		Copies plan/design from peers	Cannot decide a plan – discusses with everybody to create a plan and design	Can plan and make a workable design by own	Plans the solution effectively with innovative ideas and effective design
	Application of Subject Knowledge		Poor subject knowledge; requires support of others; can't even use templates	Lack of knowledge forces copy-paste with not much understanding	Applies subject knowledge partly	Effectively applies subject knowledge
	Application of Related other Concept and Techniques - Integrated Approach		No real application of any engg. techniques; waits for others to do his part	Conceptually weak, aware of some techniques but cannot integrate; requires guidance	Theoretically strong; encouraging approach without much help –lacks optimization	Makes integrated approach and effective use of techniques /concept; guides others
	Developing a Solution/System		Poor IT skill - cannot implement	Can implement partly	Mostly implements but complexity higher	Implements fully with all requirements satisfied – effective and less complex soln

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Course Structure of IT605D, Artificial Intelligence

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT605D**, **Artificial Intelligence**, 3rd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Mr. Amit Khan, M.E. Asst. Prof., Dept of IT • Moderator: Dr. Dipankar Majumdar, Associate Professor, PhD.
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Mr. Amit Khan (9 years, M.E. in Information Technology) • Dr. Dipankar Majumdar (11 years, PhD)
Designation as a Compulsory or Elective course (Module)	Professional Elective
Pre-requisites Courses	Class XII level Biology, Physics & Mathematics Engineering level Fundamentals of Computers, Algorithms
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 3-0-0 Credit – 3.0 Theory 3 hours Lecture One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Describe real world problems in terms of Initial and Goal conditions 2. Classify different problems in to some special groups 3. Apply solution driver to logically derive solution based on probability theory and possibility theory (fuzzy logic); 4. Evaluate the quality of solutions 5. Develop machine applications with human common sense reasoning

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Day 1	1L	Overview of Artificial intelligence	Power point slide
Day 2	2L	Problems of AI, AI technique, Tic - Tac - Toe problem.	Printed study material
Day 3	1L	Intelligent Agents: Agents & environment, nature of environment, structure of agents.	Power point slide
Day 4	2L	goal based agents, utility based agents, learning agents.	Power point slide
Day 5	1L	Problem Solving: Problems, Problem Space & search: Defining the problem as state space search.	Printed study material
Day 6	2L	Production system, problem	Class notes

			characteristics, issues in the design of search programs.	
	Day 7	1L	Search techniques: Solving problems by searching, problem solving agents, searching for solutions.	Power point slide
	Day 8	2L	Uniform search strategies: breadth first search, depth first search, depth limited search.	Printed study material on BFS and DFS
	Day 9	1L	Bidirectional search, comparing uniform search strategies.	Worked out example (as notes) on Bi-directional search
	Day 10	2L	Heuristic search strategies: Greedy best-first search, A* search, memory bounded heuristic search.	Worked out example (as notes) on best-first search and A*
	Day 11	1L	Local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms.	Printed study material
	Day 12	2L	Constraint satisfaction problems, local search for constraint satisfaction problems.	Power point slide
	Day 13	1L	Adversarial search: Games, optimal decisions & strategies in games, the mini-max search procedure.	Worked out example (as notes) on mini-max search procedure in class room
	Day 14	2L	Alpha-beta pruning, additional refinements, iterative deepening	Worked out example (as notes) on Alpha-beta pruning in class room
	Day 15	1L	Knowledge & reasoning: Knowledge representation issues, representation & mapping,	Power point slide
	Day 16	2L	Approaches to knowledge representation, issues in knowledge representation. Scaling, Reflection, Rotation	Power point slide
	Day 17	1L	Using predicate logic: Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.	Printed study material
	Day 18	2L	Logic programming, forward verses backward reasoning.	Power point slide
	Day 19	1L	Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks.	Printed study material
	Day 20	2L	Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	
	Day 21	2L	Planning: Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.	Worked out example of planning system
	Day 22	1L	Learning :Forms of learning, inductive learning, learning decision trees.	Printed study material
	Day 23	2L	Expert Systems: Representing and	

