Appendix-A
Noti.No. NU-37
Acad.Cou.mtg.-15.07.22

TEACHING AND EXAMINATION SCHEME

B. TECH. SEMESTER – I (Division A to H / Computer Science & Engg., EC Engg. and EI Engg.)

(to be made effective for student admitted from 2022-23 onwards)

Sr. No.	Course Code	Course Name	Teaching Scheme				Examination Scheme			
							Duration Hours	Component Weightage		
			L	T	P	C	SEE	CE	LPW	SEE
1	xxxxx	Mathematics I	2	1	-	3	3	0.6	-	0.4
2	xxxxx	Physics	2	-	2	3	3	0.3	0.3	0.4
3	xxxxx	Environmental Science	2	1	-	3	3	0.6	-	0.4
4	xxxxx	Computer Programming	2	-	2	3	3	0.3	0.3	0.4
5	xxxxx	Electrical Science	2	-	2	3	3	0.3	0.3	0.4
6	xxxxx	General English	2	-	2	3	3	0.3	0.3	0.4
7	xxxxx	Health, Wellness and Yoga	2	-	2	3	-	0.6	0.4	-
		Total	14	2	10	21				

B. TECH. SEMESTER – II (Division A to H / Computer Science & Engg., EC Engg. and EI Engg.)

Sr. No.	Course Code	Course Name	Teaching Scheme				Examination Scheme			
							Duration Hours	Component Weightage		
			L	T	P	C	SEE	CE	LPW	SEE
1	xxxxx	Mathematics II	2	1	-	3	3	0.6	-	0.4
2	xxxxx	Chemistry	2	-	2	3	3	0.3	0.3	0.4
3	xxxxx	Engineering Drawing & Workshop	1	-	4	3	-	0.6	0.4	-
4	xxxxx	Written Communication	2	1	-	3	3	0.6	-	0.4
5	xxxxx	Introduction to AI&ML	2	-	2	3	3	0.3	0.3	0.4
6	xxxxx	Statistics	2	-	2	3	3	0.3	0.3	0.4
		Total	11	2	10	18				

B. TECH. SEMESTER – I (Division I to P - Chemical, Civil, Electrical & Mechanical) and Integrated B.Tech. (CSE)-MBA

(to be made effective for student admitted in 2022-23)

Sr. No.	Course Code	Course Name	Teaching Scheme				Examination Scheme			
							Duration Hours	Component Weightage		
			L	T	P	C	SEE	CE	LPW	SEE
1	xxxxx	Mathematics I	2	1	-	3	3	0.6	-	0.4
2	xxxxx	Chemistry	2	-	2	3	3	0.3	0.3	0.4
3	xxxxx	Engineering Drawing & Workshop	1	-	4	3	-	0.6	0.4	-
4	xxxxx	Written Communication	2	1	-	3	3	0.6	0.3	-
5	xxxxx	Computer Programming	2	-	2	3	3	0.3	0.3	0.4
6	xxxxx	Statistics	2	-	2	3	3	0.3	0.3	0.4
		Total	11	2	10	18				

B. TECH. SEMESTER – II (Division I to P - Chemical, Civil, Electrical & Mechanical) and Integrated B.Tech. (CSE)-MBA

Sr. No.	Course Code	Course Name	Teaching Scheme				Examination Scheme			
							Duration Hours	Component Weightage		
			L	T	P	C	SEE	CE	LPW	SEE
1	xxxxx	Mathematics II	2	1	-	3	3	0.6	-	0.4
2	xxxxx	Physics	2	-	2	3	3	0.3	0.3	0.4
3	xxxxx	Environmental Science	2	1	-	3	3	0.6	-	0.4
4	xxxxx	Introduction to AI&ML	2	-	2	3	3	0.3	0.3	0.4
5	xxxxx	Electrical Science	2	-	2	3	3	0.3	0.3	0.4
6	xxxxx	General English	2	-	2	3	3	0.3	0.3	0.4
7	xxxxx	Health, Wellness and Yoga	2	-	2	3	-	0.6	0.4	-
		Total	14	2	10	21				

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech. (All Programme)
Course Code:	
Course Title:	Mathematics I
Course Type:	Introductory
Year of introduction:	2022-2023

L	T	Practical component				C
		LPW	PW	W	S	
2	1	-	-	-	-	3

Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. comprehend the concept of vector space (BL2)
2. extend the knowledge of matrix theory and its applications in engineering (BL2)
3. solve real world problems using linear transformations (BL3)
4. apply the knowledge of eigen value & eigen vector for advance matrix calculations (BL3)

Syllabus: **Total Teaching hours:30**

Unit	Syllabus	Teaching hours
Unit I	**Vector Space:** Vector space & Subspace, Linear Combination, Span Set, Linearly independent and Linearly dependent Set, Basis and Dimension of the vector space, Extension & Reduction of a set to the Basis,Coordinate of Basis and Change of basis.	08
Unit II	**Matrices and Linear Equations:** Row Echelon Form and Rank of matrix, Solution of system of algebraic simultaneous equations using Gauss Elimination Method, Reduced Row Echelon Form and Inverse of matrix by Gauss-Jordan method.	07
Unit III	**Linear Transformation:** Definition of linear transformation, Standard linear transformations, Matrix of Linear transformations, Range and Kernel of Linear Transformation, Dimension Theorem, Inverse Linear Transformation, Similarity Transformation.	07
Unit IV	**Eigne values and Eigen Vectors**: Eigen values and Eigen vectors, Basis of Eigen Space, Algebraic and Geometric multiplicity, Caley-Hamilton Theorem, Diagonalization, Symmetric matrices and Orthogonal Diagonalization, Quadratic Forms and Canonical Forms	08

Tutorial Works:
This shall consist of 10 tutorials based on the syllabus.

Self-Study:
Self-study contents will be declared at the commencement of the semester. Around 10 % of the questions will be asked from the self-study contents.

Suggested Readings/ References:

1. H Anton, Elementary linear algebra with applications; John Wiley Publication
2. D C Lay, Linear Algebra and its Application; Pearson Publication
3. B Kolman and D Hill, Elementary linear algebra with applications; Pearson Publication
4. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra: Pearson Publication
5. Seymour Lipschutz, Marc Lipson, Schaum's Outline of Linear Algebra: Mc Graw Hill Publication
6. J P Sharma and M Yeolekar, Engineering mathematics Vol-II; PHI Publication

NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B Tech (All Programmes)**
Course Code:	
Course Title:	**Environmental Science**
Course Type:	Common
Year of introduction:	2022-23

L	T	Practical component				C
		LP W	P W	W	S	
2	1	-	-	-	-	3

Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. demonstrate principles of conservation of environment and energy resources (BL2)
2. summarize environmental pollutions and control techniques (BL2)
3. illustrate concepts of sustainability and environmental impact assessment (BL2)
4. identify possible solutions regarding social issues related to the environment. (BL3)

