SECOND 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

First Edition: December 2014
First Edition (Revised): June 2015

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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**

Second Year First Semester

Syllabus of B.Tech (IT)

Second Year - Third Semester

A. THEORY							
Sl.No.	Field	Theory	Contact Hours/Week				Cr. Points
			L	T	P	Total	
1	**HU301**	Values & Ethics in Profession	3	0	0	3	3
2	**PH301**	Physics-2	3	1	0	4	4
3	**CH301**	Basic Environmental Engineering & Elementary Biology;	3	0	0	3	3
4	**CS301**	Analog & Digital Electronics	3	0	0	3	3
5	**CS302**	Data Structure & Algorithm	3	1	0	4	4
6	**CS303**	Computer Organisation	3	1	0	4	4
Total of Theory						**21**	**21**
B. PRACTICAL							
7	**PH391**	Physics-2	0	0	3	3	2
8	**CS391**	Analog & Digital Electronics	0	0	3	3	2
9	**CS392**	Data Structure & Algorithm	0	0	3	3	2
10	**CS393**	Computer Organisation	0	0	3	3	2
Total of Practical						**12**	**8**
Total of Semester						**33**	**29**

SEMESTER - III

Theory

VALUES & ETHICS IN PROFESSION
HU-301
Contracts:3L
Credits- 3

Science, Technology and Engineering as knowledge and as Social and Professional Activities

Effects of Technological Growth:

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development

Energy Crisis: Renewable Energy Resources

Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics Appropriate Technology Movement of Schumacher; later developments

Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis.

Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

Ethics of Profession:

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Profession and Human Values:

Values Crisis in contemporary society

Nature of values: Value Spectrum of a good life Psychological values: Integrated personality; mental health

Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.

Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity

Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

Text Books

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)

2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

Physics-2

Code: PH-301
Contacts: 4L
Credit: 3+1

Module 1:

Vector Calculus:

1.1 Physical significances of grad, div, curl. Line integral, surface integral, volume integral- physical examples in the context of electricity and magnetism and statements of Stokes theorem and Gauss theorem [No Proof]. Expression of grad, div, curl and Laplacian in Spherical and Cylindrical co-ordinates.

Module 2:

Electricity

2.1 Coulumbs law in vector form. Electrostatic field and its curl. Gauss's law in integral form and conversion to differential form . Electrostatic potential and field, Poisson's Eqn. Laplace's eqn (Application to Cartesian, Spherically and Cylindrically

symmetric systems – effective 1D problems) Electric current, drift velocity, current density, continuity equation, steadycurrent.

2.2 Dielectrics-concept of polarization, the relation $D=\varepsilon_0 E+P$, Polarizability. Electronic polarization and polarization in

monoatomic and polyatomic gases.

Module 3:

Magnetostatics & Time Varying Field:

3. Lorentz force, force on a small current element placed in a magnetic field. Biot-Savart law and its applications, divergence of magnetic field, vector potential, Ampere's law in integral form and conversion to differential form. Faraday's law of electro-magnetic induction in integral form and conversion to differential form.

Module 4:

Electromagnetic Theory:

4.1 Concept of displacement current Maxwell's field equations, Maxwell's wave equation and its solution for free space. E.M. wave in a charge free conducting media, Skin depth, physical significance of Skin Depth, E.M. energy flow, & Poynting Vector.

Module 5:

Quantum Mechanics:

5.1 Generalised coordinates, Lagrange's Equation of motion and Lagrangian, generalised force potential, momenta and energy. Hamilton's Equation of motion and Hamiltonian. Properties of Hamilton and Hamilton's equation of motion.

Course should be discussed along with physical problems of 1-D motion

5.2 Concept of probability and probability density, operators, commutator. Formulation of quantum mechanics and Basic postulates, Operator correspondence, Time dependent Schrödinger's equation, formulation of time indepe ndent Schrödinger's equation by method of separation of v ariables, Physical interpretation of wave function ψ (normalization and probability interpretation), Expectation values, Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well), Discussion on degenerate levels.

Module 6:

Statistical Mechanics:

3.1 Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (No deduction necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics Fermi distribution at zero & non-zero temperature, Calculation of Fermi level in metals, also total energy at absolute zero of temperature and total number of particles, Bose-Einstein statistics – Planck's law of blackbody radiation..

Basic Environmental Engineering & Elementary Biology
Code: CH301
Contacts: 3L = 3
Credits:3

General

Basic ideas of environment, basic concepts, man, society & environment, their interrelationship.

Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. 2L Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function.

Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering.

Ecology

Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function.

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain

[definition and one example of each food chain], Food web.

Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur].

Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.

Air pollution and control

Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause.

Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.

Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food.Global warming and its consequence, Control of Global warming. Earth's heat budget.

Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).

Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.

Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN.

Smog, Photochemical smog and London smog

Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification.

Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).

Water Pollution and Control

Hydrosphere, Hydrological cycle and Natural water.

Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds.

River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH.

Lake: Eutrophication [Definition, source and effect].
Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)
Standard and control: Waste water standard [BOD, COD, Oil, Grease],

Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening]

Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition.

Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic

Land Pollution

Lithosphere; Internal structure of earth, rock and soil

Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).

Noise Pollution

Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise]

Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18 hr Index) , Ldn .

Noise pollution control.

Environmental Management:

Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol.

Text Books

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
2. De, A. K., "Environmental Chemistry", New Age International.

Analog & Digital Electronics
Code: CS301
Contact: 3L
Credit: 3

Pre-requisite of Analog Electronics: Basic Electronics Parts I & II learned in the First year, semesters 1 & 2. Basic concept of the working of P-N diodes, Schottky diodes, Basic BJTs, Basic FETs and OPAMP as a basic circuit component. Concept of Feedback.

Module -1

Different Classes of Amplifiers - (Class-A, B, AB and C - basic concepts, power, efficiency; Recapitulation of basic concepts of Feedback and Oscillation. Phase Shift, Wein Bridge oscillators.

Astable & Monostable Multivibrators; Schimtt Trigger circuits, 555 Timer.

[Learning Outcome: The learner will be trained to compare the merits and demerits of the different amplifiers and must be able to bias the transistors accordingly; the student must be able to design multivibrator circuits using 555 timers]

Pre-requisite of Digital Electronics: Binary numbers & Basic Boolean algebra – already cover ed in First year; Logic gates, Truth Tables and function realization – already cov ered in First year upto minimisation of Logic expressions by algebraic method, K-map,

Module – 2:

Binary Number System & Boolean Algebra (recapitulation); BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods. Binary arithmetic, Venn diagram, Boolean algebra (recapitulation); Representation in SOP and POS forms.

Minimization of logic expressions by algebraic method.
Combinational circuits - Adder and Subtractor circuits (half & full adder & subtractor); Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator.

Module - 3:
a) Sequential Circuits - Basic Flip-flop & Latch, Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops

b) Registers (SISO,SIPO,PIPO,PISO), Ring counter, Johnson counter, Basic concept of Synchronous and Asynchronous counters (detail design of circuits excluded), Design of Mod N Counter

Module – 4:
1. A/D and D/A conversion techniques – Basic concepts (D/A :R-2-R only A/D: successive approximation)
2. Logic families- TTL, ECL, MOS and CMOS - basic concepts.

[Learning Outcome: The student must be able to convert from one number system to another, work out problems related to Boolean algebra, minimisation problems etc. The student must also learn to differentiate between the combinational and sequential circuits and design simple circuits)

Textbooks

1. Microelectronics Engineering - Sedra & Smith-Oxford.
2. Principles of Electronic Devices & circuits—B L Ther eja & Sedha—S Chand
3. Digital Electronics – Kharate – Oxford
4. Digital Electronics – Logic & Systems by J.Bigmell & R.Donovan; Cambridge Learning.
5. Digital Logic and State Machine Design (3rd Edition) – D.J.Comer, OUP

Reference Books

1. Electronic Devices & Circuit Theory – Boyelstad & Nas helsky - PHI
2. Bell-Linear IC & OP AMP—Oxford
3. P.Raja- Digital Electronics- Scitech Publications
4. Morries Mano- Digital Logic Design- PHI
5. R.P.Jain—Modern Digital Electronics, 2/e , Mc Graw H ill
6. H.Taub & D.Shilling, Digital Integrated Electronics- Mc Graw Hill.

7. D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
8. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson
9. J.Bignell & R.Donovan-Digital Electronics-5/e- Cenage Learning.
10. Leach & Malvino—Digital Principles & Application, 5 /e, Mc Graw Hill
11. Floyed & Jain- Digital Fundamentals-Pearson.

Data Structure & Algorithm
Code: CS302
Contacts: 3L +1T
Credits:4

Pre-requisites: CS 201 (Basic Computation and Principles of C), M101 & M201 (Mathematics), basics of set theory

Module - I
Linear Data Structure Introduction
Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code.

Algorithm efficiency and analysis, time and space analysis of algorithms – order notations.

Array :
Different representations – row major, column major .
Sparse matrix - its implementation and usage. Array representation of polynomials.

Linked List:
Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

Module -II
Linear Data Structure [Stack and Queue]:
Stack and its implementations (using array, using linked list), applications.

Queue, circular queue, dequeue. Implementation of queue- both linear and circular (using array, using linked list), applications.

Recursion:

Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi, Eight Queens Puzzle.

Module -III
Nonlinear Data structures Trees:
Basic terminologies, forest, tree representation (using array, using linked list).

Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left, right, full) - non-recursive traversal algorithms using threaded binary tree, expression tree.
Binary search tree- operations (creation, insertion, deletion, searching).

Height balanced binary tree – AVL tree (insertion, deletion with examples only). B- Trees – operations (insertion, deletion with exam ples only).

Graphs:

Graph definitions and concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut-vertex/articulation point, pendant node, clique, complete graph, connected components – strongly conne cted component, weakly connected component, path, shortest path, isomorphism).

Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi-list.

Graph traversal and connectivity – Depth-first sear ch (DFS), Breadth-first search (BFS) – concepts of e dges used in DFS and BFS (tree-edge, back-edge, cross-edge, forward-edge), applications.

Minimal spanning tree – Prim's algorithm (basic ide a of greedy methods).

Module - IV
Searching, Sorting:

Sorting Algorithms : Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap, application – prior ity queue), radix sort.

Searching: Sequential search, binary search, interpolation search. Hashing (3L): Hashing functions, collision resolution techniques.

Text books

1. "Data Structures And Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
2. "Fundamentals of Data Structures of C" by Ellis Horo witz, Sartaj Sahni, Susan Anderson-freed.
3. "Data Structures in C" by Aaron M. Tenenbaum.
4. "Data Structures" by S. Lipschutz.
5. "Data Structures Using C" by Reema Thareja.
6. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jag adev.
7. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

Learning outcome:

Ideally this course should act as a primer/pre-requisite for CS 503 (Design and Analysis of Algorithms). On completion of this course, students are expected to be capable of understanding the data structures, their advantages and drawbacks, how to implement them in C, how their drawbacks can be overcome and what the applications are and where they can be used. Students should be able to learn about the data structures/ methods/algorithms mentioned in the course with a comparative perspective so as to make use of the most appropriate data structure/ method/algorithm in a program to enhance the efficiency (i.e. reduce the run-time) or for better memory utilization, based on the priority of the implementation. Detailed time analysis of the graph algorithms and sorting methods are expected to be covered in CS 503 but it is expected that the students will be able to understand at least the efficiency aspects of the graph and sorting algorithms covered in this course. The students should be able to convert an inefficient program into an efficient one using the knowledge gathered from this course.

Computer Organization
Code: CS303
Contacts: 3L +1T
Credits: 4

Pre-requisite: Concept of basic components of a digital computer, Basic concept of Fundamentals & Programme structures. Basic number systems, Binary numbers, representation of signed and unsigned numbers, Binary Arithmetic as covered in Basic Computation & Principles of Computer Programming Second semester, first year. Boolean Algebra, Karnaugh Maps, Logic Gates – covered in Basic Electronics in First year

Module – 1

Basic organization of the stored program computer and operation sequence for execution of a program. Role of operating systems and compiler/assembler.

Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes.

Commonly used number systems. Fixed and floating point representation of numbers.

Module – 2
Overflow and underflow.
Design of adders - ripple carry and carry look ahead principles.

Design of ALU.
Fixed point multiplication -Booth's algorithm.
Fixed point division - Restoring and non-restoring algorithms.
Floating point - IEEE 754 standard.

Module – 3

Memory unit design with special emphasis on implementation of CPU-memory interfacing. Memory organization, static and dynamic memory, memory hierarchy, associative memory. Cache memory, Virtual memory. Data path design for read/write access.

Module – 4
Design of control unit - hardwired and microprogrammed control.

Introduction to instruction pipelining.
Introduction to RISC architectures. RISC vs CISC architectures.
I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA.

Learning Outcome:

Additional Tutorial Hours will be planned to meet the following learning outcome.

Through this course, the students will be exposed to extensive development and use of computer organization based concepts for the future knowledge outcome of Advanced Computer Architecture offered in subsequent semester. The students will be able to understand different instruction formats, instruction sets, I/O mechanism. Hardware details, memory technology, interfacing between the CPU and peripherals will be transparent to the students. Students will be able to design hypothetical arithmetic logic unit.

Text Books

1. Mano, M.M., "Computer System Architecture", PHI .
2. Behrooz Parhami " Computer Architecture", Oxford University Press

Reference Books

1. Hayes J. P., "Computer Architecture & Organisati on", McGraw Hill,
2. Hamacher, "Computer Organisation", McGraw Hill,
3. N. senthil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers" OUP
4. Chaudhuri P. Pal, "Computer Organisation & Design", PHI,
5. P N Basu- "Computer Organization & Architecture" , Vikas Pub

Practical

Physics Lab-2
Code: PH-391
Contacts: 3P
Credit: 2

Group 1: Experiments on Electricity and Magnetism

1. Determination of dielectric constant of a given dielectric material.

2. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.

3. Determination of the thermo-electric power at a certain temperature of the given thermocouple.
4. Determination of specific charge (e/m) of electron by J.J. Thomson's method.

Group 2: Quantum Physics

5. Determination of Planck's constant using photocell.
6. Determination of Lande'g factor using Electron spin resonance spetrometer.
7. Determination of Stefan's radiation constant
8. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
9. Determination of Rydberg constant by studying Hydrogen/ Helium spectrum

Group 3: Modern Physics

10. Determination of Hall co-efficient of semiconductors.
11. Determination of band gap of semiconductors.
12. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

a) A candidate is required to perform 3 experiments taking one from each group. Initiative should be taken so that most of the Experiments are covered in a college in the distribution mentioned above. Emphasis should be given on the estimation of error in the data taken.

b) In addition a student should perform one more experiments where he/she will have to transduce the output of any of the above experiments or the experiment mentioned in c] into electrical voltage and collect the data in a computer using phoenix or similar interface.

c) Innovative experiment: One more experiment designed by the student or the concerned teacher or both.

Note:
i. Failure to perform each experiment mentioned in b] and c] should be compensated by two experiments mentioned in the above list.

ii. At the end of the semester report should sent to the board of studies regarding experiments, actually performed by the college, mentioned in b] and c]

iii. Experiment in b] and c] can be coupled and parts of a single experiment.

Reference Books

(Both Physics I and II)

1. B. Dutta Roy (Basic Physics)
2. R.K. Kar (Engineering Physics)
3. Mani and Meheta (Modern Physics)
4. Arthur Baiser (Perspective & Concept of Modern Physics)

(Physics I (PH101/201) - Vibration and Waves)

1. Kingsler and Frey
2. D.P. Roychaudhury
3. N.K. Bajaj (Waves and Oscillations)
4. K. Bhattacharya
5. R.P. Singh (Physics of Oscillations and Waves)
6. A.B. Gupta (College Physics Vol.II)
7. Chattopadhya and Rakshit (Vibration, Waves and Acoustics) Optics
8. Möler (Physical Optics)
9. A.K. Ghatak
10. E. Hecht (Optics)
11. E. Hecht (Schaum Series)
12. F.A. Jenkins and H.E. White
13. Chita Ranjan Dasgupta (Degree Physics Vol 3) Quantum Physics

(Crystallography)

1. S.O. Pillai (a. Solid state physics b. Problem in Solid state physics)
2. A.J. Dekker
3. Aschroft and Mermin
4. Ali Omar
5. R.L. Singhal
6. Jak Tareen and Trn Kutty (Basic course in Crystallography)

(Laser and Holography)

1. A.K. Ghatak and Thyagarajan (Laser)
2. Tarasov (Laser)
3. P.K. Chakraborty (Optics)
4. B. Ghosh and K.G. Majumder (Optics)
5. B.B. Laud (Laser and Non-linear Optics)
6. Bhattacharyya [Engineering Physics] Oxford

(Physics II(PH 301) Classical Mechanics - For Module 5.1 in PH 301)

1. H. Goldstein
2. A.K. Roychaudhuri
3. R.G. Takwal and P.S. Puranik
4. Rana and Joag
5. M. Speigel (Schaum Series)
6. J.C. Upadhya (Mechanics)

(Electricity and Magnetism)

1. Reitz, Milford and Christy
2. David J. Griffith
3. D. Chattopadhyay and P.C. Rakshit
4. Shadowitz (The Electromagnetic Field)

(Quantum Mechanics)

1. Eisberg and Resnick
2. A.K. Ghatak and S. Lokenathan
3. S.N. Ghoshal (Introductory Quantum Mechanics)
4. E.E. Anderson (Modern Physics)
5. Haliday, Resnick and Crane (Physics vol.III)
6. Binayak Dutta Roy [Elements of Quantum Mechanics]Statistical Mechanics
7. Sears and Sallinger (Kinetic Theory, Thermodynamics and Statistical Thermodynamics)
8. Mondal (Statistical Physics)
9. S.N. Ghoshal (Atomic and Nuclear Physics)
10. Singh and Singh
11. B.B. Laud (Statistical Mechanics)
12. F. Reif (Statistical Mechanics)

(Dilectrics)

1. Bhattacharyya [Engineering Physics] Oxford

Analog & Digital Electronics
Code: CS391
Contact: 3
Credit: 2

ANALOG: At least any two of the following

1. Design a Class A amplifier
2. Design a Phase-Shift Oscillator
3. Design of a Schmitt Trigger using 555 timer.

DIGITAL : At least any five of the following

3. Design a Full Adder using basic gates and verify its output / Design a Full Subtractor circuit using basic gates and verify its output.
4. Construction of simple Decoder & Multiplexer circuits using logic gates.
5. Realization of RS / JK / D flip flops using logic gates.
6. Design of Shift Register using J-K / D Flip Flop.

7. Realization of Synchronous Up/Down counter.
8. Design of MOD- N Counter
9. Study of DAC .

Any one experiment specially designed by the college.

