B.E. /B.Tech in Computer Science & Business Systems

Semester 1

TCS

Computer Science & Business Systems

Semester 1 Curriculum

B.E. /B.Tech in Computer Science & Business Systems

Semester 1

Discrete Mathematics (PCC-CS401)

Boolean algebra: Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

Abstract algebra: Set, relation, group, ring, field.

Combinatorics: Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.

Graph Theory: Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem.

Logic: Propositional calculus - propositions and connectives, syntax; Semantics - truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness.

Text Books:

1. *Topics in Algebra,* I. N. Herstein, John Wiley and Sons.
2. *Digital Logic & Computer Design,* M. Morris Mano, Pearson.
3. *Elements of Discrete Mathematics,* (Second Edition) C. L. LiuMcGraw Hill, New Delhi.
4. *Graph Theory with Applications,* J. A. Bondy and U. S. R. Murty, Macmillan Press, London.
5. *Mathematical Logic for Computer Science,* L. Zhongwan, World Scientific, Singapore.

Reference Books:

1. *Introduction to linear algebra.* Gilbert Strang.
2. *Introductory Combinatorics,* R. A. Brualdi, North-Holland, New York.
3. *Graph Theory with Applications to Engineering and Computer Science,* N. Deo, Prentice Hall, Englewood Cliffs.
4. *Introduction to Mathematical Logic,* (Second Edition), E. Mendelsohn, Van-Nostrand, London.

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STATISTICS, PROBABILITY AND CALCULUS

Introduction to Statistics: Definition of Statistics. Basic objectives. Applications in various branches of science with examples. Collection of Data: Internal and external data, Primary and secondary Data. Population and sample, Representative sample. Descriptive Statistics: Classification and tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - central tendency and dispersion. Bivariate data. Summarization, marginal and conditional frequency distribution.

Probability: Concept of experiments, sample space, event. Definition of Combinatorial Probability. Conditional Probability, Bayes Theorem. Probability distributions: discrete & continuous distributions, Binomial, Poisson and Geometric distributions, Uniform, Exponential, Normal, Chi-square, t, F distributions. Expected values and moments: mathematical expectation and its properties, Moments (including variance) and their properties, interpretation, Moment generating function.

Calculus: Basic concepts of Differential and integral calculus, application of double and triple integral.

Text Books:

1. *Introduction of Probability Models*, S. M. Ross, Academic Press, N.Y.
2. *Fundamentals of Statistics*, vol. I & II, A. Goon, M. Gupta and B. Dasgupta, World Press.
3. *Higher Engineering Mathematics*, B. S. Grewal, Khanna Publication, Delhi.

Reference Books:

1. *A first course in Probability,* S. M. Ross, Prentice Hall.
2. *Probability and Statistics for Engineers,* (Fourth Edition), I. R. Miller, J.E. Freund and R. Johnson, PHI.
3. *Introduction to the Theory of Statistics*, A. M. Mood, F.A. Graybill and D.C. Boes, McGraw Hill Education.
4. *Advanced Engineering Mathematics*, (Seventh Edition), Peter V. O'Neil, Thomson Learning.
5. *Advanced Engineering Mathematics*, (Second Edition) M. D. Greenberg, Pearson Education.
6. *Applied Mathematics,* Vol. I & II, P. N. Wartikar and J. N. Wartikar, Vidyarthi Prakashan.

FUNDAMENTALS OF COMPUTER SCIENCE + Lab

General problem Solving concepts: Algorithm, and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops.

Imperative languages: Introduction to imperative language; syntax and constructs of a specific language (ANSI C)

- Types Operator and Expressions with discussion of variable naming and Hungarian Notation: Variable Names, Data Type and Sizes (Little Endian Big Endian), Constants, Declarations, Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, proper variable naming and Hungarian Notation.

- Control Flow with discussion on structured and unstructured programming: Statements and Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, goto labels, structured and un- structured programming.

- Functions and Program Structure with discussion on standard library: Basics of functions, parameter passing and returning type, C main return as integer, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialisation, Recursion, Pre-processor, Standard Library Functions and return types.

- Pointers and Arrays: Pointers and address, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional array and Row/column major formats, Initialisation of Pointer Arrays, Command line arguments, Pointer to functions, complicated declarations and how they are evaluated.

- Structures: Basic Structures, Structures and Functions, Array of structures, Pointer of structures, Self-referral structures, Table look up, typedef, unions, Bit-fields

- Input and Output: Standard I/O, Formatted Output – printf, Formated Input – scanf, Variable length argument list, file access including FILE structure, fopen, stdin, sdtout and stderr, Error Handling including exit, perror and error.h, Line I/O, related miscellaneous functions.

