Computer Fundamentals

COURSE CODE: 22BS1CI111

COURSE CREDITS: 3

CORE/ELECTIVE: Core

L-T-P: 3-0-0

Pre-requisite: None

Course Objectives:

1. Learn the computer organization.
2. Learn various number systems and conversion.
3. Learn various data design paradigms.
4. Learn basic computer operations and its logical implementation.
5. Planning the computer program.
6. Learn the basic association with computer environment.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Comprehension of the computer design.	Familiarity
CO-2	Demonstrate the logic of computer system.	Assessment
CO-3	Understanding and application of computer language .	usage
CO-4	Understanding of association with computer environment	Familiarity

Course Contents:

Unit	Contents	Lectures required
1	Introduction to computers: Data processing, Characteristic features of computers, Computers' evolution to their present form, Computer generations, Characteristic features of each computer generation, Basic operations performed by all types of computer systems, Basic organization of a computer system, Input unit and its functions, Output unit and its functions, Storage unit and its functions, Types of storage used in a computer system	8

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2	Number system: Non-positional number system , Positional number system, Decimal number system, Binary number system, Octal number system, Hexadecimal number system, Computer code: Computer data, Computer codes: representation of data in binary, Most commonly used computer codes, Collating sequence	8
3	Computer arithmetic: Reasons for using binary instead of decimal numbers, Basic arithmetic operations using binary numbers, Addition (+) , Subtraction (-) ,Multiplication (*), Division (/) Boolean algebra and logic circuit: Fundamental concepts and basic laws of Boolean algebra, Boolean function and minimization, Logic gates, Logic circuits and Boolean expressions, Combinational circuits and design	6
4	Processor and Memory: Internal structure of processor, Memory structure, Determining the speed of a processor, Different types of processors available, Determining the capacity of a memory, Different types of memory available, Several other terms related to the processor and main memory of a computer system Secondary storage device: Requirement, Classification of commonly used secondary storage devices, Difference between sequential and direct access storage devices ,Basic principles of operation, types, and uses of popular secondary storage devices such as magnetic tape, magnetic disk, and optical disk	8
5	Programming language: Introduction, Generation of programming language, Characteristics of good programming language, Assembly language, Categorization of High level language, Develop a programme, Compiling High level language programme, some high level language	6
6	Computer software: Types of computer software, system management programs, System Development Programs, standard application programs, unique application programs Operating system: Classification of OS (multi programming, time sharing), function of OS, Unix OS, Microkernel based OS, Online and Real time OS	6
Total lectures		42

Suggested Text Book(s):

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009.
2. H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004
3. Optimization for Engineering Design. K Deb.

Suggested Reference Book(s):
1. Sheskin, David J. (2003) Handbook of Parametric and Nonparametric Statistical Procedures. CRC Press.
2. Optimization concepts and applications in engineering, A. D. Belegundu and T. R. Chandrupatla.
3. Linear and Nonlinear programming. Stephen G. Nash and A. sofer

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Other useful resource(s):

1. Link to NPTEL course contents: https://nptel.ac.in/courses/111/105/111105039/
2. Link to NPTEL course contents : https://nptel.ac.in/courses/111/104/111104068/
3. Link to NPTEL course contents : https://nptel.ac.in/courses/112/106/112106131/
.Link to topics related to course:
  i.   https://nptel.ac.in/courses/112/106/112106134/
  ii.   https://nptel.ac.in/courses/112/106/112106131/
  iii.   https://nptel.ac.in/courses/106104019/26
  iv.   https://nptel.ac.in/courses/111/105/111105039/

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Parallel and Optimization Methods in Business Analytics)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	2	
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	
Average													

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Fundamentals of Computer Hardware and Networking

COURSE CODE: 22BS1CI112

COURSE CREDITS: 3

CORE/ELECTIVE: Core

L-T-P: 3-0-0

Pre-requisite: None

Course Objectives:

1. To understand the working principle of various communication protocols.
2. To know the concept of data transfer between nodes
3. To learn the fundamentals of Comprehension of the computer design.
4. Learn Internal and External components of computer.
5. Describe and analyze computer hardware, software, and the internet.
6. Understanding of components of networking.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Comprehension of the computer design.	Familiarity
CO-2	Learn Internal and External components of computer	Assessment
CO-3	Understanding the overview of networking.	Familiarity
CO-4	Understanding of components of networking	Familiarity
CO-5	Understanding PC Architecture & Microprocessor system	Familiarity
CO-6	Understanding Transmission Media and Topologies Media types	Familiarity

Course Contents:

Unit	Contents	Lectures required
1	Microprocessor System Introduction of System overview, Introduction to Processors, Memory Interfacing, Interfacing I/O Devices, Interfacing Data Converters, Display Interface, Serial I/O and Data Communication, Higher level Processors	7
2	Introduction to PC Architecture Study of PC-AT/ATX System, Pentium, Core, Core 2 Cord, Core 2 Duo, I3, I5, I7 Processor Basics of Processor and CPU Block Diagram of Computer and Computer Generation Motherboards, Chipset and Controllers, BIOS and the Boot Process, Computer Memory.	6
3	Internal Components IDE and SATA Devices: Hard Disk Drive and CD/DVDs Drives, SCSI Devices, Floppy Disk, Zip Drive, Backup Drive, Expansion Cards- LAN Card, IDE Card , VGA and SVGA Cards, Sound Card, Interface Cards, I/O cards, Video Cards, USB Card, Fire-Wire Cards, Internal Ports, Cables and Connector Types. External Components Monitors CRT, LCD and LED Displays, Printers:- Dot-Matrix Printer, Inkjet Printer, Laser Printer Scanner:- Photo Scanner, Documents Scanner, Bar Cord Scanner Keyboards, Mouse, External Modem, Ports and Connectors, Batteries, Power supply, Pen Drives, SCSI interface devices, Laptop Computers, Digital Advance storage technology.	8
4	Network Components Introduction of Network Cable like UTP, STP, Fiber Optics, Hub, Unmanageable Switch, Manageable Switch, Router, Modem, Wi-Fi, Access Point, PCI Wireless Card, USB Wireless Device, Print Server, USB Network Sharer, Backup Device, Server Hardware etc.	7
5	Overview of Networking Introduction to networks and networking, LAN, VLAN, CAN, MAN, WAN, Internet and Intranet etc. Uses and benefits of Network, Server-client based network, peer to peer networks. Network Hardware and Components Concept of Server, client, node, segment, backbone, host etc. Analog and Digital transmission, Network Interface Card, Crimping tools and Color standards for Straight crimping and Cross crimping Functions of NIC, Repeaters, Hub, Switches, Routers, Bridges, Router etc.	7
6	Transmission Media and Topologies Media types STP cable, UTP cable, Coaxial cable, Fiber cable, Base band and Broadband transmission, Cables and Connectors, Physical and logical topologies, Bus, Star, Ring and Mesh topologies	7
Total lectures		42

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Suggested Text Book(s):

1) Networking Complete BPB Publication
2) Computer Networking Andrew S. Tanenbawan By PHI
3) Microprocessor Architecture Programming and Application with the 8085 Ramesh Gaonkar Penram International Publication

Suggested Reference Book(s):

1) Electronics and Radio Engineering M.L. Gupta Dhanpat rai & Sons, New Delhi 2004.

2. Anita Goel, Computer fundamentals By Pearson, 1st edition, 2010.

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	3	3	2	2	1	1	1	1	1	1	1.83
CO2	3	3	3	3	3	1	1	1	1	1	1	3	2.00
CO3	3	3	2	3	2	3	2	1	1	1	2	1	2.00
CO4	3	3	3	2	3	2	1	1	1	1	1	1	1.83
CO5	2	2	3	3	3	3	1	1	1	1	1	1	1.83
C06	2	3	3	3	2	2	2	2	2	2	2	2	2.25
Average	2.67	2.83	2.80	2.80	2.60	2.20	1.20	1.00	1.00	1.00	1.20	1.40	

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CALCULUS

COURSE CODE: 22BS1MA111

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Pre-requisite: None

Course Objectives: This course gives a foundation on Calculus Differential &Integral and emphasizes

- To learn fundamental concepts of one variable calculus and its applications.
- To study the hyperbolic functions, and basics of curves.
- To learn basic concepts of definite integrals and its applications.
- To study fundamentals of the sequence and series.
- To introduce the extension of single variable calculus to multivariable calculus.

Course Outcomes: On Completion of this course the students will be able to:

S.No.	Course Outcomes	Level of Attainment
CO-1	Compare and contrast the ideas of continuity and differentiability. To find maxima and minima, critical points and inflection points of functions	Familiarity
CO-2	Recognize the appropriate tools of calculus to solve applied problems, curve tracing and understand the special functions and various co-ordinate systems	Assessment
CO-3	To understand the fundamental theorem of calculus, and some applications of definite integrals to investigate length of curves, moments and center of mass, surfaces of revolutions, and improper integrals**.**	Assessment
CO-4	To understand various types of convergence of sequence and series, Power series. Moreover, a brief introduction to multivariable calculus: limits and continuity, partial derivatives,Homogeneous Functions and Euler's theorem withapplications.	Usage

Course Contents:

Unit	Contents	Lectures required
1	Single Variable Calculus: Limits and continuity of single variable functions, differentiation and applications of derivatives,Maxima and Minima, Extrema on an interval, Rolle's Theorem, Mean Value Theorem and Applications, Fundamental Theorem of Calculus.	9
2	Transcendental Functions, Hyperbolic functions, higher order derivatives, Leibnitz rule, curvature, curve tracing in Cartesian coordinates. Polar coordinates, parametric equations, Parameterization of a curve, arc length of a curve.	9

3	Definite integrals, fundamental theorem of calculus, Applications to length, moments and center of mass, surfaces of revolutions, improper integrals.	9
4	Sequences, Series and their convergence, absolute and conditional convergence, Uniform convergence, power series, Taylor's and Maclaurin's series	8
5	Introduction to Multi-variable Calculus: Functions of several variables-limits and continuity, partial derivatives, Chain rule, Homogeneous Functions and Euler's Theorem and Applications.	7
Total Lectures		42

Suggested Text Book(s):
1. G.B. Thomas and R.L. Finney, ``Calculus and Analytic Geometry, Pearson Education India.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.

Suggested Reference Book(s):
3. Gilbert Strang, "Calculus", Wellesley-Cambridge Press; 2nd edition, 2010.
4. H. Anton, I. Bivens and S. Davis, Calculus, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Calculus)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	2	
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	
Average													

LINEAR ALGEBRA

COURSE CODE: 22BS1MA112

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Course Objectives: On successful completion of this course, a student will be able

1. To solve system of linear equations, and interpret existence and uniqueness of solutions geometrically.
2. To learn and recognize linear independence, span and dimension, and apply them to vector spaces.
3. To learn eigenvalues, eigenvectors and understand the idea behind diagonalization process.
4. To understand the relationship between a linear transformation and its matrix representation.
5. To describe vector projections, compute orthonormal basis and spectral decomposition.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the roll of matrices and their properties to solve the system of linear equations;	Familiarity
CO-2	Find eigenvalues, eigenvectors of matrices and perform diagonalization.	Assessment
CO-3	Understand linear transformation and find the matrix representation; Compute eigenvalues and eigenvectors of a square matrix; Perform factorization of a square matrix.	Assessment
CO-4	Understand basic concepts of inner product on vector spaces; Compute the orthogonal projection of a vector onto a subspace; Construct an orthonormal basis for an inner product space using the Gram Schmidt process.	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Matrices:** Algebra of matrices, row echelon form, row reduced echelon form, inverse and rank of a matrix; Kernel or Null space and solutions of linear system of equations by Gauss Elimination, Gauss-Jordan method, LU decomposition (of a matrix); Cayley-Hamilton Theorem.	**8**
2	**Vectors space:** Basics of groups, rings and fields; real and complex vector spaces; properties of vector spaces; linear dependence, basis and change of coordinates in R^n; linear span, dimension of vector space; Steinitz exchange lemma; row and column spaces associated to a matrix.	**8**
3	**Vectors and transformations:** Linear transformations - image and kernel of a linear transformation; Rank-Nullity theorem; matrix representations, change of basis, dual bases; implications for linear systems.	**8**

4	**Inner product spaces:** Introduction, norm of a vector, Cauchy-Schwarz Inequality, Triangle Inequality, generalized theorem of Pythagoras; direct sum of subspaces and its orthogonal complement; fundamental subspaces associated to a matrix and Fundamental theorem of Linear Algebra; Gram-Schmidt orthonormalization, orthogonal projections and least-square problems; Adjoint of a linear operator and linear functional.	10
5	**Matrix Factorization:** Eigenvalues and Eigenvectors, diagonalization – orthogonal diagonalization of symmetric matrices; Complex matrices and eigenvalues - Hermitian and unitary and normal matrices; Spectral theorem; Application of eigenvalues and in discrete dynamical systems.	8
Total Lectures		**42**

Suggested Text Book(s):

1. Gilbert Strang, ``Linear Algebra and Learning from Data," Wellesley-Cambridge Press, 2019.
2. R. K. Jain & S. R. K. Iyenger, ``Advanced Engineering Mathematics," 5th Edition, Narosa Publishing House, New Delhi, India, 2017
3. Ward Cheney, David R. Kincaid, ``Linear Algebra: Theory and Applications,"2nd Edition, Jones & Bartlett Learning, 2012.
4. David Poole, `` Linear Algebra: A Modern Introduction," 3rd Edition, Cengage, 2011.

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered up to T-1
2	T-2	25	1.5 Hours	Syllabus covered up to T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Linear Algebra)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	2	2	2	2	1	2	1	2	2	2	2	**1.9**
CO-2	2	3	2	3	2	1	2	1	2	2	2	2	**2**
CO-3	2	2	3	2	2	1	2	1	2	2	2	2	**1.9**
CO-4	3	3	3	3	2	1	2	1	2	3	3	2	**2.3**
Average	**2.5**	**2.5**	**2.5**	**2.5**	**2**	**1**	**2**	**1**	**2**	**2.3**	**2.3**	**2**	

Artificial Intelligence

COURSE CODE: 18B1WCI742

COURSE CREDITS: 2

CORE/ELECTIVE: ELECTIVE

L-T-P: 2-0-0

Pre-requisites: Data Structure, Discrete Structure

Course Objectives:
1. Describe introductory techniques in Artificial Intelligence
2. Heuristic search and adversarial search, Logic for knowledge representation and reasoning
3. Reasoning under uncertainty
4. Machine Learning
5. Apply introductory techniques in Artificial Intelligence to solve realistic problems.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Determine the characteristics of a given problem that an intelligent system must solve.	Familiarity
CO-2	Apply Bayes rule to determine the probability of a hypothesis given evidence.	Assessment
CO-3	Identify examples of knowledge representations for reasoning under uncertainty.	Assessment
CO-4	List the differences among the three main styles of learning: supervised, reinforcement, and unsupervised.	Assessment
CO-5	Identify examples of classification tasks, including the available input features and output to be predicted.	Assessment

Course Contents:

Unit	Contents	Lectures Required
1	**Introduction:** Intelligence, Definitions of Intelligent Agents **Single-Agent Search:** Breadth-first, Depth-first and Iterative Deepening Search, Heuristic Search (A* search), Stochastic Local Search (Simulated Annealing, Genetic algorithms)	7
2	**Adversarial Search:** Minimax Search, Alpha-beta pruning, Stochastic Games and Expectiminimax **Knowledge Representation and Logic:** Propositional Logic, Propositional Inference , First-Order Logic, Propositional Inference (Forward chaining, Backward chaining)	7
3	**Reasoning Under Uncertainty:** Probability Bayes Rule , Bayesian Networks, Bayesian Inference	7
4	**Machine Learning**: Definition and examples of broad variety of machine learning tasks, including classification, Inductive learning, Simple statistical-based learning, such as Naive Bayesian Classifier, decision trees, The over-fitting problem, Measuring classifier accuracy	11
Total lectures		**32**

Suggested Text Book(s):
1. Artificial Intelligence a Modern Approach, 3rd Edition. Prentice Hal
2. Artificial Intelligence Hardcover by Elaine Rich and Kevin Knight

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Suggested Reference Book(s):
1. Paradigms of Artificial Intelligence Programming: Case Studies in Common Lisp by Peter Norvig
2. Machine Learning by Tom M. Mitchell
3. Prediction Machines: The Simple Economics of Artificial Intelligence by Ajay Agrawal , Joshua Gans , Avi Goldfarb