(Detailed instructions for Laboratory Manual to follow for further guidance. The details will be uploaded in the website from time to time)

Data Structure & Algorithm
Code: CS392
Contacts: 3
Credits:2

Experiments should include but not limited to : Implementation of array operations:

Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem : Evaluation of expressions operations on Multiple stacks & queues :
Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queues using linked lists:
Polynomial addition, Polynomial multiplication Sparse Matrices : Multiplication, addition. Recursive and Nonrecursive traversal of Trees
Threaded binary tree traversal. AVL tree implementation Application of Trees. Application of sorting and searching algorithms, Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.
(Detailed instructions for Laboratory Manual to follow for further guidance. The details will be uploaded in the website from time to time)

Computer Organization
Code: CS393
Contacts: 3
Credits: 2

1. Familiarity with IC-chips, e.g.
a) Multiplexer , b) Decoder, c) Encoder b) Comparator Truth Table verification and clarification from Data-book.
2. Design an Adder/Subtractor composite unit .
3. Design a BCD adder.
4. Design of a 'Carry-Look-Ahead' Adder circuit.
5. Use a multiplexer unit to design a composite ALU . 6. Use ALU chip for multibit arithmetic operation.
7. Implement read write operation using RAM IC.
8. (a) & (b) Cascade two RAM ICs for vertical and horizontal expansion.
(Detailed instructions for Laboratory Manual to follow for further guidance. The details will be uploaded in the website from time to time)

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

Course Structure of PH 301, Physics-II

Format	Course Mapping
Department, Course Number and Title of Course and Year of Study	IT, B.Tech-IT, PH 301, Physics – II, 2nd Year 3rd Semester
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Ms. Satarupa Chatterjee, M.Sc, Assistant Prof., Dept. of Sc. & Hu. • Moderator: Dr. Himadri Mullick , M.Sc. Ph.D, Assistant Prof., Dept. of Sc. & Hu.
Mapping with Faculty Expertise (total experience and experience of teaching compatible course)	• Dr. Himadri Mullick (Teaching and Research experience 15 years and 3.5 years at RCCIIT). Ms. Satarupa Chatterjee (Teaching & research exp 6.5 yrs, 7 months in RCCIIT)
Designation as a Compulsory or Elective course	Compulsory (Basic Science)
Pre-requisite Courses	Physics-I (1st Year Physics)
Contact Hours, Credits and type of course (Theory, tutorial, seminar, project, etc.)	L-T-P : 3-1-0 Credit – 4.0 Theory 3 hours lecture and 1 hour tutorial One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Choose operator formalism (gradient, divergence, curl) in vector analysis and solve different surface and volume integration problems of vectors. Correlate between different coordinate systems 2. Interpret wave function and its dual nature. Identify its spatial and temporal evolution and apply operators to it to recognize a particle's physical properties such as position, momentum and energy. Solve the Schroedinger equation for practical use of potential in one dimension to estimate the shape of the wavefunction, calculate expectation values of different operators. Correlate degenerate eigenstates for corresponding energy values. 3. Distinguish between discrete and continuous distribution of charges, solve problems regarding electric field determination by using Coulomb's law & Gauss's Law of electrostatics. Find potentials using Laplace's equation in different coordinate systems. Interpret the formation of dielectric material from the concept of polarization & bound charges and relate different dielectric parameters for linear dielectric materials 4. Recognize the difference between Newtonian mechanics and analytical mechanics by using the examples of generalized coordinates, constraints of motion and solving mechanics problems using Lagrangian formalism. Analyze the connection between classical mechanics and quantum mechanics from Hamiltonian formalism. Differentiate between Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics to solve problems in different distributed systems. Construct the formulation of density of states for classical electron gas in metals and in black body radiation. Calculate heat capacities for elements.

	Lecture No.(Day)	Duration	Topics
Topics Covered based on syllabus of affiliating university MAKAUT	L – 1	2 hours	1. Vector Calculus: Physical significances of grad, div, curl. Line integral, surface integral, volume integral- physical examples in the context of electricity and magnetism
	L – 2	2 hours	Statements of Stokes theorem and Gauss theorem [No Proof]. Expression of grad, div, curl and Laplacian in Spherical and Cylindrical co-ordinates
	L – 3	2 hours	2 Electricity Coulumb's law in vector form. Electrostatic field and its curl. Gauss's law in integral form and conversion to differential form
	L – 4	2 hours	Electrostatic potential and field, Poisson's Eqn. problems related to Coulomb's Law, Gauss's law and electrostatic potential
	L – 5	2 hours	Laplace's eqn (Application to Cartesian, Spherically and Cylindrically symmetric systems – effective 1D problems)
	L – 6	2 hours	Dielectrics-concept of polarization, the relation $D=\varepsilon 0E+P$, Polarizability. Electronic polarization polarization in monoatomic and polyatomic gases
	L – 7	2 hours	3. Magnetostatics: Concept of drift current, current density, Lorentz force, force on a small current element placed in a magnetic field
	L – 8	2 hours	Biot-Savart law & its applications for straight wire, infinite wire, circular coil, solenoid & toroid
	L – 9	2 hours	Divergence & curl of magnetic field, magnetic scalar & vector potential, problems related to magnetic scalar & vector potential
	L – 10	2 hours	Ampere's law in integral form and conversion to differential form. Faraday's law of electro-magnetic induction in integral form & conversion to differential form
	L – 11	2 hours	4. Electromagnetic Theory: Concept of displacement current Maxwell's field equations, Maxwell's wave equation and its solution for free space
	L – 12	2 hours	E.M. wave in a charge free conducting media, Skin depth, physical significance of Skin Depth, E.M. energy flow & Poynting Vector
	L – 13	2 hours	5.Quantum Mechanics: Introduction to generalised coordinates, Lagrange's Equation of motion and Lagrangian, generalised force potential, momenta and energy
	L – 14	2 hours	Hamilton's equation of motion. physical problems of 1-D motion

	L – 15	2 hours	Concept of probability and probability density, operators, commutator
	L – 16	2 hours	Formulation of quantum mechanics and Basic postulates, Operator correspondence
	L – 17	2 hours	Time dependent Schrödinger 's equation, formulation of time independent Schrödinger's equation by method of separation of variables
	L – 18	2 hours	Physical interpretation of wave function ψ (normalization and probability interpretation), Expectation values
	L – 19	2 hours	Application of Schrodinger equation – an infinite square well potential (1-D and 3-D potential well). Discussion on degenerate levels
	L – 20	2 hours	6. Statistical Mechanics: Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (No deduction necessary)
	L – 21	2 hours	Calculation of Fermi level in metals, total energy at absolute zero of temperature and total number of particles
	L – 22	2 hours	Bose-Einstein statistics – Planck's law of blackbody radiation
Additional Topics	N/A		
Activities of Students and Assignments	• Take part in Classroom Demonstration/Seminar (group activity) • Take part in Quiz • 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 • Group discussion • Classroom exercises • 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-min 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 average score (4)		
Hints for Course Assessment instruments & processes (both	In addition to direct assessment tools as per University norms, following direct and indirect assessment tools are used to measure attainments of POs		

continuous and semester-end assessment)	related to the course outcome. • 3 categories of questions in Class Tests • Library Assignment • Tutorial • Classroom Demonstration/Seminar • Viva • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey The correlation mapping of assessment tools and POs related to the course are depicted in the Table of Assessment Components & Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics Table.
Text Books and/or Reference Material.	**Text Books:** 1. Vector Analysis, M. R. Spiegel, McGraw Hill Education (India). 2. Introduction to Electrodynamics, D.J. Griffiths (PHI). 3. Electromagnetics, B.B Laud, New Age International. 4. Classical Mechanics of Particles and Rigid Bodies. K. C. Gupta, John Willey. 5. Perspective of Modern Physics, A. Beiser

Department of Information Technology
RCC Institute of Information Technology, Kolkata
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Course Structure of PH 391, Physics-II Lab

Format	Course Mapping
Department, Course Number and Title of Course and Year of Study	IT, B.Tech-IT, PH391, Physics – II Lab, 2rd Year 3rd semester
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Ms. Satarupa Chatterjee, M.Sc, Assistant Prof. , • Moderator: Dr. Himadri Mullick , M.Sc. PhD, Assistant Prof.
Mapping with Faculty Expertise (total experience and experience of teaching compatible course)	• Dr. Himadri Mullick (Teaching and research experience 15 years and 3.5 years at RCCIIT) Ms. Satarupa Chatterjee (Teaching & research exp 6.5 yrs, 7 months in RCCIIT)
Designation as a Compulsory or Elective course	Compulsory (Basic Science)
Pre-requisites Courses	Class XII Physics, Physics 291 (1st Year Physics Lab)
Contact Hours, Credits and type of course (Theory, tutorial, seminar, project, etc.)	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. Determine Band Gap of a given intrinsic semiconductor by Four Probe method to correlate the theoretical examples of different intrinsic semiconductor. 2. Calculate Rydberg constant by studying Hydrogen spectrum to visualize the different lines of visible spectra and to assess this empirical fitting parameter as a fundamental physical constant. 3. Verify the Bohr's atomic orbital theory i.e., to verify the discrete energy levels of an atom. 4. Determine Stefan's constant using a Vacuum Tube Diode and to compute the energy radiated by the given material as a black body and correlate their previous knowledge of blackbody radiation 5. Determine the dielectric constant of different given capacitor to correlate their usage like insulator and limitation of their usage as a dielectric material 6. Determine Planck's constant by using photocell experiment for verification with the theoretical value studied in quantum mechanics course.

Topics Covered based on syllabus of affiliating university	Day	Duration	Topic
	Week 1	3 P	Determination of Band Gap
	Week 2	3 P	Determination of Planck's constant
	Week 3	3 P	Determination of Rydberg constant
	Week 4	3 P	Determination Hall coefficient of a

<table>
<tr><td rowspan="4"></td><td></td><td></td><td>semiconductor</td></tr>
<tr><td>Week 5</td><td>3 P</td><td>Verification of atomic orbital theory</td></tr>
<tr><td>Week 6</td><td>3 P</td><td>Determination of Stefan constant</td></tr>
<tr><td>Week 7</td><td>3 P</td><td>Determination of dielectric constant of capacitor</td></tr>
<tr><td>Additional Topics</td><td colspan="3">NA</td></tr>
<tr><td>Activities of students and Assignments</td><td colspan="3">• Do weekly laboratory experiments and document the results
• Prepare and submit Lab Report
• Do Micro Project in group and submit Report</td></tr>
<tr><td>Hints for Learning-Teaching Approach (Course Delivery)</td><td colspan="3">• Demonstration of tools and experimental set-ups
• Explanation of background theory and experimentation procedure
• Demonstration of sample experiment
• Checking of experimental data/records
• Lab interaction: helping out the students having problems</td></tr>
<tr><td>Course Assessment Policy</td><td colspan="3">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 score (4)</td></tr>
<tr><td>Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)</td><td colspan="3">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.
• Micro Project
• 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 Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics Table.</td></tr>
<tr><td>Text Books and/or Reference Material.</td><td colspan="3">1. Printed Manual</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	Physics **PH301**	1. Choose operator formalism (gradient, divergence, curl) in vector analysis. and solve different surface and volume integration problems of vectors. Correlate between different coordinate systems	S	S	M									
		2.Interpret wave function and its dual nature. Identify its spatial and temporal evolution and apply operators to it to recognize a particle's physical properties such as position, momentum and energy. Solve the Schroedinger equation for practical use of potential in one dimension to estimate the shape of the wave function, calculate expectation values of different operators. Correlate degenerate eigenstates for corresponding energy values	M	S	W									
		3.Distinguish between discrete and continuous distribution of charges, solve problems regarding electric field determination by using Coulomb's law & Gauss's Law of electrostatics. Find potentials using Laplace's equation in different coordinate systems. Interpret the formation of dielectric material from the concept of polarization & bound charges and relate different dielectric parameters for linear dielectric materials	S	S	M									
		4.Recognize the difference between Newtonian mechanics and analytical mechanics by using the examples of generalized coordinates, constraints of motion and solving mechanics problems using Lagrangian formalism. Analyze the connection between classical mechanics and quantum mechanics from	S	S	W									

		Hamiltonian formalism. Differentiate between Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics to solve problems in different distributed systems. Construct the formulation of Density of states for Classical electron gas in metals and in black body radiation. Calculate Heat capacities for elements												
2	Physics Lab **PH391**	1. Determine Band Gap of a given intrinsic semiconductor by Four Probe method to correlate the theoretical examples of different intrinsic semiconductor	S	M			W							
		2. Calculate Rydberg constant by studying Hydrogen spectrum to visualize the different lines of visible spectra and to assess this empirical fitting parameter as a fundamental physical constant	S	M										
		3. Verify Bohr's atomic orbital theory i.e., to examine the existence of discrete energy levels of an atom	S	M			W							
		4. Determine Stefan's constant using a Vacuum Tube Diode and to compute the energy radiated by the given material as a black body and correlate their previous knowledge of blackbody radiation	S	M			W							
		5. Determine the dielectric constant of different given capacitor to correlate their usage like insulator and limitation of their usage as a dielectric material	S	M			W							
		6. Determine Planck's constant by using photocell experiment for verification with the theoretical value studied in quantum mechanics course	S	M			W							

Selection of Assessment Components and Tools

		Physics **PH301**				Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)		
		Assessment Tools							
Component	**Tool #**	**Method/Element**	**PO 1**	**PO 2**	**PO 3**		**PO 1**	**PO 2**	**PO 3**
Class Performance	1.1.1	Multiple Choice Questions or 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	-
	1.1.5	Open Ended Realistic Questions (Class Test)	*M*	*S*	-		0.3 × Score	0.5 × Score	-
	1.1.6	Library/ Home Assignment	*S*	*S*	-		0.5 × Score	0.5 × Score	-
	1.1.7	Viva	*S*	-	-		0.5 × Score	-	-
	1.1.9	Tutorial	*S*	*M*	-		0.5 × Score	0.3 × Score	-
		Attendance	*M*	-	-		0.3 × Score	-	-
Class Demonstra-tion/Seminar	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	-	-
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
	2.2.5	Faculty and Staff Satisfaction Survey	*M*	*M*	*M*		0.3 × Score	0.3 × Score	0.3 × Score
					Weighted score (WS)		**Total/7.2**	**Total / 3.1**	**Total / 0.8**
					%PO attained		**WS/4 *100**	**WS/4 * 100**	**WS/4 * 100**

Assessment Rubrics

Physics **PH301**					
Assessment Tools		**Grading Criteria**			
Method/element	**Tool #**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions or 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, mostly copies from peers	Regular but solves most problems with the help of peers, 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
Viva	1.1.7	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
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% - 100%
Written Semester Exam	1.2.1	<40%	>40% - <60%	>60% - <80%	>80%

Physics **PH301**						
Assessment Tools			**Grading Criteria**			
Method/Element		**Tool#**	**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
Indirect Method	Student Semester Exit Survey	2.2.2	Poor marks obtained in sem; no confidence on subject	Got moderate marks in sem; unwilling to pursue further studies on it	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	Overall unimpressive	Encouraging effort	Impressive performance	Highly impressive – near perfect

Selection of Assessment Components and Tools

		Physics II Lab **PH391**				Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)		
Component	**Tool #**	**Method/Element**	**PO 1**	**PO 2**	**PO 5**		**PO 1**	**PO 2**	**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*		0.5 × Score	0.5 × Score	0.3 × Score
Micro Project	1.1.11	Research and gather information	*S*	-	-		0.5 × Score	-	-
		Analysis of Problem, Requirement Analysis	*M*	*S*	-		0.3 × 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*	*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	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	2.2.2	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*	*S*		0.3 × Score	0.3 × Score	0.5 × Score
					Weighted Score (WS)		**Total/4.9**	**Total / 3.1**	**Total / 2.4**
					%PO attained		**WS/4 * 100**	**WS/4 * 100**	**WS/4 *100**

Assessment Rubrics

Physics II Lab **PH391**						
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	Regularity, Technical Skill	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
	Full fill Team's Role & Duties		Does not perform any duties assigned to team role	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team role
	Share Work Equally		Always relies on others to do work	Rarely does the assigned work; needs reminding	Usually does the assigned work; rarely needs reminding	Always does the assigned work without any need to reminding
Laboratory Exams		1.2.2	<40%	>40% - <60%	>60% - <80%	>80%
Student Semester Exit Survey		2.2.2	Could not follow overall course	Know the basics but less confident in experimental accuracy	Confident to apply techniques	Very confident not only in experiment techniques, accuracy but also in analysis
Faculty and Staff Satisfaction Survey		2.2.5	Can't perform many of the experiments and assignments by own	Can perform some of the experiments and assignments by own; fair skill	Can perform most of the experiments and assignments by own; good understanding & skill	Can perform all the experiments and assignments by own; solid understanding and skill

Physics II Lab **PH391**						
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

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Course Structure of CH 301, Basic Environmental Engineering & Elementary Biology

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, CH 301, Basic Environmental Engineering & Elementary Biology, 2nd Year 3rd Semester
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Dr. S. Agarwal, PhD, Asso. Prof., Dept of Sc. & Hu. • Moderator: Dr. T. Deb, PhD, Assistant. Prof., Dept of Sc. & Hu.
Mapping with Faculty Expertise (Experience of teaching in UG Engg.)	• Dr. S. Agarwal (10 years experience in research & teaching) • Dr. T. Deb, (11 years experience in research & teaching)
Designation as a Compulsory or Elective course (Module)	Compulsory (Engineering Science)
Pre-requisite Courses	Knowledge of Class XII Level Chemistry, Biology , Physics and Mathematics
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: • Identify the basic environmental issues, laws, acts and legislations. • Recognize the threats posed due to various types of environmental pollution. • Develop an idea of statistical distribution of human population growth, mortality rate, fertility rate in our country. • Develop an idea of the geographical features of the country, also the flora and fauna, the various endemic and endangered species and many more.