- Unix system Interface: File Descriptor, Low level I/O – read and write, open, create, close and unlink, Random access – lseek, Discussions on Listing Directory, Storage allocator.

Programming Method: Debugging, Macro, User Defined Header, User Defined Library Function, makefile utility.

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FUNDAMENTALS OF COMPUTER SCIENCE + Lab (continued)

Laboratory

1. Algorithm and flowcharts of small problems like GCD
2. Structured code writing with:

    i.   Small but tricky codes

    ii.   Proper parameter passing

    iii. Command line Arguments

    iv.   Variable parameter

    v.   Pointer to functions

    vi.   User defined header

    vii. Make file utility

    viii. Multi file program and user defined libraries

    ix.   Interesting substring matching / searching programs

    x.   Parsing related assignments

Text Books:

1. *The C Programming Language,* (Second Edition) B. W. Kernighan and D. M. Ritchi, PHI.
2. *Programming in C,* (Second Edition) B. Gottfried, Schaum Outline Series.

Reference Books:

1. *C: The Complete Reference,* (Fourth Edition), Herbert Schildt, McGraw Hill.
2. *Let Us C,* Yashavant Kanetkar, BPB Publications.

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PRINCIPLES OF ELECTRICAL ENGINEERING + Lab

Introduction: Concept of Potential difference, voltage, current, Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols in order to describe electric networks, voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff-s laws and applications to network solutions using mesh and nodal analysis, Concept of work, power, energy, and conversion of energy.

DC Circuits: Current-voltage relations of the electric network by mathematical equations to analyze the network (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem) Simplifications of networks using series-parallel, Star/Delta transformation. Superposition theorem.

AC Circuits: AC waveform definitions, form factor, peak factor, study of R-L, R-C,RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits (人-Δ & 人-人).

Electrostatics and Electro-Mechanics: Electrostatic field, electric field strength, concept of permittivity in dielectrics, capacitor composite, dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors, Electricity and Magnetism, magnetic field and Faraday's law, self and mutual inductance, Ampere's law, Magnetic circuit, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, efficiency and regulation, Electromechanical energy conversion.

Measurements and Sensors: Introduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems (Current & Single-phase power). Electrical Wiring and Illumination system: Basic layout of the distribution system, Types of Wiring System &Wiring Accessories, Necessity of earthing, Types of earthing, Safety devices & system.

For Further Reading - Principle of batteries, types, construction and application, Magnetic material and B-H Curve, Basic concept of indicating and integrating instruments.

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PRINCIPLES OF ELECTRICAL ENGINEERING + Lab (continued)

Laboratory

1. Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits

2. Determination of resistance temperature coefficient

3. Verification of Network Theorem (Superposition, Thevenin, Norton, Maximum Power

4. Transfer theorem)

5. Simulation of R-L-C series circuits for XL>XC , XL< XC

6. Simulation of Time response of RC circuit

7. Verification of relation in between voltage and current in three phase balanced star and delta connected loads.

8. Demonstration of measurement of electrical quantities in DC and AC systems.

Text Books:

1. *Electric Machinery,* (Sixth Edition) A. E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, Tata McGraw Hill.
2. *A Textbook of Electrical Technology*, (vol. I), B. L. Theraja, Chand and Company Ltd., New Delhi.
3. *Basic Electrical Engineering*, V. K. Mehta, S. Chand and Company Ltd., New Delhi.
4. *Theory and problems of Basic Electrical Engineering,* (Second Edition), J. Nagrath and Kothari, Prentice Hall of India Pvt. Ltd.

Reference Books:

1. *Basic of Electrical Engineering*, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
2. *Introduction to Electrodynamics*, D. J. Griffiths, (Fourth Edition), Cambridge University Press.
3. *Engineering Circuit Analysis,* William H. Hayt & Jack E. Kemmerly, McGraw-Hill Book Company Inc.
4. *Fundamentals of Electrical and Electronics Engineering,* Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd.

PHYSICS FOR COMPUTING SCIENCE + Lab

Oscillation: Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple spring mass system. Resonance-definition., damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators.

Interference-principle of superposition-young's experiment: Theory of interference fringes-types of interference-Fresnel's prism-Newton's rings, Diffraction-Two kinds of diffraction-Difference between interference and diffraction-Fresnel's half period zone and zone plate-Fraunhofer diffraction at single slit-plane diffraction grating. Temporal and Spatial Coherence.

Polarization of light: Polarization - Concept of production of polarized beam of light from two SHM acting at right angle; plane, elliptical and circularly polarized light, Brewster's law, double refraction.

Basic Idea of Electromagnetisms: Continuity equation for current densities, Maxwell's equation in vacuum and non-conducting medium.