			using domain knowledge, expert system shells, and knowledge acquisition.	
	Day 24	2L	Basic knowledge of programming language like Prolog& Lisp	
Additional Topics (Class + Tutorial)	• Artificial Intelligence • Introduction to Natural Language Processing • Introduction to Pattern Recognition			
Activities of Students and Assignments	• Take part in Classroom Demonstration (group activity) • Take part in Quiz (individual activity) • Prepare Home Assignments • Prepare Library Assignments			
Hints for Learning-Teaching Approach (Course Delivery)	• Regular Class Lectures (learner-centric) – ✓Involve students in discussion/expression of views ✓Ask students to explain on board ✓Ask questions to students on previously discussed /ongoing topic • Class room Demonstration (on selected topics) by students in groups • Home/Library Assignment and Notes/Study Material on topics not delivered in Class/Tutorial • Outside the class interaction with individual students having difficulty			
Course Assessment Policy	Assessment will be done in following two methods: 3. Direct Assessment – (a) Continuous Assessment throughout the semester, (b) Terminal Test at the end of the semester 4. Indirect Assessment – Opinion Survey Grade will be awarded by University based on marks scored out of 100, the break-up of which is as follows: • Attendance (Cont. Assmt. by Teacher): 5% • Average of Quiz + Assignments: (Cont. Assmt. by Teacher): 10% • Best of two 1-hour Class Tests (Cont. Assmt. by Teacher): 15% • One 3-hours Term-end Exam (Terminal Assmt. by Univ.): 70% Points will be awarded by the Department upon assessing attainment of POs related to the course. Scores (1-4) assessed, using each different assessment tool, have weighted components against correlated POs (weights according to strong, medium or weak correlation). % attainment of each course-related PO is then found from the % of weighted average score w.r.t maximum avg score (4).			
Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs related to the course outcome. • 5 categories of questions in Class Tests • Library Assignment • Classroom Demonstration • Viva • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey • Employer Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Assessment Rubrics. The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics.			
Text Books and/or Reference Material	• **Text Books:** 1. Rich, Knight – "Artificial Intelligence " – TMH 2. Deepak Khemani– " A first Course Of Artificial Intelligence"- Mc Graw Hill Education. • **Reference Books:** 1. Shivani Goel – "Artificial Intelligence"- Express Learning			

Mapping of Course Outcome with Program Outcome

S. No.	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Artificial Intelligence IT605D	1. Describe real world problems in terms of Initial and Goal conditions	S	S		M								
		2. Classify different problems into some special groups	M	S		M								
		3. Apply solution driver to logically derive solution		M	S									
		4. Evaluate the quality of solutions		M	S									
		5. Develop machine applications with human common sense reasoning		S	S									

Selection of Assessment Components and Tools

IT – 605D (Artificial intelligence)							**Score (1 – 4)**	**Weighted Evaluation of POs (W_S – 0.5 | | W_M = 0.3 | | W_W = 0.2)**			
Assessment Tools			**PO 1**	**PO 2**	**PO 3**	**PO 4**		**PO 1**	**PO 2**	**PO 3**	**PO 4**
Component	**Ast - #**	**Method/Element**									
Class Performance	1.1.2	Short Answer type Questions (Class Test)	*S*	*S*	-	-		0.5 × Score	0.5 × Score	-	-
	1.1.3	Problem based Questions (Class Test)	*S*	*S*	-	-		0.5 × Score	0.5 × Score	-	-
	1.1.4	Design oriented Questions (Class Test)	*M*	*S*	*S*	M		0.3 × Score	0.5 × Score	0.5 × Score	0.3 × Score
	1.1.5	Open Ended Realistic Questions (Class Test)	*S*	*S*	-	*S*		0.5 × Score	0.5 × Score	-	0.5 × Score
	1.1.6	Assignments (Library/ Home Assignment)	*M*		-	-		0.3 × Score	-	-	-
Terminal Test	1.2.1	Written Exams (incl. MCQ, Short Answer type and Long Answer type Questions, Numerical & Design Problems)	*S*	*M*	*M*	*W*		0.5 × Score	0.3 × Score	0.3 × Score	0.2 × Score
Indirect Method	2.2.1	Employer Survey	*S*	*M*	*S*	*M*		0.5 × Score	0.3 × Score	0.5 × Score	0.3 × Score
	2.2.4	Program & Dept. Evaluation Survey	-	*S*	*S*	-			0.5 × Score	0.5 × Score	
							Weighted Score (WS)	**Total / 3.1**	**Total / 3.1**	**Total / 1.8**	**Total / 1.3**
							% of PO attained	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