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Day 1	1L	Elements of Ecology ,Definition , Abiotic factors, species, community.	Study Material on Ecology
Day 2	2L	Basic idea of Environment, Basic concepts, man& society	Group Discussion on environment
Day 3	1L	Systems (closed and open), population, interaction between the organisms. Biotic components.	Group Discussion on components of environment

	Day 4	2L	Mathematics of population growth & associated problems	Study material on Population growth and class work on selected problems
	Day 5	1L	Major ecosystems. Forest ecosystem, Grassland ecosystem.	Assignment
	Day 6	2L	Resources, Sustainable developments, Material balance	Discussion & Study material on Ecosystem
	Day 7	1L	Desert ecosystem, Aquatic, Mangrove ecosystem, Food chain, food web and energy flow.	Assignment
	Day 8	2L	Environmental degradation	Study material on environmental degradation
	Day 9	1L	Seeded BOD test, BOD reaction rate constants, effects of oxygen demanding wastes on river deoxygenation, reaeration	Discussion and study materials on BOD
	Day 10	2L	Anthropogenic degradation, Nature and scope of environmental engineering	Study material on environmental degradation
	Day 11	1L	Eutropication, Definition, source and effect, aquifers, hydraulic gradient, formed water flow standard and control of waste water treatment.	Discussion & Study material on Aquifers and hydraulic gradient. Assignment on the topic
	Day 12	2L	Atmospheric composition, Definition of pollutants, contaminants, primary pollutants, secondary pollutants, criteria pollutants	Study material on Air Pollutants
	Day 13	1L	Instruments for controlling waste water treatment, toxic elements and their effects.	Notes on waste water treatment and assignment
	Day 14	2L	Sources and effect of different air pollutants, oxides of carbon, nitrogen, sulphur, particulate matter	Study material on Air Pollutants
	Day 15	1L	Seminar Conducted on the assignments	
	Day 16	2L	Energy balance, Simple Global temperature model, problems	Notes on Energy balance, Simple Global temperature model and class work on related problems
	Day 17	1L	Solid waste management, control, definition of noise, noise pollution and effect of noise pollution and noise	Discussion & Study material. Assignment

			classification.	
	Day 18	2L	Green house effect, Global warming, Smog, Depletion of ozone layer	Assignment
	Day 19	1L	EIA, Environmental Audit & Environmental Laws and Prot. Act of India Dist. International Environmental Treads, Protocol.	Study material on Environmental Laws. Assignment Discussion & Study material.
	Day 20	2L	Lapse rate, Ambient lapse rate, Adiabatic lapse rate, Atmospheric stability,	
	Day 21	1L	Definition of noise frequency, noise pressure, noise intensity, noise threshold limiting value. Equivalent noise level (18 hour Index), noise pollution control	Study materials on Noise pollution and related
	Day 22	2L	Temperature inversion, Atmospheric dispersion, Maximum mixing depth, Ventilation coefficient, Stack and Plume	Notes on temperature inversion and related topics
	Day 23	1L	Seminar Conducted on the assignments	
	Day 24	2L	Standard and control measures for air pollution	Study materials on air pollution control
Additional Topics and Assignments	Field trips Topics of Assignments: 1. Population Growth 2. Bio-geochemical Cylces 3. Acid Rain 4. Ozone Layer Depletion & Global Warning 5. Air Pollution Control 6. Waste Water Treatment 7. Solid Waste management 8. Toxicity 9. Non-conventional Energy Resources			
Activities of Students and Assignments	• Take part in Classroom Demonstration (group activity) • Take part in Quiz • Prepare Home Assignments • Prepare Library Assignments and give Seminars			
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 • Seminars on Assignments • 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. • 3 categories of questions in Class Tests • Library Assignment & Seminars on Assignments • Classroom Demonstration • Viva • Faculty & Staff Satisfaction Survey • Employer Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Table of Assessment Tools. 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. Gourkrishna Dasmohapatra, Environment and Ecology by Vikas Publication • **Reference Books:** 1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice Hall of India Pvt. Ltd., 1991. 2. De, A. K., "Environmental Chemistry", 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	Chemistry **CH301**	1. Identify the basic environmental issues, laws, acts and legislations	M					S	M					
		2. Recognize the threats posed due to various types of environmental pollution	S					M	S					
		3. Develop an idea of statistical distribution of human population growth, mortality rate, fertility rate in our country	S					S						
		4. Develop an idea of the geographical features of the country, also of the flora and fauna , the various endemic and endangered species and many more	W					S	M					

Selection of Assessment Components and Tools

CH 301 (Basic Environmental Engineering & Elementary Biology)							**Weighted Evaluation of POs** (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)		
Assessment Tools						**Score (1 – 4)**			
Component	**Tool #**	**Tool Details**	**PO1**	**PO6**	**PO7**		**PO1**	**PO 6**	**PO 7**
Class Performance	1.1.1	Multiple Choice Questions or 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	
	1.1.5	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 Demonstra-tion / Seminar	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	-	-
Terminal Test	1.2.1	Written Semester Exam	*S*	-	*S*		0.5 × Score		0.5 × Score
Indirect Method	2.2.1	Faculty and Staff Satisfaction Survey	-	*S*	*S*		-	0.5 × Score	0.5 × Score
	2.2.5	Employer Survey	M	-	M		0.3 × Score		0.3 × Score
					Weighted Score (WS)		Total/6.2	Total /1.5	Total / 1.3
					%PO attained		**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

Assessment Rubrics

CH 301 (Basic Environmental Engineering & Elementary Biology)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Tool #**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions or 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, 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	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
Attendance	1.1.9	≤50%	>50% - 60%	>60% - 80%	>80%
Written Semester Exam	1.2.1	≤40%	>40% - 60%	>60% - 80%	>80%
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

CH 301 (Basic Environmental Engineering & Elementary Biology)						
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		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

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Course Structure of CS301, Analog and Digital Electronics

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **CS301**, **Analog and Digital Electronics** 2nd. Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: **Mr. Pankaj Pal**, M.Tech., Assistant Professor., Dept of IT • Moderator: Dr. P.N.Basu,, PhD, Professor., Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Mr. Pankaj Pal (20 years exp. in teaching) • Dr. P.N.Basu,, (41 years exp. in teaching)
Designation as a Compulsory or Elective course (Module)	Professional Compulsory
Pre-requisites Courses	Class XII Mathematics, Physics, Solid State, Basic knowledge in C language, etc.
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	Completion of this course structure, students should be able to: • Solve simple real life problems using combinational and sequential circuits • Design simple hardware systems for a given problem • Translate the Analog to equivalent Digital systems • Implement complex circuit using digital ICs

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Day 1	1L	Overview of Pre-requisite of Analog Electronics	Study Material on Electronics Devices and graphical characteristics
Day 2	2L	P-N junction diodes, Schottky diodes, etc.	Assignment on Basic problems on diodes
Day 3	1L	Basic BJTs, Basic FETs	Assignment on Basic problems on BJTs, FETs
Day 4	2L	OP.AMP. as a basic circuit component.	Assignment on Basic problems on OP.AMP.
Day 5	1L	Concept of Feedback Amplifier	Selected Problems as well as Theory at Home
Day 6	2L	Different Classes of Power Amplifiers	Theory type questions at Home as assignment
Day 7	1L	Study Class-A, B, AB and C Power Amplifier	Selected Problems as well as Theory using

				efficiency calculation at Home.
	Day 8	2L	Concepts of Feedback and Oscillation and explanation	Recapitalization on covered topics
	Day 9	1L	Multivibrators	Draw the cki. Diagram of Multivibrator and draw its waveform
	Day 10	2L	Question and Answer session using Group wise	**Assignment 1**
	Day 11	1L	Basic concepts of Multivibrators and timer(555)	Notes preparation on Multivibrators
	Day 12	2L	Number systems Binary, Octal, Decimal and Hexadecimal numbers and Boolean Algebra, Logic gates, Truth Tables and function realization	Study Material on BCD, ASCII, EBDIC, Gray codes and their conversions
	Day 13	1L	1's and 2's complement methods, Binary arithmetic, Venn diagram, K-Map method to simplify Boolean Algebra	**Assignment 2**
	Day 14	2L	Combinational circuits - Adder and Subtractor circuits (half & full adder & subtractor)	Home work on Combinational circuits
	Day 15	1L	Sequential Circuits - Basic Flip-flop & Latch	Home work on Sequential Circuits
	Day 16	2L	SR, JK, D, T and JK Master-slave F/F and conversion between them	Selected Problems as well as Theory at Home
	Day 17	1L	Question and Answer session using Group wise	**Assignment 3**
	Day 18	2L	Basic concepts of Registers	Study on Register
	Day 19	1L	SISO,SIPO,PIPO,PISO Registers	Draw the timing diagram of this model with examples
	Day 20	2L	Basic concepts of Counter; Ring counter, Johnson counter	Home work on Counter
	Day 21	1L	Synchronous and Asynchronous counters	Solving of H/W problems related to counter
	Day 22	2L	Design concepts of counter , Design of Mod N Counter	Develop a note of counter for different problems
	Day 23	1L	Basic principle of A/D and D/A converters with examples	**Assignment 4**
	Day 24	2L	Question and Answer session using Group wise	Study at home with different exam related questions
Additional Topics (Class + Tutorial)	• FND display design • Power supply design using digital display • Real life counter design using different ICs • Design Digital o/p corresponding to equivalent analog voltage • Frequency generation using Oscillator			
Activities of Students and Assignments	• Take part in Classroom Demonstration (group activity) • Take part in Quiz • 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 • 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-min 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 average 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 • Classroom Demonstration • Viva • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey • Employer Survey The correlation mapping of assessment tools and POs related to the course are depicted in the Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics Table.
Text Books and/or Reference Material	• **Text Books:** 1. Principles of Electronic Devices & circuits—B L Thereja & Sedha—S Chand and Co. 2. Digital Principles & Application, Leach & Malvino—5/e, Mc Graw Hill 3. Principles of Basic Electronics—V.K.Mehata—S Chand and Co. • **Reference Books:** 1. Electronic Devices & Circuit Theory – Boyelstad & Nashelsky – PHI 2. Floyed & Jain- Digital Fundamentals-Pearson. 3. Modern Digital Electronics, R.P.Jain— 2/e , Mc Graw Hill

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	Analog and Digital Electronics(CS301)	1. Solve simple real life problems using combinational and sequential circuits	S	S	S		S							S
		2. Design simple hardware systems for a given problem	S	S										
		3. Translate the Analog to equivalent Digital systems	S	S	S	S	S							M
		4. Implement complex circuit using digital ICs	S	S	S									

Selection of Assessment Components and Tools

CS301 (Analog and Digital Electronics)										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	PO4	PO 5	PO12								
Component	Ast #	Method/Element								PO 1	PO 2	PO 3	PO4	PO 5	PO12
Class Performance	1.1.1	Multiple Choice Questions or 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	*S*	-	-			-		0.5 × Score	-	-		-	
Class Demonstra-tion	1.1.8	Quality of Technical Content, Planning & Adherence to Context	*M*	-	-	*M*		-		0.3 × Score	-	-	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	-	-		-	
		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*	-	-	*M*	*S*	-		0.5 × Score	-	-	0.3 × Score	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*	*S*		0.5 × Score	-	0.5 × Score		0.5 × Score	0.5 × Score

Terminal Test	1.2.1	Written Semester Exam	*S*	*S*	-			-		0.5 × Score	0.5 × Score	-		-	
Indirect Method	2.2.2	Student Semester Exit Survey	*S*	*S*	*S*		*M*	*S*		0.5 × Score	0.5 × Score	0.5 × Score		0.3 × Score	0.5 × Score
	2.2.1	Faculty and Staff Satisfaction Survey	*M*	*M*	*M*		*S*	*S*		0.3 × Score	0.3 × Score	0.3 × Score		0.5 × 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/ 7.5**	**Total/ 2.9**	**Total / 1.8**	**Total / 0.3**	**Total / 0.8**	**Total /2.8**
									%PO attained	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

Assessment Rubrics

CS301 (Analog and Digital Electronics)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Ast#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions or 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	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
Attendance	1.1.9	≤50%	>50% - 60%	>60% - 80%	>80%
Written Semester Exam	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
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
	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 CS-391, Analog & Digital Electronics Lab

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B. Tech-IT, **CS-391, Analog & Digital Electronics Lab,** 2nd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Sudarsan Biswas, M.Tech, Asst. Prof., Dept. of IT • Moderator: Dr. D Majumdar, PhD, Assoc. Prof., Dept. of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Sudarsan Biswas (6 years exp in teaching Programming. Operating Systems, Data structure, Analog & Digital Electronics, Network Security & Cryptography, etc.) • Dr. D Majumdar (12 years exp in teaching Programming, Automata. DAA, OOP etc.)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Analog & Digital Electronics
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. Practise simple problems using design ideas. 2. Solve simple real life problems using the concept generated. 3. Simplify the hardware requirements as it is needed. 4. Understand the trade offs (in terms of bandwidth, power, and complexity requirements) between basic analog and digital communication systems.

Topics covered based on syllabus of affiliating University MAKAUT

Week	Duration	Topics
Week 1	1 L	To study about logic gates and verify their truth tables.
Week 2	1 L	Verify the truth table of OR Gate. AND Gate, NOT Gate, NOR Gate, XOR Gate, XNOR Gate using only NAND and NOR Gates.
Week 3	1 L	To design and construct half adder, full adder, half subtractor and full subtractor circuits and verify the truth table using logic gates.
Week 4	1 L	To design and implement 4-bit Binary to gray code converter and vice versa. BCD to excess-3 code converter.
Week 5	1 L	To design and implement R-S,J-K
Week 6	1 L	To design and implement D flip flops
Week 7	1 L	Design of Shift Register using J-K / D Flip Flop.
Week 8	1 L	To design and implement 3 bit synchronous. up/down counter.

<table>
<tr><td rowspan="4"></td><td>Week 9</td><td>1 L</td><td>Design of MOD- N Counter</td></tr>
<tr><td>Week 10</td><td>1 L</td><td>Design a Class A amplifier.</td></tr>
<tr><td>Week 11</td><td>1 L</td><td>Design a Phase-Shift Oscillator.</td></tr>
<tr><td>Week 12</td><td>1 L</td><td>Design of a Schmitt Trigger using 555 timer.</td></tr>
<tr><td>Activities of students and Assignments</td><td colspan="3">• Do weekly laboratory experiments and document the results
• Prepare and submit Lab Report
• Do Micro Project in group and submit Report</td></tr>
<tr><td>Hints for Learning-Teaching Approach (Course Delivery)</td><td colspan="3">• Demonstration of tools, experimental set-ups and experimentation procedure
• Assignments on different lab modules as per syllabus
• Lab interaction for troubleshooting and result analysis
• Checking of experimental data, result and report
• Additional assignment to practice beyond the laboratory hours</td></tr>
<tr><td>Course Assessment Policy</td><td colspan="3">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)</td></tr>
<tr><td>Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)</td><td colspan="3">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.
• Micro Project
• Students Semester Exit Survey
• Employer Survey</td></tr>
<tr><td>Text Books and/or Reference Material</td><td colspan="3">• Text Books:
1. Principles of Electronic Devices & circuits—B L Thereja & Sedha—S Chand
2. Digital Electronics – Logic & Systems by J.Bigmell & R.Donovan; Cambridge Learning
3. Digital Electronics – Kharate – Oxford
• Reference Books:
1. Electronic Devices & Circuit Theory – Boyelstad & Nashelsky - PHI
2. P.Raja- Digital Electronics- Scitech Publications</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	Analog & Digital Communication (CS-391)	1. Practise simple problems using design ideas	S											
		2. Solve simple real life problems using the concept generated	M		S									
		3. Simplify the hardware requirements as it is needed		M		M								
		4. understand the trade offs (in terms of bandwidth, power, and complexity requirements) between basic analog and digital communication systems	S	S		S								

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Selection of Assessment Components and Tools

CS-391 (Analog & Digital Communication Lab)							**Score (1 – 4)**	**Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)**			
Assessment Tools											
Component	**Tool #**	**Method/Element**	**PO 1**	**PO 2**	**PO 3**	**PO 4**		**PO 1**	**PO 2**	**PO 3**	**PO 4**
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)	*M*	*M*	-	-		0.3 × Score	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*	-	S		0.3 × Score	0.5 × Score	-	0.5 × Score
		Planning & Designing	*M*	*S*	*S*	-		0.3 × 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	Laboratory Exams (to conduct certain experiments, tool based assignments and report the procedure, results etc. followed by Viva Voce)	*M*	*M*	*S*	-		0.3 × Score	0.3 × Score	0.5 × Score	-
Indirect Method	2.2.1	Employer Survey	*S*	*M*	*S*	M		0.5 × Score	0.3 × Score	0.5 × Score	0.3 × Score
	2.2.2	Student Semester Exit Survey	*W*	*S*	-	-		0.2 × Score	0.5 × Score	-	-
							Weighted Score (WS)	**Total / 4.2**	**Total / 2.7**	**Total / 2.0**	**Total / 1.4**
							% of PO attained	**WS * 100/4**	**WS * 100/4**	**WS * 100/4**	**WS * 100/4**

Assessment Rubrics

CS-391 (Analog & Digital Communication Lab)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Tool#**	**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: Regularity, Technical Skill	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
Lab. Experiments & Assignment: Full fill Team's Role & Duties		Does not perform any duties assigned to team role	Performs very little duties	Performs nearly all duties	Performs all duties of assigned team role
Lab. Experiments & Assignment: Share Work Equally		Always relies on others to do work	Rarely does the assigned work; needs reminding	Usually does the assigned work; rarely needs reminding	Always does the assigned work without any need to reminding
Laboratory Exams	1.2.2	<40%	>40% - <60%	>60% - <80%	>80%
Student Semester Exit Survey	2.2.2	Could not follow overall course	Know the basics but less confident in experimental accuracy	Confident to apply techniques	Very confident not only in experiment techniques, accuracy but also in analysis
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

CS-391 (Analog & Digital Communication Lab)						
Assessment Tools			**Grading Criteria**			
Method/Element		**Tool#**	**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

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Course Structure – CS302 (Data Structure and Algorithm)

	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **CS302**, **Data Structure and Algorithm**, 2nd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Dr. I Pan, PhD, Assist. Prof., Dept of IT • Moderator: Dr. D Majumdar, PhD, Assoc. Prof., Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Dr. I Pan (10 years exp in teaching DAA, OOP, AI, DSA, CD etc.) • Dr. D Majumdar (12 years exp in teaching Programming, Automata. DAA, OOP etc.)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Programming concept in 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 – 4.0 Theory 3 hours Lecture/ 1 Tutorial One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Depict common linear and nonlinear data structures and algorithms, and be able to implement them 2. Analyse the complexities of different algorithms 3. Recognize appropriate data structures and algorithms for problem solving

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Day 1	1L	Introduction to Data structure, requirement and difference between data and data structure. Linear and non linear data structure	
Day 2	2L	Discussion on C and programming on arrays and structures. Concepts of pointers, pointer management	Assignments on Arrays, Structures and pointers
Day 3	1T	Discussion on Algorithms, Complexity analysis and asymptotic notations, Master Theorem	Assignment on analysis of linear and binary search techniques and comparison of algorithm complexity
Day 4	1L	Stack, operations on stack, algorithms of basic operation, dry run examples	

	Day 5	2L	Application of stack, Infix to postfix conversion, Postfix evaluation	Assignment on Infix to Postfix conversion and Postfix evaluation
	Day 6	1T	Discussion on implementation of Stack using C	
	Day 7	1L	Queue, Operations on Queue, different types of queue, sample dry run discussion	Simple program to implement Queue
	Day 8	2L	Circular Queue and Priority Queue and their implementation	Assignment of Priority queue
	Day 9	1T	Double ended queue and its variations	
	Day 10	1L	Discussion on Linear linked list, concept of nodes and head. Elaboration on creation and display in linked list	Assignment on linear linked list creation and display
	Day 11	2L	Different node Insertion operations in linked list (Insert after, Insert before operation), Deletion operations and cases	Assignment Program
	Day 12	1T	Implementation of Stack using linked list	
	Day 13	1L	Implementation of linear Queue using linked list	
	Day 14	2L	Circular and doubly linked list.	Assignment program on doubly linked list
	Day 15	1T	Discussion on Tower of Hanoi and Eight Queen problem	
	Day 16	1L	Introduction to Tree and related terminologies. Concept of Forest	
	Day 17	2L	Binary tree, Binary tree traversal techniques	Assignment on Implementation and traversal
	Day 18	1T	Threaded binary tree and recursive construction/ traversal	Assignment on thread programming
	Day 19	1L	Expression Tree, Binary search tree	Construction of binary search tree
	Day 20	2L	Issues with simple binary search Tree, Need analysis for binary search tree and height balancing. AVL tree construction and concept of rotation	Assignment on AVL tree construction
	Day 21	1T	Different deletion cases from AVL tree	
	Day 22	1L	Introduction to graph, different definitions related to graphs	
	Day 23	2L	Graph representation, adjacency matrix, adjacency list, DFS and BFS	Assignment on Programming to implement graph in C
	Day 24	1T	Spanning Tree, Prims and Kruskal Method	Assignment on Programming implementation of Prims method
	Day 25	1L	Hashing, Hash functions and Collision resolution techniques	
	Day 26	2L	Different Sorting techniques, Bubble sort, Insertion sort, Selection sort, Merge sort	
	Day 27	1T	Quick sort and Heap sort, concept of Max heap and Min heap	
Additional Topics, Activities and Assignments	• Recapitulation session on C • Emphasis on Assignments based on Array and Pointers • Specific study assignment for every weekend which are discussed and			

	analyzed during tutorial classes • Typical/Exam problem solving
Hints for Learning-Teaching Approach (Course Delivery)	• Lectures in the labs to relate theories with hands-on • Notes in every class in lieu with discussion • Case study through PPT • Program demonstration using C • Pin pointed small assignments to revise the discussion through problem solving which are solved/ evaluated in the next lecture • 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 • 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-min 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 average 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 • Faculty & Staff Satisfaction Survey • Employer Survey The correlation mapping of assessment tools and POs related to the course are depicted in the Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics Table.
Text Books and/or Reference Material	• **Text Books:** 4. Ellis Horo witz, Sartaj Sahni, Susan Anderson-freed – "Fundamentals of Data Structures of C" 5. Aaron M. Tenenbaum – "Data Structures in C" 6. S. Lipschutz – "Data Structures" • **Reference Books:** 4. Robert L. Kruse, Bruce P. Leung – "Data Structures And Program Design In C" – TMH