Other useful resource(s):
1. Link to NPTEL course contents:
   - **i.** https://nptel.ac.in/courses/106105077/
   - **ii.** https://nptel.ac.in/courses/106105079/
2. Link to topics related to course:
   - **i.** https://www.ibm.com/developerworks/library/cc-beginner-guide-machine-learning-ai-cognitive/index.html
   - **ii.** https://ai.google/education/

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment		Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Artificial Intelligence)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	3	1	1	2	1	2	1	2	2	2	1.9
CO-2	3	3	3	1	3	2	1	2	1	2	3	2	2.2
CO-3	3	3	3	3	2	1	2	2	2	2	3	2	2.3
CO-4	3	3	3	3	2	1	2	2	2	2	3	2	2.3
CO-5	3	3	3	3	2	1	2	2	2	2	2	2	2.3
Weightage	3	3	3	2.2	2	1.4	1.6	2	1.6	2	2.6	2	

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Artificial Intelligence Lab

COURSE CODE: 18B1WCI772

COURSE CREDITS: 1

CORE/ELECTIVE: ELECTIVE

L-T-P: 0-0-2

Pre-requisite: None

Course Objectives:
1. Describe introductory techniques in Artificial Intelligence
2. Heuristic search and adversarial search, Logic for knowledge representation and reasoning
3. Reasoning under uncertainty
4. Machine Learning
5. Apply introductory techniques in Artificial Intelligence to solve realistic problems.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Determine the characteristics of a given problem that an intelligent system must solve.	Familiarity
CO-2	Apply Bayes' rule to determine the probability of a hypothesis given evidence.	Assessment
CO-3	Identify examples of knowledge representations for reasoning under uncertainty.	Assessment
CO-4	List the differences among the three main styles of learning: supervised, reinforcement, and unsupervised.	Assessment
CO-5	Identify examples of classification tasks, including the available input features and output to be predicted.	Assessment

List of Experiments:

S.No	Description	Hours
1	Implementation of DFS and BFS Searching Algorithms	2
2	Implementation of A* Algorithm	2
3	Study of Prolog Language	2
4	Write simple fact for the statements using PROLOG.	2
5	Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing	2
6	WAP in turbo prolog for medical diagnosis and show that advantage and disadvantage of green and red cuts.	2
7	Write a program to solve the Monkey Banana problem	2
8	Study of LISP Language	2
9	Write a program to solve water jug problem using LISP	2
10	Consider House-votes dataset provided in lab. The task is to predict whether the voter is a republican or a democrat based on their votes using Naive Bayes algorithm with 5-fold cross validation. It has 16 binary attributes and 2 classes.	2
11	In Experiment 10, Estimate the accuracy of Naive Bayes algorithm using 5-fold cross validation on the house-votes data set.	2

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12	In Experiment 10, Estimate the precision, recall, accuracy, and F-measure using 10-fold cross-validation.	2
13	Consider Breast Cancer data set provided in class. It has 9 numeric attributes and 2 types of cancer to be predicted. Compare the performance of 10 machine learning models for given classification data set for the data partition of 70-30%. 	2

Model	Sensitivity	Specificity	Precision	Recall	Accuracy	F-Score
M1						
M2						
...						
M10						

14	Ensemble the models from Experiment 13 for given data set on data partition of 70-30%.	2

Model	Combination	Sensitivity	Specificity	Precision	Recall	Accuracy
E1	M1, M5, M6, M7, M10					
E2	M1, M2, M4					
E3	M2, M4, M6, M8, M10					
E4	M5, M7, M8					

Total Lab hours		28

Suggested Books/Resources:

1. Paradigms of Artificial Intelligence Programming: Case Studies in Common Lisp by Peter Norvig
2. Programming in Prolog-Springer by William F. Clocksin, Christopher S. Mellish
3. Machine Learning by Tom M. Mitchell
4. Prediction Machines: The Simple Economics of Artificial Intelligence by Ajay Agrawal , Joshua Gans , Avi Goldfarb
5. Artificial Intelligence a Modern Approach, 3rd Edition. Prentice Hal
6. Artificial Intelligence Hardcover by Elaine Rich and Kevin Knight
7. Link to topics related to course:
    i. https://www.ibm.com/developerworks/library/cc-beginner-guide-machine-learning-ai-cognitive/index.html
    ii. https://ai.google/education/

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

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Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO-1	3	3	3	2	1	2	1	2	1	2	2	2	**2**
CO-2	3	3	3	2	3	2	1	2	1	2	3	2	**2.3**
CO-3	3	3	3	3	2	1	2	2	2	2	3	2	**2.3**
CO-4	3	3	3	3	2	1	2	2	2	2	3	2	**2.3**
CO-5	3	3	3	3	2	1	2	2	2	2	2	2	**2.3**
Average	**3**	**3**	**3**	**2.6**	**2**	**1.4**	**1.6**	**2**	**1.6**	**2**	**2.6**	**2**	

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Applied Soft Computing Techniques

COURSE CODE: 22P1WMA231

COURSE CREDITS: 3

CORE/ELECTIVE: ELECTIVE

L-T-P: 3-0-0

Course Objectives: On successful completion of this course a student will be able

1. To describe various types of soft computing techniques, and applications of soft computing.
2. To describe the fuzzy sets and fuzzy logic
3. To describe the fuzzy controller and fuzzy rule base and approximate reasoning.
4. To describe the evolutionary computing.
5. To understand the concepts of genetic algorithm.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the basic tools of soft computing.	Familiarity
CO-2	Understand the fuzzy sets and crisp sets, fuzzy set theory and operations.	Assessment
CO-3	Understand the fuzzy controller and fuzzy rule base and approximate reasoning.	Assessment
CO-4	Understand the basic evolutionary processes.	Familiarity
CO-5	Understand the working principle and procedures of particle swarm optimization	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Introduction:** Introduction, soft computing vs. hard computing, various types of soft computing techniques, and applications of soft computing. Basic tools of soft computing - Fuzzy logic, neural network, evolutionary computing. Introduction: Neural networks, application scope of neural networks, fuzzy logic, genetic algorithm, and hybrid systems.	08
2	**Fuzzy Sets and Logic:** Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Membership function, Properties of fuzzy sets, Basic fuzzy set operations, Fuzzy and Crisp relations, Fuzzy to Crisp conversion. Fuzzifications and Defuzzifications, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms,	08
3	**Fuzzy Systems:** Fuzzy Controller, Fuzzy rule base and approximate reasoning: truth values and tables in fuzzy logic,	10

	fuzzy propositions formation of rules, decomposition of compound rules, aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference system, fuzzy expert systems.	
4	**Evolutionary Computing:** Basic Evolutionary Processes: A Simple Evolutionary System, Evolutionary Systems as Problem Solvers, A Historical Perspective, Canonical Evolutionary Algorithms - Evolutionary Programming, Evolution Strategies, A Unified View of Simple EAs- A Common Framework, Population Size.	**06**
5	**Swarm Intelligence:** Swarm intelligence, Particle Swarm Optimization (PSO) Algorithm- Formulations, Global best, Local best pseudo-code, parameters, premature convergence, topology, biases, Real valued and binary PSO.	**10**
Total Lectures		**42**

Suggested Text Book(s):

1. J. S. R. Jang, C. T. Sun and E. Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, Pearson Education, 1st. Edition, 2004.
2. S. Rajasekaran & G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy logic, and Genetic Algorithms: Synthesis and Application", Prentice Hall of India Limited, New Delhi, 2006.
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, International Editions, Electrical Engineering Series, Singapore, 1997.
4. Davis E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.

Suggested Reference Book(s):

1. Stamatios V. Kartalopoulos, "Understanding Neural Networks and Fuzzy Logic Basic concepts & Applications", IEEE Press, PHI, New Delhi, 2004.
2. Vojislav Kecman, "Learning & Soft Computing Support Vector Machines, Neural Networks, and Fuzzy Logic Models", Pearson Education, New Delhi, 2006.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2) -10 Attendance - 5

BUSINESS ACCOUNTING

COURSE CODE: 23BB1HS21
COURSE CREDITS: 4
CORE/ELECTIVE: Core
L-T-P: 3-1-0

Pre-requisite: None

Course Objectives:

To familiarize students with the mechanics of preparation of financial statements, understanding corporate financial statements, their analysis and interpretation.

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the need for financial reporting and its various uses	Familiarity
CO-2	Understand the basics of double entry system of accounting.	Assessment
CO-3	Analyze Business transactions And their recording in journaland ledger	Assessment
CO-4	Analyze and prepare trial balance and final accounts	Usage
CO-5	Understand the fundamentals of company accounts	Usage

Course Contents:

Unit	Contents	Lectures required
1	Introduction to Financial Accounting. Accounting as an Information System. Importance, Scope, and Limitations. Users of Accounting Information. Generally Accepted Accounting Principles. The Accounting Equation.	**6**
2	Nature of Accounts and Rules of Debit and Credit. Recording Transactions in General Journal. Recording Transactions in three- column Cash Book. An overview of Subsidiary books – Purchase Book, Purchase Returns Book, Sales Book, and Sales Returns Book. Opening and Closing Entries. Preparation of Ledger Accounts.	**8**
3	Introduction to International Financial Reporting Standards (IFRS). Understanding Accounting Standards issued by the ICAI related to Disclosure of Accounting Policies, Depreciation Accounting, and Revenue Recognition. Methods of charging Depreciation – Straight-line Method, and Written-down-value Method.	6
4	Preparation of Trial Balance. Adjustment Entries. Post-adjusted Trial Balance. Bank Reconciliation Statement.	**6**

5	Preparation of Financial Statements: Preparing Trading Account, Profit & Loss Account and Balance Sheet for a Sole Proprietor.	7
6	Understanding contents of Financial Statements of a Joint Stock Company as per Companies Act 2013. Understanding the contents of a Corporate Annual Report.	6
7	Preparation of Cash Flow Statement as per AS-3 (revised).	3
	Total Lecture Hours	**42**

Suggested Text Book(s):
1. S.N. Maheshwari, Suneel K. Maheshwari, and Sharad K. Maheshwari: *An Introduction to Accountancy*, Vikas PublishingHouse Pvt. Ltd, 2013.
2. R. Narayanaswamy: *Financial Accounting, A Managerial Perspective*, PHI Learning Pvt. Ltd., 2014

Suggested Reference Book(s):

1. Charles T. Horngren, Gart L. Sundem, John A. Elliott, and Donna R. Philbrick:
Introduction to FinancialAccounting, Pearson, 2011
2. J.R. Monga: *Financial Accounting: Concepts and Applications*, Mayur Paperbacks, 2017.
3. T.P. Ghosh: *Financial Accounting for Managers*, Taxmann Allied Services Pvt., 2009.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Class Performance - 10 Quizzes(2)-10 Attendance - 5

CO	**PO-1** PO1	**PO-2** PO2	**PO-3** PO3	**PO-4** PO4	**PO-5** PO5	**PO-6** PO6	**PO-7** PO7	**PO-8** PO8	**Average** Average
CO-1	3	3	2	2	3	3	2	3	2.6
CO-2	3	3	2	2	3	3	2	3	2.6
CO-3	3	3	2	2	3	3	2	3	2.6
CO-4	3	3	3	3	3	3	3	3	3.0
CO-5	3	3	3	3	3	3	3	3	3.0
Average	3	3	2.4	2.4	3	3	2.4	3	2.8

Data Analytics

COURSE CODE: 18B1WCI843

COURSE CREDIT: 3

CORE/ELECTIVE: ELECTIVE

L-T-P: 3-0-0

Pre-requisites: Linear algebra, calculus, probability theory and statistics

Course Objectives:

Data Analytics is the science of analyzing data to convert information to useful knowledge. This knowledge could help us understand our world better, and in many contexts enable us to make better decisions. While this is the broad and grand objective, the last 20 years has seen steeply decreasing costs to gather, store, and process data, creating an even stronger motivation for the use of empirical approaches to problem solving.

Course outcomes:

S.No.	Course outcomes	Level of Attainment
CO-1	Gaining factual knowledge regarding data acquisition, data cleansing, and various aspects of data analytics and visualization	Familiarity
CO-2	Learning the principles of data analytics and its underlying methods and algorithms	Assessment
CO-3	Learning to apply the methods of data collection and data analytics to solve business and related problems in support of business decision- making	Assessment
CO-4	Developing the skills necessary to use related software tools to perform data collection, cleansing, and analytics	Usage

Course Contents:

Unit	Contents	Lectures required
1	Introduction to the course, Descriptive Statistics, Probability Distributions	5
2	Inferential Statistics through hypothesis tests, Permutation & Randomization Test	4
3	Regression, ANOVA(Analysis of Variance)	5
4	Differentiating algorithmic and model based frameworks Regression : Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours Regression & Classification	7
5	Bias-Variance Dichotomy, Model Validation Approaches Logistic Regression, Linear Discriminant Analysis Quadratic Discriminant Analysis Regression and Classification Trees Support Vector Machines	8
6	Ensemble Methods: Random Forest, Neural Networks, Deep learning	4
7	Clustering, Associative Rule Mining, Challenges for big data anlalytics	4
8	Creating data for analytics through designed experiments, Creating data for analytics through Active learning Creating, data for analytics through Reinforcement learning	5
Total lectures		**42**

Approved in Academic Council held on 28 July 2021

Suggested Reference Book(s):

1 Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: Springer, 2009.

2. Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John Wiley & Sons, 2010.

Other useful resource(s):

1. Link to NPTEL course contents: https://onlinecourses.nptel.ac.in/noc15_mg05/preview

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Data Analytics)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	2	1.8
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	2
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	1.8
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	2.1
Average	2	2.5	2.5	2.5	2.5	1	1	1	2	2.3	1.5	2	

Approved in Academic Council held on 28 July 2021

Disaster Risk Analysis and Management

CourseCode: _____

Course Credits: 3

Core/Elective: Open Elective

L–T–P:3–0–0

Pre–requisite: Engineering Mathematics, Introduction to Statistics

Course Objectives:

After occurrences of disasters such as Nepal Earthquake, Tsunami and Earthquake in 2011 in Japan, it has become obvious that all communities should be prepared for disasters across the world.AnapproachwhichusesconceptsofInformationTechnologytounderstand,assess,and manage various disasters is the new way forward. In this course, students will understand application of basics of data analysis in real–life Civil Engineering problems and further develop strategic plans to manage various types of disasters including earthquakes, floods, pandemics, wars, cyber theft,etc.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO–1	To understand the practical applications of probability and statistics in engineering problems.	Assessment
CO–2	To understand the various types of disasters/hazards and assessing the risk of their occurrences.	Assessment
CO–3	To understand and analyze the fragility of various systems subjected to hazards.	Assessment
CO–4	To be able to use information technology in disaster planning, management, and response.	Application

Course Contents:

S. No.	Contents	Lectures Required
1.	Introduction to Risk Assessment and Information Technology concepts required for the course	2
2.	**Probability and Statistics Basics Revision:** Set Theory,Probability Concepts: Understanding of Probability, Conditional Probability, Baye's Theorem, Total Probability Theorem, Evaluation of Mean, Median, Standard Deviation, Variability), Random Variables, Discrete Random Variables, Continuous Random Variables, Probability Distributions, Confidence Intervals, Hypothesis Testing, Regression and Correlation, Monte Carlo Simulation, Goodness of Fit	6

3.	**Hazards:** Introduction to Disasters and Catastrophic events (Seismic, Flood, Tsunami, Hurricane, Industrial Disaster, Economic Crisis, Pandemics, Cyber Security Threat, War), Risk/Hazard Assessment, Multi–Hazard Risk Assessment	10
4.	**Probabilistic Risk Assessment:** Risk Assessment of Systems subjected to a hazard, Fault Tree and Event Tree Analysis, Fragility Analysis, Failure Probabilities & Initiating Events, Uncertainties (Epistemic & Aleatory), Uncertainty Quantification	10
5.	**Disaster Planning:** Disaster Preparedness by planning and placement of IT components in an area, Disaster Mitigation by setting monitoring networks and protocol, Risk Assessment of IT components in various hazards.	10
6.	**Disaster Management:** Introduction to Disaster Management, Disaster Response of all stakeholders.	4
TOTAL		**42**

Suggested Textbook(s):

1. Biswal, Purna Chandra, Probability and Statistics, PrenticeHall.

2. Devore, J.L., Probability and Statistics for Engineers, Thomson Asia Pte.Ltd.

3. Rao S.S, Engineering Optimization, theory and practice, New AgeInternational

4. Pandey, Mrinalini, Introduction to Disaster Management, WileyIndia

Suggested Reference Book(s):

