GUJARAT TECHNOLOGICAL UNIVERSITY
(Established by Government of Gujarat under Gujarat Act No.:20 of 2007)

ગુજરાત ટેકનોલોજિકલ યુનિવર્સિટી

(ગુજરાત સરકારના ગુજરાત અધિનિયમ ક્રમાંક : ૨૦/૨૦૦૭ દ્વારા સ્થાપિત)

Accredited with A+ Grade by NAAC

Draft Syllabus
for
Diploma Engineering
1ˢᵗ Semester (w.e.f. 2024-25)

(COMMON SUBJECTS)

Gujarat Technological University
Nr. Visat Three Roads, Visat - Gandhinagar Highway
Chandkheda, Ahmedabad – 382424 – Gujarat

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(Established by Government of Gujarat under Gujarat Act No.:20 of 2007)
ગુજરાત ટેકનોલોજીકલ યુનિવર્સિટી
(ગુજરાત સરકારના ગુજરાત અધિનિયમ ક્રમાંક : ૨૦/૨૦૦૭ દ્વારા સ્થાપિત)
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INDEX

S. No.	Name of Branches
1.	Mathematics -1
2.	Applied Physics
3.	Modern Physics
4.	Applied Chemistry
5.	Basic Chemistry
6.	Engineering Chemistry
7.	Communication Skills in English
8.	Sports and Yoga

GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering
Level: Diploma
Branch: ALL
Course / Subject Code:
Course / Subject Name: Mathematics-I

w. e. f. Academic Year:	2024
Semester:	1st Semester
Category of the Course:	BSC

Prerequisite:	Linear equation in two variables, Factorization, Polynomial, Quadratic Equation, Coordinate Geometry, LCM, GCD, Concept of Set.
Rationale:	This course of Mathematics is being introduced for providing a solid foundation in basic mathematics concepts and operations that are crucial for further education and everyday problem-solving. This course is an attempt to include topics which are directly applicable to various fields of engineering, technology, business and sciences and develop logical reasoning and critical thinking abilities. The course is designed focusing on multidisciplinary and competency development to ensure students can effectively use mathematical methods and principles in their vocational and technical fields. The components of course ensure that it is comprehensive, practical and aligned with both academic and professional requirements.

Course Outcome:
After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Interpret the function graphically, numerically and analytically.	A(Application)
02	Demonstrate the ability to algebraically analyse basic functions used in Trigonometry.	A(Application)
03	Demonstrate the ability to Crack engineering related problems based on concepts of Vectors.	A(Application)
04	Solve basic engineering problems under given conditions of straight lines and circle.	A(Application)
05	Demonstrate the ability to analyse and illustrate the Functions using the concept of Limit.	A(Application)

Revised Bloom's Taxonomy (RBT)

GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering
Level: Diploma
Branch: ALL
Course / Subject Code:
Course / Subject Name: Mathematics-I

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	**T**	**PR**	**C**	**ESE (E)**	**PA / CA (M)**	**PA/CA (I)**	**ESE (V)**	
3	**1**	**0**	**4**	**70**	**30**	**-**	**-**	**100**

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1. Determinant and Function	1.1 Determinant and its value up to 3rd order (Without properties) 1.2 Function and simple examples. 1.3 Logarithm as a function 1.4 Laws of Logarithm and related Simple examples	9	23
2. Trigonometry	2.1 Units of Angles (degree and radian) 2.2 Trigonometric Functions 2.3 Allied & Compound Angles, Multiple –Submultiples angles 2.4 Graph of Sine and Cosine, 2.5 Periodic Trigonometric function 2.6 Sum and factor formulae 2.7 Inverse Trigonometric function	12	20
3. Vectors	3.1 Vector, Addition, Subtraction, Magnitude and direction. 3.2 Scalar and Vector Product and it's properties 3.3 Angle between two Vectors 3.4 Applications of Scalar and Vector Product (Work Done and Moment of Force)	9	20

GUJARAT TECHNOLOGICAL UNIVERSITY
Program Name: Diploma in Engineering
Level: Diploma
Branch: ALL
Course / Subject Code:
Course / Subject Name: Mathematics-I