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Course Structure of CS 392, Data Structure and Algorithm

	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **CS392**, **Data Structure and Algorithm**, 2nd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Dr. I Pan, PhD, Assist. Prof., Dept of IT • Moderator: Dr. D Majumdar, PhD, Assoc. Prof., Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Dr. I Pan (10 years exp in teaching DAA, OOP, AI, DSA, CD etc.) • Dr. D Majumdar (12 years exp in teaching Programming, Automata. DAA, OOP etc.)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Programming concept in C
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. Solve simple problems applying concepts of Data Structure 2. Practice the use of linear and non linear data structure for different problems 3. Develop user friendly tiny utility application
Topics covered based on syllabus of affiliating University MAKAUT	**Day** / **Duration** / **Topics** Week 1 / 3 Lab / Assignment on Array , Structure, Pointers, Week 2 / 3 Lab / Assignment on Stack Implementation, Operation and Application (Infix to Postfix Conversion and Postfix evaluation) Week 3 / 3 Lab / Assignment on Implementation of Linear, Circular and Priority Queue Week 4 / 3 Lab / Assignment on Linked list (Linear, Circular and Doubly linked list) Week 5 / 3 Lab / Assignment on Linked list implementation of Stack and Queue Week 6 / 3 Lab / Assignment on Binary search Tree construction, insertion of node, deletion of node and traversal Week 7 / 3 Lab / Assignment on Graph representation and traversal. Additional assignment on spanning tree detection either through Prims or by Kruskal Week 8 / 3 Lab / Assignment of Hashing, Collision Resolution and Heap Sort
Additional Topics, Activities and	• Assignment on Arrays, Structure and Pointers in C • Implementation of Hashing and collision resolution

Assignments	• Implementation of Heap and Max heap and Min heap generation • Multiple Assignments for continuous evaluation
Hints for Learning-Teaching Approach (Course Delivery)	• Program demonstration through projector • Lab Assignments on different modules as per syllabus • Interactive problem solving and doubt-clearing session • Additional assignment 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 average 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 (to evaluate overall understanding on common issues related to Data Structure programming): 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. • Micro Project • Students Semester Exit Survey • Employer Survey • Faculty and Staff Satisfaction Survey
Text Books and/or Reference Material	• **Text Books:** 1. Aaron M. Tenenbaum – "Data Structures in C" 2. S. Lipschutz – "Data Structures" • **Reference Books:** 1. Ellis Horo witz, Sartaj Sahni, Susan Anderson-freed – "Fundamentals of Data Structures of C"

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	Data Structure and Algorithms (CS302) - ***Theory***	1. Depict common linear and non linear data structures and algorithms and be able to implement them	S	M										
		2. Analyse the complexity of different algorithms	S		M									
		3. Recognize appropriate data structure and algorithm for problem solving	S											
2	Data Structure and Algorithms (CS392) - ***Practical***	1. Solve simple problems applying concepts of Data Structure		S										
		2. Practice the use of linear and non linear data structure for different problems					S							
		3. Develop user friendly tiny applications			S		S							

Selection of Assessment Components & Tools

CS - 302 (Data Structure and Algorithms)						Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)		
Assessment Tools									
Component	**Tool#**	**Method/ Element**	**PO 1**	**PO 2**	**PO 3**		**PO 1**	**PO 2**	**PO 3**
Class Performance	1.1.1	Multiple Choice Question or 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*		0.3 × Score	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	-	-
	1.1.9	Attendance	*M*	-	-		0.3 × Score	-	-
Terminal Test	1.2.1	Written Semester Exam (incl. MCQ, Short Answer type and Long Answer type Questions, Numerical & Design Problems)	*S*	*M*	*M*		0.5 × Score	0.3 × Score	0.3 × Score
Indirect Method	2.2.1	Employer Survey	*S*	*M*	*S*		0.5 × Score	0.3 × Score	0.5 × Score
	2.2.5	Faculty & Staff Satisfaction Survey	-	*S*	*S*			0.5 × Score	0.5 × Score
						Weighted Score (WS)	**Total / 3.9**	**Total / 3.1**	**Total / 1.8**
						% of PO attained	**WS * 100/4**	**WS * 100/4**	**WS * 100/4**

CS - 392 (Data Structure and Algorithms)						Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)		
Assessment Tools									
Component	**Tool#**	**Method/ Element**	**PO 2**	**PO 3**	**PO 5**		**PO 2**	**PO 3**	**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	-	-
Micro Project	1.1.11	Research and gather information	-	-	-		-	-	-
		Analysis of Problem, Requirement Analysis	*S*	*M*	-		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	*M*	*M*	*M*		0.3 × Score	0.3 × Score	0.3 × Score
		Developing Solution/System using IT skill	-	*S*	*S*		-	0.5 × Score	0.5 × Score
Terminal Test	1.2.2	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	2.2.1	Employer Survey	*M*	*S*	*S*		0.3 × Score	0.5 × Score	0.5 × Score
	2.2.2	Student Semester Exit Survey	*S*	-	*S*		0.5 × Score	-	0.5 × Score
	2.2.5	Faculty & Staff Satisfaction Survey	*S*	*S*	*M*		0.5 × Score	0.5 × Score	0.3 × Score
					Weighted Score (WS)		**Total / 4.2**	**Total / 3.1**	**Total / 2.4**
					% of PO attained		**WS * 100/4**	**WS * 100/4**	**WS * 100/4**

Assessment Rubrics

CS - 302(Data Structure and Algorithms)					
Assessment Tools		**Grading Criteria**			
Method/ Element	**Tool#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Question or 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	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
Attendance	1.1.9	<40%	>40% - <60%	>60% - <80%	>80%
Written Semester Exam	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
Faculty & Staff Satisfaction Survey	2.2.5	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

CS - 392 (Data Structure and Algorithms)						
Assessment Tools		**Grading Criteria**				
Method/ Element		**#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Attendance		1.1.9	<40%	>40% - <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	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 Solution/System using IT skill		Poor IT skill - cannot implement	Can implement partly	Mostly implements but complexity higher	Implements fully with all requirements satisfied – effective and less complex soln
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 skilled 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	Can identify and confident to apply techniques	Efficient in selection of approach, can reason out how to do and what to do

			problem		
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

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Course Structure of CS 303, Computer Organisation

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **CS 303**, **Computer Organisation** (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)	Compulsory (Engineering Science)
Pre-requisites Courses	Concept of basic components of a digital computer, Basic concept of Fundamentals & Programme structures. Basic number systems, Binary numbers, representation of signed and unsigned numbers, Binary Arithmetic as covered in Basic Computation & Principles of Computer Programming Second semester, first year. Boolean Algebra, Karnaugh Maps, Logic Gates – covered in Basic Electronics in First year
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T :P: 3-1-0 Credit – 4.0 Theory 3 hours Lecture and 1 hour Tutorial One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: • Explain von Neumann architecture and its bottleneck, stored program concept, computer components, addressing modes, the roles of Operating Systems, Assemblers and Compilers • Compare principles of number systems and solve related conversion problems • Explain fundamental design of different aspects in Arithmetic and Logic Unit • Design fundamental memory components and modules • Design basic hardwired and micro-programmed control units in Central Processing Unit (CPU) • Draw the CISC and RISC architectures and state the difference between the two • Explain model Input Output (I/O) operations and design of the I/O subsystem

<table>
<tr><td></td><td colspan="4">• Solve numerical problems relating to Memory, CPU and I/O</td></tr>
<tr><td rowspan="30">Topics covered based on syllabus of affiliating University MAKAUT (Lesson Plan)</td><td>Day</td><td>Duration</td><td>Topics</td><td>Assignments/notes</td></tr>
<tr><td>Day 1</td><td>2L</td><td>Basic organization of the stored program computer and operation sequence for execution of a program. Fetch, decode and execute cycle, Concept of operator, operand, registers and storage</td><td>Discussion on type of questions</td></tr>
<tr><td>Day 2</td><td>2L</td><td>Instruction format. Instruction sets and addressing modes.</td><td>Real life examples</td></tr>
<tr><td>Day 3</td><td>2L</td><td>Role of operating systems and compiler/assembler</td><td>Discussion on type of questions</td></tr>
<tr><td>Day 4</td><td>2L</td><td>Commonly used number systems. Fixed and floating point representation of numbers.</td><td>Problems and solutions</td></tr>
<tr><td>Day 5</td><td>2L</td><td>Revisions</td><td>Library assignment on CPU specs</td></tr>
<tr><td>Day 6</td><td>2L</td><td>Concepts of Arithmetic in Computers. Overflow and underflow. Design of adders - ripple carry and carry look ahead principles.</td><td>Circuit examples</td></tr>
<tr><td>Day 7</td><td>2L</td><td>Design of ALU. Fixed point multiplication -Booth's algorithm</td><td>Concept flowchart</td></tr>
<tr><td>Day 8</td><td>2L</td><td>Fixed point division - Restoring and non-restoring algorithms</td><td>-do-</td></tr>
<tr><td>Day 9</td><td>2L</td><td>Floating point - IEEE 754 standard; Revisions.</td><td>examples</td></tr>
<tr><td>Day 10</td><td>2L</td><td>Revisions.</td><td>Home assignment: memory design</td></tr>
<tr><td colspan="4">Internal Examination 1</td></tr>
<tr><td>Day 11</td><td>2L</td><td>Memory unit design with special emphasis on implementation of CPU-memory interfacing.</td><td>Question answers</td></tr>
<tr><td>Day 12</td><td>2L</td><td>Memory organization, static and dynamic memory, memory hierarchy</td><td>Circuit example</td></tr>
<tr><td>Day 13</td><td>2L</td><td>associative memory; Cache memory,</td><td>Example discussion</td></tr>
<tr><td>Day 14</td><td>2L</td><td>Cache Memory contd.; Virtual memory.</td><td>example</td></tr>
<tr><td>Day 15</td><td>2L</td><td>Virtual Memory Contd.; Data path design for read/write access;</td><td>example</td></tr>
<tr><td>Day 16</td><td>2L</td><td>Revisions.</td><td>Assignment
Design small cpu</td></tr>
<tr><td>Day 17</td><td>2L</td><td>Design of control unit - hardwired control.</td><td></td></tr>
<tr><td>Day 18</td><td>2L</td><td>Design of control unit - microprogrammed control;.</td><td></td></tr>
<tr><td colspan="4">Internal Examination 2</td></tr>
<tr><td>Day 19</td><td>2L</td><td>Introduction to instruction pipelining :</td><td></td></tr>
<tr><td>Day 20</td><td>2L</td><td>Introduction to RISC architectures. RISC vs CISC architectures.</td><td></td></tr>
<tr><td>Day 21</td><td>2L</td><td>I/O operations - Concept of handshaking,</td><td></td></tr>
<tr><td>Day 22</td><td>2L</td><td>Polled I/O, interrupt and DMA.</td><td></td></tr>
<tr><td>Day 23</td><td>2L</td><td>Revisions</td><td>MAKAUT questions discussion</td></tr>
<tr><td>Day 24</td><td>2L</td><td>Revisions</td><td>Assignment discussion and evaluation report</td></tr>
</table>

Additional Topics, Activities and Assignments	• Practice problems • Assignments • Recapitulation of prerequisite
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 • 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 • Group presentation
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 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 average 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 • Microproject • Viva • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey • Employer Survey The correlation mapping of assessment tools and POs related to the course are depicted in the Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics.
Text Books and/or Reference Material	**Text Books:** 1. Mano, M.M., "Computer System Architecture", PHI. 2. Behrooz Parhami " Computer Architecture", Oxford University Press Reference Book: 1. Hayes J. P., "Computer Architecture & Organisation", McGraw Hill, 2. Hamacher, "Computer Organisation", McGraw Hill, 3. N. senthil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers" OUP 4. Chaudhuri P. Pal, "Computer Organisation & Design", PHI, 5. P N Basu- "Computer Organization & Architecture" , Vikas Pub

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Course Structure of CS393, Computer Organization Lab

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **CS393**, **Computer Organization Lab**, 2nd 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 (8 years, M.E. in Information Technology) • Dr. Dipankar Majumdar (11 years, PhD)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Engineering level Fundamentals of Computers, Digital Electronics
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. Recognize basic logic gates with IC chips. 2. Design sequential and combinational circuits using IC Chips. 3. Connect the theory of computer organization with hardware. 4. Apply fundamentals of digital design.

Topics covered based on syllabus of affiliating University MAKAUT

Week	Duration	Experiment Name	Materials
Week1	3L	Familiarity with IC-chips, e.g. a)Multiplexer , b) Decoder Truth Table verification and clarification from Data-book.	Lab Manual
Week2	3L	Familiarity with IC-chips, e.g. c) Encoder d) Comparator Truth Table verification and clarification from Data-book.	Lab Manual
Week3	3L	Design an Adder/Subtractor composite unit.	Lab Manual
Week4	3L	Design a BCD adder	Lab Manual
Week5	3L	Use ALU chip for multibit arithmetic operation.	Lab Manual
Week6	3L	Use a multiplexer unit to design a composite ALU.	Lab Manual
Week7	3L	Design of a ‘ Carry-Look-Ahead’ Adder circuit	Lab Manual

<table>
<tr><td></td><td>Week8</td><td>3L</td><td>Implement read write operation using RAM IC.</td><td>Lab Manual</td></tr>
<tr><td></td><td>Week9</td><td>3L</td><td>8. (a) & (b) Cascade two RAM ICs for vertical and horizontal expansion.</td><td>Lab Manual</td></tr>
<tr><td></td><td>Week10</td><td>3L</td><td>Booth's Multiplier. (Additional Topic)</td><td></td></tr>
<tr><td></td><td>Week11</td><td>3L</td><td>Practice Session.</td><td></td></tr>
<tr><td>Additional Topics (Class + Tutorial)</td><td colspan="4">• Experiment on Booth’s Multiplier
• Additional assignment to practice beyond the laboratory hours</td></tr>
<tr><td>Hints for Learning-Teaching Approach (Course Delivery)</td><td colspan="4">• Introduction of different components, tools and experimental set-up
• Demonstration of processes and circuits through projector
• Lab assignments on different modules as per syllabus
• Hands-on guidance and troubleshooting
• Checking and discussing experimental data/result
• Outside the lab interaction with individual students having problems</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 + 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).</td></tr>
<tr><td>Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)</td><td colspan="4">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.
• Micro Project
• Student Semester Exit Survey
• Employer Survey
• Prog. & Dept. Evaluation Survey
The correlation mapping of assessment tools and POs related to the course are depicted in the Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics.</td></tr>
<tr><td>Text Books and/or Reference Material</td><td colspan="4">• Text Books:
1. Mano, M.M– “Computer System Architecture” – PHI
2. Hamacher “Computer Organisation”, McGraw Hill.

• Reference Books:
1. Hayes J. P., “Computer Architecture & Organization” McGraw Hil
2. P N Basu- “Computer Organization & Architecture” , Vikas Pub</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	Computer Organization **CS303**	1. Explain von Neumann architecture and its bottleneck, stored program concept, computer components, addressing modes, the roles of Operating Systems, Assemblers and Compilers	S											
		2. Compare principles of number systems and solve related conversion problems	S			M								
		3. Explain fundamental design of different aspects in Arithmetic and Logic Unit	S											
		4. Design fundamental memory components and modules	M		S									
		5. Design basic hardwired and micro-programmed control units in Central Processing Unit (CPU)	M		S									
		6. Draw the CISC and RISC architectures and state the difference between the two	S											
		7. Explain model Input Output (I/O) operations and design of the I/O subsystem	S	W	S									
		8. Solve numerical problems relating to Memory, CPY and I/O	M	S										

Selection of Assessment Components and Tools

CS303 Compiler Organization							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	1.1.1	Multiple Choice Questions or 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*	-	-	*W*		0.5 × Score	-	-	0.2 × 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 Exam	*S*	*S*	-	-		0.5 × Score	0.5 × 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
	2.2.1	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 / 4.5**	**Total / 3.4**	**Total / 3.8**
						%PO attained		**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

Assessment Rubrics

CS303 Computer Organization					
Assessment Tools		**Grading Criteria**			
Method/Element	**#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions or 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	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
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 Semester Exam	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
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

CS 303 Computer Organization						
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		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

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Computer Organization Lab CS393	1. Recognize basic logic gates with IC chips	S	M										
	2. Design sequential and combinational circuits using IC Chips	M		S									
	3. Connect the theory of computer organization with hardware	S											
	4. Apply fundamentals of digital design	M		S									

Selection of Assessment Techniques

CS-393 (Computer Organization 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 1	PO 2	PO 3
Component	Tool #	Method/Element							
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)	*M*	*M*	-		0.3 × Score	0.3 × Score	-
Micro Project	1.1.11	Micro Project (in labs) (to conduct experiments, integrate result, analyse result and report)	*M*	*S*	*M*		0.3 × Score	0.5 × 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*	*M*	*S*		0.3 × Score	0.3 × Score	0.5 × Score
Indirect Method	2.2.1	Employer Survey	*S*	*M*	*S*		0.5 × Score	0.3 × Score	0.5 × Score
	2.2.2	Student Semester Exit Survey	*W*	*S*	-		0.2 × Score	0.5 × Score	-
	2.2.4	Program & Dept. Evaluation Survey	-	*S*	*S*		-	0.5 × Score	0.5 × Score
					Weighted Score (WS)		**Total / 1.9**	**Total / 2.4**	**Total / 1.8**
					% of PO attained		**WS/4 * 100**	**WS/4* 100**	**WS/4 * 100**

Assessment Rubrics

CS-393 (Computer Organization Lab)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Ast - #**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Attendance	1.1.9	<40%	>40% - <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%
Employer Survey	2.2.1	Can't answer anything	Try to answer basic questions	Good in both theory and designing circuits, however weak skilled question	Promptly responses to any question, designing approach is efficient and confidently manages any circuits
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 basic circuit design assignments	Can design previously seen circuits but application to new circuit is poor	Can analysis a given problem very well but adopts complex strategy for designing	Efficient design approach towards any problem

Second Year Second Semester

Syllabus of B.Tech (IT)

Second Year - Fourth Semester

A. THEORY							
Sl.No	Field	Theory	Contact Hours/Week				Cr. Pts
			L	T	P	Total	
1	M(CS)401	Numerical Methods	2	1	0	3	2
2	M401	Mathematics-3	3	1	0	4	4
3	CS401	Communication Engg & Coding Theory	2	0	0	3	3
4	CS402	Formal Language & Automata Theory	3	1	0	4	4
5	IT401	Object Oriented Programming & UML	3	1	0	4	4
Total of Theory						**18**	**17**
B. PRACTICAL							
6	HU481	Technical Report Writing & Language Lab Practice	0	0	3	3	2
7	M(CS)491	Numerical Methods	0	0	2	2	1
9	CS492	Software Tools	0	0	3	3	2
10	IT491	Object Oriented Programming & UML	0	0	3	3	2
Total of Practical						**14**	**9**
Total of Semester						**32**	**26**

SEMESTER - IV

Theory

NUMERICAL METHODS
Code: M (CS) 401
Contacts: 2L+1T
Credits: 2

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors
Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Inter polation.