1. Nikolaidis, E., Engineering Design Reliability Handbook, CRC Press

Other useful resource(s):
1. Link to NPTEL course:https://nptel.ac.in/courses/111/104/111104146/

Evaluation Scheme:

S. No.	Exam	Marks	Duration	Coverage/Scope of Examination
1.	T–1	15	1 hr	Syllabus up to T–1
2.	T–2	25	1.5 hrs	Syllabus up to T–1 (5 marks) Syllabus up to T–2 (20 marks)
3.	T–3	35	2 hrs	Syllabus up to T–1 (5 marks) Syllabus up to T–2 (5 marks) Syllabus up to T–3 (25 marks)
4.	Teaching Assessment	25	Throughout the Semester	Course Project (20) Attendance (5)

Course Outcomes (COs) Contributions to the Program Outcomes (POs):

CO	PO–1	PO–2	PO–3	PO–4	PO–5	PO–6	PO–7	PO–8	PO–9	PO–10	PO–11	PO–12	Average
CO–1	3	3	2	1	2	2	0	0	1	1	1	3	1.6
CO–2	3	3	3	2	2	3	0	0	1	2	1	3	1.9
CO–3	3	3	1	3	3	3	1	0	1	2	1	3	2
CO–4	3	3	3	3	3	3	3	2	3	3	3	3	2.9
Average	3	3	2.25	2.25	2.5	2.75	1	0.5	1.5	2	1.5	3	

Introduction to Computational Mechanics

COURSE CODE: 23B2WBT702

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Course Objectives:

1. To make the students to know the importance of this subject in the field of engineering particularly Civil Engineering.
2. To make them learn the fundamentals of Mechanics, equation of static equilibrium & dynamic equilibrium of particles and rigid bodies.
3. To learn importance of trusses, beams and frames in civil construction.
4. To learn kinematics, kinetics of particle and rigid body, related principles.
5. To implement the above know-how to solve practical problems.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Analyse the beam under flexure for different loadings and to draw shear force and bending moment diagram	Familiarity
CO-2	Analyse planar and spatial systems to determine the forces in members of trusses, frames and problems related to friction	Assessment
CO-3	Determine the resultant force and moment for a given system of forces; Determine the centroid and second moment of area	Assessment
CO-4	Determine the Simple stresses and strains, Hooke's Law, thermal stresses and its application	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Introduction:** Basic terminologies in mechanics, units,fundamentals of statics,composition and resolution of forces,moments, couples and their Application. types of beams, loadings and calculation of support reactions	8
2	Distributed forces, centre of gravity and moment of inertia: - moment of inertia of a composite section,moment of inertia of a built-up section, theorems of pappus-guldinus.	7
3	Analysis of perfect frames (analytical method and graphical method), perfect frame, imperfect frame and deficient frame, redundant frame, method of joints, method of sections., equilibrium of strings, shape of a loaded string, tension in a string carrying point loads and uniformly distributed load, supports at different levels	8
4	Physical and mechanical properties of structural materials, simple stresses and strains, stress-strain relation, elastic constants and their relationship, composite/compound bars, thermal stresses, thermal stresses in compound bars, hoop stresses.	8
5	Virtual work: concept of virtual work, sign conventions, Application of the principle of virtual work on beams carrying point load, carrying uniformly distributed load, application of principle of virtual work on ladders, application of principle of virtual work on lifting machines.	8
6	Analysis of simple beams and trusses using STADD PRO	3
Total lectures		**42**

Suggested Text Book(s):

1. S. S. Bhavikatti- Engineering Mechanics- New age International (P) limited publishers
2. R.S. KHURMI- Engineering Mechanics - S. Chand & Company Ltd
3. Anil Kumar Dhiman, Poonam Dhiman and D.C Kulshreshtha: Engineering Mechanics, Static and Dynamics, Publisher: MacGraw Hill Education

Suggested Reference Book(s):

1. Beer & Johnston : Vector Mechanics; Static & Dynamics, Publishers: Tata McGraw Hill

Other useful resource(s):

1. Link to NPTEL course Contents: https://nptel.ac.in/courses/122104015/
2. Link to topics related to course:

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignments - 10 Attendance -05 Quiz- 10

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	2	**1.75**
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	**2.00**
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	**1.75**
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	**2.08**
Average	**2**	**2.5**	**2.5**	**2.5**	**2.5**	**1**	**1**	**1**	**2**	**2.25**	**1.5**	**2**	

Civil Engineering Materials and Energy Efficient Building

COURSE CODE: 23B11CE313

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Course Objectives:

1. To introduce the students to a wide range of materials that can be used in construction and maintenance of civil engineering project.
2. To gain understanding of properties and usage of bricks, stones, timber and miscellaneous materials used in construction.
3. IntroducinggreenRatingSystemsandEnergyEfficientBuildings.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Learn about properties and usage of bricks, stones, timber and miscellaneous materials used in construction.	Familiarity
CO-2	Learn about various tests conducted on civil engineering materials.	Familiarity
CO-3	Learn how various civil engineering materials usage during a construction work.	Usage
CO-4	Learn concepts of energy efficiency in building.	Usage
CO-5	IntroducinggreenRatingSystemsandEnergyEfficientBuildings.	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Introduction to Civil Engineering Material:** Scope, selection criteria of construction material, classification and properties of civil engineering material.	3
2	**Building Stones:** Introduction, characteristics of good building stones, selection, and use of stone, dressing of stones.	4
3	**Bricks :** Introduction,constituents of brick earth, manufacture of bricks, good qualities of bricks, classification of bricks, standard test for bricks	4
4	**Cement:** Introduction, type, properties and uses of cement, ingredients of cement, manufacture of cement, composition and function of cement clinker, standard test of cement, admixtures. **Concrete:** Introduction, classification of concrete, water-cement ratio, strength and workability of concrete, defects, non-destructive testing of concrete.	9
5	**Mortar:** Introduction, classification of mortar, function of mortar, selection of mortar for civil engineering works. **Timber:** Introduction, growth and structure of tree, classification of tree, characteristics of good timber, defect of timber, seasoning of timber, preservation of timber	6
6	**Asphalt, Bitumen, Tar and Miscellaneous Materials:** Type, properties and uses of asphalt, bitumen and tar, type, properties and uses of glass, plastic materials, insulating materials, gypsum products, composite materials.	6
7	**Energy Efficient Building:** Introduction, conventional versus energy efficient buildings, Energy efficiency and conservation requirements for existing buildings, IAQ requirement analysis.Green buildings rating Systems, climatological factors,materialspecifications and heat transfer principles, thermal performanceevaluation, heat loss from buildings, design of artificial ventilationsystem, carbon footprint estimation. Energy efficient lighting system design, LEED and TERI GRIHA ratings, performanceratings ofgreen buildings.Zeroenergy building.	10
Total lectures		42

Suggested Text Book(s):

1. S.K Duggal: Building Materials, 4th Edition, New Age International Publishers,2012
2. M.L Gambhir, Neha Jamwal, Building Materials, Mc Graw Hill, 2014
3. Mili Majumdar (ed.), Energy-efficient Buildings in India.

Suggested Reference Book(s):

1. Peter A. Thornton and Vito J. Colangela Prentice "Fundamental of Engineering Materials", Hall Publishing Company, 1985.
2. Parbin Singh "Civil Engineering Material", Katson Books,2008.
3. R.K.Rajput "Engineering Material", S. Chand & Company Ltd,2004.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignments (10) - 10 Presentation(1) -10 Attendance/Quiz -5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	2	**2**
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	**2**
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	**1.75**
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	**2.0**
CO-5	2	2	3	3	3	2	2	1	3	2	2	2	**2.25**
Average	**2**	**2.4**	**2.6**	**2.6**	**2.6**	**1.2**	**1.2**	**1**	**2.2**	**2.2**	**1.6**	**2**	

Introduction to Geomatics

COURSE CODE: 23B11CE311

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

 L-T-P: 3-0-0

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Course Objectives:

1. To produce up-to-date *Engineering Plans* of the areas in which the work will be carried out.
2. To get familiarity with basic principles of surveying.
3. To ensure that the construction takes place in the correct relative and absolute position on the ground.
4. To get familiarity of advanced surveying Instruments and mapping techniques like Photogrammetry, Remote Sensing, GIS, and GPS.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Perform a boundary survey and preparation of engineering maps.	Familiarity
CO-2	Basic principles of various methods of surveying, and related problems.	Familiarity & Assessment
CO-3	Will be able to get correct relative and absolute position on the ground where construction is required.	Familiarity & Assessment
CO-4	Understanding of working of modern survey equipment sand Implement procedures for its use and care of field equipment.	Familiarity
CO-5	Understanding concepts of digital techniques in surveying like Remote sensing, GIS and GPS	Familiarity

Course Contents:

Unit	Contents	Lectures required
1	**Introduction:** History of surveying and mapping, importance of geomatics engineering, plane and geodetic surveying, concept of datum and map projection system, datums, geodetic coordinate system.	3
2	Measurement of horizontal distances, vertical angles and horizontal angles- concept of bearing, usage of compass, theodolite and tacheometer, source of errors.	4
3	**Measurements of elevations:** Instruments, levelling operations: profile levelling and cross section levelling, differential levelling, methods of levelling, errors in levelling, Contouring operations – methods of plotting; direct method and indirect methods- spot levelling, tacheometric method, method of plane tabling.	6
4	**Traverse surveying and Computations:** Methods of traversing, consecutive coordinates, errors, balancing of traverse, omitted measurement, area computations.	5
5	**Modern Field Survey Systems:** Principle of electronic distance measurement, modulation, types of EDM instruments, distomat, total station – parts of a total station – accessories –advantages and Application, global positioning, systems- segments, GPS measurements.	5
6	**Curves:** Elements of simple and compound curves – Method of setting out of simple circular curve – Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve.	4
6	**GIS**- Introduction to GIS, types of data, components of GIS.GIS architecture, vector data models, raster data models	5
7	**Remote Sensing:** Introduction –Electromagnetic spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing, IRS satellite constellation, application in civil engineering.	5
8	**Photogrammetry Surveying:** Fundamentals. Types of Photographs, Geometry of Photographs, and Concept of Relief Displacement. **Stereoscopy:** Determination of ground coordinates with parallax measurements. digital photogrammetry, digital image processing, concepts of digital maps, integration of information and analysis; microwave remote sensing	5
Total lectures		**42**

Suggested Text Book(s):

1. S. K. Duggal: Surveying, 3rd Edition, Tata McGraw-Hill Publishing Company ,2012
2. A. M. Chandra: Plane Surveying,2nd Edition, New Age International Publishers, New Delhi,2006
3. B. C. Punmia: Surveying-1, Surveying-2, Laxmi Publication Delhi,2005
4. N. N. Basak: Surveying &Leveling Tata McGraw Hill Publishing Com. New Delhi
5. Gopi S., Sathikumar R., Madhu N.: Advanced Surveying, Pearson, 2010

Reference Books:

1. B.C.Punmia: Surveying-3, Laxmi Publication Delhi, 2005

Suggested Reference Book(s):

1. Kavanagh, Barry F.: Surveying : Principles and Application, 7th Edition, Pearson EducationAsia,2006
2. A. M. Chandra: Higher Surveying 2nd Edition, New Age International Publishers New Delhi,2006
3. Clark David: Plane and Geodetic surveying for Engineers, vol-1 & vol-2,6th Edition, CBS Publishers, 2006.

Other useful resource(s):

1. Link to NPTEL courseContents: https://nptel.ac.in/courses/105107122/
2. Link to topics relatedtocourse:
  i. https://nptel.ac.in/courses/105107122/1-3
 ii. https://nptel.ac.in/courses/105107122/8-18
iii. https://nptel.ac.in/courses/105107122/23-32
 iv. www.surveyofindia.gov.in/

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (5) - 10 Quizzes (2)-10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CourseOutcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	2	3	1	2	2	2	3	2	3	2	3	2.33
CO-2	3	3	3	2	2	2	2	1	2	2	3	3	2.33
CO-3	3	3	3	2	3	2	1	2	3	3	2	3	2.5
CO-4	3	2	2	3	3	2	2	2	3	3	2	3	2.5
CO-5	3	3	2	3	3	1	2	2	2	3	3	3	2.5
Average	3	2.6	2.6	2.2	2.6	1.8	1.8	2	2.4	2.8	2.4	3	

Geomatics Lab

COURSE CODE: 23B17CE371

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Course Objectives:

1. To get students familiar about the usage and working principle of different surveying instruments
2. Application of instruments to calculate various parameters such as horizontal angles, ground elevations, vertical distance, vertical angles, horizontal distance etc.
3. Able to plot the ground features in the maps with the help of plane table survey.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Calculate horizontal angles, bearing of lines, and measurement of horizontal distance, ranging of line using different instruments in the field.	Assessment
CO-2	Able to perform different types of leveling operation to be performed in the field, knowledge of establishing BM.	Assessment
CO-3	Able to measure vertical distance, vertical angles, horizontal distance.	Assessment
CO-4	Able to plot the ground features in the field with the help of plane table survey.	Assessment
CO-5	Understanding of using Total Station, Tacheometer, Levels in the field.	Assessment

List of Experiments

Sr. No.	Description	Hours
1	To plot a traverse of a given area with the help of compass/theodolite and a chain.	2
2	To establish benchmark at given site by performing fly leveling.	2
3	To work out difference of elevation between two points by reciprocal leveling.	2
4	To determine the position of station occupied by plane table using three-point problem.	2
5	To study the different parts of a Theodolite and measure the horizontal angles between two lines by method of repetition	2
6	To locate the points at desired locations in the field by the method of intersection.	2
7	Find out the horizontal distance and difference of elevation between two Points by fixed hair of tacheometry.	2
8	Introduction to Total Station	2
9	Measuring height of the building with the help of Total Station	2
10	Find out relative elevations of the ground using Total station	
11	Understanding and analyzing parallax and stereo pairs using pocket stereoscope	2
		22

Suggested/Resources:

1. S. K. Duggal: Surveying, 3rd Edition, Tata McGraw-Hill Publishing Company ,2012
2. A.M.Chandra: Plane Surveying,2nd Edition, New Age International Publishers, New Delhi,2006
3. B.C.Punmia: Surveying-1, Surveying-2, Laxmi Publication Delhi,2005
4. N.N.Basak: Surveying &Leveling Tata McGraw Hill Publishing Com. New Delhi

Reference Books:

1. B.C.Punmia : Surveying-3, Laxmi Publication Delhi, 2005

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO-1	3	3	3	3	2	2	1	3	3	3	2	3	**2.58**
CO-2	3	3	3	3	3	2	2	3	3	3	2	3	**2.75**
CO-3	3	3	2	3	2	3	2	3	3	3	2	3	**2.67**
CO-4	3	3	3	2	3	2	1	3	3	3	2	3	**2.58**
CO-5	3	2	3	2	3	2	2	3	3	3	2	3	**2.58**
Average	**3**	**2.8**	**2.8**	**2.6**	**2.6**	**2.2**	**1.6**	**3**	**3**	**3**	**2**	**3**	

Water Quality Engineering

COURSE CODE - 23B11CE312

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Course Objectives:

1. To apprehend water quality criteria and standards.
2. To understand the knowledge about sources, causes and impact of various pollutants in water.
3. To be abreast with physical, chemical and biological methods of water treatment.
4. To understand the process and designing of water supply and treatment systems.
5. Understand the software Application in water supply modelling.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the different sources of raw water and the associated water demands from such sources.	Familiarity
CO-2	Understand the different treatment processes associated for supplying treated water for different uses and meeting the quality criterion of Indian standards.	Assessment
CO-3	Understand the importance of the disinfection process (purification) of treated water supply for domestic purposes.	Assessment
CO-4	Understand the different components of water distribution system including network analysis.	Usage
CO-5	Understand the impact of water pollutants on environment, self-purification and disposal standards using various modelling methods.	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Introduction**: Importance of planned water supplies; financing, planning and execution of modern water supply schemes. **Water demands**: Various types of demands; the per capita demand: variations in demand; design periods; population forecasting by various methods. **Sources of water**: Kinds of water sources and their characteristics; factors governing the selection of a source of water supply; storage capacity of impounded reservoir. **Quality of water**: physical, chemical and biological characteristics of water, common water borne diseases, standards of purified water for various purposes	10
2	**Treatment of water**: screening and types; aeration units; sedimentation; sedimentation tanks and their types; sedimentation aided with coagulation; classifications of filters and their constructional and operational details. **Water softening**: Importance of water softening; lime- soda process; zeolite process. **Miscellaneous treatment methods**: Removal of color, odor and taste, iron and manganese; fluoridation and de-fluoridation.	10
3	**Disinfection:** Methods of disinfection; chlorination and its types.	4
4	**Collection and Distribution of water:** Intakes and their design for lakes, streams and rivers; methods of distribution; concept of service and balancing reservoirs; capacity of distribution reservoirs; Design of water distribution systems; analysis of pipe networks by Hardy Cross method, equivalent pipe method, method of sections and Newton-Raphson method; Layout of distribution system; the house water connection; construction and maintenance of distribution systems. **Pipes-Joints-Fittings:** various types of conduits; testing and inspection; joints in pipes; valves in pipe line. **Pumps and pumping stations:** Types of pumps and their choice; pumping stations; economical diameter of rising main; hand pumps; pump testing; Water hammer and its control measures.	10

5	**Modelling techniques:** To connect various issues and themes related to availability of water, developing water stress index.Numerical problems using computer applications and software for data set generations.	**8**
Total lectures		**42**

Suggested Text Book(s):

1. J. S Birdie, G S Birdie: Water Supply and Sanitation Engineering, 9th Edition, Dhanpat Rai Publications, India, 2014.
2. Garg S.K: Environmental Engineering – Water Supply Engineering (Volume -1), Khanna Publishers, India, 2015.
3. B.C. Punmia, A.K. Jain, A.K. Jain: Water Supply Engineering, 2ndEdition, Laxmi Publications. India, 2016.
4. Integrated Computer Application in Water Supply: Application and Implementations for Systems Operation and Management by Bryan Coulbeck (Volume 2), Annotation copyright Book News, Inc. Portland, Or.