Syllabus: **Total Teaching hours:30**

Unit	Syllabus	Teaching hours
Unit-I	Multidisciplinary Nature of Environment: Introduction to environment and multidisciplinary nature of environment, energy and environment, Energy resources- Present energy resources in India, energy demand scenario in India, growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Environment conservation and management, Bio-diversity and its conservation, Atmospheric chemistry and ozone depletion, Greenhouse effect and its causes, Climate change: causes, effects, challenges, and remedial measures.	07
Unit-II	Environmental Pollution: Introduction of environmental pollution, various pollution parameters, Environment Performance indices. Types of environmental pollution and pollutants. Causes, effects and control measures of – Air pollution, Water pollution, Waste management: Solid, Plastic, E-waste, Construction & Demolition, 5 R's concept of waste management (refuse, reduce, reuse, repurpose, and recycle), Soil/land pollution, Noise pollution, Radioactive pollution and Thermal pollution. Role of an individual in prevention of pollution.	12
Unit-III	Sustainability and Environmental Impact Assessment: Concept of Sustainability and importance of sustainable development, introduction to sustainable development goals, case studies of sustainable designs/products/material/projects. Overview of environmental management systems. Introduction to green technologies, environmental impact assessment, carbon credit and carbon footprint.	05

Unit-IV	Social Issues and the Environment: Environment ethics, issues and possible solutions. Urban problems related to energy, water conservation, rain water harvesting, domestic Bio-composting, rehabilitation problems and concerns, Introduction of national and international environmental legislations and treaties.	06

Self-Study: The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings/ References:

- Dara, S. S., & Mishra, D. D. A textbook of Environmental Chemistry and Pollution Control, S. Chand & Company Ltd.
- Dhameja, S. Environmental Studies. S. Kataria and Sons.
- Ristinen, R., & Kraushaar, J. Energy and the Environment, Wiley.
- Masters, G. Introduction to Environmental Engineering and Science, Prentice-Hall Publications.
- Basak, A. Environmental Studies, Pearson Publications.
- Bharucha, E., Textbook of Environmental Studies, Universities Press

Suggested List of Experiments: -

Suggested Case List: -

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B.Tech.(All Programmes), Integrated B.Tech. (CSE)-MBA
Course Code:	XXXX
Course Title:	Computer Programming
Course Type:	Common
Year of Introduction:	2022-23

L	T	Practical Component				C
		LPW	PW	W	S	
2	-	2	-	-	-	3

Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to –

1. demonstrate the significance and application of C language constructs in program development (BL2)
2. apply the programming skill to solve real-life problems through software or hardware/software co-design (BL3)
3. build task-specific, user-oriented, time-constrained program (BL3)
4. analyze logically the problem and select the optimized method to solve the problem (BL4)

Syllabus: **Total Teaching hours: 30**

Unit	Syllabus	Teaching hours
Unit-I	**Introduction to Computers:** Introduction to Computers and the Internet in Industry and Research, Web Resources, Hardware and Software, Computer Organization, Programming Languages, Introduction to the C Programming Language, Typical C Program Development Environment and steps.	03
Unit-II	**Introduction to Programming:** Understanding logic using Flowchart, Algorithms, Pseudocode, Test-cases Programming with C: keywords, syntax and library functions, data types, operators and expressions, declarative, imperative and decision statements, control structures.	05
Unit-III	**Functions:** Math Library Functions, User-defined functions, Function Call Stack and Stack frames, Passing Arguments by Value and By Reference, Scope Rules, Recursion, Recursion vs. Iteration. Arrays: Defining Arrays, Sorting Arrays, Searching Arrays, Multidimensional Arrays, Variable-Length Arrays, Passing Arrays to Functions.	07
Unit-IV	**Pointers:** Pointer Variable Definitions and Initialization, Pointer Operators, Passing Arguments to Functions by Reference, Pointer Expressions and Pointer Arithmetic, Relationship between Pointers and Arrays, Arrays of Pointers, Pointers to Functions. Introduction to dynamic memory allocation. Characters and Strings: Fundamentals of Strings and Characters, Character-Handling Library Functions, String-Conversion Functions, Standard Input/Output Library Functions for string, String-Manipulation Functions of the String-Handling Library, Comparison Functions of the String-Handling Library.	07

Unit-V	**Structures:** Structure Definitions, Defining Variables of Structure Types, Operations That Can Be Performed on Structures, Initializing Structures, Accessing Structure Members, Using Structures with Functions **File Processing:** Files and Streams, creating a File, Reading and writing Data from a File.	08

Self-Study: The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents

Suggested Readings/ References:

1. Deitel and Deitel, 'C How to program', Pearson
2. E Balagurusamy, 'Programming in ANSI C', McGraw Hill
3. Yashwant Kanitkar, 'Let Us C', BPB Publications
4. V Rajaraman, 'Fundamentals of Computers', Prentice Hall of India
5. Joyce Farrell, 'Programming Logic and Design Comprehensive', Cenage Learning
6. David Gries, 'The Science of Programming', Springer, New York, Hedelberg, Berlin
7. Dromey R.G., 'How to solve it by computers', Prentice Hall of India
8. Jean-Paul Tremblay, Richard B. Bunt, 'Introduction to Computer Science', McGraw-Hill
9. Kernighan., Ritchie, 'ANSI C Language', Prentice Hall of India
10. Sedgewick R., 'Algorithms in C', Addison Wesley
11. Schaum Ourline Series, 'Programming in C', McGraw-Hill
12. E Balagurusamy, 'Pointers in C', McGraw-Hill

Suggested List of Experiments:

Sr. No.	Title	Hours
1	**Introduction to CodeBlocks IDE, Writing and compiling a simple C program** a. Introduction to CodeBlocks IDE. Use CodeBlocks to write and compile a simple C program ("Hello World"). b. Write C programs: i. To scan and print values of different types of variables ii. To print address of a variable iii. To demonstrate different escape sequences	02
2-3	**C programs to demonstrate various operators** Write C programs for the following: a. To scan two numbers and display result of different arithmetic operations (+, -, *, / and %) b. A company has following scheme for payment to their staff. • Net salary = Gross salary – Deduction • Gross salary = Basic + DA + HRA + Medical • Deduction = Insurance + PF • DA (Dearness allowance) = 50% of Basic	04

- HRA (House rent allowance) = 10% of Basic
- Medical = 4% of Basic
- PF (Provident Fund) = 5% of Gross
- Insurance = 7% of Gross

Calculate the net payment to any employee.

c. The driver is driving a car from city Ahmedabad to city Mumbai, in Ahmedabad temperature displays in Celsius while in Mumbai the temperature displayed in Fahrenheit, a driver wants to find the difference between the temperatures of two cities in Celsius.

d. To calculate simple interest.

e. A boy was punished and asked to cover 5 rounds of the circular ground. Area of the ground is 32000 sq mtr. Calculate how many kilometres the boy has covered.

f. Read the price of item in decimal form. For example, 12.52 and separate rupee and paise from the given value. For example, 12 rupees and 52 paise.

g. To swap the value of two numbers (i) using and (ii) without using a temporary variable.

h. To find greatest of two and three numbers using the ternary operator.