Numerical integration: Trapezoidalrule, Simpson's 1/3 rule, Expression for corresponding error terms.

Numerical solution of a system of linear equations:
Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.

Numerical solution of Algebraic equation:
Bisection method, Regula-Falsi method, Newton-Raphson method
Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method.

Text Books

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis. J.B.Scarborough: Numerical Mathematical Analysis.
3. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution

References Books

1. Balagurusamy: Numerical Methods, Scitech. Baburam: Numerical Methods, Pearson Education.
2. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
3. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
4. Srimanta Pal: Numerical Methods, OUP

MATHEMATICS
Code: M 401
Contacts: 3L +1T = 4
Credits: 4

Note 1: The whole syllabus has been divided into five modules.

Note 2: Structure of the question paper

There will be three groups in the question paper. In Group A, there will be one set of multiple choice type questions spreading the entire syllabus from which 10 questions (each carrying one mark) are to be answered. From Group B, three questions (each carrying 5 marks) are to be answered out of a set of

questions covering all the five modules. Three questions (each carrying 15 marks) are to be answered from Group C. Each question of Group C will have two or three parts covering not more than two modules. Sufficient questions should to be set covering the whole syllabus for alternatives.

Module I

Theory of Probability: Axiomatic definition of probability. Conditional probability. Independent events and related problems. Bayes theorem (Statement only) & its application. One dimensional random variable. Probability distributions-discrete and continuous. Expectation. Binomial, Poisson, Uniform, Exponential, Normal distributions and related problems. t, $\chi 2$ and F-distribution (Definition only). Transformation of random variables. Central Limit Theorem, Law of large numbers (statement only) and their applications. Tchebychev inequalities (statement only) and its application. (14L)

Module II

Sampling theory: Random sampling. Parameter, Statistic and its Sampling distribution. Standard error of statistic. Sampling distribution of sample mean and variance in random sampling from a normal distribution (statement only) and related problems.

Estimation of parameters: Unbiased and consistent estimators. Point estimation. Interval estimation. Maximum likelihood estimation of parameters (Binomial, Poisson and Normal). Confidence intervals and related problems.

Module III

Testing of Hypothesis: Simple and Composite hypothesis. Critical region. Level of significance. Type I and Type II errors.

One sample and two sample tests for means and proportions. $\chi 2$ - test for goodness of fit. (5L)

Module IV

Advanced Graph Theory: Planar and Dual Graphs. Kuratowski's graphs. Homeomorphic graphs. Eulers formula (n - e + r = 2) for connected planar graph and its generalisation for graphs with connected components. Detection of planarity. Graph colouring. Chromatic numbers of Cn, Kn , Km,n and other simple graphs. Simple applications of chromatic numbers. Upper bounds of chromatic numbers (Statements only). Chromatic polynomial. Statement of four and five colour theorems. (10L)

Module V

Algebraic Structures: Group, Subgroup, Cyclic group, Permutation group, Symmetric group (S3), Coset, Normal subgroup,

Quotient group, Homomorphism & Isomorphism (Elementary properties only).

Definition of Ring, Field, Integral Domain and simple related problems. (12L)

Text Books

1. Banerjee A., De S.K. and Sen S.: Mathematical Probability, U.N. Dhur & Sons.
2. Gupta S. C and Kapoor V K: Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
3. Mapa S.K. :Higher Algebra (Abstract & Linear), Sarat Book Distributors.
4. Sen M.K., Ghosh S. and Mukhopadhyay P.: Topics in Abstract Algebra, University Press.
5. West D.B.: Introduction to Graph Theory, Prentice Hall.

References Books

1. Babu Ram: Discrete Mathematics, Pearson Education.

2. Balakrishnan: Graph Theory (Schaum's Outline Series), TMH.
3. Chakraborty S.K and Sarkar B.K.: Discrete Mathematics, OUP.
4. Das N.G.: Statistical Methods, TMH.
5. Deo N: Graph Theory with Applications to Engineering and Computer Science, Prentice Hall.
6. Khanna V.K and Bhambri S.K. : A Course in Abstract Algebra, Vikas Publishing House.
7. Spiegel M R., Schiller J.J. and Srinivasan R.A. : Probability and Statistics (Schaum's Outline Series), TMH.
8. Wilson: Introduction to graph theory, Pearson Edication.

Communication Engineering & Coding Theory
Code: CS401
Contacts: 2L
Credits: 3

Module - 1
Elements of Communication system, Analog Modulation & Demodulation, Noise, SNR Analog-to-Digital Conversion. (Basic ideas in brief)

[Details: Introduction to Base Band transmission & Modulation (basic concept); Elements of Communication systems (mention of transmitter, receiver and channel); origin of noise and its effect, Importance of SNR in system design; Basic principles of Linear Modulation (Amplitude Modulation); Basic principles of Non-linear modulation (Angle Modulation - FM, PM); Sampling theorem, Sampling rate, Impulse sampling, Reconstruction from samples, Aliasing; Analog Pulse Modulation - PAM (Natural & flat topped sampling), PWM, PPM; Basic concept of Pulse Code Modulation, Block diagram of PCM; Multiplexing - TDM, FDM;

Module - 2
Digital Transmission

[Details: Concept of Quantisation & Quantisation error, Uniform Quantiser; Non-uniform Quantiser, A-law & __law companding (mention only); Encoding, Coding efficiency; Line coding & properties, NRZ & RZ, AMI, Manchester coding PCM, DPCM; Baseband Pulse Transmission, Matched filter (mention of its importance and basic concept only), Error rate due to noise; ISI, Raised cosine function, Nyquist criterion for distortion-less base-band binary transmission, Eye pattern, Signal power in binary digital signals;

Module - 3
Digital Carrier Modulation & Demodulation Techniques

[Details: Bit rate, Baud rate; Information capacity, Shanon's limit; M-ary encoding, Introduction to the different digital modulation techniques - ASK, FSK, PSK, BPSK, QPSK, mention of 8 BPSK, 16 BPSK ; Introduction to QAM, mention of 8QAM, 16 QAM without elaboration; Delta modulation, Adaptive delta modulation (basic concept and importance only, no details; introduction to the concept of DPCM, Delta Modulation, Adaptive Delta modulation and their relevance; Spread Spectrum Modulation - concept only..

Module - 4
Information Theory & Coding

[Details: Introduction, News value & Information content;, Entropy;, Mutual information;, Information rate; Shanon-Fano algorithm for encoding;, Shannon's Theorem - Source Coding Theorem;, Channel Coding Theorem, Information Capacity Theorem (basic understanding only); Error Control & Coding - basic principle only.

Text Books

1. An Introduction to Analog and Digital Communications by Simon Haykin; Published by Wiley India.
2. Data Communication and Networking by Behrouz A. Forouzan, Published by Tata McGraw-Hill

References Books

1. Communication Systems 4th Edition by Simon Haykin; Published by Wiley India (Student Edition)
2. Principles and Analog and Digital Communication by Jerry D Gibson, Published by MacMillan.
3. Communication Systems by A. B. Carlson, Published by McGraw-Hill.
4. Understanding Signals and Systems by Jack Golten, Published by McGraw Hill.

Learning Outcome: [These are the minimum competence to be developed; the students will be encouraged to learn more and acquire better understanding.]

Formal Language & Automata Theory
Code: CS402
Contacts: 3L +1T
Credits: 4

Prerequisites of Formal Language & Automata Theory:

Elementary discrete mathematics including the notion of set,function,relation,product,partial order,equivalence relation,graph& tree. They should have a thorough understanding of the principle of mathematical induction.

Module-1
Fundamentals: Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram (Relating of Automata concept to sequential circuit concept) Design of sequence detector,

Introduction to finite state model
Finite state machine: Definitions, capability & state equivalent, kth- equivalent concept
Merger graph, Merger table, Compatibility graph
Finite memory definiteness, testing table & testing graph.
Deterministic finite automaton and non deterministic finite automaton. Transition diagrams and Language recognizers.
Finite Automata: NFA with Î transitions - Significance, acceptance of languages.

Conversions and Equivalence: Equivalence between NFA with and without Î transitions. NFA to DFA conversion. Minimization of FSM, Equivalence between two FSM's , Limitations of FSM

Application of finite automata, Finite Automata with output- Moore & Melay machine.

Learning outcome of Finite Automata

The student will be able to define a system and recognize the behavior of a system. They will be able to minimize a system and compare different systems.

Module-2
Regular Languages : Regular sets.
Regular expressions, identity rules. Arden's theorem state and prove

Constructing finite Automata for a given regular expressions, Regular string accepted by NFA/DFA Pumping lemma of regular sets. Closure properties of regular sets (proofs not required).

Grammar Formalism: Regular grammars-right linear and left linear grammars.
Equivalence between regular linear grammar and FA.
Inter conversion, Context free grammar.
Derivation trees, sentential forms. Right most and leftmost derivation of strings. (Concept only)

Learning outcome of Regular Languages and Grammar

Student will convert Finite Automata to regular expression. Students will be able to check equivalence between regular linear grammar and FA.

Module-3
Context Free Grammars, Ambiguity in context free grammars.
Minimization of Context Free Grammars.
Chomsky normal form and Greibach normal form.

Pumping Lemma for Context Free Languages.
Enumeration of properties of CFL (proofs omitted). Closure property of CFL, Ogden's lemma & its applications
Push Down Automata: Push down automata, definition.
Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence.

Equivalence of CFL and PDA, interconversion. (Proofs not required
Introduction to DCFL and DPDA.

Learning outcome of PDA and context free grammar:

Students will be able to minimize context free grammar. Student will be able to check equivalence of CFL and PDA. They will be able to design Turing Machine.

Module-4
Turing Machine : Turing Machine, definition, model
Design of TM, Computable functions
Church's hypothesis, counter machine
Types of Turing machines (proofs not required)
Universal Turing Machine, Halting problem
Learning outcome of Turing Machine :
Students will be able to design Turing machine.

Text Books

1. "Introduction to Automata Theory Language and Computation", Hopcroft H.E. and Ullman J. D., Pearson edu cation.
2. "Theory of Computer Science ", Automata Languages and computation", Mishra and Chandrashekaran, 2nd edition, PHI.

3. "Formal Languages and Automata Theory", C.K.Nagpal, Oxford

Reference Books

1. "Switching & Finite Automata", ZVI Kohavi, 2nd Edn ., Tata McGraw Hill
2. "Introduction to Computer Theory", Daniel I.A. Cohe n, John Wiley
3. "Introduction to languages and the Theory of Computa tion", John C Martin, TMH
4. "Elements of Theory of Computation", Lewis H.P. & Pa padimitrou C.H. Pearson, PHI.

Object Oriented Programming & UML
Code: IT401
Contacts: 3L+1T
Credits: 4

Prerequisites of Object Oriented Programming & UML:

The fundamental point in learning programming is to develop the critical skills of formulating programmatic solutions for real problems. It will be based on basic knowledge of algorithms and procedural programming language. Once the basic skill of writing programs using loop, methods and arrays will be clear then the student can develop object oriented software using class encapsulation and inheritance.

Object oriented design

Concepts of object oriented programming language, Major and minor elements, Object, Class, relationships among objects, aggregation, links, relationships among classes-association, aggregation, using, instantiation, meta-class, grouping constructs.

Object oriented concepts

Difference between OOP and other conventional programming – advantages and disadvantages. Class, object , message passing, inheritance, encapsulation, polymorphism

Basic concepts of object oriented programming using Java
Implementation of Object oriented concepts using Java.

Language features to be covered: Class & Object proprieties
Basic concepts of java programming – advantages of j ava, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested & inner classes, basic string handling concepts- String (discuss charAt() , compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray() , toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods) & StringBuffer classes (discuss append(), capacity(), charAt(), delete(), deleteCharAt(), ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods), concept of mutable and immutable string, command line arguments, basics of I/O operations – keyboard i nput using BufferedReader & Scanner classes.

Reusability properties–
Super class & subclasses including multilevel hi erarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of abstract classes & methods, interfaces. Creation of packages, importing packages, member access for packages.

Exception handling & Multithreading–
Exception handling basics, different types of ex ception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes.

Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads.

Applet Programming (using swing) –
Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets, concept of delegation event model and listener, I/O in applets, use of repaint(), getDocumentBase(), getCodeBase() methods, layout manager (basic concept), creation of buttons (JButton class only) & text fields.

Text Books

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development " – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complet e reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHI NG
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Prim er" – 3rd Ed. – TMH

Practical

Communication Skill & Report Writing
Code: HU481
Credit -2

Guidelines for Course Execution:

Objectives of this Course: This course has been designed:
1. To inculcate a sense of confidence in the students.
2. To help them become good communicators both socially and professionally.

3. To assist them to enhance their power of Technical Communication.

Detailed Course Outlines:
A. Technical Report Writing:

1. Report Types (Organizational / Commercial / Business / Project)
2. Report Format & Organization of Writing Materials
3. Report Writing (Practice Sessions & Workshops)

B. Language Laboratory Practice
1. Introductory Lecture to help the students get a clear idea of Technical Communication & the need of Language Laboratory Practice Sessions

2. Conversation Practice Sessions: (To be done as real life interactions) a) Training the students by using Language Lab Device/Recommended Texts/cassettes /cd's to get their Listening Skill & Speaking Skill honed b) Introducing Role Play & honing over all Communicative Competence

3. Group Discussion Sessions:

a) Teaching Strategies of Group Discussion

b) Introducing Different Models & Topics of Group Discussion

c) Exploring Live /Recorded GD Sessions for mending students' attitude/approach & for taking remedial m ensure Interview Sessions;

a) Training students to face Job Interviews confidently and successfully

b) Arranging Mock Interviews and Practice Sessions for integrating Listening Skill with Speaking Skill in a formal situation for effective communication

4. Presentation:

a) Teaching Presentation as a skill

b) Strategies and Standard Practices of Individual /Group Presentation

c) Media & Means of Presentation: OHP/POWER POINT/ Other Audio-Visual Aids

5. Competitive Examination:

a) Making the students aware of Provincial /National/International Competitive Examinations

b) Strategies/Tactics for success in Competitive Examinations

c) SWOT Analysis and its Application in fixing Target

Text Books

1. Nira Konar: English Language Laboratory: A Comprehensive Manual PHI Learning, 2011
2. D. Sudharani: Advanced Manual for Communication Laboratories & Technical Report Writing Pearson Education (W.B. edition), 2011

Reference Books

1. Adrian Duff et. al. (ed.): Cambridge Skills for Fluency
2. Speaking (Levels 1-4 Audio Cassettes/Handbooks)
3. Listening (Levels 1-4 Audio Cassettes/Handbooks) Cambridge University Press 1998
4. Audio Cassettes/CD'S OUP 2004

NUMERICAL METHODS
Code : M(CS) 491
Contacts : 2L
Credits :1

1. Assignments on Newton forward /backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5. Assignments on ordinary differential equation: Euler's and Runga-Kutta methods.
6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

Communication Engineering & Coding Theory
Code : CS 491
Contacts : 3L
Credits :2

Practical Designs & Experiments:
Module - 1: Generation of Amplitude Modulation (Design using transistor or Balanced Modulator Chip (to view the wave shapes)
Module - 2: Generation of FM using VCO chip (to view the wave shapes)
Module - 3: Generation of PAM
Module - 4: Generation of PWM & PPM (using IC 555 Timer)

Software Tools
Code : CS 492
Contacts : 3L
Credits :2

- Introduction to Visual Basic & difference with BASIC. Concept about form Project, Application, Tools, Toolbox,
- Controls & Properties. Idea about Labels, Buttons,Text Boxes.
- Data basics, Different type variables & their use in VB,
- Sub-functions & Procedure details, Input box () & Msgbox ().
- Making decisions, looping
- List boxes & Data lists, List Box control, Combo Boxes, data Arrays.
- Frames, buttons, check boxes, timer control,
- Programming with data, ODBC data base connectivity.
- Data form Wizard, query, and menus in VB Applications, Graphics.
- Case studies using any of the following items including relevant form design with the help of visual programming aids.

a) Payroll accounting system.
b) Library circulation management system.
c) Inventory control system.
d) University examination & grading system.
e) Patient information system.
f) Tourist information system.
g) Judiciary information system.
h) Flight reservation system.
i) Bookshop automation software.
j) Time management software.

Object Oriented Programming & UML(Contents Modified)
Code: IT491
Contacts: 3
Credits: 2

1. Assignments on class, constructor, overloading, inheritance, overriding
2. Assignments on wrapper class, arrays
3. Assignments on developing interfaces- multiple inheritance, extending interfaces
4. Assignments on creating and accessing packages
5. Assignments on multithreaded programming
6. Assignments on applet programming

Note: Use Java for programming
Preferably download "java_ee_sdk-6u4-jdk7-windows.exe" from http://www.oracle.com/technetwork/java/javaee/downloads/java-ee-sdk-6u3-jdk-7u1-downloads-523391.html

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

Course Structure of MCS(401), Numerical Methods

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **MCS(401)**, Numerical Methods, 2rd 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. Dipankar Majumdar, PhD, Associate Professor, Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Mr. Soumyadip Dhar (8 years, M.E in Computer Science and Engineering) • Dr. Dipankar Majumdar (11 years, PhD)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Basic Mathematics, Engineering Mathematics
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 2-1-0 Credit – 2 Theory 2 hours Lecture/1 hour Practical One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Identify and classify numerical problems in IT and allied domain 2. Deal with the complex problems (for which analytical solution cannot be obtained or hand calculation cannot be done) by applying appropriate numerical methods

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Day 1	1L	Interpolation: Lagrange's Interpolation.	
Day 2	2L	Newton's Forward interpolation,	
Day 3	1L	Newton's backward interpolation	-
Day 4	2L	Newton's divided difference.	Selected Problems as Home Assignment
Day 5	1L	Numerical Integration Trapezoidal rule	Selected Problems as Home Assignment
Day 6	1L	Numerical Integration	Selected Problems as

			:Simson's 1/3 rule	Home Assignment
	Day 7	2L	Numerical solution of Algebraic equation: Bisection method	Selected Problems as Home Assignment
	Day 8	1L	Regula-Falsi method	Selected Problems as Home Assignment
	Day 9	2L	Newton-Raphson method.	Selected Problems as Home Assignment
	Day 10	1L	Numerical solution of ordinary differential equation: Euler's method	Selected Problems as Home Assignment
	Day 11	2L	Runge-Kutta methods	Selected Problems as Home Assignment
	Day 12	1L	Predictor-Corrector Methods and Finite Difference method.	Selected Problems as Home Assignment
	Day 13	2L	System of ordinary differential equation: Gauss elimination method,.	Selected Problems as Home Assignment
	Day 14	2L	LU Factorization method,	Selected Problems as Home Assignment
	Day 15	2L	Gauss-Seidel iterative method	Selected Problems as Home Assignment
	Day 16	1L	Approximation in numerical computation: Truncation and rounding errors	Selected Problems as Home Assignment
	Day 17	2L	Fixed and floating-point arithmetic Propagation of errors.	Selected Problems as Home Assignment
	Day 18	1L	Revision of important topics and Doubt clear class	
	Day 19	1L	Revision of important topics and Doubt clear class	
	Day 20	1L	Revision of important topics and Doubt clear class	
	Day 21	1L	Problem practice	
	Day 22	1L	MAKAUT previous years question paper solve.	
	Day 23	1L	MAKAUT previous years question paper solve.	-
Additional Topics (Class + Tutorial)	• Introduction to MATLAB			
Activities of Students and Assignments	• Take part in Quiz • 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-min 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 average 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 • Tutorial • Viva • Student Semester Exit Survey The correlation mapping of assessment tools and POs related to the course are depicted in the Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics Table.
Text Books Books and/or Reference Books Material	• **Text Books:** 1. C.Xavier: C Language and Numerical Methods. 2. Dutta & Jana: Introductory Numerical Analysis.