Suggested Reference Book(s):

1. H. Peavy, D. Rowe, G. Tchobanoglous "Environmental Engineering", Ist Edition, McGraw Higher Education Publications, India, 2017.

Other useful resource(s):

1. Link to NPTEL course Contents:https://nptel.ac.in/courses/105104102/Domestic%20water%20treat.htm

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus

4.	Teaching Assessment	25	Entire Semester	Assignments (10) - 10
				Presentation (1) -10
				Attendance/Quiz -5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	1	1	1	1	2	2	2	2	**1.66**
CO-2	2	3	2	3	1	1	2	2	2	2	1	2	**1.91**
CO-3	3	2	2	2	2	1	2	1	2	2	1	2	**1.83**
CO-4	2	2	3	3	2	2	2	2	2	3	2	1	**2.16**
CO-5	3	2	3	3	1	2	2	1	3	2	2	1	**2.08**
Average	**2.4**	**2.2**	**2.4**	**2.6**	**1.4**	**1.4**	**1.8**	**1.4**	**2.2**	**2.2**	**1.6**	**1.6**	

Water Quality Lab

COURSE CODE: 23B17CE372

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Course Objectives:

1. Physical Characteristics of water samples.

2. Inorganic Constituents of water samples.

3. Biological Characteristics of water samples.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Identify environmental problems arising due to engineering and technological activities and the science behind those problems.	Familiarity
CO-2	Determination of various inorganic impurities in water samples	Assessment
CO-3	Determine physical, chemical and biological characteristics of water and waste water samples.	Assessment

CO-4	Analyze material balance for different environmental systems.	Usage

List of Experiments:

S. No	Description	Hours
1	Determination of pH and Temperature of water and wastewater sample.	2
2	Determination of total solids, suspended solids and dissolved solids of water and wastewater sample.	2
3	Determination of specific conductivity of water and wastewater sample.	2
4	Determination of turbidity.	2
5	Determination of chlorides of water and wastewater sample.	2
6	Determination of type and extent of alkalinity of water and wastewater sample.	2
7	Determination of type and extent of acidity of water and wastewater sample.	2
8	Determination of temporary and permanent hardness.	2
9	Determination of optimum dose of coagulant.	2
10	Determination of Sulphates of water and wastewater sample.	2
11	Determination of Kjeldahl Nitrogen (Inorganic) of the sample.	2

12	Determination of dissolved oxygen.	2
13	Determination of Biological oxygen demand (BOD).	2
14`	Determination of Chemical oxygen demand (COD).	2
Total Lab Hours		**28**

Suggested Resources:

1. Standard methods for the examination of water and wastewater. (2012). 21st Edition, Washington: APHA.

2. Sawyer, C. N., McCarty, P. L., and Perkin, G.F., Chemistry for Environmental Engineering and Science, 5th edition McGraw-Hill Inc., 2002

3. Kotaiah, B., and Kumara Swamy, N., Environmental Engineering Laboratory Manual, Charotar Publishing House Pvt. Ltd., 1st Ed., 2007

4. Mathur, R.P., Water and Wastewater testing: A laboratory Manual (2013).

Evaluation Scheme:

S. No	Exam	Marks
1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks

Course Outcomes (COs) contribution to the Program Outcomes (POs)

Course Outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average

CO-1	3	3	3	3	2	2	1	1	1	1	1	1	**1.83**
CO-2	3	3	3	3	3	1	1	1	1	1	1	3	**2.00**
CO-3	3	3	2	3	2	3	2	1	1	1	2	1	**2.00**
CO-4	3	3	3	2	3	2	1	1	1	1	1	1	**1.83**
Average	**3**	**3**	**2.75**	**2.75**	**2.5**	**2**	**1.25**	**1**	**1**	**1**	**1.25**	**1.5**	

Environmental Studies

COURSE CODE -

COURSE CREDITS: 0

CORE/ELECTIVE: Audit

L-T-P: 2-0-0

Course Objectives:

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Estimate the population- economic growth, energy requirement and demand.
3. Analyze material balance for different environmental systems
4. Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
5. Identify the major pollutants and abatement devices for environmental management and sustainable development.
6. Recognizing the major concepts of environmental studies, developing problem solving ability, forecasting the global climate change.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Introducing basic concept of environmental studies, interdisciplinary nature and scope of the subject.	Familiarity
CO-2	Understanding ecosystem services and its functioning as well as equitable use of natural resources.	Assessment
CO-3	Understanding Pollution, A threat to the environment and finding its solutions, Pollutant sampling and monitoring of samples.	Assessment
CO-4	Correlating the concept of Biodiversity and its importance to human mankind.	Usage
CO-5	Understanding social issues and their impact on environment	Usage
CO-6	Role of Information Technology in environment and human health.	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Multidisciplinary nature of environmental studies:** The Multidisciplinary nature of environmental studies: Definition, scope and importance, Need for public awareness, Types of Ecosystems, World Biomes, Ecosystem functioning, Biogeochemical cycles.	3
2	**Natural resources, their consumption & Protection:** Natural resources, their consumption & Protection: Water, Land Energy (Renewable, non-renewable, wind, solar, hydro, Biomass), Mineral, Forest, & Food resources, Role of an individual in conservation of natural resources, Equitable use of resources.	4
3	**Pollution- a threat to environment:** Pollution- a threat to environment: Air, Water & Land pollution, sources & causes, Space pollution, causes & effects, toxicity limits of pollutants. Critical issues concerning global Environment (Urbanization, population growth, global warming, climate change, acid rain, ozone depletion etc.) and the Roots in: Cultural, Social, Political, Commercial, industrial, territorial domains	4
4	**Environmental standards & Quality:** Environmental standards & Quality: Air, Water & Soil Quality, Pollutant sampling, pollution control systems. Green Chemistry and its Application.	3
5	**Biodiversity and its conservation:** Biodiversity loss: Diversity of flora and fauna, species and wild life diversity, Biodiversity hotspots, threats to biodiversity.	4
6	**Social Issues and the Environment:** Waste land reclamation, consumerism and waste products, eco-consumerism, dematerialization, green technologies, eco-tourism. Water conservation, rain water harvesting, watershed management. Environment protection act, Air (prevention and control of population) act; Water (prevention and control of pollution) act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation National Environmental Policy; Function of pollution control boards (SPCB and CPCB), their roles and responsibilities.	4
7	**Human Population and the environment:** Population growth, variation among nations. Population explosion—Family welfare program. Environment and human health. Human rights. Value education. HIV/AIDS. Women and child welfare. Role of Information technology in environment and human health. Case Studies.	4

8	**Field work:** Field Work: Explore the surrounding flora & fauna (Study of common plants, insects, birds document environmental assets), documentation of industries in local region and their possible effects, measure of water, air and land quality, Visit to a local polluted site-urban/rural /industrial / agricultural, Study of simple ecosystems-pond, river, hill slopes etc.	4
Total lectures		**30**

Suggested Text Book(s):

1. Environmental Studies By: M. P. Poonia and S.C. Sharma, Khanna Publishers
2. Textbook of Environmental Studies for UG Courses –ErachBharucha, University Press
3. Joseph, B., 2005, Environmental Studies, Tata McGraw Hill, India.

Suggested Reference Book(s):

1. Nebel, B.J. & Wright, R.T., 1993, Environmental Science, 8th Edition, Prentice Hall, USA.

2. Chiras D D. (Ed.). 2001. Environmental Science – Creating a sustainable future. 6th ed. Jones & Barlett Publishers.

3. David Laurance. 2003. Environment Impact assessment, Wiley publications.

4. Chhokar KB, Pandya M & Raghunathan M. 2004. Understanding Environment. Sage publications, NewDelhi.

Other useful resource(s):

1. Issues of the journal: Down to Earth, published by Centre for Science and Environment.
2. Audio visuals from: Discovery, National Geographic etc.
3. Rachel Carson 1960. Silent springs

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	Quiz-1	15	1 Hour.	Syllabus covered up to T-1
2	Quiz-2	25	1.5 Hours	Syllabus covered up to T-2
3.	Quiz-3	35	2 Hours	Entire Syllabus

4.	Teaching Assessment	25	Entire Semester	Assignments- 10 Presentation -10 Attendance-5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CourseOutcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2 2	2 2	2 2	2 2	2 1	1	1 1	2 1	2 2	2 2	2 2	1. 2 8	**1.8**
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	**2.0**
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	**1.8**
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	**2.1**
CO-5	2	3	3	2	2	1	1	1	1	1	3	2	**1.8**
CO-6	2	2	2	2	1	1	1	2	2	2	2	2	1.8
Average	**2.0**	**2.5**	**2.5**	**2.33**	**2.16**	**1.0**	**1.0**	**1.16**	**1.8**	**2.0**	**1.8**	**2.0**	

Environmental Science and Technology

COURSE CODE:22BS1GE211

COURSE CREDITS: 2

CORE/ELECTIVE: CORE

L-T-P: 2-0-0

Pre-requisite: None

Course Objectives:

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Estimate the population- economic growth, energy requirement and demand.
3. Analyze material balance for different environmental systems
4. Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
5. Identify the major pollutants and abatement devices for environmental management and sustainable development.
6. Recognizing the major concepts of environmental studies, developing problem solving ability, forecasting the global climate change

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Introducing basic concept of environmental studies, interdisciplinary nature and scope of the subject	Familiarity
CO-2	Understanding ecosystem services and its functioning as well as equitable use of natural resources.	Assessment
CO-3	Understanding Pollution, A threat to the environment and finding its solutions, Pollutant sampling and monitoring of samples.	Assessment
CO-4	Correlating the concept of Biodiversity and its importance to human mankind	Usage
CO-5	Understanding social issues and their impact on environment.	Usage
CO-6	Role of Information Technology in environment and human health	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Unit 1: Multidisciplinary nature of environmental studies:** The Multidisciplinary nature of environmental studies: Definition, scope and importance, Need for public awareness, Types of ecosystems, World Biomes, Ecosystem functioning, Biogeochemical cycles.	3

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2	**Unit 2: Natural resources, their consumption & Protection:** Natural resources, their consumption & Protection: Water, Land Energy (Renewable, non-renewable, wind, solar, hydro, Biomass), Mineral, Forest, & Food resources, Role of an individual in conservation of natural resources, Equitable use of resources.	4
3	**Unit 3: Pollution- a threat to environment:** Pollution- a threat to environment: Air, Water & Land pollution, sources & causes, Space pollution, causes & effects, toxicity limits of pollutants. Critical issues concerning global Environment (Urbanization, population growth, global warming, climate change, acid rain, ozone depletion etc.) and the Roots in: Cultural, Social, Political, Commercial, industrial, territorial domains	4
4	**Unit 4: Environmental standards & Quality:** Environmental standards & Quality: Air, Water & Soil Quality, Pollutant sampling, pollution control systems. Green Chemistry and its applications	3
5	**Unit 5: Biodiversity and its conservation:** Biodiversity loss: Diversity of flora and fauna, species and wild life diversity, Biodiversity hotspots, threats to biodiversity	4
6	**Unit 6: Social Issues and the Environment:** Waste land reclamation, consumerism and waste products, eco-consumerism, dematerialization, green technologies, eco-tourism. Water conservation, rain water harvesting, watershed management. Environment protection act, Air (prevention and control of population) act; Water (prevention and control of pollution) act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation National Environmental Policy; Function of pollution control boards (SPCB and CPCB), their roles and responsibilities.	4
7	**Unit 7: Human Population and the environment:** Population growth, variation among nations. Population explosion—Family Welfare Programme. Environment and human health. Human rights. Value education.HIV/AIDS. Women and Child Welfare. Role of Information Technology in environment and human health. Case Studies.	4
8	**Unit 8: Field work:** Field Work: Explore the surrounding flora & fauna (Study of common plants, insects, birds document environmental assets), documentation of industries in local region and their possible effects, measure of water, air and land quality, Visit to a local polluted site-Urban/Rural /Industrial / Agricultural, Study of simple ecosystems-pond, river, hill slopes etc	4
Total lectures		**30**

Suggested Text Book(s):

1. Environmental Studies By: M. P. Poonia and S.C. Sharma, Khanna Publishers
2. Textbook of Environmental Studies for UG Courses –Erach Bharucha, University Press
3. Joseph, B., 2005, Environmental Studies, Tata McGraw Hill, India.

Approved in Academic Council held on 28 June 2023

Suggested Reference Book(s):

1. Nebel, B.J. & Wright, R.T., 1993, Environmental Science, 8th Edition, Prentice Hall, USA.
2. Chiras D D.(Ed.). 2001. Environmental Science – Creating a sustainable future. 6th ed. Jones &Barlett Publishers.
3. David Laurance. 2003. Environment Impact assessment, Wiley publications.
4. Chhokar KB, Pandya M & Raghunathan M. 2004. Understanding Environment. Sage publications, New Delhi.

Other useful resource(s):

1. Issues of the journal: Down to Earth, published by Centre for Science and Environment.
2. Audio visuals from: Discovery, National Geographic etc.
3. Rachel Carson 1960. Silent springs

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered up to T-1
2	T-2	25	1.5 Hours	Syllabus covered up to T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2)-10 Attendance - 5

Approved in Academic Council held on 28 June 2023

GEOINFORMATICS

COURSECODE:

COURSECREDITS: 3

CORE/ELECTIVE: ELECTIVE

L-T-P:3-0-0

Pre-requisites: Knowledge of surveying, map reading and basic mathematics

CourseObjectives:
1. Toapply the concepts of Photogrammetry and its applications.
2. Understand the basic concept of Remote Sensing and know about different types of satellite and sensors.
3. To understand Energy interactions with atmosphere and with earth surface features, Interpretation of satellite and top sheet maps
4. Understand different components of GIS and Learning about map projection and coordinate system.