4-5 **C programs to demonstrate use of conditional statements** 04

Write C programs for the following:

a. Write a program to take the values for A, B, C of a quadratic equation $A*X2+B*X+C=0$ and then find all the roots of the equation. It is guaranteed that $A \neq 0$ and that the equation has at least one real root.

b. Write a C program to make a simple calculator using the following:
   i. if…else if
   ii. switch-case

c. In an organization, employees are paid on hourly basis. Clerks are paid 100/hr, Teachers are paid 200/hr and Principal is paid 400/hr. If the weekly hours exceed 44, then employee should be paid 2 times their regular pay for the overtime. Write a C program to compute the weekly salary of the employee and also the program should take care that the employee should not be paid for hours beyond 50 in a week. Use best suitable control construct to implement the program.

d. Ajay and Amit are playing a game with a number X. In one turn, they can multiply X by 2. The goal of the game is to make X divisible by 10. Write a C program to find the number of turns necessary to win the game (it may be possible to win in zero turn, 1 turn or it might be impossible (-1 turns)).

e. Write a program to implement a simple number guessing game. Program should generate an integer randomly and ask the user to guess the integer. Based on the number guessed, it should display the appropriate message (correct or incorrect).

f. Write a C program to find the grade of a student based on the following policy.
Class test: 12% weightage, Tutorial-12%, SE:16%, LPW:20%, SEE:40%.
Grade is decided based on the below range of total marks.

Grade	Range of total marks
A+	91-100
A	81-90
B+	71-80
B	61-70
C+	51-60
C	>40
Fail	<40

6-7 **C programs to demonstrate use of loop constructs** 02

Write C Programs:

a. To display following patterns:

A A B A B C A B C D	1 0 1 1 0 1 0 1 0 1	1 1 2 1 1 2 3 2 1 1 2 3 4 3 2 1
1 A B 2 3 4 C D E F	* * * * * * * * * * * * * * *	1 1 2 1 2 3 1 2 3 4

b. To check whether the input number is an Armstrong number

c. To check whether the entered number is Prime

d. To check whether the entered number is Palindrome

e. Enhance the number guessing game developed earlier. The program should now display more appropriate message (Greater, Smaller or Correct). It should allow maximum 5 attempts from the user and still if the user cannot guess the number correctly, it should display "Sorry".

8-9	**C programs based on arrays** a. Write a program i. To read data from keyboard and store into 1-D array ii. To read data from array and copy its square back to another array iii. To reverse all elements of original array iv. To find out maximum element of an original array and print its location b. Write a program to delete an element from 1-D array. c. Write a program that fills a 5 x 5 matrix with the following data: i. Upper left triangle with -1 ii. Lower right triangle with 1 iii. Right to left diagonal with 0 Display the matrix on the screen. d. Suppose that a class has 5 students. Each student study four subjects; CP, CS, Math, and Physics. Make a 2D array for the same. Write a C program i. To find total marks in all subjects obtained by each student. ii. To find average marks obtained by all 5 students in C programming subject.	04
10	**C programs to explore String manipulation** Write C programs: a. Write a program to delete a character entered by the user from the input string. All occurrences of the input character should be deleted from the string. b. Write a program to swap even positioned characters with odd positioned characters in a given string. c. Read a name from keyboard and find out how many times same character (case insensitive) is repeating. Example: Input: Anand Output: a is repeating two times, n is repeating two times Input: Kunal Output: None of the character are repeating. d. Write a program to sort the strings entered by user as per dictionary order.	02
11-12	**C programs to understand user defined function and parameter passing** a. Find union and intersection of two input integer arrays using user defined function. The function should return the resultant array to the main function.	04

b. Consider a currency system in which there are notes of seven denominations, namely Rs. 1, Rs. 2, Rs. 5, Rs. 10, Rs. 20, Rs. 50 and Rs. 100. A sum of Rs. N is entered as an input. Write a function to compute the smallest number of notes that will combine to give Rs. N.

c. Write a program to compute F(n) such that F(n) = 0, if n = 0, F(n) = 1, if n = 1, otherwise F(n) = F(n - 1) + F(n - 2).

d. Aman has 10 balls that have different numbers on it and Shoaib has 6 balls. They both arrange balls in all different possible ways. What is the ratio of number of arrangements made by Aman to that made by Shoaib? Use recursive function to calculate.

e. Perform Q 7c using user defined function iteratively.

02

Understanding C programs based on structures using virtual lab

(https://cse02-iiith.vlabs.ac.in/List%20of%20experiments.html)

a. Create a structure which holds various attributes (e.g., name, id, basic_salary, DA%, HRA%, total_salary etc.) of an employee. Write a program which allows you to scan these (except total_salary) attributes for 3 employees. The program should support following operations:
   i. Display (total salary of the selected employee)
   ii. Max (find and display name of the employee with maximum salary)

b. Write a structure to accept item information such as name, quantity and unit price. Structure should take information about 5 items. Create a user defined function that calculates the cost of each item. Print details of each item such as:

Name	Quantity	Price	Cost
Notebook	5	50.0	250.0
Pen Drive	2	500.0	1000.0
Pen	20	5.0	100.0

c. Write a structure for a complex number which has a real part and an imaginary part. Add the 2 complex numbers, store it in another complex number using user defined function and display the result as a complex number.

	13-14	**C programs to demonstrate use of pointers** a. Write a UDF using concept of pointers which can accept a one-dimensional array as an argument. The function should add 1 to all odd element of the array and 2 to all even elements of the array. The final array should be displayed by the main () function. Repeat this program for two-dimensional array. b. Write a function that swaps values of three numbers in a cyclic order and prints the output from main function. Example: a = 1, b = 2, c = 3 → Output: a = 3, b = 1, c = 2 c. Write a program to print array elements in reverse using pointer. d. Write a UDF which accepts three strings as arguments. The function should concatenate first two strings and keep the result in the third string which should be displayed by the main () function.	04
	15	**C Programs for file processing** Write C Programs: a. To calculate the length of a file b. To concatenate two files c. To copy content of one file in to another file	02
Suggested Case List:	-NA-		

NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B. Tech. (All Programmes)**
Semester:	**I / II**
Course Code:	**2EE1XX**
Course Title:	**Electrical Science**
Course Type:	**Vocational**
Year of Introduction:	**2022 – 23**

L	T	Practical component				C
		LPW	PW	W	S	
2	0	2	-	-	-	3

Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. illustrate the role of circuit elements in different system conditions. **(BL2)**
2. distinguish the operational aspects of AC-DC systems. **(BL4)**
3. appraise the role of semiconductor devices and their applications. **(BL4)**
4. apply the concepts of digital electronics for logic circuit design. **(BL3)**
5. explain use of electrical safety devices in basic applications. **(BL2)**

Syllabus: **Teaching Hours: 30**

Unit-0 **Course Description** **02**

Overview of the course, discussion on course policy, course website and blog, importance of the course, evaluation, professional relevance, present scenario and future trends, relevance to UN SDG.

Unit-1 **Review of DC Circuits** **05**

Kirchhoff's laws, mesh and nodal analysis, star-delta transformation, Superposition theorem, Thevenin's and Norton's theorem, electrostatics, absolute and relative permittivity, electric field, capacitor types, *charging and discharging of capacitor.*

Unit-2 **Single-phase AC Circuits** **05**

Generation of alternating emf and associated terms, phasor representation, *Analysis of RL and RC series and parallel circuits*, power triangle, power factor, *resonance in RLC series and parallel circuit*, related numerical.