4. **Coordinate** **Geometry**	4.1 Straight line (Two-point form) and slope of straight line 4.2 Slope point form, Intercept form, General form of line 4.3 Condition of parallel and perpendicular lines 4.4 Equations of Parallel lines and Perpendicular lines to the given lines 4.5 Angle between two lines. 4.6 Equation of circle with center and Radius. 4.7 General equation of circle. 4.8 Tangent and normal to a circle.	8	20
5. **Limit**	5.1 Limit of a Function. 5.2 Standard formulae of Limit and related simple examples.	7	17
	Total	45	100

Suggested Specification Table with Marks (Theory):

Unit No.	Unit Title	Distribution of Theory Marks						
		R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**	**Total**
1	**Determinant and Function**	4	7	5	0	0	0	16
2	**Trigonometry**	4	5	5	0	0	0	14
3	**Vectors**	4	6	4	0	0	0	14
4	**Coordinate Geometry**	4	5	5	0	0	0	14
5	**Limit**	3	4	5	0	0	0	12
	Total	19	27	24	0	0	0	70
	%	27	39	34	0	0	0	100

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:
(a) Books:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Engineering Mathematics (Third edition).	Croft, Anthony	Pearson Education, New Delhi, 2014.ISBN 978-81-317-2605-1
2	A Text Book of Vector Analysis	Narayan Shanti and Mittal P.K	S. Chand Publication, ISBN 978-8121922432
3	Calculus and Analytic Geometry	G. B. Thomas, R. L. Finney	Addison Wesley, 9th Edition, 1995.ISBN 978-8174906168
4	Understanding Engineering Mathematics	John Bird	Routledge; 1st edition ISBN 978-0415662840
5	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publ., NewDelhi,2014, ISBN: 978-0-470-45836-5

GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering
Level: Diploma
Branch: ALL
Course / Subject Code:
Course / Subject Name: Mathematics-I

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
6	Mathematics-I	Deepak Singh	Khanna Book Publishing Co ISBN: 978-93-91505-42-4
7	Mathematics-II	Garima Singh	Khanna Book Publishing Co ISBN: 978-93-91505-52-3

(b) Open-source software and website:

	- https://www.youtube.com/channel/UCLJVrQyPYsseCf78QWCDsvA/featured (YouTube Channel of DTEGUJ) - https://www.geogebra.org/?lang=en - https://phet.colorado.edu/ - www.dplot.com/ - DPlot - www.wolfram.com/mathematica/ - https://www.khanacademy.org/ - www.easycalculation.com - www.scilab.org/ - SCI Lab - https://ncert.nic.in/textbook/pdf/lemh102.pdf - https://www.geeksforgeeks.org - https://www.mathsisfun.com/geometry/slope.html - https://www.statisticshowto.com/limit-of-functions/
Apps in Google Play Store	- National Digital Library - e-Granthalaya - NSDC eBook Reader: Kaushal ePustakalaya - ePathshala - IGNOU e-content

List of Laboratory/Learning Resources Required:

1. Computer System, smart phone & LCD Projector
2. Scientific Calculator (Display type: Natural Display Algebraic input logic: Natural V.P.A.M.Significand function: 10+2.)

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w. e. f. Academic Year:	2024
Semester	1st
Category of the Course:	BSC

Prerequisite:	10+
Rationale:	Physics is branch of science mainly deals with interaction of energy and matter and considered as the mother of all engineering disciplines. Diploma engineers (technologists) have to deal with various materials while using/ maintaining machines. More over the basic knowledge of principles of physics helps diploma students to lay foundations of core engineering courses. The laws and principles of physics, formulae and knowledge of physical phenomena and physical properties provides a means of estimating the behavior of things before we design and observe them. This course of modern physics has been designed as per program requirements to help students to study the relevant core engineering courses. The complicated derivations have been avoided. This course will help the diploma engineers to use/apply the basic concepts and principles of physics solve well designed engineering problems and comprehend different technology based applications.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Use relevant instruments with precision to measure the dimension of given physical quantities in various engineering situations.	
02	Solve various engineering problems by the concept of linear momentum and circular motion.	
03	Apply basic concepts of properties of matter in solving engineering problems efficiently.	
04	Apply the basic concepts of heat transfer and thermometric properties to provide solutions for various engineering problems.	
05	Use the concept of waves, ultrasonic and semiconductor for engineering applications	

Revised Bloom's Taxonomy (RBT)