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	Numerical Methods. Sys. MCS 401 - *Theory*	Identify and classify numerical problems in IT and allied domain	S	S										
		Deal with the complex problems (for which analytical solution cannot be obtained or hand calculation cannot be done) by applying appropriate numerical methods		M	S									

Selection of Assessment Components

MCS - 401 (Numerical Methods.)						**Score (1 – 4)**	**Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)**		
Component	**Tool #**		**PO 1**	**PO 2**	**PO3**		**PO 1**	**PO 2**	**PO3**
Class Performance	1.1.1	Multiple Choice Questions or 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 Exam (incl. MCQ, Short Answer type and Long Answer type Questions, Numerical & Design Problems)	*S*	*M*	*M*		0.5 × Score	0.3 × Score	0.3 x 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**	**Total / 0.3**
						% of PO attained	**WS * 100/4**	**WS * 100/4**	**WS * 100/4**

Assessment Rubrics

MCS - 401 (Numerical Methods.)					
Assessment Tools		**Assessment Techniques**			
Assessment Method	**Tool #**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions or 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	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
Attendance	1.1.9	<40%	>40% - <60%	>60% - <80%	>80%
Written Semester Exam	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

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Course Structure of MCS491, Numerical Methods Lab

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **MCS491**, **Numerical Methods Lab**, 2rd 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.Dipankar Majumdar, Associate 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.Dipankar Majumdar (11 years, PhD)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Basic Mathematics, Engineering Mathematics
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 0-0-2 Credit – 1.0 Practical 3 hours Laboratory One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Demonstrate the use of numerical methods for modern scientific calculation design 2. Construct programs with numerical packages like MATLAB 3. Design algorithm for solving complex numerical problem.

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Week 1	3 Lab	MATLAB Introduction	Week 1
Week 2	3 Lab	Newton's Forward and backward interpolation	Week 2
Week 3	3 Lab	Trapezoidal rule	Week 3
Week 4	3 Lab	Simpson's 1/3 rule	Week 4
Week 5	3 Lab	Bisection method	Week 5
Week 6	3 Lab	Regula falsi method	Week 6

Additional Topics (Class + Tutorial)	• Micro project using MATLAB
Activities of Students and Assignments	• Do weekly laboratory experiments and document the results • Prepare and submit Lab Report • Do Micro Project in group and submit Report

Hints for Learning-Teaching Approach (Course Delivery)	• Program demonstration through projector • Explanation of background theory and experimentation procedure • Lab Assignments on different modules as per syllabus • Checking of experimental data/records • Outside the lab interaction with individual students having problems or issues related to Numerical method
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 average 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. • Micro Project • Student Semester Exit Survey • Program & Development Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics Table.
Text Books Books and/or Reference Books Material	• **Text Books**: 1) C.Xavier: C Language and Numerical Methods. 2). Dutta & Jana: Introductory Numerical Analysis.

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	Numerical Methods Lab MCS 491 - *Practical*	Demonstrate the use of numerical methods for modern scientific calculation	S				S							
		Construct programs with numerical packages like MATLAB	M				S							
		Design algorithm for solving complex numerical problem	M		S									

Selection of Assessment Components & Tools

MCS - 491 (Numerical Methods. Lab)						**Score (1 – 4)**	**Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)**		
Component	**Tool #**		**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)	*S*	-	*S*		0.5 × Score	-	0.5 × Score
Micro Project	1.1.11	Micro Project (in labs) (to conduct experiments, integrate result, analyse result and report)	*M*	*S*	-		0.3 × 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)	*M*	*M*	*M*		0.3 × Score	0.3 × 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 / 1.8**	**Total / 1.3**	**Total / 1.6**
						% of PO attained	**WS * 100/4**	**WS * 100/4**	**WS * 100/4**

Assessment Rubrics

MCS - 491 (Numerical Methods. Lab)					
Assessment Tools		**Assessment Techniques**			
Assessment Method	**Tool#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Attendance	1.1.9	<40%	>40% - <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 M- 401, Engineering Mathematics

Format	Course Mapping
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **M- 401**, **Engineering Mathematics**, 2rd Year 4th Semester
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Dr. K.K. Ghosh, PhD, Associate Prof., Dept of IT/ Dept. of Sc. & Hu. • Moderator: Dr. P.N. Dutta, Professor, Dept of IT/ Dept. of Sc. & Hu.
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Dr. K.K. Ghosh, 15 years experience in teaching Engg. Mathematics and 10 years experience in Pure Mathematics • Dr. P.N. Dutta, 24 years experience in teaching Engg. Mathematics and 15 years experience in Pure Mathematics
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Class XII Mathematics, B.Tech. First Year Mathematics
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 3-1-0 Credit – 4.0 Theory 3 hours Lecture / 1 hour Tutorial One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Explain many core engineering topics with relevant mathematical theories and derivation 2. Solve and model engineering applications using probability and statistical techniques, and algebraic structures 3. Apply probability theory and graph theory in the domain of Artificial Intelligence, Data Structure, Data Mining, Image Processing, Soft Computing and Multimedia

Topics covered based on syllabus of affiliating University MAKAUT	Day	Duration	Topics	Assignment/Notes
	Day 1	2L	Axiomatic Definition of Probability, Deduction of Classical Definition and Discussion with Addition Law. Boole's Inequality.	-
	Day 2	2L	Conditional Probability, Independent Event., Multiplicative Law., Baye's Theorem, Applications of Conditional Probability and Baye's Theorem.	-
	Day 3	2L	Definition of Random Variable,	

			Discrete and Continuous Random Variables with examples. Probability mass function, Distribution Function and Probability Density functions.	Worked out example (as notes)
	Day 4	2L	Bernoullean Sequence of Trials, Mean or Expectation of a Random variable, Variance and Standard Deviation. Binomial Probability Distribution.	
	Day 5	2L	Mean and Variance of Binomial Distribution, related Problems. Poisson Distribution. Approximation of Binomial Distribution with Poisson Distribution.	Problems as Home Assignment
	Day 6	2L	Mean and Variance of Poisson Distribution, Problems related to Poisson Distribution, Uniform Distribution, Its Mean and variance, Associated Problems.	Problems as Home Assignment
	Day 7	2L	Exponential Distribution Its Mean and Variance . Normal Distribution and its Properties	Study material, Worked out example (as notes)
	Day 8	2L	t-Distribution, χ^2 – Distribution , F-Distribution and their properties	
	Day 9	2L	Transformation of Random Variables and some general transformation.	
	Day 10	2L	Chebychev's Inequality, Weak Law of Large Numbers and Central Limit Theorem,	
	Day 11	2L	Measures of Central Tendencies and Dispersions: Mean, Median Mode, Variance and Standard Deviation	Problems as Home Assignment
	Day 12	2L	Population, Sample and Random Sampling, Sampling Distributions, Sample Mean and Sample Variance	
	Day 13	2L	Concept of Estimation, Point Estimation, Unbiased and Consistent Estimator, Maximum Likelyhood Estimation, Interval Estimation and Confidence Interval.	-
	Day 14	2L	Statistical Hypothesis, Type-I and Type-II Error, Neyman –Pearson Theorem	Problems as Home Assignment
	Day 15	2L	Definition of Planar graphs and their detection, Kuratowski's Graphs, Euler's Formula, Dual Graphs and their properties.	Study material
	Day 16	2L	Vertex-Colouring of Graphs, Chromatic Number and their Bounds, Chromatic Polynomial and its Determination.	Problems as Home Assignment
	Day 17	2L	Discussions on Algebraic Structures, Groupoid, Semigroup, Monoid, Group and their elementary properties.	-

<table>
<tr><td rowspan="3"></td><td>Day 18</td><td>2L</td><td>Subgroups and its characterization, Cyclic Groups, Normal Subgroup, Permutation and Quotient Groups.</td><td>-</td></tr>
<tr><td>Day 19</td><td>2L</td><td>Homomorphism, Isomorphism and related results.</td><td rowspan="2">Study material, Worked out example (as notes)</td></tr>
<tr><td>Day 20</td><td>2L</td><td>Ring and its Properties, Subring, Integral Domain and Field.</td></tr>
<tr><td>Additional Topics</td><td colspan="4">• Different Types of Stochastic Processes and its applications and in particular details of Markov Process.
• Practical Applications of Graph Colouring in real Life situations, Matching</td></tr>
<tr><td>Activities of Students and Assignments</td><td colspan="4">• Take part in Quiz
• Prepare Home Assignments
• Prepare Library Assignment</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
• 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 + 3 Assignments: (Cont. Assmt. by Teacher): 10%
• Best of two 45-min 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 average 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.
• 2 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 and POs related to the course are depicted in the Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics Table.</td></tr>
</table>

Text Books Books and/or Reference Books Material	• **Text Books:** 1. Banerjee A., De S.K. and Sen S.: Mathematical Probability, U.N. Dhur & Sons. 2. Gupta S. C and Kapoor V K: Fundamentals of Mathematical Statistics, Sultan Chand & Sons. 3. Mapa S.K: Higher Algebra (Abstract & Linear), Sarat Book Distributors. 4. Sen M.K., Ghosh S. and Mukhopadhyay P.: Topics in Abstract Algebra, University Press. • **Reference Books:** 1. West D.B.: Introduction to Graph Theory, Prentice Hall. 1. 2. Probability, Statistics and Random Processes, T Veerarajan, Tata McGraw-Hill 3. Clark, J., and Holton, D.A., A First Look at Graph Theory, Allied Publishers Ltd.

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	*Engineering Mathematics M-401*	1. Explain many core engineering topics with relevant mathematical theories and derivation	S	S										S
		2. Solve and model engineering applications using probability and statistical techniques, and algebraic structures	S	S	S									
		3. Apply probability theory and graph theory in the domain of Artificial Intelligence, Data Structure, Data Mining, Image Processing, Soft Computing and Multimedia.	M	S	S									

Selection of Assessment Components and Tools

M - 401 (Engineering Mathematics)							**Score (1 – 4)**		**Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)**		
Component	**Tool#**	**Tool Details**	**PO 1**	**PO 2**	**PO 3**	**PO 12**		**PO 1**	**PO 2**	**PO 3**	**PO 12**
Class Performance	1.1.1	Multiple Choice Questions or 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
	1.1.6	Library/ Home Assignment	*S*	-	-	*M*		0.5 × Score	-	-	0.3 × Score
	1.1.7	Viva	*S*	-	-	*W*		0.5 × Score	-	-	0.2 × 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	-	-	-
Terminal Test	1.2.1	Written Semester Exam	*S*	*S*	-	-		0.5 × Score	0.5 × 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
						Weighted Score		**Total/4.6**	**Total / 2.1**	**Total / 0.8**	**Total / 2.5**
						%PO attained		**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

Assessment Rubrics

M - 401 (Engineering Mathematics)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Tool#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions or 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%
Library/ Home Assignment	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	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
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 Semester Exam	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

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

Course Structure of CS401, Communication Engineering & Coding Theory

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **CS401**, **Communication Engineering & Coding Theory,** 2nd. Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: **Mr. Pankaj Pal**, M.Tech, Assistant. Professor, Dept of IT • Moderator: Dr. P.N.Basu,, PhD, Professor, Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Mr. Pankaj Pal (20 years exp in teaching) • Dr. P.N.Basu (41 years exp in teaching)
Designation as a Compulsory or Elective course (Module)	Professional Compulsory
Pre-requisites Courses	Class XII Mathematics, Basic Electric al Technology, Basic knowledge in Analogue and Digital Electronics, Circuit Theory, etc.
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	At the end of the course, students will be able to • Understand how the electronics communication is useful in IT systems • Solve and Design simple communication problems • Analyze the coding efficiency • Implement communication circuits using analog and digital ICs

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Day 1	1L	Basic ideas of Elements of Communication system, Analog Modulation & Demodulation, Noise, SNR Analog-to-Digital Conversion.	Study Material on Elements of Communication system, Analog Modulation & Demodulation, Noise and SNR
Day 2	2L	Introduction to Base Band transmission & Modulation, Elements of transmitter, receiver and channel; Origin of noise and its effect, Importance of SNR in system design	Assignment on Basic problems on Modulation
Day 3	1L	Amplitude Modulation	Assignment on Basic Questions on Rreceiver and channel, Noise, SNR in system design
Day 4	2L	Basic principles of Non-linear modulation (Angle Modulation - FM, PM); Sampling	Assignment on Basic problems on Modulation - FM, PM) and Sampling

			theorem	
	Day 5	1L	Analogue Pulse Modulation - PAM , PWM, PPM	Selected Problems as well as Theory at Home
	Day 6	2L	Basic concept of Pulse Code Modulation, Block diagram of PCM ; Multiplexing - TDM, FDM	Theory type questions at Home as assignment
	Day 7	1L	Concept of Quantisation & Quantisation error, Uniform Quantization	Notes based on given topics.
	Day 8	2L	Non-uniform Quantization, A-law & μ-law, Companding ; Encoding, Coding efficiency	Recapitalization on covered topics
	Day 9	1L	Line coding & properties, NRZ & RZ, AMI ,Manchester coding PCM, DPCM	Develops Notes on the given Questions
	Day 10	2L	Question and Answer session using Group wise	**Assignment 1**
	Day 11	1L	Baseband Pulse Transmission, Matched filter, Error rate	Notes preparation on Multivibrators
	Day 12	2L	ISI, Raised cosine function, Nyquist criterion for distortion-less base-band binary transmission, Eye pattern, Signal power in binary digital signals	Study Material for the given topics
	Day 13	1L	Details: Bit rate, Baud rate ; Information capacity, Shanon's limit	**Assignment 2**
	Day 14	2L	M-ary encoding, Introduction to the different Digital Modulation techniques - ASK, FSK, PSK, BPSK, QPSK, mention of 8 BPSK, 16 BPSK	Home work on Digital Modulation
	Day 15	1L	Introduction to QAM, mention of 8QAM, 16 QAM without elaboration	Home work on QAM,8QAM and 16 QAM
	Day 16	2L	Introduction to QAM,8QAM, 16 QAM ; Delta modulation, Adaptive delta modulation	Selected Problems as well as Theory at Home
	Day 17	1L	Question and Answer session using Group wise	**Assignment 3**
	Day 18	2L	Introduction to DPCM, Delta Modulation, Adaptive Delta modulation ; Spread Spectrum Modulation	Study on DPCM, Delta Modulation, Adaptive Delta modulation ; Spread Spectrum Modulation
	Day 19	1L	Introduction to **I**nformation Theory & Coding, News value & Information content	Notes on Information Theory & Coding
	Day 20	2L	Entropy ; Mutual information; Information rate	Home work on Entropy, Mutual information; Information rate
	Day 21	1L	Shanon-Fano algorithm for encoding	Solving of H/W problems related to Shanon-Fano algorithm
	Day 22	2L	Shannon's Theorem - Source Coding Theorem	Develop a note of Shannon's Theorem and Source Coding Theorem
	Day 23	1L	Channel Coding Theorem, Information Capacity Theorem	**Assignment 4**

	Day 24	2L	Error Control & Coding and Question and Answer session using Group wise	Study at home with different exam related questions
Additional Topics (Class + Tutorial)	• Different types of Noise • Receiver and Transmitter design using circuit components • Design Digital filter • Frequency generation using Oscillator			
Activities of Students and Assignments	• Take part in Classroom Demonstration (group activity) • Take part in Quiz • 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 • 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-min 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 average 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 • Classroom Demonstration • Viva • Student Semester Exit Survey • Faculty & Staff Satisfaction Survey • Employer Survey The correlation mapping of assessment tools and POs related to the course are depicted in the Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics Table.			
Text Books Books and/or Reference Books Material	• **Text Books:** 1. Principles of Analogue and digital Communication Systems -Sanjoy Sarma-S.K Kataria and Sons. 2. An Introduction to Analog and Digital Communications by Simon Haykin; Published by Wiley India. • **Reference Books:** 1. Principles and Analog and Digital Communication by Jerry D Gibson, Published by MacMillan. 2. Communication Systems by A. B. Carlson, Published by McGraw-Hill 3. Data Communication and Networking by Behrouz A. Forouzan, Published by Tata McGraw-Hill			

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	**Communication Engineering & Coding Theory (CS401)**	1. Understand how the electronics communication is useful in IT systems	S	M	M		M							S
		2. Solve and Design simple communication problems	S	M			S							
		3. Analyze the coding efficiency	S	S										M
		4. Implement communication circuits using analog and digital ICs	S	S	S									M

Selection of Assessment Components and Tools

CS401 (Communication Engineering & Coding Theory)								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	PO12						
Component	Tool #	Method/Element							PO 1	PO 2	PO 3	PO 5	PO12
Class Performance	1.1.1	Multiple Choice Questions or 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	*S*	-	-	-	-		0.5 × 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	-	-	-	-
		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*	-	-	*S*	-		0.5 × Score	-	-	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*	*S*		0.5 × Score	-	0.5 × Score	0.5 × Score	0.5 × Score

Terminal Test	1.2.1	Written Semester Exam	*S*	*S*	-	-	-		0.5 × Score	0.5 × Score	-	-	-
Indirect Method	2.2.2	Student Semester Exit Survey	*S*	*S*	*S*	*M*	*S*		0.5 × Score	0.5 × Score	0.5 × Score	0.3 × Score	0.5 × Score
	2.2.1	Faculty and Staff Satisfaction Survey	*M*	*M*	*M*	*S*	*S*		0.3 × Score	0.3 × Score	0.3 × Score	0.5 × 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/ 7.5**	**Total / 2.9**	**Total / 1.8**	**Total / 0.8**	**Total / 2.8**
%PO attained									**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

Assessment Rubrics

CS401 (Communication Engineering & Coding Theory)					
Assessment Tools		**Grading Criteria**			
Method/Element	**Tool#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Multiple Choice Questions or 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	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
Attendance	1.1.9	≤50%	>50% - 60%	>60% - 80%	>80%
Written Semester 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
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
	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 CS491,Communication Engineering and Coding Theory Lab

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **CS491,Communication Engineering and Coding Theory Lab,**2nd. Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: **Mr. Pankaj Pal**, M.Tech., Assistant. Professor., Dept of IT • Moderator: Dr. S. Bhattacharyya, PhD, Associate Professor, Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Mr. Pankaj Pal (20 years exp in teaching .) • Dr. S. Bhattacharyya, (15 years exp in teaching.)
Designation as a Compulsory or Elective course (Module)	Professional Compulsory
Pre-requisites Courses	Class XII Mathematics, Basic Electrical Technology, Basic knowledge in Analogue and Digital Electronics, Circuit Theory, etc..
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	At the end of the course, students will be able to **1.** Analyze/ Recognize how the Analog and Digital Processes are done **2.** Analyze/ Recognize how the receiver and transmitter communicate the signal **3.** Analyze/ Recognize how the digital signal is generated and transmitted **4.** Analyze/ Recognize how the Amplitude and Frequency modulation and demodulation are done

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Day 1	3L	Generation of Amplitude Modulation	Design using transistor or Balanced Modulator Chip and view the wave shapes
Day 2	3L	Generation of FM using VCO chip	Assignment on based on FM using transistor and OPAmp.and view the wave shapes
Day 3	3L	Generation of PAM	Assignment on PAM using OPAmp. and view the wave shapes
Day 4	3L	Generation of PWM & PPM	Assignment on PWM and PPM to generate waveform using OPAmp.