Unit-3 **Magnetic Circuits** **03**

Introduction to magnetic circuits, terms and definitions, comparison between electric and magnetic circuit, magnetic circuit analysis, dot convention, series-parallel connection of inductors, rise and decay of current in inductive circuit.

Unit-4 **Polyphase AC Circuits** **05**

Generation of three-phase emf, *star connection, delta connection, relationship between line and phase quantities,* solution to three phase balanced circuits, *power measurement in three-phase circuits,* variation in wattmeter reading with power factor, related numerical.

Unit-5 **Analog Electronics** **05**

Half and full wave rectifiers, special purpose diodes, clipper & clamper circuits, regulator, BJT and its applications as amplifier, oscillator, timer IC and multivibrators.

Unit-6 **Digital Electronics** **05**

Number systems and its arithmetic, binary codes, Boolean-algebra & simplification of Boolean expression; logic gates, concept of universal logic; implementation of Boolean expressions using logic gates, application of digital circuits (e.g. *adder*, subtractor, multiplexer, de-multiplexer, analog to digital converter, digital to analog converter).

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

This shall consist of at least 10 practical / simulations based on the above syllabus.

Suggested Reading:

1. Hughes, E., Smith, I. M., Hiley, J. and Brown, K., Electrical and Electronic Technology, Prentice Hall (India).
2. Vincent Del Toro, Textbook of Principles of Electrical Engg., Prentice Hall of India Pvt. Ltd., New Delhi.
3. William Hart Hayt, George W. Hughes, Introduction to Electrical Engineering, Mc-Graw-Hill
4. U. A. Patel, Elements of Electrical and Electronics Engineering, Atul Prakashan.
5. A. E. Fitzgerald, Arvin Grabel, David E. Higginbotham, Textbook of Basic Electrical Engineering, TMH Publishing Co.
6. Rohit Mehta, V. K. Mehta, Principles of Electronics, S. Chand Publications.
7. J. Nagrath, Basic Electrical Engineering, TMH Publishing Co. Ltd.

Suggested List of Experiments (not restricted to the following):
(Only for Information)

1. To verify Kirchhoff's current and Kirchhoff's voltage law.
2. To demonstrate charging and discharging phenomenon of a capacitor and determine time constant.
3. To analyse single phase RL and RC series circuit.
4. To demonstrate and analyse the resonance curve of R-L-C series AC circuit.
5. To verify the relationships between line and phase quantities in three phase star and delta connection.
6. To measure power in three phase circuit by two wattmeter method.
7. To implement rectifier circuits using PN junction diode.
8. To design and realize bipolar junction transistor as an amplifier in common emitter configuration.
9. To design and realize binary to gray code converter.
10. To synthesize the arithmetic expressions using adders.
11. To demonstrate domestic wiring systems
12. To explain electrical protective equipment functioning and demonstrate operation.
13. To plot the I-V characteristic and the P-V curve of solar cell and find the maximum power point, efficiency of a given solar cell.
14. Virtual lab experiments – VI characteristic of diodes, Virtual lab experiment – Half and full wave rectifier, Transistor based amplifier circuits (http://vlabs.iitkgp.ac.in/be/#)

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2022 - 23 and onwards

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech. (All Programme)
Course Code:	
Course Title:	General English
Course Type:	Common
Year of introduction:	2022-2023

L	T	Practical component				C
		LPW	PW	W	S	
2	-	2	-	-	-	3

Course Learning Outcomes (CLOs):
At the end of the course, the students will be able to -

1. develop and built upon their abilities in listening, speaking and reading skills. BL3
2. inculcate the habit of reading and listening, thereby, absorbing profound ideas, learning appropriate expressions and enhancing vocabulary. BL3
3. demonstrate effective speaking skills by preparing, organising and presenting their ideas during critical conversation BL3
4. examine ethical, moral, social and cultural values through the study of literature. BL4

Syllabus: **Total Teaching hours:30**

Unit	Syllabus	Teaching hours
Unit I	Introduction to English, characteristics of language, formation of words, root words, antonyms-synonyms, One word, Idioms, homophones, pronunciation.	03
Unit II	Different types of listening, identifying details, listening for gist, following signpost, Inference, listening to stress, rhythm and intonation.	06
Unit III	IPA pronunciation, syllable division, basic speaking skills, fluency, accuracy, using functions, appropriacy, turn taking, interruptions, responding and initiating, vocabulary, discourse markers.	02
Unit IV	Subskills of writing, different kinds of paragraphs, topic sentence, coherence, cohesion, steps of writing.	04

Unit V	Types of reading, reasons for poor reading, inference, reading comprehension, critical reading, predication, top-down reading.	**06**
Unit VI	Vocabulary, punctuation, verbs, verb forms, phrasal verbs, tense, adjective, articles, subject-verb concord, idioms.	**09**

Self-Study:
Self-study contents will be declared at the commencement of the semester. Around 10 % of the questions will be asked from the self-study contents.

Suggested Readings/ References:

1. The Monkey's Paw, W. W. Jacobs, Perfection Learning, 1979.
2. How to survive the 21st century, Yuval Harari, 2020.
3. The necklace, Guy de Maupassant, The Dramatic Publishing Company Books,1965.
4. A Communicative Grammar of English, Geoffrey Leech and Prof Jan Svartvik, Pearson Publication, 2013.
5. Grammar in Use Intermediate with Answers, Raymond Murphy, Cambridge University Press, 2019.
6. Wren & Martin High School English Grammar and Composition, revised by N.D.V Prasad Rao, S Chand Publishing, 2017.
7. Word Power Made Easy, Norman Lewis, Goyal Publishers, 2020.
8. English for Engineers and Technologists (Combined Edition, Vol. 1 and 2), Orient Blackswan, 2006.
9. The King's Speech (Movie), 2010.
10. Life of Pie (Movie), 2012.

L = Lecture, T = Tutorial, P = Practical, C = Credit

Suggested Laboratory Component:

Sr. No.	Topic	Hours
1.	Introduction to lab component	2
2.	Listening subskills- exercises	4
3.	Pronunciation, Presentations	6
4.	Speaking subskills-activities	6
6.	Reading subskills- activities	4
7.	Group Discussion	6
8.	Grammar virtual lab	2

NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B. Tech. (All Programmes)**
Semester:	**I / II**
Course Code:	**XXXXX**
Course Title:	**Health, Wellness & Yoga**
Course Type:	**Common**
Year of Introduction:	**2022 – 23**

Credit Scheme

L	T	Practical component				C
		LPW	PW	W	S	
2	0	2	-	-	-	3

Course Learning Outcomes (CLOs):

At the end of the course, students will be able to –

1. explain the concept of health and nutrition and describe the significance of macronutrients and micronutrients (BL2)
2. list risk factors, causes, signs, symptoms, and diagnosis of selected disorders (BL4)
3. discuss the prevention and general management of lifestyle disorders & elaborate on substance abuse, their prevention, and management (BL5)
4. relate to the importance of Yoga in health and well-being and perform different Asanas properly (BL3)
5. practice pranayama and meditation in their life (BL3)