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		**Tutorial / Practical**		
L	**T**	**PR**	**C**	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content			No. of Hours	% of Weightage
1.	1.a Explain physical quantities and their units. 1.b Convert unit of a given physical quantity in one system of units into another systems of units. 1.c Explain methods to measure the dimensions of given object by using relevant instruments. 1.d Estimate errors in the measurement. 1.e Apply the concept of least count, errors and significant figures to solve the given problems.		1.1 Measurement and units in engineering and science 1.2 Physical quantities: fundamental and derived quantities, 1.3 Systems of units: CGS, MKS and SI, Interco version of units MKS to CGS and vice versa, requirements of standard units and unit systems, 1.4 Principle, construction, working, applications of Vernier calipers and Micrometer screw gauge with their errors. 1.5 Accuracy, precision , error, estimation of errors: absolute error, relative error ,percentage error, rounding off, significant digits	07	17
2.	2.a Apply the concept of linear momentum and its conservation to explain recoil of gun. 2.b Apply the concept of centripetal and centrifugal		2.1 Force, momentum, law of conservation of linear momentum, its applications such as recoil of gun, impulse and its applications 2.2 Circular motion, angular displacement, angular velocity,	08	14

		forces to solve given engineering problems	angular acceleration and their interrelation 2.3 Centripetal and centrifugal forces examples: banking of roads and bending of cyclist		
3.		3.a Explain the Hooke's law, stress-strain curve and moduli of elasticity. 3.b Explain surface tension, cohesive and adhesive forces. 3.c Apply Ascent formula to determine surface tension of the given liquid. 3.d Explain viscosity, coefficient of viscosity, terminal velocity and Stokes' law. 3.e Explain types of fluid motion and Reynolds number	**3.1 Elasticity** 3.1.1 Deforming and restoring Force 3.1.2 Stress-Strain with their types 3.1.3 Hooke's law 3.1.4 Moduli of elasticity, Young's modulus, Bulk modulus, Shear modulus 3.1.5 Stress-Strain curve **3.2 Surface Tension** 3.2.1 Surface tension; concept and units 3.2.2 Cohesive and adhesive forces 3.2.3 Molecular range and sphere of Influence 3.2.4 Laplace's molecular theory 3.2.5 Angle of contact, Ascent Formula (No derivation) 3.2.6 Relation between Surface tension and Surface energy 3.2.7 List the Applications of surface tension 3.2.8 Effect of temperature and impurity on surface tension **3.3 Viscosity** 3.3.1 Viscosity and its SI units 3.3.2 Newton's law of Viscosity 3.3.3 Viscous force, velocity gradient and coefficient of viscosity and its SI units. 3.3.4 Types of fluid motion, stream line and turbulent flow, critical velocity, Reynold's number 3.3.5 Stokes' law : free fall of an object through viscous medium	12	28

			and terminal velocity*(No derivation) 3.3.6 Effect of temperature on viscosity.		
4.	4.a Distinguish between heat and temperature. 4.b Explain modes of heat transmission. 4.c Explain various temperature scales and conversion between them. 4.d Explain heat capacity and specific heat. 4.e Explain types of thermometers and their uses. 4.f Apply the concept of coefficient of thermal conductivity to solve Engineering problems. 4.g Explain expansion in solids and coefficient of linear expansions in solids.	4.1 Heat and temperature 4.2 Modes of Heat transfer: Conduction, Convection(natural and forced) and Radiation* 4.3 Temperature measurement scales: Kelvin, Celsius and Fahrenheit and interconversion between them 4.4 Heat capacity and specific heat 4.5 Types of thermometers: Mercury thermometer, Bimetallic thermometer: Principle, Construction, Working, Advantages and Disadvantages) and their uses. 4.6 Coefficient of thermal conductivity and its engineering applications. 4.7 Expansion of solids, coefficient of linear expansion	08	17	
5.	5.a Explain wave and wave motion with example. 5.b Distinguish between longitudinal and transverse waves. 5.c Explain frequency, periodic time, amplitude, wave length and wave velocity 5.d Explain principle of superposition of waves, interference. 5.e Explain reverberation, reverberation time, echo,	5.1 Waves, wave motion, and types of waves: longitudinal and transverse waves 5.2 Frequency, periodic time, amplitude, wave length and wave velocity and their relationship 5.3 Superposition of waves, Interference: constructive and destructive interference, conditions for stationary interference pattern. 5.4 Reverberation, reverberation time, echo, noise and coefficient	10	24	