Quantum Mechanics: Introduction - Planck's quantum theory- Matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, time independent and time dependent Schrödinger's wave equation, Physical significance of wave function, Particle in a one dimensional potential box, Heisenberg Picture.

Crystallography: Basic terms-types of crystal systems, Bravais lattices, miller indices, d spacing, Atomic packing factor for SC, BCC, FCC and HCP structures.

Semiconductor Physics: Conductor, Semiconductor and Insulator; Basic concept of Band theory.

Laser and Fiber optics: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Ruby Laser, CO_2 and Neodymium lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in engineering. Fiber optics and Applications, Types of optical fibers.

Thermodynamics: Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st law, second law of thermodynamics and concept of Engine, entropy, change in entropy in reversible and irreversible processes.

PHYSICS FOR COMPUTING SCIENCE + Lab (continued)

Laboratory

1) Magnetic field along the axis of current carrying coil – Stewart and Gee

2) Determination of Hall coefficient of semi-conductor

3) Determination of Plank constant

4) Determination of wave length of light by Laser diffraction method

5) Determination of wave length of light by Newton's Ring method

6) Determination of laser and optical fiber parameters

7) Determination of Stefan's Constant.

Text Books:

1. *Concepts of Modern Physics*, (Fifth Edition) A Beiser, McGraw Hill International.
2. *Fundamentals of Physics,* David Halliday, Robert Resnick and Jearl Walker, Wileyplus.

Reference Books:

1. *Optics,* (Fifth Edition) Ajoy Ghatak, Tata McGraw Hill.
2. *Sears & Zemansky University Physics*, Addison-Wesley.
3. *Fundamentals of Optics,* (Third Edition) Jenkins and White, McGraw-Hill.

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Business Communication & Value Science - I

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Lectures: 3 Hr./Week	Semester Examination: 50 marks	4
Tutorials: 0 Hr. / Week	Continuous Assessment: Yes	
Lab: 2-4 Hrs. / Week	Term Work: 50 marks	

Course ID:

1.6 (Year 1 Semester 1)

	Leadership Oriented Learning (LOL)	

Nature of Course	Behavioral
Pre requisites	Basic Knowledge of high school English

Course Objectives:

1	Understand what life skills are and their importance in leading a happy and well-adjusted life
2	Motivate students to look within and create a better version of self
3	Introduce them to key concepts of values, life skills and business communication

Course Outcomes:

Upon completion of the course, students shall have ability to

C1.6.1	Recognize the need for life skills and values	[U]
C1.6.2	Recognize own strengths and opportunities	[U]
C1.6.3	Apply the life skills to different situations	[AP]
C1.6.4	Understand the basic tenets of communication	[U]
C1.6.5	Apply the basic communication practices in different types of communication	[AP]

Course Contents:

- **Overview of the course** with immersion activity
- **Overview of biz communication**
- **Self-awareness, confidence and communication**
- **Essentials of Business communication**

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- **Application of communication skills**
- **Application of Life Skills**
- **Assignment**

Total Hours:	**65**

Text Books:

	There are no prescribed texts for Semester 1 – there will be handouts and reference links shared.

Reference Books:

1	English vocabulary in use – Alan Mc'carthy and O'dell
2	APAART: Speak Well 1 (English language and communication)
3	APAART: Speak Well 2 (Soft Skills)
4	Business Communication – Dr. Saroj Hiremath

Web References:

1	Train your mind to perform under pressure- Simon sinek https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-under-pressure-capture-your-flag/
2	Brilliant way one CEO rallied his team in the middle of layoffs https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-before-numbers.html
3	Will Smith's Top Ten rules for success https://www.youtube.com/watch?v=bBsT9omTeh0

Online Resources:

1	https://www.coursera.org/learn/learning-how-to-learn
2	https://www.coursera.org/specializations/effective-business-communication

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C1.6.1	Understand	Immersion (interview)	5
C1.6.2	Understand	Create Resume	4

C1.6.3	Apply	Group Assignment – community service	5
C1.6.4	Understand	Group activities	3
C1.6.5	Apply	Record a conversation	3
Summative Assessment based on End Semester Project			
Bloom's Level			
Understand	Paper		50
Apply	Trek followed by project		
Analyse			

Lesson Plan

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
1	Recognize the need for life skills and values	Understand	**Overview of LOL** (include activity on introducing self)	Lecture & reflection	1 hour
			Class activity – presentation on favorite cricket captain in IPL and the skills and values they demonstrate	Activity	1 hour
			Self-work with immersion – interview a maid, watchman, sweeper, cab driver, beggar and narrate what you think are the values that drive them	Immersion activity	2 hours
			Overview of business communication	Lecture with videos	1 hour
			Activity: Write a newspaper report on an IPL match	Class activity with 3 iterations - Formative Evaluation	1 hour
			Activity: Record a conversation between a celebrity and an interviewer	Class activity with 3 iterations - Formative Evaluation	1 hour