Syllabus: **Teaching Hours: 30 (lectures) +30 (Lab)**

UNIT I **Introduction to health and nutrition** **11 hours**

Basic concepts of Health, nutrition, and nutritional status indicators, Macronutrients: Carbohydrates (including dietary fibers), fats and proteins, Micronutrients: Vitamins, minerals, anti-oxidants, gut flora, Significance of macronutrients and micronutrients for optimal health, Functional foods: Definition of functional foods, Role of functional ingredients and food in nutrition, Health attributes of functional foods

UNIT II **Fundamentals, prevention, and management of certain lifestyle diseases:** **11 hours**

Hypertension and Heart attack, Diabetes and Obesity, Anxiety and Depression, Constipation, Diarrhea and Acidity

UNIT III **Addiction and drug abuse:** **8 hours**

Nature of drug abuse and addiction, diagnostic criteria and factors associated with the development of addiction, General prevention and treatment approaches for addiction and abuse, Alcohol, smoking, cannabis, marijuana, opiates addiction and abuse, Mental health and psychological support for drug abuse and addiction

UNIT IV **Health and Wellness through Yoga** **04 hours**

Introduction to Yoga - Nature of Yoga science, Definition of yoga, Characteristics of a Yogi, Importance of balanced diet

UNIT V **Asanas** **18 hours**

Benefits and limitations of the Asanas, Performance of Asanas: Sarvangasan, Uttanapadasan, Halasan, Naukasan, Vajrasan, Shashakasan, Mandukasan, Paschimotasan, Gomukhasan, Janusirasan, Ardhkatichkrasan, Tadasan, Vrikshasan, Trikonasan, Bhujangasan, Shalbhasan

UNIT VI **Pranayama and meditation** **08 hours**

Different types of Pranayama, meditations, and Bandhas, the advantages and the limitations of all these practices.

Laboratory Work:
This shall consist of at least 10 practicals based on the above syllabus.

Suggested Reading:

1. *Yogi Svatmarama,* The Hatha Yoga Pradipika, Motilal Banarsidass publishers.
2. *Swami Ramdev,* Yog Its Philosophy and Practice, Divya Prakashan.
3. *Swami Ramdev,* Pranayama Rahasya, Divya Prakashan
4. Michelle McGuire and Kathy Beerman. Nutritional Sciences: From fundamental to food. Cassio.
5. Pressman, Alan H., Sheila Buff, and Gary Null. The Complete Idiot's Guide to Vitamins and Minerals. New York: Alpha Books.
6. Carolyn D. Berdanier, Lynnette A. Berdanier, Janos Zempleni. Advanced Nutrition: Macronutrients, Micronutrients, and Metabolism. Publisher: CRC Press.
7. Functional Foods and Nutraceuticals By Aluko, Rotimi E. Publisher: Springer
8. Egger, G., Binns, A., Rossner, S., & Sagner, M. *Lifestyle medicine: Lifestyle, the environment and preventive medicine in health and disease*. Academic Press, USA.
9. Kumar, M. K. R. *Guide to Prevention of Lifestyle Diseases*. Deep and Deep Publications, India
10. DiPiro, J. T., Talbert, R. L., Yee, G. C., Matzke, G. R., Wells, B. G., & Posey, L. M. *Pharmacotherapy: A Pathophysiologic Approach*. McGraw-Hill Medical, USA.
11. Walker, R. *Clinical pharmacy and therapeutics.* Elsevier Health Sciences, Netherland.

Suggested List of Exercises (not restricted to the following):
(Only for Information)

1. To introduce the Yoga system and its impact on the human body and mind
2. To prepare the body for the performance of the Asanas through sukshma vyayam and loosening exercises
3. To introduce and perform the standing position Asanas.
4. To explain and perform the sitting position Asanas.
5. To explain and perform the supine position Asanas.
6. To describe and perform the prone position Asanas.
7. To learn and perform relaxation practices.
8. To explain and practice the pranayama.
9. To introduce and practice Bandhas.
10. To explain and practice the Jyoti Tratak and Meditation.

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. the academic year 2022 - 23 and onwards

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech. (All Programme)
Course Code:	
Course Title:	Mathematics II
Course Type:	Introductory
Year of introduction:	2022-2023

L	T	Practical				C
		LPW	PW	W	S	
2	1	-	-	-	-	3

Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. distinguish between different kind of infinite series (BL2)
2. use multivariable differential calculus to solve real world problems (BL3)
3. identify special functions and its applications (BL1)
4. apply multivariable integral calculus to solve engineering problems (BL3)

Syllabus:

Total Teaching hours: 30

Unit	Syllabus	Teaching hours
Unit I	**Infinite Series:** Convergence of series, tests for convergence, power series, Maclaurin's and Taylor's series, Series for exponential, trigonometric and logarithmic functions.	07
Unit II	**Multivariable Differential Calculus:** Limit, continuity and partial derivatives, total derivative and chain rule, Euler's theorem, Maclaurin's and Taylor's series in two variables, Tangent plane and normal line, Maxima and minima of a function of two variables, Method of Lagrange multipliers.	07
Unit III	**Integral Calculus:** Evaluation of definite and improper integrals, Beta and Gamma functions and their properties, Applications of definite integrals to evaluate surface areas and volumes of revolutions.	07
Unit IV	**Multivariate Integral Calculus:** double and triple integrals, change of order of integration in double integrals, Change of variables, Applications: area by double integration and volume by triple integration.	09

Tutorial Works:

This shall consist of 10 tutorials based on the syllabus.

Self-Study:

Self-study contents will be declared at the commencement of the semester. Around 10 % of the questions will be asked from the self-study contents.

Suggested Readings/ References:

1. G B Thomas and R L Finney, Calculus and Analytic geometry; Pearson
2. T Veerarajan, Engineering Mathematics; McGraw-Hill
3. B V Ramana, Higher Engineering Mathematics; McGraw-Hill
4. B S Grewal, Higher Engineering Mathematics; Khanna Publishers
5. E Kreyszing, Advanced Engineering Mathematics; John Wiley & Sons Iyenger
6. N P Bali and M Goyal, A text book of Engineering Mathematics; Laxmi Publications

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of the Programme:	B. Tech. (All Programmes)
Course Code:	
Course Title:	Written Communication
Course Type:	Common
Year of introduction:	2022-2023

L	T	Practical component				C
		LPW	PW	W	S	
2	1	-	-	-	-	3

Course Learning Outcomes (CLOs):
At the end of the course the students will be able to:

1. organise ideas coherently and make arguments to express their position — BL3
2. develop their arguments clearly and correctly — BL3
3. illustrate different forms of writing — BL2
4. demonstrate ethical understanding and skills in writing — BL2

Syllabus: **Total Teaching hours: 30**

Unit	Syllabus	Teaching hours
Unit I	Introduction to writing, types, purpose, importance, audiences & their recognition	**5**
Unit II	Process of writing, organization, pre, post and rewriting, editing, concise writing, clarity, accuracy, avoiding obscure words, jargons, fog index, redundancies, gender neutral language, data visualization tools, precise writing.	**8**
Unit III	Ethics in writing, guide for ethical standards, plagiarism, copyright, referencing, citations, summarizing	**7**
Unit IV	Paragraph, essay writing, types of essays, argumentative, expository, narrative, and descriptive essays.	**5**
Unit V	Forms of writing, report writing, SOP writing, resume writing, proposal writing, web pages, presentations & tools	**5**

Self-Study:
Self-study contents will be declared at the commencement of the semester. Around 10 % of the questions will be asked from the self-study contents.