Additional Topics (Laboratory + Tutorial)	• FM Demodulation using PLL and find out Free running, Capture and Lock range frequencies

	• Generation of PCM and its Demodulation • Additional assignment to practice beyond the laboratory hours
Activities of Students and Assignments	• Do weekly laboratory experiments and document the results • Prepare and submit Lab Report • Prepare Laboratory Assignments • Do Micro Project in group and submit Report
Hints for Learning-Teaching Approach (Course Delivery)	• Hands-on program demonstration or through projector • Explanation of background theory and experimentation procedure • Checking of experimental data/records • Lab Assignments on different modules as per syllabus • Interactive problem solving and troubleshooting
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 average 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. • Micro Project (in Lab) • 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 Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics Table.
Text Books Books and/or Reference Books Material	• **Text Books:** 1. Principles of Analogue and digital Communication Systems -Sanjoy Sarma-S.K Kataria and Sons. 2. An Introduction to Analog and Digital Communications by Simon Haykin; Published by Wiley India. • **Referance Books:** 1. Data Communication and Networking by Behrouz A. Forouzan, Published by Tata McGraw-Hill 2. Communication Systems by A. B. Carlson, Published by McGraw-Hill

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	Communication Engineering and Coding Theory Lab (CS491)	1. Analyze/ Recognize how the Analog and Digital Processes are done	S	M			S							
		2. Analyze/ Recognize how the receiver and transmitter transfer and receive the signal	M	M			S							
		3. Analyze/ Recognize how the digital signal is generated and transmitted	S	S			S							
		4. Analyze/ Recognize how the Amplitude and Frequency modulation and demodulation are done	S	S			S							

Selection of Assessment Components and Tools

CS - 491 (Communication Engineering and Coding Theory Lab)						Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)		
Component	**Tool #**		**PO1**	**PO2**	**PO 5**		**PO1**	**PO2**	**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)	*S*	-	*S*		0.5 × Score	-	0.5 × Score
Micro Project	1.1.11	Micro Project (in labs) (to conduct experiments, integrate result, analyse result and report)	*M*	*S*	-		0.3 × 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)	*M*	*M*	*M*		0.3 × Score	0.3 × 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 / 1.8**	**Total / 1.3**	**Total / 1.6**
						% of PO attained	**WS * 100/4**	**WS * 100/4**	**WS * 100/4**

Assessment Rubrics

CS - 491 (Communication Engineering and Coding Theory Lab)					
Assessment Tools		**Assessment Techniques**			
Assessment Method	**Tool#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Attendance	1.1.9	<40%	>40% - <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 CS 402, Formal Language and Automata Theory

Format	Course Mapping
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **CS 402**, **Formal Language and Automata Theory**, 2nd Year
Identification of Course Designers: names of faculty (writers & editors/ moderator) with designations & qualifications	• Writer: Dr. D Majumdar, PhD, Assoc. 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. D Majumdar (12 years exp in teaching Automata, C++, Web Tech) • Dr. S Bhattacharyya (13 years exp in teaching Programming, Multimedia, etc.)
Designation as a Compulsory or Elective course (Module)	Professional Core
Pre-requisites Courses	Basic Programming and Discrete Mathematics
Contact Hours, Credits and Type of course (theory, tutorial, seminar, project, etc.), Class/Laboratory/Tutorial schedule, Duration	L-T-P : 3-1-0 Credit – 4.0 Theory 3 hours Lecture,/ 1 hour Tutorial One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1 Relate fundamental computation theories with logic circuit operations 2 Paraphrasing finite automata with finite state machines 3 Construct regular expression from finite automata 4 Develop operation principles of machines
Topics covered based on syllabus of affiliating University MAKAUT	

Day	Duration	Topics / Agenda	Assignment/Notes
1	2L	Concept of Strings, Alphabets & languages, Graphs & Trees, Set & Relations.	Chalk and Board Lecture with Handwritten Notes
2	1L	FSM: Sequential circuits, State Table, State Diagram & State Assignments.	Chalk and Board Lecture with Handwritten Notes
3	1T	Discussion and Problem Solving	Problem Set 1

4	2L	FA, DFA, NFA, Acceptability of Strings by DFA.	Chalk and Board Lecture with Handwritten Notes
5	1L	Language from DFA & vice-versa.	Chalk and Board Lecture with Handwritten Notes
6	1T	Discussion and Problem Solving	Problem Set 2
7	2L	Equivalence of DFA & NFA, Conversion.	Chalk and Board Lecture with Handwritten Notes
8	1L	Minimization of FA, Myhill-Nerode theorem, Applications.	Chalk and Board Lecture with Handwritten Notes
9	1T	Discussion and Problem Solving	Problem Set 3A
10	2L	Moore & Mealy machines, Conversions.	Chalk and Board Lecture with Handwritten Notes
11	1L	Regular Expressions, Regular sets.	Chalk and Board Lecture with Handwritten Notes
12	1T	Discussion and Problem Solving	Problem Set 3B
13	2L	NFA from regular expressions.	Chalk and Board Lecture with Handwritten Notes
14	1L	Arden's theorem, Regular Expressions from DFA.	Chalk and Board Lecture with Handwritten Notes
15	1T	Discussion and Problem Solving	Problem Set 3C
16	2L	Idea of Grammar, Classification, Identification.	Chalk and Board Lecture with Handwritten Notes
17	1L	Generation of Language from a Grammar.	Chalk and Board Lecture with Handwritten Notes
18	1T	Discussion and Problem Solving	Problem Set 4A
19	2L	Regular Language, Pumping Lemma, Application.	Chalk and Board Lecture with Handwritten Notes
20	1L	Closure properties of Regular sets.	Chalk and Board Lecture with Handwritten Notes
21	1T	Discussion and Problem Solving	Problem Set 4B
22	2L	ConText Books Free Grammars, Derivation Trees, Simplification.	Chalk and Board Lecture with Handwritten Notes
23	45 Mins	1st Class Test	Written Test
24	1T	Discussion and Problem Solving	Problem Set 4C

25	2L	CNF & GNF, Problems.	Chalk and Board Lecture with Handwritten Notes
26	1L	Closure Properties of ConText Books Free Languages.	Chalk and Board Lecture with Handwritten Notes
27	1T	Discussion and Problem Solving	Problem Set 5A
28	2L	PDA: Definition, ID, moves.	Chalk and Board Lecture with Handwritten Notes
29	1L	PDA: Language recognized by PDA.	Chalk and Board Lecture with Handwritten Notes
30	1T	Discussion and Problem Solving	Problem Set 5B
31	2L	Deterministic PDA, Empty Stack, Equivalence of PDA & CFL.	Chalk and Board Lecture with Handwritten Notes
32	1L	Construction of PDA.	Chalk and Board Lecture with Handwritten Notes
33	1T	Discussion and Problem Solving	Problem Set 5C
34	2L	TM: Concept, ID, moves.	Chalk and Board Lecture with Handwritten Notes
35	1L	Language recognized by TM, Construction of TM.	Chalk and Board Lecture with Handwritten Notes
36	1T	Discussion and Problem Solving	Problem Set 5A
37	2L	Universal TM.	Chalk and Board Lecture with Handwritten Notes
38	1L	Concept of Synchronous, Asynchronous & Linear Sequential Circuits.	Chalk and Board Lecture with Handwritten Notes
39	1T	Discussion and Problem Solving	Problem Set 5B
40	2L	Merger graph, Compatibility Graph.	Chalk and Board Lecture with Handwritten Notes
41	45 Mins	2nd Class Test	Written Test
42	1T	Discussion and Problem Solving	Problem Set 5C
43	2L	Merger Table, Problems.	Chalk and Board Lecture with Handwritten Notes
44	1L	Finite memory, information loss.	Chalk and Board Lecture with Handwritten Notes
45	1T	Discussion and Problem Solving	Problem Set 5A

<table>
<tr><td></td><td>
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<tr><td>46</td><td>2L</td><td>Testing table & Testing Graph.</td><td>Chalk and Board Lecture with Handwritten Notes</td></tr>
<tr><td>47</td><td>1L</td><td>Structure of Sequential machines, Concept of Partitions, Closed Partitions, Lattice of Partitions, Serial & Parallel Decomposition</td><td>Chalk and Board Lecture with Handwritten Notes</td></tr>
</table>
</td></tr>
<tr><td>Additional Topics (Class + Tutorial)</td><td>• Basic Theory of Compiler Design
• Design of a small Lexical Analyser</td></tr>
<tr><td>Activities of Students and Assignments</td><td>• Take part in Classroom Demonstration (group activity)
• Take part in Quiz
• Prepare Home Assignments
• Prepare Library Assignments</td></tr>
<tr><td>Hints for Learning-Teaching Approach (Course Delivery)</td><td>• Chalk-Board Lectures
• Case study through PPT
• 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>Course Assessment Policy</td><td>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-min 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 average score (4).</td></tr>
<tr><td>Hints for Course Assessment instruments & processes (both continuous and semester-end assessment)</td><td>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/ Microproject
• Classroom Demonstration
• Viva
• Student Semester Exit Survey
• Faculty & Staff Satisfaction Survey
• Employer Survey
The correlation mapping of assessment tools and POs related to the course are depicted in the Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics Table.</td></tr>
<tr><td>Text Books Books and/or Reference Books Material</td><td>• Text Books:
1. Introduction to Automata Theory Language and Computation, Hopcroft H.E. and Ullman J. D., Pearson education.
2. Theory of Computer Science “, Automata Languages and Computation, Mishra and Chandrashekaran, 2nd edition, PHI.
3. Switching & Finite Automata, ZVI Kohavi, 2nd Edn., Tata McGraw Hill</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	Formal Language and Automata Theory (CS 402)	1. Relate fundamental computation theories with logic circuit operations	S	M										
		2. Paraphrasing finite automata with finite state machines	S	M	M									
		3. Construct regular expression from finite automata	M	M	S		M							
		4. Develop operation principles of machines	M		S									

Selection of Assessment Components and Tools

CS 402 (Formal Language and Automata Theory)							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	Tool #	Method/Element						PO 1	PO 2	PO 3	PO 5
Class Performance	1.1.1	Multiple Choice Questions or 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*	-	-	*W*		0.5 × Score	-	-	0.2 × 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 Exam	*S*	*S*	-	-		0.5 × Score	0.5 × 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
	2.2.1	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 / 4.5**	**Total / 3.4**	**Total / 3.8**
						%PO attained		**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

Assessment Rubrics

CS 402 (Formal Language and Automata Theory)					
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
Viva	1.1.7	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
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 Semester Exam	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
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

`CS 402 (Formal Language and Automata Theory)						
Assessment Tools			**Grading Criteria**			
Method/Element		**Tool#**	**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

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Course Structure of CS492, Software Tools

Format	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT**, CS492, Software Tools,**4Th Semester
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: **Mr. Pankaj Pal**, M.Tech., Assistant. Professor, Dept of IT • Moderator: Dr. S. Bhattacharyya, PhD, Associate Professor, Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Mr. Pankaj Pal (20 years exp in teaching) • Dr. S. Bhattacharyya, (15 years exp in teaching)
Designation as a Compulsory or Elective course (Module)	Professional Compulsory
Pre-requisites Courses	Basic knowledge of C, BASIC language, Some experience using 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 Practical 3 Hours Laboratory One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Implement the Project in Graphics mode using Visual Basic 2. Design new project that may be effective for complex computation 3. Implement different software modules in IT application 4. Handle the picture objects

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Day 1	3L	To learn about how to generate program using CASE statement using Visual Basic.	Study Material and assignment on CASE statement using Visual Basic.
Day 2	3L	To learn about how to calculate age using Visual Basic	Assignment on based on Basic problems on age calculation
Day 3	3L	To learn about how to calculate average of numbers using Visual Basic.	Assignment on number system
Day 4	3L	To learn about how to generate Savings Account Calculation using Visual Basic.	Assignment on different types account calculation
Day 5	3L	To Create Class and Objects	Assignment based on Class and Objects.
Day 6	3L	To learn about how to create" Students Record"	Assignment on different types of database calculation

<table>
<tr><td rowspan="3"></td><td></td><td></td><td>using class in Visual Basic</td><td></td></tr>
<tr><td>Day 7</td><td>3L</td><td>To learn about how to generate 'Sum of N numbers" using for loop statement in Visual Basic</td><td>Assignment on different types of series calculation</td></tr>
<tr><td>Day 8</td><td>3L</td><td>To learn about how to create Multiple Document Interface(MDI) using Visual Basic</td><td>Assignment on different types of Multiple Document Interface(MDI) using</td></tr>
<tr><td>Hints for Learning-Teaching Approach (Course Delivery)</td><td colspan="4">• Hands-on program demonstration or through projector
• Explanation of program logic
• Checking of program output and errors
• Lab Assignments on different modules as per syllabus
• Interactive debugging and troubleshooting</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 + 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 average score (4)</td></tr>
<tr><td>Hints for Course Assessment instruments & processes (both continuous and semester-end assessment</td><td colspan="4">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.
• Micro Project (in Lab)
• Student Semester Exit Survey
• Employer Survey
• Faculty & Staff Satisfaction Survey
The correlation mapping of assessment tools and POs related to the course are depicted in the Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics Table.</td></tr>
<tr><td>Text Books Books and/or Reference Books Material</td><td colspan="4">• Text Books:
1. Visual Basic 6 Complete Paperback - Steve Brown-Sybex
2. Programming in Visual Basic 6- Francesco Balena-Microsoft
Reference Books:
1. Murach's Visual Basic 6- Anne Boehm- Murach
2. Computer Programming Concepts and Visual Basic 6- David I. Schneider-UNIVERSITY OF PHOENIX</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 Tools Lab (CS492)	1. Implement the Project in Graphics mode using Visual Basic		M	M		S							
		2. Design new project that may be effective for complex computation		M	S		S							
		3. Implement different software modules in IT applications.		S	S		S							
		4. Handle picture objects		S	M		M							

Selection of Assessment Components and Tools

CS – 492 (Software Tools)						Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)		
Assessment Tools									
Component	**Tool#**	**Method/ Element**	**PO 2**	**PO 3**	**PO 5**		**PO 2**	**PO 3**	**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	-	-
Micro Project	1.1.11	Research and gather information	-	-	-		-	-	-
		Analysis of Problem, Requirement Analysis	*S*	*M*	-		0.5 × Score	0.3 × Score	-
		Planning & Designing	*S*	*S*	-		0.5 × Score	0.5 × Score	-
		Application of Subject Knowledge	-	-	-		-	-	-
		Application of Related other Concept and Techniques - Integrated Approach	*M*	*M*	*M*		0.3 × Score	0.3 × Score	0.3 × Score
		Developing Solution/System using IT skill	-	*S*	*S*		-	0.5 × Score	0.5 × Score
Terminal Test	1.2.2	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	2.2.1	Employer Survey	*M*	*S*	*S*		0.3 × Score	0.5 × Score	0.5 × Score
	2.2.2	Student Semester Exit Survey	*S*	-	*S*		0.5 × Score	-	0.5 × Score
	2.2.5	Faculty & Staff Satisfaction Survey	*S*	*S*	*M*		0.5 × Score	0.5 × Score	0.3 × Score
						Weighted Score (WS)	**Total / 3.7**	**Total / 3.1**	**Total / 2.4**
						% of PO attained	**WS * 100/4**	**WS * 100/4**	**WS * 100/4**

Assessment Rubrics

CS – 492 (Software Tools)						
Assessment Tools			**Grading Criteria**			
Method/ Element		**#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Attendance		1.1.9	<40%	>40% - <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	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 Solution/System using IT skill		Poor IT skill - cannot implement	Can implement partly	Mostly implements but complexity higher	Implements fully with all requirements satisfied – effective and less complex soln
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 skilled 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

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Course Structure of IT 401, Object Oriented Programming & UML

	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT401**, **Object Oriented Programming & UML**, 2nd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Dr. I Pan, PhD, Assist. Prof., Dept of IT • Moderator: Dr. D Majumdar, PhD, Assoc. Prof., Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Dr. I Pan (10 years exp in teaching DAA, OOP, AI, DSA, CD etc.) • Dr. D Majumdar (12 years exp in teaching Programming, Automata. DAA, OOP 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 : 3-1-0 Credit – 4.0 Theory 3 hours Lecture/ 1 Tutorial One Semester
Course Outcomes	Upon successful completion of this course, students should be able to: 1. Visualize a given scenario in terms of Objects and Behaviours 2. Develop models for given scenario 3. Translate models into object oriented program to automate functionalities of objects and entities

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Day 1	1L	Concept of OOP, Requirement for modular development tools to support Software development, Effect on software maintenance	
Day 2	2L	Concept of Class, Objects, different attributes of object oriented programming with some real life example	Problem analysis and identification of different objects and their attributes
Day 3	1T	Discussion on assignments. Brief introduction to C++	
Day 4	1L	Class relationship among objects, aggregation, association, links, relationship among class associations, meta class	
Day 5	2L	Basic difference between OOP and POP, advantage and disadvantages. Introduction to	Demonstration on How to write first Java Program, Compilation