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			Quiz Time	Summative Evaluation for Unit	30 mins
	Recognize own strengths and opportunities	Understand	**Self-awareness** – identity, body awareness, stress management	Anubhaab Activities (Please conduct at least one activity per week and include the Meditation session in it)	4 hours
2	Understand the basic tenets of communication Unit name: Be At Ease (BAE) (in Millennial lingo it means Before Anyone Else)	Understand	**Essential Grammar – I:** Refresher on Parts of Speech – Listen to an audio clip and note down the different parts of speech followed by discussion Tenses: Applications of tenses in Functional Grammar – Take a quiz and then discuss	Lecture with audio and video	1 hour
			Sentence formation (general & Technical), Common errors, Voices. Show sequence from film where a character uses wrong sentence structure (e.g. Zindagi Na Milegi Dobara where the characters use 'the' before every word)	Lecture with video/audio	1 hour
			Communication Skills: Overview of Communication Skills Barriers of communication, Effective communication		1 hour

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			Types of communication- verbal and non – verbal – Role-play based learning **Importance of Questioning**	Activity based learning	1 hour
			Listening Skills: Law of nature- Importance of listening skills, Difference between listening and hearing, Types of listening.	Activity based learning	1 hour
	Recognize own strengths and opportunities	Understand	**Expressing self**, connecting with emotions, visualizing and experiencing purpose	Anubhaab Activities (Please conduct at least one activity per week and include the Meditation session in it)	4 hours
	Apply the basic communication practices in different types of communication	Apply	**Activity:** Skit based on communication skills	Formative Evaluation	4 hours
			Evaluation on Listening skills – listen to recording and answer questions based on them	Formative Evaluation	30 mins
3	Understand the basic tenets of communication Talk Mail Write (TMW) - In Millennial it means **That Moment When**	Understand	**Email writing**: Formal and informal emails, activity	Activity based learning	1 hour
			Verbal communication: Pronunciation, clarity of speech	Audio and video based learning	30 minutes
			Vocabulary Enrichment: Exposure to words from General Service List (GSL) by West, Academic word list (AWL) technical specific terms related to the field of technology, phrases, idioms, significant	Activity based learning (Group Discussion) Flipped classroom	1 hour

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			abbreviations formal business vocabulary – Read Economic Times, Reader's Digest, National Geographic and take part in a GD, using the words you learnt/liked from the articles. Group discussion using words learnt	where students will study words before coming to class	
			Practice: Toastmaster style Table Topics speech with evaluation	Activity based learning	2 hours over 2/3 days
			Written Communication: Summary writing, story writing	Activity based learning	1 hour
			Build your CV – start writing your comprehensive CV including every achievement in your life, no format, no page limit	Formative Evaluation	30 minutes
	Apply the basic communication practices in different types of communication	Apply	**Project:** Create a podcast on a topic that will interest college students	Formative Evaluation	1 hour
	Recognize own strengths and opportunities	Understand	**Life skill:** Stress management, working with rhythm and balance, colours, and teamwork	Anubhaab Activities (Please conduct at least one activity per week and include the Meditation session in it)	4 hours
	Apply the basic communication practices in different types of communication	Apply	**Project:** Create a musical using the learnings from unit	Formative Evaluation	2 hours

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Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
4	**Unit 4** Recognize the need for life skills and values Unit name: Realities of Facing Life (ROFL)	Understand	**Understanding Life Skills:** Movie based learning – **Pursuit of Happyness.** What are the skills and values you can identify, what can you relate to?	Interactive learning	3 hours
			Introduction to life skills What are the critical life skills	Activity and Video	1 hour
			Multiple Intelligences Embracing diversity – Activity on appreciation of diversity	Video and activity based	1 hour
	Apply the life skills to different situations	Apply	**Life skill:** Community service – work with an NGO and make a presentation	Field work: Formative Evaluation	10 hours
			Life skill: Join a trek – Values to be learned: Leadership, teamwork, dealing with ambiguity, managing stress, motivating people, creativity, result orientation	Field work: Formative Evaluation	12 hours
				TOTAL	**65 hours**
	Summative Evaluation	**Bloom's Level**	**Type of Assessment**	**Marks**	**Total**
		Understand	Knowledge Test	20 marks	**50 marks**
		Apply	Project (to be evaluated by TCS)	20 marks	
		Apply	Group discussion (to be evaluated by TCS)	10 marks	

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Induction Program (Non Credit)

(To be Finalised by Respective Institute)