Tutorials: Around 10 tutorials will be given to students in alignment with the theory classes. In the batch of 25-20 students, these tutorials will enhance macro and micro-skills of written communication.

Suggested Readings/ References:

1.Writing Tools: 50 Essential Strategies for Every Writer, Roy Peter Clark, Little, Brown and Company; Special edition (10 January 2008).
2.The Science of Strong Business Writing, Bill Birchard, Harvard Business Review, 2021.
3.Technical Writing Process & Product,Sharon J. Gerson& Steven M. Gerson, Pearson, 1999.
4.Writing and publishing a scientific research paper, Subhash Chandra Parija and Vikram Kate, Springer/Singapore, 2021.
5.Effective Technical Communication (2nd edition), M. Ashraf Rizvi, McGraw Hill Education, 2018.
6.Effective Academic Writing, Alice Savage and Patricia Mayer, Oxford University Press, 2013.

L = Lecture, T = Tutorial, P = Practical, C = Credit
^ this is not an exhaustive list

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B.Tech.
Course Code:	
Course Title:	Engineering Drawing and Workshop
Course Type:	Vocational Course
Year of introduction:	2022-23

L	T	Practical component				C
		LPW	PW	W	S	
1	0	4	-	-	-	3

Course Learning Outcomes (CLOs):

After successful completion of the course, the student will be able to: -

1 relate the applications of engineering drawing and drawing standards with various disciplines of engineering, and construct the basic engineering curves, (BL1)
2 apply the principles of orthographic and isometric projections for various solid geometries, (BL3)
3 make use of computer aided drafting tools for preparing engineering drawings, (BL3)
4 summarize the understanding of workshop practices and make use of various tools for given jobs. (BL2)

Syllabus:

Total Teaching Hours: 15

Unit	Syllabus	Teaching Hours
Unit I	**Introduction to Engineering Drawing** Importance and applications of engineering drawing for various branches of engineering, drawing instruments, BIS code of practice, lines, lettering and dimensioning, scales, basic geometrical construction, sheet layout.	02
Unit II	**Engineering Curves** Construction of cycloid, epicycloid and hypocycloid, involutes, Archimedean spiral, and helix.	04
Unit III	**Introduction to Orthographic and Isometric Projections** Principle of orthographic projections, projections of points, straight lines, planes and regular solids. Conversion of pictorial views into orthographic projections including	09

sectional orthographic projections.

Conversion of orthographic views into isometric projections / views.

Self - Study: The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work: The laboratory work will be based on:

Engineering Drawing: Orthographic and Sectional Orthographic Projection, Isometric Projection, Computer Aided Drafting (CAD).

Workshop: Each student is required to prepare a job for Welding, Fitting, Sheet metal work and Carpentry. Demonstration will be given for Plumbing, Black smithy and use of conventional and NC Machine Tools.

Suggested Readings/References:

1. N D Bhatt, Engineering Drawing, Charotar Publication.
2. J D Bethune, Engineering Graphics with AutoCAD®, PHI Publication.
3. IS SP 46: 2003. Engineering Drawing Practices for Schools and Colleges.
4. H S Bawa, Workshop Practice -I and II, TMH Publication.

List of experiments

Sr No.	Title of the experiment	Hours
	Engineering Drawing:	
1.	To prepare a drawing sheet on Engineering curves.	4
2.	To draw a sheet involving projection of lines and planes.	6
3.	To prepare a drawing sheet on Orthographic Projection.	6
4.	To draw a sheet involving Isometric Projection.	4
5.	To create basic objects using Computer Aided Drafting tool.	2
6.	To create precise drawing, dimensions and editing using Computer Aided Drafting tool.	4
7.	To create advanced drawing using Computer Aided Drafting tool	4
	Workshop:	
8.	To prepare a practice job in carpentry shop.	6
9.	To prepare a Butt Joint in welding shop.	4
10.	To prepare a practice job in fitting shop.	8
11.	To prepare an utility article in sheet metal shop.	4
12.	Demonstration of smithy and plumbing processes.	4
13.	Demonstration of conventional and CNC machine tools.	4

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B.Tech.(All Programmes), Integrated B.Tech. (CSE)-MBA
Course Code:	XXXX
Course Title:	Introduction to AI & ML
Course Type:	Common
Year of Introduction:	2022-23

L	T	Practical Component				C
		LPW	PW	W	S	
2	-	2	-	-	-	3

Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to –

1. define the need of artificial intelligence and machine learning (BL1)
2. explain working of artificial intelligence and machine learning algorithms (BL2)
3. make use of machine learning techniques to solve problems in different domains using scientific programming (BL2)
4. identify the patterns in the data using scientific programming language (BL3)

Syllabus: **Total Teaching hours: 30**

Unit	Syllabus	Teaching hours
Unit-I	**Foundational Concepts in Artificial Intelligence** Introduction to Computational Systems, Problem Formulation and Problem Solving, Intelligence vs Artificial Intelligence (AI), History of AI, Data vs Information vs Knowledge, Rule-based and Structural Knowledge Representation, Jargons of AI, Importance and Applications of AI in different domains	05
Unit-II	**Data Exploration** Types of Data, Data Collection Methods, Data Characteristics, Handling Missing Values, Introduction to Data Visualization, Data Exploration, Data Analysis and Data Engineering	06
Unit-III	**Introduction to State Space and State Space Search** State, State Space, State Space Search, Hill Climbing, Steepest Ascent Hill Climbing, Solving Problems using State Space Search	05
Unit-IV	**Introduction to Machine Learning** Role of Machine Learning (ML) in AI, Applications of Machine Learning in different Domains, Jargons of ML, Supervised Learning – Classification vs Regression, KNN for classification and regression, Unsupervised Learning – K means algorithm, Biological Neural Networks to Artificial Neural Networks, Perceptron Learning, Reinforcement Learning – Q Learning	10
Unit-V	**Introduction to Deep Learning** Role of DL in AI, Machine Learning vs Deep Learning, Applications of Deep Learning in Different Domains, Types of Deep Networks	04

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents

Suggested Readings/ References:

1. Artificial Intelligence, Kevin Knight, Elaine Rich, and Shivashankar B. Nair, McGraw Hill Education
2. Data Mining-Concepts and Techniques, Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufmann
3. Elements of Artificial Neural Networks, Kishan Mehrotra, MIT Press
4. Machine Learning: A Multistrategy Approach, Tom M. Mitchell, McGraw Hill Education India
5. Artificial Intelligence - A Modern Approach, Russell, S. and Norvig, P, Prentice Hall