			JAVA, Evolution of JAVA through different requirements and milestones, Compilation of steps of JAVA, Discussion on platform independence, Byte code, JVM	and Execution. Assignment on simple programming in JAVA platform.
	Day 6	1T	Extended discussion on C++ and pointer to some notable differences in JAVA	
	Day 7	1L	Access specifiers, Class and object, declaration and initialization of objects, introduction to data types, conditional structure and loop in java	Simple program to implement loop and conditional blocks and switch case statements
	Day 8	2L	Nesting of methods, Constructor, access modifiers in JAVA, Inheritance, Method overloading and Method overriding, static, abstract, final, garbage collection in JAVA, finalize() method	Assignment of method overriding
	Day 9	1T	Discussion on super, abstract classes, this operator	
	Day 10	1L	Introduction to array, single, two and multi dimensional array, concept of variable length columns in two dimensional array	Assignment of Bubble/ Insertion sort for single dimension array and multiplication table for two dimensional array
	Day 11	2L	Introduction to String and StringBuffer class with its different methods and application	Assignment on string related program and operations
	Day 12	1T	Discussion Vectors and wrapper classes	
	Day 13	1L	Introduction to Interfaces, extension and implementation of interfaces, accessing interface variables	Assignment on multiple inheritance
	Day 14	2L	JAVA API packages, naming convention, creating and accessing packages, Using a package, adding a class to a package, class hiding	Assignment on different packages and their accesses through other packages
	Day 15	1T	JAVA API packages some hints from Oracle JAVA websites	
	Day 16	1L	Introduction to Errors, compile time and runtime errors, Exceptions, Syntax for exception handling codes, multiple catch statements, Use of finally statement, Throwing own exception, Using exception for debugging	
	Day 17	2L	Introduction to Threads, declaring class, implementing run() method, starting new thread, Stopping and blocking a thread, Thread life cycle, Using thread methods, thread exceptions, thread priority and thread synchronization	Assignment on thread class, Runnable Interface
	Day 18	1T	Concept of socket, discussion on different socket creation techniques in JAVA	Assignment on thread programming
	Day 19	1L	Concept of streams, stream class, byte stream class (IO stream),	

			character stream. Some useful I/O classes	
	Day 20	2L	Use of file class, I/O exceptions, reading and writing characters, reading/ writing bytes, handling primitive data types, Concatenating and buffering files	Assignment on IO files
	Day 21	1T	Concept of some stream classes (Object, Piped, Pushback, Filtered)	
	Day 22	1L	Introduction to applet, difference with application, writing applet, building applet code, applet life cycle	
	Day 23	2L	Creating an executable applet, applet tag, adding applet to HTML file, running the applet, passing parameters to applet, aligning display	Applet programming, small interactive applet design
	Day 24	1T	Using Numerical values in applet, getting input from user, program analysis	
Additional Topics, Activities and Assignments	• Basic and elementary concept of C++ • JSP - Introduction • Small assignments of C++ at the beginning • Assignments of JSP incorporating web applets • Weekend assignments are discussed and analyzed during tutorial classes • Special tip for weak areas identified through class performances in different assignments			
Hints for Learning-Teaching Approach (Course Delivery)	• Case study through PPT • Program demonstration using Java • Notes in every class in lieu with discussion • Pin pointed small assignments to revise the discussion through problem solving which are solved/ evaluated in the next lecture • Assignments are individually checked and corrected with relevant guidelines for improvements as and when needed • 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-min 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 average 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 • Faculty & Staff Satisfaction Survey • Employer Survey			

	The correlation mapping of assessment tools and POs related to the course are depicted in the Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics Table.
Text Books Books and/or Reference Books Material	• **Text Books:** 1. Balagurusamy – "Programming with JAVA: A Primer (3rd Ed.)" – TMH 2. Sierra, Bates – "Head First JAVA (2nd Ed.)" – SPD – O'Reilly 3. Deitel, Deitel – "JAVA How to Program (6th Ed.)" - Pearson • **Reference Books:** 1. Naughton, Schildt – "The Complete Reference Books JAVA 2" – TMH

Department of Information Technology
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Course Structure - IT 491, Object Oriented Programming & UML

	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **IT491**, **Object Oriented Programming & UML**, 2nd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Dr. I Pan, PhD, Assist. Prof., Dept of IT • Moderator: Dr. D Majumdar, PhD, Assoc. Prof., Dept of IT
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Dr. I Pan (10 years exp in teaching DAA, OOP, AI, DSA, CD etc.) • Dr. D Majumdar (12 years exp in teaching Programming, Automata. DAA, OOP 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 : 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. Solve simple problems applying concepts of Object oriented technology 2. Practice the use of built-in packages and methods available in JAVA API 3. Develop user friendly object oriented applications for small scale real life problems using JAVA
Topics covered based on syllabus of affiliating University MAKAUT	**Day** / **Duration** / **Topics** Week 1 / 3 Lab / Assignment on class, object, conditional statement, loops Week 2 / 3 Lab / Assignment on constructor, method overloading, method overriding, inheritance Week 3 / 3 Lab / Assignment on Arrays and Strings Week 4 / 3 Lab / Assignment using StringBuffer, Vectors and wrapper class Week 5 / 3 Lab / Assignment on interface, multiple inheritance, extending interface Week 6 / 3 Lab / Assignment on creating and accessing package Week 7 / 3 Lab / Assignment on multithreaded programming Week 8 / 3 Lab / Assignment on applet programming
Additional Topics, Activities and Assignments	• Programming using JAVA swing • Socket Programming • Graphic programming in JAVA • Interactive Applet design using Graphics • Additional assignment to practice beyond the scheduled laboratory hours

Hints for Learning-Teaching Approach (Course Delivery)	• Program demonstration through projector • Lab Assignments on different modules as per syllabus • Library assignment to solve different question involving JAVA programs from previous placements drives and entrance examinations for higher studies • 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 + 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 average 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. • Micro Project (in lab) • Student Semester Exit Survey • Employer Survey • Faculty and Staff Satisfaction Survey The correlation mapping of assessment tools/elements and POs related to the course are depicted in the Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) are depicted in the Assessment Rubrics Table.
Text Books Books and/or Reference Books Material	• **Text Books:** 3. Balagurusamy – "Programming with JAVA: A Primer (3rd Ed.)" – TMH 4. Sierra, Bates – "Head First JAVA (2nd Ed.)" – SPD – O'Reilly 5. Deitel, Deitel – "JAVA How to Program (6th Ed.)" - Pearson • **Reference Books** 2. Naughton, Schildt – "The Complete Reference Books JAVA 2" – 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	Object Oriented Programming and UML (IT401) - ***Theory***	1. Visualize a given scenario in terms of Objects and Behaviours	S	M										
		2. Develop models for given scenario	S		M									
		3. Translate models into object oriented program to automate functionalities of objects and entities	S											
2	Object Oriented Programming and UML (IT491) - ***Practical***	1. Solve simple problems applying concepts of Object oriented technology		S										
		2. Practice the use of built-in packages and methods available in JAVA API					S							
		3. Develop user friendly object oriented applications for small scale real life problems using JAVA			S		S							

Selection of Assessment Techniques

IT – 401 (Object Oriented Programming and UML)						Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)		
Assessment Tools									
Component	Tool#	Method/ Element	PO 1	PO 2	PO 3		PO 1	PO 2	PO 3
Class Performance	1.1.1	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*		0.3 × Score	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	-	-
	1.1.9	Attendance	*M*	-	-		0.3 × Score	-	-
Terminal Test	1.2.1	Written Semester Exam (incl. MCQ, Short Answer type and Long Answer type Questions, Numerical & Design Problems)	*S*	*M*	*M*		0.5 × Score	0.3 × Score	0.3 × Score
Indirect Method	2.2.1	Employer Survey	*S*	*M*	*S*		0.5 × Score	0.3 × Score	0.5 × Score
	2.2.5	Faculty & Staff Satisfaction Survey	-	*S*	*S*			0.5 × Score	0.5 × Score
						Weighted Score (WS)	**Total / 3.9**	**Total / 3.1**	**Total / 1.8**
						% of PO attained	**WS * 100/4**	**WS * 100/4**	**WS * 100/4**

IT – 491 (Object Oriented Programming and UML)						Score (1 – 4)	Weighted Evaluation of POs (W_S – 0.5 || W_M = 0.3 || W_W = 0.2)		
Assessment Tools									
Component	Tool#	Method/ Element	PO 2	PO 3	PO 5		PO 2	PO 3	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	-	-
Micro Project	1.1.11	Research and gather information	-	-	-		-	-	-
		Analysis of Problem, Requirement Analysis	*S*	*M*	-		0.5 × Score	0.3 × Score	-
		Planning & Designing	*S*	*S*	-		0.5 × Score	0.5 × Score	-
		Application of Subject Knowledge	-	-	-		-	-	-
		Application of Related other Concept and Techniques - Integrated Approach	*M*	*M*	*M*		0.3 × Score	0.3 × Score	0.3 × Score
		Developing Solution/System using IT skill	-	*S*	*S*		-	0.5 × Score	0.5 × Score
Terminal Test	1.2.2	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	2.2.1	Employer Survey	*M*	*S*	*S*		0.3 × Score	0.5 × Score	0.5 × Score
	2.2.2	Student Semester Exit Survey	*S*	-	*S*		0.5 × Score	-	0.5 × Score
	2.2.5	Faculty & Staff Satisfaction Survey	*S*	*S*	*M*		0.5 × Score	0.5 × Score	0.3 × Score
						Weighted Score (WS)	**Total / 3.7**	**Total / 3.1**	**Total / 2.4**
						% of PO attained	**WS * 100/4**	**WS * 100/4**	**WS * 100/4**

Assessment Rubrics

IT - 401 (Object Oriented Programming and UML)					
Assessment Tools		**Grading Criteria**			
Method/ Element	**Tool#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Quiz	1.1.1				
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
Attendance	1.1.9	<40%	>40% - <60%	>60% - <80%	>80%
Written Semester Exam	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
Faculty & Staff Satisfaction Survey	2.2.5	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 - 491 (Object Oriented Programming and UML)						
Assessment Tools			**Grading Criteria**			
Method/ Element		**#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Attendance		1.1.9	<40%	>40% - <60%	>60% - <80%	>80%
Lab. Experiments & Assignment		1.1.10	Irregular	Regular but often search helps from other	Regular and solve all problems of its own	Regularly solves all problems and capable to generate ideas
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	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 & 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 Solution/System using IT skill		Poor IT skill - cannot implement	Can implement partly	Mostly implements but complexity higher	Implements fully with all requirements satisfied – effective and less complex soln
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 skilled 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 prob.	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

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Course Structure of HU 481, Technical Report Writing and Language Lab Practice

	Course Curriculum
Department, Program, Course Number, Title of Course and Year of Study	IT, B.Tech-IT, **HU 481**, **Technical Report Writing and Language Lab Practice**, 2nd Year
Identification of Course Designers: names of faculty (writers & editors/moderator) with designations & qualifications	• Writer: Dr. S. K. Dey, PhD, Assoc. Prof. • Moderator: Dr. A. Mukherjee, PhD, Asst. Prof.
Mapping with Faculty Qualification & Expertise (Experience of teaching in UG Engg.)	• Dr. S. K. Dey (25 years exp in teaching linguistic.)
Designation as a Compulsory or Elective course (Module)	Compulsory
Pre-requisites Courses	Basic knowledge of English
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: 4. Confidence to speak in English and to become good communicator 5. Proportionately contribute in group activity both socially & professionally 6. Prepare report of different technical projects in suitable manner

Topics covered based on syllabus of affiliating University MAKAUT

Day	Duration	Topics	Assignment/Notes
Week 1	3 Lab	Technical report types, format	
Week 2	3 Lab	Skills of writing	
Week 3	3 Lab	Conversation practice	
Week 4	3 Lab	Role playing	
Week 5	3 Lab	Different topics and models of Group discussion	
Week 6	3 Lab	Analyze Live and recorded GD	
Week 7	3 Lab	Interview situation practice	

Additional Topics, Activities and Assignments	• Oral Presentation on Current Affairs • JAM on Current Affairs • Contrastive Analysis between Technical and non–Technical Report Writing

Hints for Learning-Teaching Approach (Course Delivery)	• Participate in presentation, JAM, Group Discussion and other Language Lab activities • Submit Reports of different types • Complete Micro Project(s) and submit report(s) • Demonstration in an interactive mode • Conduct GD, JAM • Review of student activities/assignments/projects and suggestions to improve • 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: 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 + lab activities + report (Cont. Assmt. by Teacher): 40% • One 3-hours Term-end Exam incl. viva-voce and report submission (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 (Theoretical - Practical test) - Objective and Organization: 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 • Faculty & Staff Satisfaction Survey • Employer Survey The correlation mapping of assessment tools and POs related to the course are depicted in the Table of Assessment Tools. The grading criteria against each assessment tool to ascertain the scores (1-4) is depicted in the Assessment Rubrics Table..
Text Books Books and/or Reference Books Material	• **Text Books:** 1. Advanced English Language Laboratory (MAKAUT EDITION)

Mapping of Course Outcome with Program Outcome

S. No	Course Code	Course Outcome	PO1	PO2	PO4	PO9	PO10	PO11	PO12
1	Technical Report Writing & Language Lab Practice (HU481)	1. Understand a new technological topic/situation or engineering requirement in English language and present it in cotemporary style using English language with proper examples, case studies and other statistical data - oriented features	S	M	M	-	S	S	S
		2. Build up motivation for gathering and sharing relevant knowledge, team spirit and leadership qualities to cope up with stringent work schedule and deadline in academia or industry	M	-	-	S	S	S	-
		3. Plan, execute, analyse and evaluate technical report and technical presentation as may be frequently required in academia or industry keeping an eye to social and environmental need	M	S	M	-	S	S	M
		4. Demonstrate knowledge & application skills, gained on emerging technology/concepts in IT and allied domain through technical report writing and technical presentation in multi-disciplinary situations	S	S	M	-	S	M	S

Selection of Assessment Component

HU – 481 (Technical Report Writing & Language Lab Practice)											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 4	PO 9	PO 10	PO 11	PO 12		PO 1	PO 2	PO 4	PO 9	PO 10	PO 11	PO 12
Component	Tool #	Method/Element															
Class Performance	1.1.9	Attendance	*S*	-	-	*M*	*S*	-	M		0.5 × Score	-	-	0.3 × Score	0.5 × Score	-	0.3 × Score
	1.1.10	Laboratory Practice/Assignments (incl. problem solving, quiz, home assignment and preparing lab reports)	*M*	*S*	*M*	*S*	*S*	-	M		0.3 × Score	0.5 × Score	0.3 × Score	0.5 × Score	0.5 × Score	-	0.3 × Score
Micro Project	1.1.11	Research and gather information	*S*	*M*	*S*	*M*	-	-	*S*		0.5 × Score	0.3 × Score	0.5 × Score	0.3 × Score	-	-	0.5 × Score
		Analysis and Understanding of technical problem/ topic/issue	*M*	*S*	-	-	-	-	M		0.3 × Score	0.5 × Score	-	-	-	-	0.3 × Score
		Planning & Organization , Coverage & Depth and Adherence to Context of Report & Presentation	*M*	*M*	-	-	-	*S*	-		0.3 × Score	0.3 × Score	-	-	-	0.5 × Score	-
		Application of technical knowledge and English language skill in Report & Presentation	*S*	-	-	-	*S*	*S*	*M*		0.5 × Score	-	-	-	0.5 × Score	0.5 × Score	0.3 × Score
		Presentation style, Confidence, Interaction & Communication Skill	-	-	-	*M*	*S*	*M*	-		-	-	-	0.3 × Score	0.5 × Score	0.3 × Score	-
		Leadership & Teamwork	-	-	-	*S*	-	*S*	-		-	-	-	0.5 × Score	-	0.5 × Score	-
Terminal Test	1.2.2	Lab Test (Theoretical test, practical performance on allotted work, report – organization and quality, viva voce)	-	-	-	-	*S*	-	-		-	-	-	-	0.5 × Score	-	-
Indirect Method	2.2.1	Employer Survey	-	-	-	-	*S*	*S*	M		-	-	-	-	0.5 × Score	0.5 × Score	0.3 × Score
	2.2.5	Faculty & Staff Satisfaction Survey	*M*	-	-	-	*S*	-	-		0.3 × Score	-	-	-	0.5 × Score	-	-
										Weighted Score (WS)	**Total / 2.7**	**Total / 1.6**	**Total / 0.8**	**Total / 1.9**	**Total / 3.5**	**Total / 2.3**	**Total / 2.0**
										% of PO attained	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**	**WS/4 * 100**

Assessment Rubrics

HU – 481 (Technical Report Writing & Language Lab Practice)						
Assessment Tools			**Grading Criteria**			
Method/Element		**Tool#**	**Poor (Score – 1)**	**Developing (Score – 2)**	**Good (Score – 3)**	**Excellent (Score – 4)**
Attendance		1.1.9	≤50%	>50% - 60%	>60% - 80%	>80%
Laboratory Practice/Assignments		1.1.10	Irregular , poor approach <40%	Regular but often searches help from instructor >40% - <60%	Regular and does activities and assignments by own >60% - <80%	Regular and self sufficient; activities and assignments are neat >80%
Terminal Test		1.2.2	<40%	>40% - <60%	>60% - <80%	>80%
Employer Survey		2.2.1	Lack managerial skill and attitude, unaware of new technology	Scope for improvement of managerial skill and attitude, lacks technical updates and understanding	Good managerial skill and attitude, lacks leadership and technical depth	Excellent managerial skill and attitude, has leadership quality and technically updated
Faculty & Staff Satisfaction Survey		2.2.5	Poor technical knowledge and English speaking & writing skill, careless approach in team, weak soft skill, reluctant learner	Strives to learn but conceptually weak, needs guidance, plays some role in team, slow learner, lacks in soft skill and confidence	Has basic technical knowledge, good report writing skill and soft skill Lacks in technical depth and leadership, good learner	Has solid knowledge, always updated and confident, has excellent report writing and soft skill and leadership quality, an advanced learner
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 and Understanding of technical problem/ topic/issue		Asks every other person to explain the topic without any thinking	Understands the topic grossly, cannot analyze correctly – requires guidance	Understands the topic; good attempt in analyzing and preparing in input	Pinpoints the salient points, conceives additional features; prepares standard input
	Planning & Organization , Coverage & Depth and Adherence to Context of Report & Presentation		Poor contribution in documentation and report preparation	Helps in data/point collection but lacks proper planning for report writing and preparing presentation, plays supportive role	Develops the basic structure and content of report/presentation but some portion are out of context, takes care of topic coverage	Does major part of report writing and preparing presentation , makes the report technically comprehensive (depth) and focused
	Application of technical knowledge and English language skill in Report & Presentation		Poor technical knowledge and language skill; requires support of others to represent correctly;	Inadequate knowledge forces copy-paste with not much understanding, English not so good and requires guidance	Fairly good technical knowledge and moderate English speaking & writing skill makes the report and presentations average quality	Thorough technical knowledge and strong English speaking & writing skill makes the reports and presentation excellent
	Presentation style, Confidence, Interaction & Communication Skill		Unimpressive reflecting lack of confidence, low voice, poor communication skills, low confidence	Starting well but frequently faltering and losing confidence, medium voice , limited comm. skills	Acceptable but does not make impact on the audience, often fails to communicate effectively, acceptable voice	Attracts attention and makes the presentation lively, applies the art of effective communication, strong voice, high confidence & control
	Leadership & Teamwork		Contributes minimally, neglects team role	Contribution insignificant, cares for other team members	Contribution significant, helps other team members	Contributes maximum, takes additional responsibilities, guides team members and leads the team