CourseOutcomes:

S.No.	CourseOutcomes	Level of Attainment
CO-1	Understand the concepts of Photogrammetry	Understanding
CO-2	Understand the principles of aerial and satellite remote sensing and to comprehend the energy interactions with earth surface features	Understanding
CO-3	Understand the spatial and non spatial data features in GIS and understand the map projections and coordinates systems	Analysis
CO-4	Apply knowledge of GIS and understand the integration of Remote Sensing and GIS	Familiarity

CourseContents:

Unit	Contents	Lectures Required
1.	**Introduction** – Basic concepts and foundation of Remote Sensing elements, Data information, Remote sensing data collection, Electromagnetic spectrum, Energy interaction with the atmosphere and with earth surface features, Types of Platforms and Sensors, Imaging Systems; Non-Imaging Sensors; Across Track and Along Track Scanners	8
2.	**Image Interpretation** – Principles, interpretation keys, Elements of special and spectral Identification, Generation of thematic maps, Radar image interpretation, Supervised and Unsupervised classification	6
3.	**Microwave Remote Sensing** – Scattering of Microwaves, Synthetic Aperture Radar, SAR vs RAR, understanding RAR imagery	6
4.	**Geographical Information System:** Introduction to GIS, Components of GIS, Geospatial data: Spatial Data – Attribute Data- Joining Spatial and Attribute Data, GIS Operations: Spatial Data input- Attribute Data Management-Data Display-Data Exploration-Data Analysis.	7
5.	**Vector data model**- Representation of simple features- Topology and its importance: coverage and its data structure, shape file:, data models for composite features Object Based Vector Data Model; Classes and their Relationships **Raster data model -** Elements of Raster data model: Types of Raster data: Raster data structure: Data conversion, Integration of Raster and Vector data.	8
6.	**Introduction to QGIS –** Interface, creating shape file, creating basic map, raster and vector analysis	7
	TOTAL	42

SuggestedTextbook(s):

1. George joseph, 'Fundamentals of Remote Sensing', 2nd edition, 2013.
2. Gopi S., Sathikumar R. and Madhu N., "Advance Surveying", third edition, 2010, Pearson.
3. Burrough, P.A., and McDonnell, R.A., 'PrinciplesofGeographicalInformationSystems', 2ndEdition, OxfordUniversityPress, 1998.
4. Demers, M.N., FundamentalsofGeographicInformationSystems, JohnWiley&Sons, 3rdEdition, 2002.

SuggestedReferenceBook(s):

1. 'RemoteSensingandImageInterpretation',T.M.LillesandandR.W.Kiefer,JohnWiley&Sons,Singapore,2002.
2. 'IntroductiontoRemoteSensing',J.B.Cambell,Taylor& Francis,UK,2002.
3. 'RemoteSensing-Principles andInterpretation',F.F. SabinsJr,W.H. Freeman&Co.,NewYork,1986.
4. 'RemoteSensing-ModelsandMethodsforImageProcessing',R.A.Schowengerdt,ElsevierIndiaPvt.Ltd.,NewDelhi,2006

Otheruseful resource(s):

Link to NPTELcourses:

1. https://nptel.ac.in/courses/105/103/105103176/
2. https://nptel.ac.in/courses/105/104/105104100/
3. https://nptel.ac.in/courses/105/101/105101206/
4. https://nptel.ac.in/courses/121/107/121107009/
5. https://nptel.ac.in/courses/105/103/105103193/

EvaluationScheme:

S.No	Exam	Marks	Duration	Coverage / Scope ofExamination
1.	T-1	15	1 Hour.	Syllabuscovered upto T-1
2.	T-2	25	1.5 Hours	Syllabuscovered upto T-2
3.	T-3	35	2 Hours	EntireSyllabus
4.	TeachingAssessment	25	ThroughouttheSemester	Assignment (4) – 10Quizzes(2)-10(BestScore) Attendance -5

CourseOutcomes(COs)contributiontotheProgramOutcomes(POs)

Course Outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	1	2	2	3	3	1	1	3	2	2	2	2	2
CO-2	2	2	2	2	3	2	1	1	2	2	2	2	1.9
CO-3	2	3	3	3	2	2	1	3	2	2	1	2	2.16

CO-4	1	1	2	2	3	2	2	3	2	3	2	3	2.16
Average	1.5	2	2.25	2.5	2.75	1.75	1.25	2.5	2	2.25	1.75	2.25	

Business Communication

COURSE CODE: 23BB1HS111
COURSE CREDITS: 3
CORE/ELECTIVE: CoreL-T-P: 2-1-0

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Course Objectives

1. The students will be able to analyze different communication concepts and situations to make choicesabout the most effective and efficient ways to communicate.
2. The student will learn to deliver effective presentations in contexts that may require power point, extemporaneous or impromptu oral presentations.
3. The student will learn to write effective business documents using appropriate styles.
4. The student will learn to design effective resumes, and write effective emails, letters and reports
5. Students will be able to understand and apply negotiation and conflict resolution skills in variousbusiness situations

Course Outcomes:

S. No	Course Outcomes	Level of Attainment
CO-1	Understand and learn the concepts of better and effective communication	Familiarity
CO-2	Enable students to prepare better Power Point Presentations with clarity of expression and appropriate language.	Assessment
CO-3	Help make communication better by learning the nature and mechanics of effective writing	Assessment
CO-4	Design effective resumes, and write effective emails, letters and reports	Usage
CO-5	Help understand and apply fundamental negotiation and conflict resolution skills	Usage

Course Contents:

Chapter	Topics	Hours
1	• Introduction to Business communication: Meaning and Importance • Importance of communicating effectively: Theories of communication • Understanding interpersonal Communication: The Johari Window Model • Stages of communication: Ideation, encoding, transmission, decoding & response • Feedback in organisations • Barriers to effective communication: Physical, Social, Psychological, Cultural, Language & organizational • Guidelines to overcome communication barriers •	5
2	**Nonverbal Communication** • Nonverbal communication defined • Functions of nonverbal communication: Conveying meanings, expressing emotion, presenting self, managing interactions, defining relationship • Nonverbal Communication Codes: Communicating through Body Movements, Voice, Touch, Personal Space, Time, Physical Appearance	4
3	**Effective Presentation Skills**	4

	• Planning Presentations • Making PowerPoint Presentations • Pre- presentation jitters • Preparation and Practice • Delivering the Presentation • Qualities of a Skillful Presenter • Capturing and Maintaining Attention • Handling Questions	
4	**Communication Strategies & Professional Writing** • Principles of Business Writing • Seven C's of Communication • Writing Process: Pre-writing, writing & post-writing • Neutral and positive messages, Negative messages, Persuasive messages • Writing Letters, Emails, Resume, Cover Letter	6
5	**Report Writing** • Functions of a report • Types of reports • Format of the reports • Use of Visuals-Charts, Tables, Pictures	3
6	**Interview Techniques** • Analysing yourself and the market • Different types of interview questions • Making a positive first impression • Handling difficult Question	2
7	**Negotiation and Conflict Resolution** • Introduction to negotiations, Negotiation fundamentals, Negotiation dynamics • Communication problems and skills for conflict resolution • Types of conflicts • Conflict resolution skills	4
	Total Hours	28

Teaching Methodology

The course will be delivered with the help of lectures, interactive sessions, presentations, and cases.

Text Book:

Lehman, Carol M.; Dufrene, Debbie D.; Sinha, Mala. (2012). *BCOM*. Cengage Learning

Suggested Readings:

Mukherjee H.S.(2013). *Business Communication-connecting at work*. Oxford University Press.

Lesikar R.V, and Flately M.E. (2006). *Basic Business Communication Skills for empowering the internetgeneration*. McGraw Hill Education.

Kristen Bell DeTienne. (2011). *Guide to Electronic Communication*. Pearson

William, Krisan, Logan, Merrier. (2012). *Communicating in Business*. Cengage Learning

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1-> Unit 1, 2 and 3
2	T-2	25	1.5 Hours	Syllabus covered upto T-2-> Upto T1 + Unit 4 and 5 (partially)
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Class Performance - 10 Quizzes(2) -10 Attendance - 5

Attainment of POs through COs

Sr. No	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	AVG
CO-1	3	1	3	3	1	2	3	3	2.4
CO-2	2	1	3	3	1	3	1	3	2
CO-3	2	1	3	3	1	2	1	2	2
CO-4	3	1	3	3	1	2	2	3	1.9
CO-5	3	2	3	3	3	1	3	3	2
Average Score	2.6	1.2	3	3	1.4	2	2	2.8	2.06

PRINCIPLES AND PRACTICES OF MANAGEMENT

COURSE CODE: 23BB1HS112

COURSE CREDITS: 4

CORE/ELECTIVE: Core

L-T-P: 3-1-0

Pre-requisite: None

Objectives:

- To understand of basic concepts, principles and practices of management.
- To develop an insight of coordination and proper administration of business.
- To inculcate the ability to apply multifunctional approach to achieve organizational objectives.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the basic concepts of management theories.	Familiarity
CO-2	Understand the process of basic management functions.	Familiarity
CO-3	Analyze the internal and external decisions to be made by managers	Assessment
CO-4	Develop the suitable strategies based on management theories to achieve organization's objective	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Introduction to Management:** Evolution of Management: - Contribution of Taylor, Mayo & Fayol, Different approaches of management, role of manager, tasks of a professional manager, Management & its functions. Level of Management, managerial skills at various levels. Management as a Science or Art - Management as a profession, Administration and Management, Functional Areas of Management.	9
2	**Planning:** Nature and Importance of Planning- Types of Plans - Levels of Planning - Steps in planning - Making Effective Plans- Objectives and Management By Objective (MBO) –Management By Exception (MBE) - Policy and Strategy- Forecasting and Decision Making - Nature of decision making - Types of decisions – Decision	6

	Making Process – Rational Perspectives and Behavioural Aspects of decision making.	
3	**Organizing:** Principles of Organization - Types of Organization - Organizational Structure and Design – Line, Staff and functional authority – Conflict between Line and Staff – Overcoming the Line-Staff Conflict. Departmentation - Span of control – Authority, Responsibility and Accountability - Principles of Delegation - Steps - Centralization Vs Decentralization – Factors determining the degree of Decentralization of authority.	6
4	**Staffing:** Nature and Purpose of staffing – Importance of staffing – Components of Staffing - Manpower planning - Recruitment and Selection - Training and Development - Performance Appraisal.	5
5	**Directing:** – Nature of Directing function - Principles – Importance of Effective Direction – Motivating people at work – Early motivational theories, Directing & Leadership:- X Theory, & Y Theory, Hawthorne & Tinstone studies Leadership. Definition, Stogdill trait theory, Managerial grid, Fiedlers contingency approach. Leadership and change - Effective Communication skills for directing – Barriers of communication.	10
6	**Controlling:** - Concept, Nature and Importance - Essentials of Control - Requirements of an Effective Control System – Behavioural Implications of Control – Techniques of Managerial control - Co-ordination – Need for co-ordination – Types of Co-ordination - Techniques of Coordination - Cooperation. Supervision – Position of a supervisor – Qualities of a good– Essential requirements of effective supervision.	6
	Total Lecture Hours	42

Suggested Text Book(s):

- Stoner, Freeman, Gilbert Jr. (2014). Management (6th edition), New Delhi: Prentice Hall India
- Koontz, H., &Weihrich, H. Essentials of Management, McGraw Hill Publishers

Suggested Reference Book(s):

- Gupta, R.S., Sharma, B.D., & Bhalla. N.S. (2011). Principles & Practices of Management (11thedition). New Delhi: Kalyani Publishers.
- Williams. Management, (International edition) South-western Cengage Learning.
- John R. Schermerhorn. Management, Wiley-India
- L M Prasad, (2007). Principles and Practices of Management, Himalaya Publishing House
- Rao, P.S. (2009). Principles of Management, Himalaya Publishing House.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Class Performance - 10 Quizzes(2) -10 Attendance - 5

Attainment of POs through COs

Course outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	Average
CO-1	3	3	2	2	3	3	2	3	2.6
CO-2	3	3	2	2	3	3	2	3	2.6
CO-3	3	3	2	2	3	3	2	3	2.6
CO-4	3	3	3	3	3	3	3	3	3.0
Average	3	3	2.3	2.3	3	3	2.3	3	2.7

BUSINESS ENVIRONMENT

COURSE CODE: 23BB1HS113

COURSE CREDITS: 4

CORE/ELECTIVE: Core

L-T-P: 3-1-0

Pre-requisite: None

Objective:

- To understand the internal and external business environment in which companies operate.
- To assess the impact of environmental conditions on performance of business.
- To get deeper insights of Indian Business Environment so that one can take right decision atright time make the organization a successful business entity.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the basic concepts of business environment.	Familiarity
CO-2	Assessing the changing dynamics of business environment and its impact on company's performance	Assessment
CO-3	Understanding the role of institutional support provided by domestic and international government	Assessment
CO-4	Make optimal business decisions by understanding the dynamics of changing business environment	Usage

Course Contents:

S.No.	Units	Hours
1	**Introduction:** Introduction to Business Environment; Features and Importance of the study; Environmental Scanning; Types of Environment – internal, external, micro and macro; Five forces of competition; Industry Life Cycle Analysis; Environmental Analysis; Nature, Scope and Objectives of Business – business system/process, classification of business, classification of industries, characteristics of business, goals of business.	7
2	**Economic Environment:** Introduction to Economic Environment; Different Types of Economic System; Nature and Structure of Indian Economy; National Income; Economic Policies; Planning in India; India's Monetary and Fiscal Policies; Inflation; Industrial Policies; Role of Public Sectors; Liberalisation; Privatisation and Disinvestments; Small Scale Industries	6
3	**Political and Legal Environment:** Introduction to Indian Political Environment; Basic tenets of Indian Constitutions; Functions of State; Economic role of government; Basic understanding about Company Law, Industries (Development and Regulation Act), MRTP Act, Consumer Protection	6

4	**Socio-Cultural Environment:** Introduction to Indian Socio-Cultural Environment – Family, Social Class, Culture, Cultural Values, Culture and /organisation Behaviour; Business and Society; Social Responsibility of Business; Social Audit; Demographic Environment; Corporate Governance	6
5	**Financial Environment:** Indian Financial System; Money Markets and Capital Markets; Stock Exchanges in India; Depositories; Financial Institutions	6
6	**Global Environment:** Globalization – Meaning and Significance, Globalization of World Economy, Stages of Globalization, Impact of Globalization on Indian Industry, A Critical Appraisal of Globalization; Multinational Corporations – Definitions, Meaning, Organizational Model, Reasons for Growth of MNCs, MNCs in India, A Critical Appraisal of MNCs; GATT/WTO and Global Environment – Objectives and Evaluation of GATT, Different Rounds of Negotiation, Uruguay Round, Formation of WTO, Advantages of WTO, WTO and Developing Countries, WTO and India	6
7	**Infrastructure and Policies:** India's Export-Import Policies; India's Foreign Trade; FDI in India – Different Theories of FDI, Modes of FDI, Determinants and Impacts of FDI, A Critical Appraisal; FEMA – Meaning, Capital Account Transactions, Current Account Transactions, Role of RBI, Exports of Goods and Services, Realisation and Repatriation of Foreign Exchange, Contravention and Penalties, FERA and FEMA – A Comparison	5
	Total Hours	42

Suggested Text Book(s):

- Business Environment: Text and Cases by Francis Cherunilam, Himalaya Publishing House.
- Business Environment by Shaikh Saleem, Pearson Education

Suggested Reference Book(s):

- Business Environment by Vivek Mittal, Excel Books.
- Business Environment by Justin Paul,
- Indian Economy by Dutt and Sundharam, S. Chand
- Newspapers, Magazines and Internet.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Class Performance - 10 Quizzes(2) -10 Attendance - 5

Attainment of POs through COs

Course outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	Average
CO-1	3	3	2	2	3	3	3	3	2.8
CO-2	3	3	2	2	2	3	2	3	2.5
CO-3	3	3	2	2	3	3	2	3	2.6
CO-4	3	3	3	3	3	3	3	3	3.0
Average	3	3	2.3	2.3	2.8	3	2.5	3	2.7

MANAGERIAL ECONOMICS

COURSE CODE: 23BB1HS114

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Objective:

The purpose of this course is to apply micro economic concepts and techniques in evaluating businessdecisions taken by firms. The emphasis is on explaining how tools of standard price theory can be employed to formulate a decision problem, evaluate alternative courses of action and finally choose among alternatives. Simple geometry and basic concepts of mathematics will be used in the course ofteaching.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Understand the roles of managers in firms	Familiarity
CO-2	Analyze the demand and supply conditions and assess the position of a company	Assessment
CO-3	Analyze real-world business problems with a systematic theoretical framework.	Assessment
CO-4	Design competition strategies, including costing, pricing, product differentiation, and market environment according to the natures of products and the structures of the markets.	Usage
CO-5	Make optimal business decisions by integrating the concepts of economics, mathematics and statistics	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Demand, Supply and Market equilibrium:** Individual demand, market demand, individual supply, market supply, market equilibrium; Elasticities of demand and supply: Price elasticity of demand, income elasticity of demand, cross price elasticity of demand, elasticity of supply	8

2	**Theory of consumer behavior:** Cardinal utility theory, ordinal utility theory(indifference curves, budget line, consumer choice, price effect, substitution effect, income effect for normal, inferior and Giffen goods), revealed preference theory.	6
3	**Producer and optimal production choice:** Optimizing behavior in short run(geometry of product curves, law of diminishing margin productivity, three stages of production), optimizing behavior in long run (isoquants, isocost line, optimal combination of resources)	6
4	**Costs and scale:**Traditional theory of cost (short run and long run, geometry of cot curves, envelope curves), modern theory of cost (short run and long run), economies of scale, economies of scope.	6
5	**Theory of firm and market organization :**Perfect competition (basic features, short run equilibrium of firm/industry, long run equilibrium of firm/industry, effect of changes in demand, cost and imposition of taxes) ; monopoly (basic features, short run equilibrium, long run equilibrium, effect of changes in demand, cost and imposition of taxes, comparison with perfect competition, welfare cost of monopoly), price discrimination, multiplant monopoly ; monopolistic competition (basic features, demand and cost, short run equilibrium, long run equilibrium, excess capacity) ; oligopoly (Cournot's model, kinked demand curve model, dominant price leadership model, prisoner's dilemma)	10
6	**Factor market:** demand for a factor by a firm under marginal productivity theory (perfect competition in the product market, monopoly in the product market), market demand for a factor, supply of labour, market supply of labour, factor market equilibrium.	6
	Total Hours	**42**

Suggested Text Book(s):

Peterson and Lewis. Managerial Economics, PHI

Suggested Reference Book(s):

Dominick Salvatore (2009). Principles of Microeconomics (5th ed.) Oxford University PressLipsey and
Chrystal. (2008). Economics. (11th ed.) Oxford University Press
Koutosyannis (1979). Modern Micro Economics. Palgrave Macmillan Pindyck,
Rubinfeld and Mehta. (2009). Micro Economics. (7th ed.). Pearson.