Assessment Rubrics

IT - 605D (Artificial Intelligence)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Ast - #**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Short Answer type Questions (Class Test)	1.1.2	<40%	>40% - <60%	>60% - <80%	>80%
Problem based Questions (Class Test)	1.1.3	<40%	>40% - <60%	>60% - <80%	>80%
Design oriented Questions (Class Test)	1.1.4	<40%	>40% - <60%	>60% - <80%	>80%
Open Ended Realistic Questions (Class Test)	1.1.5	<40%	>40% - <60%	>60% - <80%	>80%
Assignment (Library/ Home)	1.1.6	Irregular	Regular but often search helps from instructor	Regular and solve all problems of its own	Regularly solves all problems and in addition to that is capable to generate new ideas
Written exams	1.2.1	<40%	>40% - <60%	>60% - <80%	>80%
Employer survey	2.2.1	Can't answer anything	Try to answer basic questions	Good in both theory and programming, however weak skilled question	Promptly responses to any question, programming approach is efficient and confidently manages any program
Prog. & Dept. evaluation survey	2.2.4	Poor understanding of any related questions	Try to response queries if initial hints are given	Also attempts to answer conceptual questions	Can manage any types of questions at any difficulty level with utmost confidence

IT - 605D (Artificial Intelligence)						
Assessment Tools			**Grading Criteria**			
Method/Element		**Ast - #**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Classroom Demonstration	Quality of Technical Content, Planning & Adherence to Context	1.1.8	Sketchy and incoherent, mostly irrelevant and out of context	Moderate coverage of topic, sometimes out of context	Informative but not to the point always	Smart, comprehensive, very relevant and effective
	Study & Understanding of the Topic		Minimal or no use of examples/cases; hardly any reference used	Very few meaningful examples used, no reference used	Examples and test cases used but not explained properly; References used but not following norms	Optimal use of well-chosen examples to clearly explain the topic
	Basic Knowledge in the related Science & Technology		Wrong response or explanation, least awareness	sketchy explanation, skipping complicated parts	Good explanation at some places, lack of thorough study	Clear understanding, thorough preparation
	Effective Use of Context Specific Examples, Test Cases and References		Cannot connect and explain the scientific reason behind or related technology	Can connect but cannot explain properly relevant theory or technology	Explains but not convincing and clear; lacks good knowledge of related technology	Demonstrates sound knowledge of related theory and technology; appears aware of latest related developments
	Q&A and interaction		Hardly invites questions and monotonous delivery	Accepts limited questions and makes minimal interaction	Interacts only at the end of demonstration	Interactive demonstration involving the audience
Micro Project	Research and gather information	1.1.11	Does not collect any information on the topic	Collects very limited info; some related to the topic	Collects some basic info; most refer to the topic	Collects a great deal of relevant information; all refer to the topic
	Analysis of Problem, Requirement Analysis		Asks every other person to explain the problem without any thinking	Understands the problem, cannot do requirement analysis correctly – requires guidance	Understands the problem and requirement; good attempt but incomplete documentation	Pinpoints the salient requirements, conceives additional features; prepares standard documentation
	Planning & Designing		Copies plan/design from peers	Cannot decide a plan – discusses with everybody to create a plan and design	Can plan and make a workable design by own	Plans the solution effectively with innovative ideas and effective design
	Application of Subject Knowledge		Poor subject knowledge; requires support of others; can't even use templates	Lack of knowledge forces copy-paste with not much understanding	Applies subject knowledge partly	Effectively applies subject knowledge
	Application of Related other Concept and Techniques - Integrated Approach		No real application of any engg. techniques; waits for others to do his part	Conceptually weak, aware of some techniques but cannot integrate; requires guidance	Theoretically strong; encouraging approach without much help –lacks optimization	Makes integrated approach and effective use of techniques /concept; guides others
	Developing a Solution/System		Poor IT skill - cannot implement	Can implement partly	Mostly implements but complexity higher	Implements fully with all requirements satisfied – effective and less complex soln

Mapping of Course Outcome with Program Outcome

S. No	Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Seminar (IT681)	1. Gather beyond the curriculum technical knowledge	S											
		2. Write and understand documentation of a standard report										S		
		3. Build up team spirit and leadership qualities.									S	S		

Selection of Assessment Components and Tools

IT – 681 (Seminar)							Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)		
Assessment Tools			PO 1	PO 9	PO 10	Score (1 – 4)	PO 1	PO 9	PO 10
Comp-onent	#	Method/Element							
Major Project (Cont. Assmt..)	1.1.12	Research & Literature Survey	S				0.5 × Score		
		Study, Investigation & Requirement Analysis	S				0.5 × Score		
		Application of latest Technology /Concept	S				0.5 × Score		
		Documentation & Report			S				0.5 × Score
		Leadership & Teamwork		S				0.5 × Score	
Terminal Test : Project Presentation	1.2.3	Quality of Technical Content, Planning & Adherence to Context, Demo of Prototype	M	W	S		0.3 × Score	0.2 × Score	0.5 × Score
		Depth of Understanding & Preparation	S	M			0.5 × Score	0.3 × Score	
		Body Language, Confidence & Communication Skill			S				0.5 × Score
		Q/A, Interaction, Manners	S	W	S		0.5 × Score	0.2 × Score	0.5 × Score
		Assessment by University Examiner	S	M	S		0.5 × Score	0.3 × Score	0.5 × Score
	2.2.5	Faculty and Staff Satisfaction Survey	S	M	S		0.5 × Score	0.3 × Score	0.5 × Score
	2.2.5	Employer Survey	M	M	S		0.3 × Score	0.3 × Score	0.5 × Score
						Weighted Score (WS)	**Total/ 4.1**	**Total/2.1**	**Total / 3.5**
						%PO attained	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