Suggested List of Experiments:

Sr.	Title	Hours
1	Introduction to Python language, libraries and basic constructs using Virtual Lab. (https://python-iitk.vlabs.ac.in/List%20of%20experiments.html)	02
2	Write a program to calculate and report various descriptive statistics measures.	02
3	Write a program to handle missing values in data.	02
4	Write a program for a 6-city symmetric TSP using a brute-force approach.	02
5	Write a program for a 6-city symmetric TSP using a nearest neighbor heuristic.	02
6	Write a program that can read Boston house price data and divide these data in training and test set as per the user choice	02
7	Write a program for classifying iris images using a KNN classifier.	02
8	Implement accuracy, precision, recall and f1-measure for Practical 7.	02
9	Write a program for predicting selling price of houses in Boston dataset.	02
10	Implement MAE, MSE, RMSE and MAPE for Practical 9.	02
11	Write a program to cluster data in iris flower dataset using k-means algorithm.	02
12	Evaluate the outcome of Practical 11 against various performance metrics.	02
13	Implement the Perceptron Learning Algorithm.	02
14	Implement AND gate using perceptron learning algorithm	02
15	Can you implement XOR gate using a perceptron learning algorithm? Write a code and justify your answer through reasoning and demonstration.	02

Suggested Case List:

-NA-

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech. (All Programme)
Course Code:	
Course Title:	Statistics
Course Type:	Common
Year of introduction:	2022-2023

L	T	Practical				C
		LPW	PW	W	S	
2	-	2	-	-	-	3

Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. know the basic concepts of probability, random variables and probability distribution and its uses (BL1)
2. compute and interpret descriptive statistics using numerical and graphical techniques (BL3)
3. use hypothesis testing methods to make appropriate decision for scientific and social problems (BL3)
4. analyze real data using software (BL4)

Syllabus:

Total Teaching hours: 30

Unit	Syllabus	Teaching hours
Unit I	**Probability and Random Variable:** Deterministic and probabilistic approaches, Definition of Probability, Mutually Exclusive and exhaustive events, Conditional probability, Independence of events, Bayes' Theorem, Discrete & Continuous Random Variables, Probability Mass Functions, Probability Density Functions, Cumulative Distribution Functions, Mean, Variance and Expectation of Random Variables.	07
Unit II	**Probability Distributions:** Bernoulli Distribution, Binomial Distribution, Poisson Distribution and Normal Distribution	05
Unit III	**Descriptive Statistics:** Measures of central tendency, Measures of Dispersion, Numerical Summaries of Data, Frequency Distributions and Histograms, scatter diagrams, Stem and Leaf Diagram, Box plots, Types of Sampling	05
Unit IV	**Hypothesis Testing:** Null and alternative hypotheses, the critical and acceptance regions, p-value in hypothesis test, Type of error, power of test, hypothesis testing for large and small sample, test on the mean of normal distribution, tests on the variance and standard deviation of a normal distribution, Tests on population proportion	07
Unit V	**Correlation and Regression:** Least square method, Linear correlation and regression, Karl Pearson's and Spearman's Correlation coefficient, Properties of the linear regression, least square regression line y on x and x on y, basic non- linear regression, statistical fallacy	06

Self-Study:
Self-study contents will be declared at the commencement of the semester. Around 10 % of the questions will be asked from the self-study contents.

Laboratory Works:
Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated

Suggested Readings/ References:

1. C.M. Douglas and G.C. Runger, Applied Statistics and Probability for Engineers, Wiley.
2. J. Susan Milton and Jesse Arnold, Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences, McGraw Hill Education.
3. Timothy C. Urdan, Statistics in Plain English, Routledge.
4. Bertsekas, Dimitri and J. Tsitsiklis, Introduction to Probability, Athena Scientific
5. Alvin Drake, Fundamentals of Applied Probability Theory, McGraw-Hill
6. Sheldon Ross, A First Course in Probability, Prentice Hall

Practical List

Sr.	Practical
1	Introduction to MATLAB
2	Vector, matrix, basic operations on matrices using MATLAB
3	Flow controls: If , If else, while, for and switch
4	Two dimensional and three-dimensional plotting
5	Library for Statistics in MATLAB
6	Program to implement conditional probability (Bayes' Theorem)
7	Program to graphical represent the data using Piechart, bargraph, boxplot, stem & leaf and validate the result using Excel
8	Program to evaluate measures of central tendency and dispersion for given data and validate the result using Excel
9	Program to find correlation coefficient using Spearman's rank and validate the result using Excel
10	Program to find correlation coefficient using Karl Pearson correlation method and validate the result using Excel
11	Program for linear and nonlinear curve fitting for given data and validate the result using Excel
12	Program to find the linear regression for given and validate the result using Excel
13	Program to find critical and acceptance region using Z-test and testing of hypothesis
14	Program to find critical and acceptance region using T-test and testing of hypothesis
15	Rice Virtual Lab in Statistics: Case study on correlation

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech. (All)
Course Code:	XXXXX
Course Title:	Chemistry
Course Type:	Introductory
Year of introduction:	2022-2023

L	T	Practical component				C
		LPW	PW	W	S	
2	-	2	-	-	-	3

Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to –

1. illustrate the basic fundamentals and defend their application in various fields of engineering (BL1)
2. classify the materials on the basis of their properties. (BL2)
3. select the appropriate experimental method of analysis and interpret its result (BL3)
4. identify and apply the principles of green chemistry in improving the existing technology (BL3)

Syllabus: **Total Teaching hours: 30**

Unit	Final Version of Syllabus	Teaching hours
Unit I	**Water and its Treatment:** Introduction, Sources of water impurities, Hardness of water, Softening of water, Desalination processes, Introduction to Waste-water treatments, Specifications for drinking water (BIS standards).	07
Unit II	**Fuel:** Calorific Value, Types of fuel, Selection of fuels, Analysis of coal:- Proximate and ultimate analysis, Flue gases: Orsat apparatus, Alternative fuels, Green hydrogen.	05
Unit III	**Lubricants:** Introduction, Classification and functions of lubricants, Mechanisms of Lubrication, Properties:- Lubricating oil and Greases, Selection of lubricants.	04
Unit IV	**Corrosion Science:** Introduction, Types of corrosion, Mechanism of corrosion, Factors Affecting Corrosion, Corrosion control and Preventions.	05
Unit V	**Green Chemistry:** Overview, Set of Principles of Green Chemistry, Importance and application of Green Synthesis.	04
Unit VI	**Engineering Materials**: High Temperature Polymers, Conducting Polymers, Foamed Plastics, Polymer Composites, Organic Electronic Materials, Explosives:- Introduction, Classification, Characteristics, Disarmament, Weapons of Mass Destruction (WMD), Peaceful uses of explosives, Fuel cells and Batteries.	05

Self-Study:
Self-study contents will be declared at the commencement of the semester. Around 10 % of the questions will be asked from the self-study contents.