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1-> Unit 1, 2 and 3
2	T-2	25	1.5 Hours	Syllabus covered upto T-2-> Upto T1 + Unit 4 and 5 (partially)
3.	T-3	35	2 Hours	Entire Syllabus

4.	Teaching Assessment	25	Entire Semester	Class Performance - 10 Quizzes(2) -10 Attendance - 5				

Attainment of POs through COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	Average
CO1	3	3	2	2	2	2	3	3	2.5
CO2	3	3	2	2	2	3	2	3	2.5
CO3	3	3	2	2	2	3	2	3	2.5
CO4	3	3	3	3	3	3	3	3	3.0
CO5	3	3	2	2	2	3	3	3	2.6
Average	**3**	**3**	**2.2**	**2.2**	**2.2**	**2.8**	**2.6**	**3**	**2.6**

Ethics and Corporate Social Responsibility

COURSE CODE: 23BBWHS132

COURSE CREDITS: 4

CORE/ELECTIVE: Elective

L-T-P: 3-1-0

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Pre-requisite: None

Course Objectives:

1. Learn critical appreciation of the main currents in ethical thought applied to the businesses.
2. Learn the value of ethical thought in the development of business theory.
3. Learn to appraise ethical considerations presented in a variety of business settings.
4. Learn substantial debates regarding the implications of ethical arguments for business activity.
5. Learn the role of business ethics in the Indian as well as global business environment and to recognize thechallenges of business social responsibility.
6. Learn to develop critical thinking skills via the application of concepts and theories to business cases.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
1	To increase the awareness of the ethical dimension of business and its decision making process across all functions.	Familiarity
2	To become familiar with the social standards, values, ethical principles and moral philosophy that provide criteria for decision making.	Assessment
3	The role of business ethics in the Indian as well as global business environment and to recognize the challenges of business social responsibility.	Assessment
4	To develop critical thinking skills via the application of concepts and theories to business cases.	Usage
5	Critical appreciation of the main currents in ethical thought applied to the businesses.	Familiarity

Course Contents:

SNo.	Unit	Contents	No. of Lectures
1.	Introduction to Business Ethics	• Definition,Meaning and Concept • Principles of Business Ethics • Importance of Business ethics	2

2.	Ethical Dilemma	- Characteristics of Ethical Organizations - ethical decision making - ethical reasoning the - dilemma resolution process.	4
3.	Framing Business Ethics	- Corporate Social Responsibility - Stakeholders - Citizenship	3
4.	Managing CSR	- Organizational Mission, Vision and Values - Triple Bottom Line - Corporate Community Involvement	3
5.	Employees: Professional Obligations	- Greed and conflicts of interest - Insider trading - Theft and fraud - Whistle-blowing	3
6.	Employees: Rights	- Discrimination and harassment - Privacy - Health and safety	3
7.	Consumers: Protection	- Consumer protection - Product recalls	3
8.	Relation between Corporate Social Responsibility and Corporate Governance.	Corporate Governance, Disclosure, and Executive Compensation	3
9.	Business values for 21st century	- Introduction - Requisite Business Values - Action needed	3
10.	Evaluating Business Ethics	- Normative Ethical Theories - Egoism - Utilitarianism - Ethics of duties - Rights and justice	4
11.	Safety, Risk, and Environmental Protection	- Work environment risks and controls - Environmental Technology for Sustainable Development - Risk Control - Regulating health and safety	3
12.	Global Business Ethics	- Bribery - Repressive Regimes - Overseas Suppliers	3

13.	Corporate Social Responsibility within the organisation	• CSR and Society • Strategic • Planning and CSR • Environmental Aspects of CSR • CSR under the Companies Act,2013 • CSR Practices in India	5
		Total contact HRS	42

Recommended Reading (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)	
1.	Shelekar S.A.,Bhat K.G.*Ethics in Management*.Himalayan Publishing House, Mumbai 2015
2.	Crane A.Matten D. *Business EthicsManaging Corporate citizenship and sustainability in the age of Globalization* Oxford University Press 2016
3.	Bajaj P.S.Agarwal R. *Business Ethics An Indian Perspective* New Delhi 2004
4.	J.P. Sharma, Corporate Governance, Business Ethics & CSR, Ane Books Pvt. Ltd., Nee Delhi.
5.	Fernando, A. C. Business Ethics and corporate governance. PearsonEducation. (2010).

Evalution Scheme:

S.No.	Exam	Marks	Duration	Coverage/ Scope of Examination
1.	T-1	15	1 Hour	Syllabus covered upto T-1
2.	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Attendance:5 Quiz -10 Presentations -10

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Business ethics and Corporate social responsibility)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	Average
CO-1	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3
CO-3	1	3	1	2	2	1	3	3	2
CO-4	1	1	1	1	1	1	2	3	1.3
CO-5	1	2	1	1	1	1	3	3	1.6
Average	1.8	2.4	1.8	2	2	1.8	2.8	3	

CRITICAL AND CREATIVE THINKING

COURSE CODE: 23BBWHS231
CREDITS: 4
CORE/ELECTIVE: CORE
L-T-P: 3-1-0

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Pre-requisite: None**Course**

Objectives:
1. Introduce students to the fundamental concepts, principles, and techniques of critical and creativethinking.
2. Cultivate students' ability to analyze complex problems, evaluate information, and identify logicalfallacies.
3. Encourage students to think outside the box, generate innovative ideas, and explore diverseperspectives.

Course Outcomes:

SNo	Course Outcomes	Level of Attainment
CO-1	Demonstrate an understanding of the foundational concepts and principles of critical and creative thinking.	Familiarity
CO-2	Analyze complex problems, evaluate evidence, and identify logical fallacies in reasoning.	Assessment
CO-3	Generate innovative ideas and explore multiple perspectives to approach challenges from different angles.	Assessment
CO-4	Apply decision-making strategies and critically evaluate options to make informed choices.	Assessment
CO-5	Utilize critical and creative thinking techniques to solve real-world problems in various contexts.	Assessment

Course Contents:

Unit	Contents	Lectures required
1	**Realm of Creativity**: Definition, Lateral thinking, Traits of creative people, Essence Creativity, Elaborative Creativity and Expressive Creativity	5
2	**Influences on Creativity:** Motivation, Environment, Technology and Training	5
3	**Demographic specificity creative people**: Age, Gender, Race and Geography	3
4	**Mastering Creative Problem Solving**: Structuring of Ill-defined Problems Creative Problem Solving,Models of Creative Problem-Solving Useful Mechanisms of Convergent Thinking Mechanisms of Divergent Thinking	6
5	**Enhancing Critical and Creative Intelligence**: Creative Intelligence Abilities; A Model of Creative Intelligence, Concepts of Critical- Critical thinking standards, Benefits and Barriers of Critical thinking	7
6	**Acquiring A Creative Persona**: Traits Congenial to Creativity Creative Personality and Form of Creativity Motivation and Creativity Strategies forChanging Motivation	5

7	**Designing a Creativogenic Environment:** Environmental Stimulants of Creativity, Creative organizations, Force stimulating innovativeness, Designing innovative organizations.	5
8	**Techniques of Creative Problem Solving:** Principles and Techniques forChurning up Creative Ideas A Comparison of Creativity Techniques	6
	Total lectures	42

Suggested Text Book(s):

S.No.	Name of Books
1	Khandwalla, Pradeep N.2004. Life Long Creativity: An Unending Quest. New Delhi: Tata Mc Graw Hill

Suggested Reference Book(s):

S.No	Name of Books
1	Carter, Philip. Test and Assess your brain quotient: Discover your true intelligence with tests of aptitude, logic, memory, EQ, creative and lateral thinking. Kogan Page Publishers, 2008
2	Crawford, Robert Platt. The Techniques of Creative Thinking: How to Use Your Ideas to Achieve Success. Paperback – Import, 1 September 2012.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3	T-3	35	2 Hours	Entire Syllabus
4	Teaching Assessment	25	Entire Semester	Class Performance– 10 Assignments- 10 Attendance -5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	Average
CO1	3	1	1	2	3	2	3	3	2.25
CO2	2	3	1	2	2	2	2	3	2.13
CO3	3	2	1	2	3	2	3	3	2.38
CO4	3	3	1	2	2	2	2	3	2.25
CO5	3	3	1	2	2	2	3	3	2.38
Average	2.8	2.4	1	2	2.4	2	2.6	3	2.28

Professional Communication Practice

COURSE CODE: 23B11HS212

COURSE CREDITS: 0

CORE/ELECTIVE: CORE

L-T-P:0-1-0

Course Objective: This course has been designed with the objective of inculcating in the students a high degree of communicative competence. It is essential for all professionals today that their talents be noticed by prospective recruiters and later on their colleagues, superiors and subordinates in the workplace. In order to standout amongst their workgroups a high degree of communicative ability goes a long way and helps them get noticed.

Course Outcomes: The following are the likely outcomes of studying the course of Professional Communication practice.

S.No.	Course Outcomes	Level of Attainment
CO-1	Improved spoken and written communication in English.	Familiarity
CO-2	Develop the ability to interact effectively in the professional setting.	Familiarity
CO-3	Design a good resume and be able to update it from time to time.	Assessment
CO-4	Make effective and impressive presentations using digital media	Usage
CO-5	Develop the confidence to perform well in interviews.	Assessment

Tutorial ExerciseNo.	Module	Topics	Hours
1.	**Professional Communication and CV/Resume Writing (W)**	An introduction to professional communication' Introduction to CV writing, difference between a CV and a Resume, samples of good CVs/Resumes and cover letters, DraftingResumes	3
2	**Personal (L&S) Interview**	Interviewing for employment, Types of interviews, Preparing for the personal interview. Practice session for interviews	3
3	**Text speak: (Language Lab)**	Writing: What will I learn?, Text speak: an overview, Text terms (1), Text terms (2), Inviting people to do things, Responding appropriately, Text speak and speaking, Quick quiz: text speak	1
4	**Presentation skills (L,S&W)**	Making professional presentations, using effective body language, using visuals effectively.	3

	5	**Essays:** **Descriptive:** **Software:** **Practical Writing:**	What will I learn?, Planning your essay (1), Planning your essay (2), Words and senses (1), Vocab focus: choosing precise words, Linking ideas (1), Linking ideas (2), Quick quiz: descriptive essays	1
	6	**Technical Report Writing (R&W)/Technology and communication (Language Lab)**	A Short Report: Hotel and restaurants (II), Software: Practical Writing: What will I learn? Restaurant reviews: structure, Vocab: Hotels and restaurants, Topic sentences (1), Mixing sentences (1), Mixing sentences (2), Past or Present?, Write two reviews, Quick quiz: a short report Lab work: Write any one review	2
	7	**Creating and Maintaining LinkedIn Profile (Language Lab)**	Job Applications: Your Online Profile, Software: Practical Writing What will I learn? Your online profile: overview, What does a profile look like The structure of a profile Proofreading: grammar Spell checking, Writing focus: punctuation marks Practise proofreading Quick quiz: your personal profile Lab work: Write your personal profile	1
			Total Hours	14

Methodology

The course follows a teaching-learning method with classroom discussions and activities on fundamental concepts of communication with a strong emphasis on skill development of students. In Tutorial classes the students are assessed on their learning and performance of any given task/exercise. They learn to structure their communication to the requirements of the recruiters and later the organizations they will be working for. Thus professional communication extends to learning how to write a good resume, performing well in all types of interviews and group discussion and also to make effective presentations..

Report writing and Creating a LinkedIn Profile will be a part of continuous evaluation and hence should be discussed throughout thesemester. Total

Reference Book:

Lesikar, Raymond V; Flately, Marie E. Basic Business Communication: Skills for Empowering Internet Generation. McGraw Hill, 2004.

Relevant Links:

1. **Business English Communication https://nptel.ac.in/courses/109/106/109106129/#**
2. **Developing soft skills and Personality https://nptel.ac.in/courses/109/104/109104107/**
3. **Speaking Effectively https://nptel.ac.in/courses/109/105/109105117/**
4. **Technical English for Engineers https://nptel.ac.in/courses/109/106/109106094/**

Evaluation: Each of the class activities have a score allotted to them. These scores add upto give the final marks in the course.

S.No	Exam	Marks
1	Report Writing	10
2	LinkedIn Prifile	10
3	PPT	20

4	GD (10)	10
5	PI (10)	20
6	Resume (10) (Added)	20
7	Attendance (5)	10

Attainment of POs through COs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	1	2	2	2	1	3	1	1	1	3	2	3	1.83
CO2	1	2	2	2	1	3	1	1	3	3	2	3	2
CO3	0	0	0	1	1	3	0	1	1	3	0	2	1
CO4	1	2	1	2	2	3	1	0	3	3	2	2	1.83
CO5	0	0	1	2	1	3	0	0	2	3	1	3	1.33
Average	0.6	1.2	1.2	1.8	1.2	3	0.6	0.6	2	3	1.4	2.6	1.6

Life Skills and Interpersonal Dynamics

COURSE CODE:

COURSE CREDITS: 3

CORE/ELECTIVE:

CoreL-T-P: 3-0-0

Pre-requisite: None

Objective:

This course is designed to help students understand themselves and others in their development as professionals and responsible citizens. This starts with developing an understanding of their own needs and wants what they 'really want to be' in their life and profession. This understanding of oneself then leads to understanding others better so that effective personal and professional relationships can be built. The moment a student enters the workplace they are confronted with organizational values and ethical dilemmas. This course helps facilitate the students to understand harmony at all the levels of human living, and live an ethical and happy life.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the fundamentals of human Behavior and its determinants.	Familiarity
CO-2	Understand the meaning of personality and be able to classify individuals into different personality types	Assessment
CO-3	Evaluate attitude and its relationship with personality and behavior.	Assessment
CO-4	Analyze interpersonal dynamics of groups and teams	Usage
CO-5	Understand motivation and its importance in work and life	Usage
CO-6	Developing emotional intelligence	Usage

Course Contents:

Unit	Contents	Lectures required
1	Understanding Interpersonal dynamics and its importance in personal and professional life. Self-Esteem and Self-Confidence, Self-Motivation ,Self-Awareness and Goal Setting; Emotional Intelligence, Perception,	**5**

2	Defining personality. The MBTI framework, The Big Five.	4
3	Attitude and its determinants. Relationship between attitude and behavior. Importance of attitude in the workplace.	4
4	Stress Management, Cause and effect of stress, coping with stress, values associated to positive stress management	2
4	Theories of motivation: Maslow's need hierarchy, Herzberg's two factor theory, Behavioral theories and contingency theories.	5
5	Leadership: Trait, Behavioral and contingency theories of leadership. Charismatic leader, transactional and transformational leadership.	5
6	Dynamics of group behavior, forming groups, converting groups to teams and managing team dynamics	5
7	Emotional intelligence: Definition, measurement and development of emotional intelligence	4
8	Problem Solving, Steps in problem solving, Decision making, Models of Decision Making, Creativity and Critical thinking, Analytical thinking.	4
9	Social and Negotiation Skills, Conflict Management	4
	Total Lecture Hours	**42**

Suggested Text Book(s):

Stephen P. Robbins, Timothy A. Judge, Organizational Behavior, Pearson Education, 15th, 2015

Suggested Reference Book(s):

Greenberg Jerald and Baron Robert A.: Behaviour in Organisations:
Understanding and Managing The Human Side of Work, Prentice Hall of India
Kavita Singh: Organisational Behaviour, Vikas Publications

Mc Shane L. Steven, Glinow Mary Ann Von & Sharma Radha R. - Organisational
Behaviour; Tata McGraw Hill.