	noise and coefficient of absorption of sound. 5.f Apply Sabine's formula to calculate reverberation time. 5.g Explain ultrasonic waves and their properties. 5.h List engineering and medical applications of ultrasonic waves. 5.i Apply the concept of energy band gap to classify Conductor, Semiconductors and insulators 5.j Apply the concept impurity doping to the semiconductors	of absorption of sound 5.5 Sabine's formula (derivation not required) for reverberation time, methods to control reverberation time and their applications 5.6 Ultrasonic waves and their properties, List the applications of ultrasonic waves in the field of engineering and medical 5.7 Conductors, Semiconductors and insulator in reference to Energy band gap* 5.8 Intrinsic Semiconductors 5.9 Extrinsic Semiconductors: P & N type, electric conduction in N-type and P-type semiconductor, temperature dependence of conductivity of semiconductor.			
Total				45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
26	**37**	**37**	**0**	**0**	**0**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Text Book of Physics for Class XI (Part-I, Part-II)	N.C.E.R.T., Delhi	N.C.E.R.T., Delhi, 2019 ISBN 81-7450-508-3(Part-I) & ISBN 81-7450-566-0 (Part-II)
2	Text Book of Physics for Class XII (Part-I, Part-II)	N.C.E.R.T., Delhi	N.C.E.R.T., Delhi, 2019 ISBN 81-7450-631-4 (Part-I) & ISBN 81-7450-671-3 (Part II)
3	Applied Physics, Vol. I and Vol. II	TTTI Publications	Tata McGraw Hill, Delhi, 2019
4	Concepts in Physics Vol. I and Vol. II	H C Verma	Bharti Bhawan Ltd. New Delhi, 2019 ISBN-13: 978-8177091878 ISBN-13: 978-8177092325
5	Engineering Physics	DK Bhattacharya & Poonam Tandon	Oxford University Press, New Delhi, ISBN:9781680158687
6	B. Sc. Practical Physics	C. L. Arora	S. Chand Publication, New Delhi, ISBN: 9788121909099
7	A Textbook of Engineering Physics	M.N. Avadhanulu, P.G. Kshirsagar, TVS Arun Murthy	S. Chand Publication, 11th edition ,New Delhi, 2018 ISBN-13: 978-9352833993
8	SEARS and ZEMANSKY'S University Physics with modern Physics	Hugh D. Young & Roger A. Freedman	Person Publication 14th Edition, USA, ISBN 10: 0-321-97361-5; ISBN 13: 978-0-321-97361-0 (Student edition)
9	Physics for Scientists and Engineers with Modern Physics	John W. Jewett & Raymond A. Serway	CENGAGE Learning, 10th edition, Boston, 2010, ISBN-10: 1337553298
10	University Physics (Volume I, II & III) (Open-source Material)	William Moebs, Samuel J. Ling & Jeff Sanny	OPENSTAX, Houston, Texas, 2016, ISBN-13: 1-947172-20-4
11	PHYSICS for SCIENTISTS &	Douglas C. Giancoli	Pearson, 7thedition, Delhi, 2015,

	ENGINEERS with Modern Physics		ISBN-13: 978-1292057125
12	Principles of Physics	Jearl Ealker, David Halliday, Robert Resnick	Wiley India, Navi Mumbai 10th edition, 2015, ISBN-13: 978-8126552566
13	NCERT Physics	NCERT	NCERT Physics
14	Physics in Daily Life With illustrations	L.J.F. Hermans & Wiebke Drenckhan	EDP Sciences, France, 2012, ISBN: 978-2-7598-0705-5
15	Introductory Physics: Building Models to Describe Our World (Open-Source Material)	Ryan Martin, Emma Neary, Joshua Rinaldo & Olivia Woodman	Creative Commons license, 2019, GitHub
16	The Feynman Lectures on Physics - Vol. I, II & III,	Feynman Richard	Pearson Education, 2012, ISBN-10 : 9332580952, ISBN-13 : 978-9332580954
17	Conceptual Physics	Paul G. Hewitt,	Pearson Education, 12 edition, ISBN-10: 9352861779 ISBN-13: 978-9352861774.