Laboratory Works:
Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

Suggested Readings/ References:

1. P.C. Jain and Monika Jain, Textbook of Engineering Chemistry, Dhanpat Rai Publishing Co.
2. Shashi Chawla, Textbook of Engineering Chemistry, Dhanpat Rai Publishing Co.
3. S.S. Dara, Textbook of Engineering Chemistry, S. Chand and Company.
4. Mike Lancaster, Green Chemistry: An Introductory Text, Royal Society of Chemistry.
5. J.C. Kuriacose and J. Rajaram, Chemistry in Engineering and Technology, Tata Mc Graw Hill.
6. Prasanta Rath, Engineering Chemistry, Cengage Learning.
7. Sunita Rattan, A Textbook of Engineering Chemistry, S.K. Kataria & Sons.
8. O.G. Palanna, Engineering Chemistry, Tata Mc Graw Hill.

Practical List

Sr.	Practical
1	Estimation of temporary, permanent, and total hardness of water sample
2	Determination of strength of Na_2CO_3 and $NaHCO_3$ in water sample by using standard HCl solution
3	Determination of moisture content in coal sample
4	Preparation of Urea-formaldehyde resin
5	pH metric titration of strong acid with strong base
6	Conductometric titration of strong acid and strong base
7	Determination of penetration index of lubricating grease
8	Determination of viscosity of lubricating oil by Redwood viscometer
9	Determination of the flash point and fire point of a lubricant or fuel by Pensky-Marten's apparatus
10	Determination of aniline point of an oil sample
11	Redox titration of ferrous sulphate with potassium permanganate
12	Determination of the cloud point and pour point of a lubricant
13	Determination of the saponification number of an oil
14	Virtual Lab: Determination of hardness of various water samples
15	Virtual Lab: Determination of alkalinity of various water samples

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	**B.Tech. First Year**
Course Code:	**XXXX**
Course Title:	Physics
Course Type:	Introductory
Year of Introduction:	2022-23

Credit Scheme

L	T	Practical component				C
		LPW	PW	W	S	
2	0	2	-	-	-	3

Course Learning Outcomes (CLOs):
At the end of the course, the student will be able to –

1. Understand the fundamental principles of Physics behind the current technological advancements (BL2)
2. Apply the concepts of Physics for solving engineering problems (BL3)
3. Analyse the existing technological limitations with the help of modern Physics concepts (BL4)
4. Measure various characteristics of physical quantities and establish the proof of concepts (BL4)

Syllabus: **Total Teaching Hours: 30**

Unit	Syllabus	Teaching Hours
Unit 0	**Importance of Applied Physics in Engineering** Significance of Applied Physics in Engineering, Challenges, requirements, and applications of Physics in engineering.	**01**
Unit I	**Lasers and Holography** Introduction, Basics of Interaction of radiation with matter, Condition for light Amplification, Population inversion and metastable state, pumping, the principle pumping scheme: Three and Four-level scheme, Construction and working of the optical resonator, Ruby Laser, Applications of the laser beam, Holography.	**04**
Unit II	**Introduction to Fiber Optics** Introduction of fiber-optic system, Principle and construction of fiber cable, Acceptance angle and numerical aperture, Types of Optical fiber: Based on material & based on the mode of propagation, Index profile, Fiber optic communication link, Losses in optical fiber communication, Advantages of fiber optic system.	**04**

Unit III	**Introductory Quantum Mechanics** Introduction to Quantum Physics, Compton effect, Wave function, Probability density, Normalization of the wave function, Expectation values, Quantum Mechanical Operators, Schrodinger Equations- Time-dependent and independent forms, Particle in a three-dimensional box.	**04**
Unit IV	**Semiconductor Physics** Molecular Orbital theory- bonding, antibonding, and non-bonding orbitals, Formation of energy bandgap in semiconductors, Classification of bandgap- direct and indirect, optical and electronic, Fermi Dirac distribution function, Fermi Energy and Energy band structure of various semiconductors, Variation of Fermi energy level with carrier concentration and temperature.	**04**
Unit V	**Fundamentals of Nanomaterials** Introduction – Nanoscale; Nanomaterials: Methods for the synthesis of nanomaterials, Properties of nanomaterials – Electrical, Magnetic, Optical, Mechanical, Characterization techniques – X-ray Diffraction (XRD) - Single Crystal, Powder, and Laue techniques, Scanning Electron Microscopy, Tunnelling Electron Microscopy, Nanostructures; Carbon nanotubes Characteristics and applications, Nanotechnology and environment.	**05**
Unit VI	**Acoustics and Ultrasonics** Introduction, Defection due to the reflection of sound, Sabine's empirical formula, Reverberation theory, Eyring's equation, Acoustical defects and their remedies, Acoustic materials, Ultrasonic waves, Piezoelectric method, Properties and application of ultrasonic waves.	**04**
Unit VII	**Physics of Industry Instruments** CO_2 laser, Semiconductor diode laser, Fiber optic sensors, Nuclear accelerator – LINAC, Cyclotron, Detectors - GM Counter, Scintillation Detector, Vacuum pumps - rotary pump, diffusion pump, Ion pump, Measurement of vacuum with different gauges.	**04**

Self-Study:
Self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from the self-study contents.

Laboratory Work:
Laboratory work will be based on above syllabus with minimum 10 experiments to be incorporated.

Suggested Readings:

1. M. N. Avadhnulu and P. Kshirsagar, A Text Book of Engineering Physics, S Chand.
2. T. Pradeep, Nano: The Essentials, New Central Book Agency.
3. B. L. Theraja, Physics for Engineers, S Chand Publication.
4. K. Thyagarajan and Ajoy Ghatak, Lasers: Fundamentals and Applications, Springer.
5. Nouredine Zettili, Quantum Mechanics: Concepts and Applications, Wiley.
6. G. Aruldhas, Engineering Physics, PHI.
7. Sulbha Kulkarni, Nanotechnology: Principles and Practices, Springer.

L= Lecture, T= Tutorial, P= Practical, C= Credit

List of Practical

Sr. No.	Title
1.	To analyse fundamental units and dimensions (prerequisite)
2.	To estimate the solar energy in terms of solar power and V-I characteristics, the power load characteristics of the solar cell
3.	To evaluate the charge-to-mass ratio for electrons by applying a perpendicular magnetic field on the electron beam in CRT
4.	To measure the electromotive force by dynamic magnetic field and verification of Faraday's law
5.	To measure the energy efficiency of a power transformer.
6.	To measure the resistivity of semiconductors by four-point probe method at different temperatures.
7.	Determination of forbidden energy band gap in a semiconductor using a junction diode
8.	To measure the wavelength of light from a sodium vapour lamp and find the thickness of thin film using Newton's rings method
9.	To determine the velocity of ultrasonic waves in liquid and its compressibility using an ultrasonic interferometer
10.	To determine the refractive index of a liquid by lens method
11.	Resistivity measurement by Hall Effect for semiconductor sample
12.	To determine the value of Planck's constant by the reverse photoelectric method
13.	To study characteristics of Geiger – Muller Tube
14	Virtual Laboratory Experiment on Resistivity measurement by Hall Effect for metal samples
15	To measure the wavelength of light from various light sources and find the thickness of thin film using Newton's rings method (Virtual Laboratory)