Newstrom John W.: Organisational Behaviour, Tata McGraw Hill
Luthans Fred: Organisational Behaviour, Tata McGraw Hil

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Class Performance - 10 Quizzes(2) -10 Attendance - 5

Attainment of POs through COs

Course outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	Average
CO-1	1	3	3	2	3	2	3	3	2.5
CO-2	2	3	2	2	3	2	2	3	2.4
CO-3	3	3	2	2	3	2	3	3	2.6
CO-4	3	3	3	3	3	3	3	3	3.0
CO-5	3	3	3	3	3	3	3	3	3.0
Average	3	3	2.4	2.4	3	3	2.4	3	2.8

Linear Algebra for Data Science and Machine Learning

COURSE CODE: 22B1WMA731

COURSE CREDITS: 3

CORE/ELECTIVE: ELECTIVE

L-T-P: 3-0-0

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Course Objectives: This course gives a foundation on applied linear algebra concepts, and emphasizes their usage in data science and machine learning. On successful completion of this course a student will be able

1. To learn orthogonality and obtain orthonormal bases using Gram-Schmidt process.
2. To learn eigenvalues, eigenvectors and understand the idea behind diagonalization process.
3. To describe vector projections and implement the least-squares solution to Ax=b.
4. To describe and interpret singular value decomposition and principal component analysis
5. To learn and describe how to find minimum value of cost function with gradient descent.
6. To gain understanding of theoretical results in linear algebra with implementation with coding.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the roll of matrices and their properties in data science; Understand linear transformation and find the matrix representation of a linear transformation given bases of the relevant vector spaces.	Familiarity
CO-2	Find orthogonalization, eigenvalues, eigenvectors of matrices and perform diagonalization.	Assessment
CO-3	Make use of the matrix algebra techniques to solve computational problems such as finding principal components and reducing dimensionality for datasets.	Assessment & Usage
CO-4	Appraise the matrix algebra techniques for implementing the machine learning algorithms. Identify minimum values of cost function and calculate the gradient descent.	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Fundamental concepts:** Notion of vectors and matrices in data science: basics of matrix algebra, vector space; linear combination of input variables from data; role of basis vectors in reducing data storage; definition and meaning of eigenvalues and eigenvectors in the rotation of a image; orthogonal and identity matrices in Machine learning; probability fundamentals.	10
2	**Matrices and Machine learning:** Data representation by system of linear equations Ax = b; linear transformations, range and null spaces; orthogonal complement of the column space of A, orthogonal projections; finding the best fit line for the data points with regression - minimizing the residual sum of squares to find the scalar weights from the data set.	12

3	**Matrix operations & approximations:** Fundamental theorem of linear algebra: rank-nullity theorem; eigendecomposition, spectral decomposition, singular value decomposition (SVD) - Moore-Penrose matrix pseudoinverse and data compression; principal component analysis (PCA) and dimensionality reduction; low-rank approximations; Python implementation of SVD, PCA.	12
4	**Applications:** Computing singular values and reduction of image size; optimizing cost/loss function: gradient of function, gradient descent and stochastic gradient descent, back propagation algorithm.	8
Total Lectures		42

Suggested Text Book(s):

1. Jason Brownlee, ``Basics of Linear Algebra for Machine Learning," Machine Learning Mastery, 2018.

Reference Book(s):

1. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, ``Mathematics for Machine Learning," Cambridge University Press, 2020.
2. Gilbert Strang, ``Linear Algebra and Learning from Data," Wellesley-Cambridge Press, 2019.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered up to T-1
2	T-2	25	1.5 Hours	Syllabus covered up to T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Linear Algebra for Data Science and Machine Learning)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	2	**1.75**
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	**2**
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	**1.75**
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	**2.0**
Average	**2**	**2.5**	**2.5**	**2.5**	**2.5**	**1**	**1**	**1**	**2**	**2.25**	**1.5**	**2**	

LIFE SKILLS AND INTERPERSONAL DYMANICS

COURSE CODE:

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 2-1-0

Pre-requisite: None

Course Objectives:

Course Outcomes:

S.No	Course Outcomes	Level of Attainment
CO-1	Understand the fundamentals of human Behavior and its determinants.	Familiarity
CO-2	Understand the meaning of personality and be able to classify individuals into different personality types	Assessment
CO-3	Understand attitude and its relationship with personality and behavior.	Assessment
CO-4	Understand motivation and its importance in work and life	Assessment
CO-5	Analyze interpersonal dynamics of groups and teams and develop Emotional Intelligence	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Understanding Interpersonal dynamics** and its importance in personal and professional life. Self-Esteem and Self-Confidence, Self-Motivation ,Self-Awareness and Goal Setting; Emotional Intelligence, Perception,	4
2	**Personality**. The MBTI framework, The Big Five.	2
3	**Attitude** and its determinants. Relationship between attitude and behavior. Importance of attitude in the workplace.	2

4	**Stress Management**, Cause and effect of stress, coping with stress, values associated to positive stress management	2
5	**Theories of motivation**: Maslow's need hierarchy, Herzberg's two factor theory, Behavioral theories and contingency theories.	3
6	**Leadership**: Trait, Behavioral and contingency theories of leadership. Charismatic leader, transactional and transformational leadership.	4
7	**Dynamics of Group Behavior**: forming groups, converting groups to teams and managing team dynamics	4
8	**Emotional intelligence**: Definition, measurement and development of emotional intelligence	3
9	**Problem Solving & decision making**: Steps in problem solving, Decision making, Models of Decision Making, Creativity and Critical thinking, Analytical thinking.	2
10	**Social and Negotiation Skills, Conflict Management**	2
Total lectures		28

Suggested Text Book(s):

1. Greenberg Jerald and Baron Robert A.: Behavior in Organizations: Understanding and Managing The Human Side of Work, Prentice Hall of India,2022
2. Stephen P. Robbins, Timothy A. Judge: Organizational Behavior, Pearson Education,2018

Suggested Reference Book(s):
1. Mc Shane L. Steven, Glinow Mary Ann Von & Sharma Radha R. – Organizational Behaviour,Tata McGraw Hill.2006
2. Newstrom John W.: Organisational Behaviour, Tata McGraw Hill,2001

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2

3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Sr No	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	0	2	1	3	2	3	3	3	3	3	0	3	2.1
CO-2	0	2	3	3	2	3	3	3	3	3	0	3	2.3
CO-3	0	2	1	3	2	3	3	3	3	3	0	3	2.1
CO-4	0	2	1	3	2	3	3	3	3	3	2	3	2.3
CO-5	0	2	3	3	2	3	3	3	3	3	2	3	2.4
Average Score	**0**	**2**	**1.8**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**0.8**	**3**	

MACROECONOMICS

COURSE CODE: 23BB1HS212

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Pre-requisite: None

Course Objectives:

1. To understand the basic theories and principles of macroeconomics.
2. To understand the linkages between major economic variables; level of output and prices, inflation, interest rates and exchange rates.
3. To study the impact of monetary and fiscal policy on the aggregate behavior of individuals.

Course Outcomes:

SNo	Course Outcomes	Level of Attainment
CO-1	Understand the concepts of Macroeconomics and its interrelations with Microeconomics.	Familiarity
CO-2	Understand the concepts of national income, calculation methods of national income, and concepts related to national income.	Assessment
CO-3	Apply the principles of Macroeconomics in explaining the behaviour of different Macroeconomic variables at national as well as global level.	Assessment
CO-4	Analyze the interrelationship among different macroeconomic issues such as money, foreign exchange, inflation, unemployment, economic growth and foreign trade.	Usage
CO-5	Make optimal business decisions by applying the concepts of macroeconomics	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Measurement of macroeconomic variables:** National Income Accounts, Gross Domestic Product, National Income, Personal and Personal disposable income; Classical theory of income and employment: Quantity Theory of Money – Cambridge version, Classical aggregate demand curve, Classical theory of interest rate, effect of fiscal and monetary policy.	8

2	**Keynesian theory of Income and employment:** Keynesian model, components of aggregate demand, equilibrium income, changes in equilibrium, multiplier (investment, Government expenditure, lump sum tax, foreign trade), effect of fiscal and monetary policy, crowding out, composition of output and policy mix, policy mix in action; ISLM model : properties of ISLM curves, factors affecting the position and slope of ISLM curves, determination of equilibrium income and interest rates, effect of monetary and fiscal policy, relative effectiveness of monetary and fiscal policy.	10
3	**Money:** Functions of money, quantity theory of money, determination of money supply and demand, theory of money multiplier, indicators and instruments of monetary control	8
4	**Inflation:** Meaning, demand and supply side factors, consequences of inflation, anti-inflationary policies, natural rate theory, monetary policy-output and inflation, Phillips curve (short run and long run)	6
5	**Open Economy:** brief introduction to BoP account, market for foreign exchange and exchange rate, monetary and fiscal policy in open economy, Mundell Fleming model (perfect capital mobility and imperfect capital mobility under fixed and flexible exchange rate)	10
	Total lectures	42

Suggested Text Book(s):

1. Mankiw: Principles of Macroeconomics with MindTap, 8thEdition, Cengage Learning, 2022.
2. WA McEacheren and Simrit Kaur: Macro ECON: A South Asian Perspective, 2nd Edition, Cengage Learning, 2018.

Suggested Reference Book(s):

1. Olivier Blanchard: Macroeconomics, 7th Edition, Pearson, 2020.
2. RT Froyen: Macroeconomics, 10th Edition, Pearson, 2013.
3. AM Thomas: Macroeconomics: An Introduction, 1st Edition, Cambridge University Press, 2021.
4. R Dornbusch, S Fischer and R Startz: Macroeconomics, 12th Edition, TMH, 2018.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus

4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	Average
CO1	3	3	2	2	2	2	3	3	2.5
CO2	3	3	2	2	2	3	2	3	2.5
CO3	3	3	2	2	2	3	2	3	2.5
CO4	3	3	3	3	3	3	3	3	3.0
CO5	3	3	2	2	2	3	3	3	2.6
Average	**3**	**3**	**2.2**	**2.2**	**2.2**	**2.8**	**2.6**	**3**	**2.6**

ORGANIZATION BEHAVIOUR

COURSE CODE: 23BB1HS211

COURSE CREDITS:4

CORE/ELECTIVE: CORE
L-T-P: 3-1-0

Pre-requisite: None

Course Objectives:

1. Explain organizational theory by learning about individual behavior
2. Analyze leadership styles and determine their effectiveness in employee situations
3. Identify methods to resolve organizational problems
4. Describe the impact of corporate culture on employee behavior
5. Analyze team dynamics, team building strategies and cultural diversity

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Understand the basic concepts of Organizational behavior	Familiarity
CO-2	Analyze and apply the components of individual behavior and learn the concepts of perception, attitude and values	Assessment
CO-3	Apply the theories of leadership and motivation in workplace. And thus, be able to distinguish between different styles of leadership and contribute to the effective performance of a team as a team leader.	Usage
CO-4	Analyze group and team behavior and demonstrate skills required for working in groups (team building)	Usage
CO-5	Justify organizational change and conflict working relationships within organization and demonstrate how to apply relevant theories to solve problems of change and conflict.	Usage

Course Contents:

Sr No	Content	Lectures required
Modules		
	Introduction to Organizational Behaviour: Diversity in Organizations,	**2**
Module 1	The Individual	**18**
	Attitudes and Job Satisfaction Emotions and Moods , Personality and Values, Perception and Individual Decision Making Motivation Concepts 201 8 Motivation: From Concepts to Applications	
Module 2	Foundations of Group Behavior	**16**
	Understanding Work Teams Communication Leadership Power and Politics Conflict and Negotiation Foundations of Organization Structure	
Module 3	Organizational Culture	**6**
	Human Resource Policies and Practices Organizational Change Stress Management	
	Total	**42**

Methodology

The course follows a teaching-learning method with classroom discussions and activities on fundamental concepts on skill development of students with regard to speaking, listening and, logically interpreting ideas into words and reasoning in the classroom.

Suggested Text Book(s):

1. Stephen P. Robbins ,Organizational Behavior
2. Dipak Kumar Bhattacharya, Organizational Behaviour
3. Nelson,Quick, Khandelwal, ORGB

Suggested Reference Book(s):
1. Working with Emotional Intelligence, Daniel Goleman
2.OrganizationalBehavior, K. Aswathappa
3. OrganizationalBehaviorAn Introduction, Christine Cross Ronan Carbery

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3	T-3	35	2 Hours	Entire Syllabus
4	Teaching Assessment	25	Continuous evaluation	10 marks case study 10 marks case study 5 marks Class participation

Sr No	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	Average Score
CO-1	3	3	3	3	2	1	3	3	2.6
CO-2	3	3	3	3	3	2	3	3	2.8
CO-3	3	3	3	3	3	2	3	3	2.8
CO-4	3	3	3	3	3	2	3	3	2.8
CO-5	3	3	3	3	3	2	3	3	2.8
Average Score	3	3	3	3	3	1.8	3	3	

Perennial Power Structures

COURSECODE:22B1WCE733

COURSE CREDITS: 3

CORE/ELECTIVE: OPEN ELECTIVE

L-T-P: 3-0-0

Pre-requisite: None

CourseObjectives:

1. To understand the electric powergrids.
2. Tounderstandtheworkingmechanismsofpowerplantsofdifferentrenewableenergysources.
3. Tounderstandtheefficiencyof apowerplantandfactorsaffectingit.
4. Tounderstandplanning,construction,andmaintenanceofapowerplant.
5. To evaluate the environmental impact of power plantprojects.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	To understand the electric power grids.	Assessment
CO-2	To understand the working mechanisms of power plants of different renewable energy sources.	Assessment
CO-3	To understand the efficiency of a power plant and factors affecting it.	Assessment
CO-4	To understand planning, construction, and maintenance of a power plant.	Familiarity
CO-5	To evaluate the environmental impact of power plant projects.	Assessment

Course Contents:

Unit	Contents	Lecture Required
1.	**Introduction, Various types of energy sources:** Renewable &Non–Renewable, Conventional & Non–Conventional. Utilization of various energy resourcesintheWorldandIndia.Effectofusingvariousenergysourcesonthe environment.Advantagesanddisadvantagesofpowergenerationfromdifferent types of energy sources. Conditions for using different energysources.	1
2.	**Economics of Electric Power Grid:** Power contribution from eachtype of plant in an area, cost analysis of power plants.	2
3.	**Hydropower:** Working and favorable conditions for a hydropower plant Efficiency of Hydropower; Firm Power, Secondary Power, Types of Hydropower Scheme, Types of Turbines, Environment Impact Assessment Planning, Construction practices, and Maintenance protocols of Hydropower project via case study.	10
4.	**Tidal:** Working and favorable conditions for a tidal plant; Efficiency of Tidal power plant; Environment Impact Assessment; Planning, Construction practices, and Maintenance protocols of Tidal Power project via case study.	9
5.	**Wind:**WorkingandfavorableconditionsforaWindPowerplant;Efficiencyof Wind power; Environment Impact Assessment; Planning, Construction practices,andMaintenanceprotocolsofWindPowerprojectviacasestudy.	10
6.	**Solar:** Working and favorable conditions for a Solar plant; Efficiency of Solar power;EnvironmentImpactAssessment;Planning,Constructionpractices,and Maintenance protocols of Solar Power project via casestudy.	10
	TOTAL	42

Suggested Textbook(s):

1. Rajput, R.K., Power Plant Engineering, Laxmi Publications Pvt.Ltd.
2. Twidell, J., Weir, T., Renewable Energy Sources,Routledge.
3. Nelson,V.,IntroductiontoRenewable Energy(Energyand the Environment),CRCPress.

Suggested Reference Book(s):

1. USDepartmentof Energy,IntroductiontoRenewableEnergyTechnology:AYear LongScienceand Technology Course, Createspace IndependentPub.