Assessment Rubrics

IT - 681 (Seminar)

Assessment Tools			Grading Criteria			
Method/Element		**#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Major Project (Cont. Assessment)	Research & Literature Survey	1.1.12	Does not collect any information on the topic	Collects very limited info; some related to the topic	Collects some basic info; most refer to the topic	Collects a great deal of relevant information; all refer to the topic
	Study, Investigation & Requirement Analysis		Asks every other person to explain the project without any thinking or study of similar system	Understands the problem, studies similar system but cannot contribute to requirement analysis – requires guidance	Understands the problem and does most of requirement analysis, prepares basic documentation (SRS)	Takes lead role in pinpointing the salient requirements, conceives additional features, fine tunes and standardizes documentation (SRS)
	Application of latest Technology /Concept		Poor IT skill, also reluctant to learn new technology/concept	Conceptually weak, aware of some techniques but cannot apply; requires guidance	Have good technical knowledge/concept - applies some, ready to learn new techniques	Makes integrated approach and effective use of new techniques /concept, learns quickly and guides others
	Documentation & Report		Poor contribution in documentation and report preparation	Helps in documenting different stages but lacks report writing skills, plays supportive role	Develops the basic structure of project report, checks documentation standard	Does major part of report writing, makes the report technically comprehensive and ensures adherence to standards
	Leadership & Teamwork		Does not perform any duties assigned to team role	Performs minimal duties, cares for other team members	Performs nearly all duties, helps other team members	Performs all duties, takes additional responsibilities, guides other members and leads the team
Terminal Test (Project Presentation)	Quality of Technical Content, Planning & Adherence to Context , Demo of Prototype	1.2.3	Least contribution in making the ppt and prototype, Poor quality, Minimal part played in giving the presentation and the demo	Some contribution in making the ppt and the prototype, Average quality, Fair part played in giving the presentation and the demo	Significant contribution in making the ppt and the prototype, Good quality, Active part played in giving the presentation and the demo	Maximum contribution in making the ppt and the prototype, Best quality, Leading part played in giving the presentation and the demo
	Depth of Understanding and Preparation		Poor understanding	Does not understand all modules	Understands working of all modules but lacks knowledge about reason and remedies of project limitation;	Clearly understands working of all modules, limitations and possible remedies; thorough preparation
	Body Language, Confidence & Communication Skill		Unimpressive reflecting lack of confidence, low voice, poor linguistic skills	Starting well but frequently faltering and losing confidence, medium voice , limited linguistic skills	Acceptable but does not make impact on the audience, good linguistic skill but often fails to communicate effectively, acceptable voice,	Attracts attention and makes the demo lively, applies the art of effective communication, strong voice, strong linguistic skill
	Q&A and interaction, Manners		Wrong response or explanation, ill-mannered	Sketchy explanation, skips complicated parts, needs support, lacking manners	Good explanation at some Qs, helps other members while answering, good manners	Clear explanation with examples, volunteers answering hard/critical Qs, well mannered
	Assessment by University Examiner		≤40%	>40% - 60%	>60% - 80%	>80%

Faculty and Staff Satisfaction Survey	2.2.5	Generally poor knowledge understanding & programming skill, careless approach in team, weak soft skill	Conceptually weak, needs guidance in programming, plays some role in team, lacks in soft skill	Has basic knowledge, good programming skill, report writing skill and soft skill. lacks in technical depth and leadership, hard worker	Has solid knowledge, can manage any type of questions at any difficulty level with utmost confidence, has excellent report writing and soft skill and leadership quality, good finisher
Employer Survey	2.2.1	Lack professional skill and attitude, got poor exposure in SDLC	Scope for improvement of professional skill and attitude, lacks exposure in all stages of SDLC	Good professional skill and attitude, good exposure in SDLC stages, lacks leadership and technical depth	Excellent professional skill and attitude, has leadership quality and technically sound, proficient in conducting all stages of SDLC