Evaluation Scheme:

S. No.	Exam	Marks	Duration	Coverage/Scope of Examination
1.	T-1	15	1 Hour.	Syllabus covered up to T-1
2.	T-2	25	1.5 Hours	Syllabus covered up to T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Throughout the Semester	Assignments (20) Attendance (5)

Course Outcomes (COs) contribution to the Program Outcomes (POs)

Course Outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	1	2	3	3	3	1	2	1	2	3	2.25
CO-2	3	3	0	1	3	3	3	1	1	1	2	3	2
CO-3	3	3	0	1	3	3	3	1	1	1	2	3	2
CO-4	3	3	2	2	3	3	3	3	3	2	3	3	2.75
CO-5	3	3	3	2	2	3	3	2	1	2	1	2	2.25
Average	3	3	1.2	1.6	2.8	3	3	1.6	1.6	1.4	2	2.8	

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BIOSENSORS

COURSE CODE: 21B1WPH831

COURSE CREDITS: 3

CORE/ELECTIVE: ELECTIVE (OPEN)

L-T-P: 3-0-0

Pre-requisite: None

Course Description:

Biomaterials science, the study of the application of materials to problems in biology and medicine, is characterized by medical needs, basic research, and advanced technological development. Biomaterials directly impact many disciplines within the field of biomedical engineering. This interdisciplinary course introduces biomaterials research as related to medicine and biotechnology, emphasizing the interactions between materials and biological structures. Fundamental issues related to the function of biomaterials are explored based on their biocompatibility, stability, interfaces, and behavior in the body. Biomaterials testing methods, interaction with proteins and cells, cardiovascular, drug delivery, regulatory issues, and emerging research directions will also be discussed.

Course Objectives:

Over the last few years, there has been a significant shift in the understanding of the structure, function and behaviour of biomaterials, with the introduction of new types of biomaterials, extended clinical applications and indeed entirely new concepts of what constitutes a biomaterial. The objectives of this new course are:

I. To explore and introduce these new concepts of biomaterials science.

II. The subject matter will build upon the principles of materials science on the one hand, including materials chemistry and nanoscale materials, and the principles of biology and disease on the other hand, including cell biology and immunology and drug and gene therapies.

II. The overall aim will be to develop an understanding of the roles of materials science and biology principles in the structure and function of clinical biomaterials and the relationship between these properties and the current and future profile of health care products.

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Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Development insight to the basics of biosensing technology. Significance of Biosensors	Familiarity
CO-2	Fundamentals principles and Applications of Biosensors	Familiarity
CO-3	Understanding of Biosensing Technology	Analytical skills
CO-4	Various strategies to apply the scientific theory and mechanisms to practical issues	Innovative Skills
CO-5	The students will be exposed to recent publications that highlight key advances in this field and learn how various chemical, biological and engineering concepts are used in synergy to achieve state-of-the-art sensing	Innovative Skills

Course Contents:

Unit	Contents	Lectures required
1	Introduction to Biosensor/sensor, Definitions, History, concepts and Biosensors- Advantages and limitations. Fundamental elements of biosensor devices and design considerations, calibration, dynamic range, signal to noise, sensitivity. Fundamentals of surfaces and interfaces, modifications of sensor surface.	8
2	Aspect of the sensors : Recognition event and element : Catalytic, Single and multiple enzyme, Transducers Method of immobilization and Enzyme Kinetics: adsorption, encapsulation, covalent attachment, diffusion issues. Bio Affinity: Labeled and Label free, whole cell sensing, Generations of Biosensor	10
3	Electrochemistry for biosensors: Red-ox potentials, membrane potential, Electrochemical Biosensors: potentiometric biosensors (ISE's and ISFETs); amperometric biosensors, Conductimetric and Impedimetric Biosensors. Applications	12
4	Optical Biosensor: fundamentals of optics- sources, detectors, and optical circuits; detection of absorbance, reflectance, and fluorescence; Surface plasmon resonance (SPR) based devices. Lab-on-a-chip: TAS and m-TAS devices, Sensors based on Fiber Optic. Applications	7
5	Nanomaterials in Biosensors: Quantum dots, Carbon based Nano Material such as CNT etc., Metal oxide based nano particles, Multifunctional nanomaterials, Core/shell nanoparticle system	5
Total lectures		**42**

Suggested Text Book(s):

1. B. R Eggins, Biosensors an Introduction , 1st ed. John Wiley & Sons Publishers, 1996.
2. L.J. Blum, P. R. Coulet, Biosensors Principles and Applications, 1st ed. Marcel Dekker Inc, 1991.
3. D. G. Buerk, Biosensors Theory and Applications, 1st ed. Technomic Publishing. Co Inc, 1993.
4. J.Y. Yoon, Introduction to Biosensors, 1st ed. Springer-Verlag New York, 2012.
5. M. Zourob, Recognition Receptors in Biosensors, 13th ed. Springer-Verlag New York, 2010.
6. Z. Liron, Novel Approaches in Biosensors and Rapid Diagnostic Assays, 1st ed. Springer US, 2012.

Suggested Reference Book(s):

1. R. F. Taylo,r Handbook of Chemical and Biological Sensors, Ltd ed. IOP Publishing, 1996 .
2. A. Sadana & N. Sadana, Handbook of Biosensors and Biosensor Kinetics, Elsevier, 2011.
3. J. M. Cooper, Biosensors, Oxford University Press, 2003.
4. E. A. Hall, Biosensors, 1st ed., Open University, Milton Keynes, 1990.
5. G.Ramsay, Sensor Physics & Technology - Biosensors, 1st ed. Champan & Hall, 1993.
6. A. Pasquarelli, Biosensors and Biochips, Springer, 2021.

Other useful resource(s):

https://onlinecourses.nptel.ac.in/noc22_ph01/preview
https://onlinecourses.nptel.ac.in/noc22_ee50/preview

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Biosensors)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3		2	2	3	3	2				2	2.5
CO-2	3	1			2	2	2	2				3	2.14
CO-3	1	1	1		1			1				1	1
CO-4	2	2	2	2	1			1				2	1.7
CO-5	3	3	3	3	2				3	3		3	2.9
Average Score	2.4	2.5	2	3.5	1.6	2.5	2.5	1.5	3	3		2.2	2.04

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

(Established by H.P. State Legislature vide Act No. 14 of 2002)

Computational Nanotechnology

Course code: 22B1WPH731

Course credits: 3 (3-0-0)

Core/Elective: Elective (Open)

L-T-P: 3-0-0

Pre-requisite: None

Course Objectives:

I. To introduce students with science and technology involved with materials of nano dimension using computational methods

II. To enable the students in gaining problem solving capability

III. To familiarize students with numerical methods to solve real materials problem at very basic level

IV. To enhance student's ability to think about problems in nanotechnology to take future broader challenges in the area of science

Course Outcome:

S.No.	Course Outcomes	Level of Attachment
CO-1	To learn fundamentals and science aboutmaterialswith nano-dimension	Familiarity
CO-2	Learn writing programs to address physical properties of materials	Assessment and usage
CO-3	Learning computational methods and theories for solving science of materials	Assessment and usage
CO-4	Learning various computational tools to solve real material problems that may open a broader career opportunities	Assessment and usage
CO-5	To develop ideas about problems in real materials	Familiarity

Course Contents:

Unit	Contents	Lecture required
1	**Introduction: Quantum dots**, Bulk, quantum well, quantum wire and quantum dots; properties of nanomaterials in short; example of application of nanomaterials	4
2	**Typical nanomaterials:** Graphene, Carbon nanotubes, nanocomposite, Light emitting diodes	2

3	**Basic quantum mechanical ideas:** Time-independent Schrodinger equation, eigenvalue problems	11
4	**Numerical programming:** Solve eigenvalue problem using numerical methods, Algorithm development and understanding	5
5	**Basic solid-state physics:** Crystal structure, Block wave function, Some numerical exercises	4
6	**Theory of many-electron system:** Introduction to Hartree-Fock theory and Density functional theory,	6
7	**Exercises on numerical software:** Density functional theory (DFT) software; Tools to understand the behavior of nanomaterials, TB-LMTO-ASA/quantum espresso, installation, simulation of crystal structures	7
8	**Density functional theory running:** practically understanding DOS and band structure of any material	8
Total lectures		42

Suggested Text Book(s):

1. J. V. Guttag, Introduction to Computation and Programming Using Python: With Application to Understanding Data, 2nd ed. MIT Press Ltd, 2016.

2. K. N. ANAGNOSTOPOULOS, Computational Physics A: Practical Introduction to Computational Physics and Scientific Computing, National Technical University of Athens, Publisher Lulu.com, 2016.

3. K.K. Chattopadhyay and A.N. Banerjee, Introduction to Nanoscience and Nanotechnology, PHI Learning pvt Ltd., 2009.

4. J. Wang, Computational Modeling and Visualization of Physical Systems with Python, Wiley-VCH, 2016.

5. R.H. Landau, M. J. Páez, C. C. Bordeianu, Computational Physics: Problem Solving with Python, 3rd Edition, Wiley-VCH, 2015.

Suggested Reference Book(s):

1. J. Ramsden, Nanotechnology: An Introduction, Elsevier Publishers, 2011.

2. R.M. Martin, Electronic Structure: Basic Theory and Practical Methods, Cambridge University Press, 2012.

3. J. Izaac, J. Wang, Computational Quantum Mechanics, Springer International Publishing, 2019.

4. A. Scopatz and K. D. Huff, Effective Computation in Physics. Field Guide to Research with Python, O'Reilly, 2015.

5. R.Landau, M. J. Páez, and C. C. Bordeianu, Survey of Computational Physics, Princeton University Press, 2022.

6. W. R. Gibbs, Computation in Modern Physics, 3rd ed. New Mexico State University, USA: World Scientific Publishing Co Pte Ltd, 2006.

Other useful resource(s):

https://www2.fkf.mpg.de/andersen/LMTODOC/LMTODOC.html

https://www.youtube.com/watch?v=pOtnzAXlXvI&list=PLwdnzlV3ogoUY43XoMwVVCWDSImC9mVQB

https://www.youtube.com/watch?v=mLZTDccwtfg&list=PLy0giqEzkJNiUkrNqszvG39J9hHTEWRa5

EvaluationScheme:

S. No.	Exam	Marks	Duration	Coverage / Scope of Examination
1.	T-1	15	1 Hour.	Syllabus covered upto T-1
2.	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (3) -10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Computational Nanotechnology)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	3	2	2	1	1	-	-	-	-	2	2.125
CO-2	2	3	3	3	3	1	1	-	-	-	-	3	2.375
CO-3	3	2	2	2	2	1	1	-	-	-	-	2	1.875
CO-4	3	2	2	2	2	3	3	-	-	-	-	2	1.875
CO-5	2	3	3	3	3	1	1	-	-	-	-	3	2.375
Average	2.6	2.6	2.6	2.4	2.4	1.4	1.4	-	-	-	-	2.4	

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Biomaterials

COURSE CODE: xxB1WPHxxx

COURSE CREDITS: 3

CORE/ELECTIVE: Elective (OPEN)

L-T-P: 3-0-0

Pre-requisite: None

Course Objectives:

I. To apply basic physics know how to state of the art bio-based issues.
II. Experimental data analysis.
III. Apply the knowledge of Physics to design experimental bio-based components.
IV. Concept of alloying composites, compatibility, biodegradability, etc.
V. To study innovative materials for artificial tissue materials /organs.
VI. Concept of nano materials in biotechnology

COURSE CONTENTS

We have designed our courses keeping in mind the expectations of aspiring students for the studies. The present curriculum is quite compatible to the national level syllabi followed in UGC & AICTE recognized Universities/institutions. Written below are the individual contents of the courses and special highlights has been done on the percentage compatibility with other institutions

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To study the characteristics and classification of Biomaterials	Familiarity
CO-2	To explore different metals and ceramics used as biomaterials	Familiarity
CO-3	To study different polymeric materials and composites that could be used as implants and transplants	Analytical & Computational skills
CO-4	Artificial organ developed using these materials	Innovative Skills
CO-5	Use of nanotechnology for biomaterials	Technical skills

Course Contents:

Unit	Contents	Lectures required
1	Structure of Bio-Materials and Bio-Compatibility: Definition and classification of bio-materials, mechanical properties, visco-elasticity, surface properties, Chemical, Thermal, Electrical and Optical properties, body response to implants, blood compatibility.	10
2	Implant Materials (Metals and Ceramics): Metallic implant materials, stainless steels, co-based alloys, Ti-based alloys, ceramic implant materials, aluminum oxides, hydroxyl-apatite glass ceramics carbons, medical applications.	8
3	Implant Materials (Polymeric and Composite): Polymerization, polyolefin, polyamides, Acrylic, polymers, rubbers, high strength thermoplastics, medical applications.	8
4	Tissue Replacement Implants: Soft-tissue replacements, sutures, surgical tapes, adhesive, percutaneous and skin implants, maxillofacial augmentation, blood interfacing implants, hard tissue replacement implants, internal fracture fixation devices, joint replacements.	8
5	Artificial Organs: Artificial Heart, Prosthetic Cardiac Valves, Limb prosthesis, Externally Powered limb Prosthesis, Dental Implants	8
Total lectures		**42**

Suggested Text Book(s):

1. J.B. Part, Biomaterials Science and Engineering, Plenum Press, 1984.

2. J.Y. Wong and V. D. Bronzino (Eds), Biomaterials, CRC Press: Taylor and Francis, 2006.

3. R. Pignatello (Editor), Biomaterials Science and Engineering, InTech Publishing, 2011.

4. L. E. Aguilar, Biomaterial Science: Anatomy and Physiology Aspects, Walter de Gruyter GmbH & Co KG, 2022.

Suggested Reference Book(s):

1. B.B. Ratner, A.S. Hoffman, F. J. Schoen, J. E. Lemnos, Biomaterials Science: An Introduction to Materials in Medicine, Elsevier Academic Press, 2004.

2. R. Lakes, and J. D. Bronzino, The Biomedical Engineering Handbook, 2nd ed.. Boca Raton: CRC Press LLC, 2000.

3. J.Park and R. S. Lakes, Biomaterials: An introduction, Springer, 2007.

Other useful resource(s):

https://nptel.ac.in/courses/102106057
https://nptel.ac.in/courses/113104009

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Biomaterials)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3		2	2	3	3	2				2	2.5
CO-2	3	1			2	2	2	2				3	2.14
CO-3	1	1	1		1			1				1	1
CO-4	2	2	2	2	1			1				2	1.7
CO-5	3	3	3	3	2				3	3		3	2.9
Average Score	2.4	2.5	2	3.5	1.6	2.5	2.5	1.5	3	3		2.2	2.04

UNIVERSAL HUMAN VALUES II-Understanding Harmony

COURSE CODE: 23B11HS211

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 2-1-0

Pre-requisite: None

Course Objectives:

1. Development of a holistic perspective based on self-exploration about themselves (human being), Family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/ existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Self Awareness, Social awareness (family, society, nature).Sustainability in relationships and Critical thinking	Familiarity
CO-2	. Introspection and self reflection	Assessment
CO-3	Sensitive to commitment towards human values, human relationship and human society	Usage
CO-4	Developing commitment and courage	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education** 1. Purpose and motivation for the course, recapitulation from Universal Human Values-I 2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.	6
2	**Understanding Harmony in the Human Being - Harmony in Myself!** 7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body' 8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility 9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) 10. Understanding the characteristics and activities of 'I' and harmony in 'I' 11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail 12. Programs to ensure Sanyam and Health.	6
3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** 13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship 14. Understanding the meaning of Trust; Difference between intention and competence 15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship 16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals	5

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	17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.	
4	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence** 18. Understanding the harmony in the Nature 19. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self regulation in nature 20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space 21. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.	5
5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics** 22. Natural acceptance of human values 23. Definitiveness of Ethical Human Conduct 24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. 26. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations	6
	Total lectures	**28**

Suggested Text Book(s):

1. Text Book 1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999. 2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004

Suggested Reference Book(s):
1. The Story of Stuff (Book).
3. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
4. Small is Beautiful - E. F Schumacher.
5. Slow is Beautiful - Cecile Andrews
6. Economy of Permanence - J C Kumarappa

7. Bharat Mein Angreji Raj - PanditSunderlal
8. Rediscovering India - by Dharampal
9. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
10. India Wins Freedom - Maulana Abdul Kalam Azad
11. Vivekananda - Romain Rolland (English)
12. Gandhi - Romain Rolland (English)

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	Average
CO-1	3	3	3	3	3	3	3	3	**3**
CO-2	3	3	3	3	3	3	3	3	**3**
CO-3	3	3	3	3	3	3	3	3	**3**
CO-4	3	3	3	3	3	3	3	3	**3**
Average	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	3

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