(b) Open-source software and website:

1. https://ocw.mit.edu/courses/physics/
2. https://www.einstein-online.info/en/category/elementary/
3. https://academicearth.org/physics/
4. www.nptel.iitm.ac.in
5. http://phys23p.sl.psu.edu/phys_anim/Phys_anim.htm
6. http://www.atoptics.co.uk/
7. http://www.olabs.edu.in/
8. https://phet.colorado.edu/
9. https://www.iitm.ac.in/academics/learning-for-all/national-programme
10. https://www.khanacademy.org/
11. https://vlab.amrita.edu/
12. https://www.amrita.edu/project/online-labs/
13. https://www.vlab.co.in/
14. https://iitb.vlabs.co.in/
15. https://vlab.amrita.edu/
16. https://praxilabs.com/
17. https://www.compadre.org/osp/
18. https://www.instructables.com/

19. https://www.labster.com/simulation-courses
20. https://lab4u.co/en/home/
21. https://www.labxchange.org/
22. https://virtuallabs.merlot.org/vl_physics.html
23. https://www.ncbionetwork.org/iet/labsafety/
24. https://www.thephysicsaviary.com/Physics/Programs/Labs/find.php
25. https://sites.google.com/view/thephysicsaviary/all-labs?authuser=0
26. https://sciencelessonsthatrock.com/secondary-science-virtual-labs-html/
27. https://www.mheducation.com/highered/virtual-labs.html#virtuallabs
28. https://roqed.com/product-physics/

(c) Android/iOS Applications:
1. Physics Lab: https://play.google.com/store/apps/details?id=com.civitas.quantumphysics&pli=1
2. Lab4u: https://play.google.com/store/apps/details?id=com.lab4u.lab4physics
3. Phet: https://play.google.com/store/apps/details?id=edu.colorado.phet.androidApp
4. Micrometer screw: https://play.google.com/store/apps/details?id=com.priantos.micrometersimulator
5. Vernier Callipers: https://play.google.com/store/apps/details?id=com.vernier.tavifom

Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs.
1	Use Vernier caliper to measure the dimensions of a given object.	I	02
2	Use micrometer screw gauge to measure diameter of a given wire and determine volume of a given metallic piece.	I	02
3	Use Hooke's law to determine force constant of a given spring.	III	02
4	Use Searle's method to determine Young's modulus of the given metallic wire.	III	02
5	Use capillary rise method and travelling microscope to determine the surface tension of a given liquid.	III	02
6	Use Stokes' law to determine the viscosity of a given liquid (e.g., glycerin).	III	02
7	Use different types of thermometers to measure temperature of a hot bath and	IV	02
8	Use Searle's method to measure the coefficient of thermal conductivity of a	IV	02
9	Use Searle's method to determine the coefficient of linear expansion of the	IV	02
10	Determine acceleration due to gravity 'g' by using simple pendulum.	V	02
11	Use sonometer to find the frequency of given tuning fork.	V	03

12	Use resonance tube to determine velocity of sound in air at room temperature.	V	03
13	Use ultrasonic interferometer to determine the velocity of ultrasonic waves in	V	03
14	Use electrical vibrator to find the frequency of AC mains.	V	03
		TOTAL	**30**

List of Laboratory/Learning Resources Required:

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Vernier caliper analog - least count 0.02 mm	1, 4
2	Micrometer screw gauge analog (0-25 mm) – least count 0.01mm	2, 4
3	Rigid support, spring, 20 g hanger, six 20 g slotted weight, fine pointer, vertical wooden scale, hook	3
4	Young modulus apparatus (Searle's pattern): two aluminum graduated scales mounted on pillar supports, two pointers with clamps for attaching to specimen, brass and steel rod, cord and hook for carrying weight.	4
5	Travelling microscope - high magnification power, stainless steel scale with Vernier least count - 0.02 mm for taking the recordings, horizontal scale graduated up to 20 cm, vertical scale graduated up to 15 cm.	5
6	One meter high and 5 cm broad glass cylindrical jar with millimeter graduations along its height, steel balls	6
7	Hot water bath	7
8	Mercury filled glass thermometer 0-110 °C, Mercury filled glass thermometer 0-250 °C. Digital food thermometer, bimetallic thermometer.	7
9	Searle's thermal conductivity apparatus - made up of pure copper and outer boxes are of wooden polished material, 04 thermometers, steam generator, measuring cylinder, constant water level tank, pinch cork, rubber tube	8
10	Linear expansion apparatus, steam generator, rubber tubing, metal rods of aluminum, iron, copper, brass, and steel.	9
11	A bob	10
12	A sonometer with set of tuning forks, two sharp edge wedges and a weight box.	11
13	Resonance tube apparatus, tuning forks of different frequencies, rubber pad, thermometer	12
14	Stop watch (least count = 1/100 s)	8, 10

GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: All Engineering
Level: Diploma
Course / Subject Code:
Course / Subject Name: Applied Physics

15	Clamp with stand.	5
16	0.5 kg hanger, 0.5 kg slotted weight.	4
17	Hot plate (1800 W)	8, 9
18	Ultrasonic interferometer - gold plated quartz crystal, operating voltage - 220 Volt, display - analog, frequency - 2MHz with position control	13
19	Electrical Vibrator, uniform cord, weight pan, weight box, pulley, meter scale, sensitive balance	14

Suggested Project List:

1. Measurement: Measure physical quantities using smart phone applications.
2. Arduino: Physical quantities such as Voltage, Magnetic field, Temperature, Light, Sound and distance can be measured with the help of low-cost sensors and Arduino.
3. Prepare proto type Vernier calipers of given least count.
4. Unit Systems: Charts/Models of conversion from MKS to CGS and vice versa.
5. Density Tower: A stack of different immiscible liquid are staked in a glass cylinder to demonstrate the concept of density.
6. Centrifugal Force: Flexible steel strips mounted on a hand driven rotor can be used to visualize centrifugal force.
7. Bird lifts Elephant: A toy bird and toy elephant of different mass are attached to the two ends of string and passes through hollow pipe.
8. Cup does not spill: Water filled cup can sit on disc and tied with string and when rotated, water does not spill can be used to visualize centrifugal force.
9. Upside down ⊥: A ⊥ and two wooden discs can be used to demonstrate centrifugal force.
10. Centrifuge machine: It can be used to visualize concept more efficiently.
11. Beck's Centripetal Force apparatus: This apparatus used to measure the force needed to keep a mass rotating around in a circular path
12. Newton's cradle: This model can best demonstrate the law of conservation of momentum.
13. Wedge shaped glass vessel: For demonstration of capillary forces and surface tension for both wetting and non-wetting fluids.
14. Laminar flow fountain: A larger bore pipe, washing mesh, juice straw can be used to prepare laminar flow fountain.
15. Wood and Copper rod: A rod made up two completely different thermometric materials wrapped with paper and put it on flame.
16. Ball and Ring: This apparatus can be used to demonstrate heat conduction.
17. Heat Convection tube: A Glass rectangular glass tube filled with liquid and supplying heat better shows heat transfer in fluids.

18. Heat Convection Gas apparatus: A box, open pipe and lamp inside box can be used to demonstrate heat convection.
19. Hand Glass Boiler: A liquid filled glass tube with bulb shape can be held in hand and body heat can rise liquid into the boiler.
20. Metal bars: Different metal bars of same physical size and shape can be used to demonstrate heat conduction.
21. Heat Switch: A bimetallic strip can be used as an electrical switch via heat transfer.
22. Linear Expansion: A metal wire tightened at two ends and a metallic sphere hanged at the middle of wire. This wire is supplied by 12 Volt battery for some time. Sagging effect is observed.
23. Domino model: A model showing fundamental idea about wave and how it travels.
24. Shive Wave Machine: For demonstration of Frequency, Wavelength, wave velocity.
25. Wave Generator: model for generating transverse wave.
26. Powell's Wave machine: For demonstration of Frequency, Wavelength, wave velocity
27. Chand's Plates: A model which provides a nice way to visualize the effects of vibrations on mechanical surfaces like flat sheet of metal mounted on a central stalk to a sturdy base. When the plate is made to vibrate, set up form complex but symmetrical patterns over its surface.
28. Slinky: A nice way to demonstrate transverse and longitudinal waves.
29. Singing Rijke Tube: A wired mesh is inserted in metal pipe and then air inside the pipe is heated, moving up and down the pipe, resonating sound is produced.

APPENDIX

a. Application level based numerical should be given at the time of instruction and assessment in each unit.
b. 'Definition' of units of fundamental physical quantities are only for information and not to be asked in examination in any form.
c. Students can be introduced to system of units other than SI, MKS, CGS unit systems but not to be asked in examinations.
d. Interrelation between different Moduli must not be introduced.
e. For terminal velocity, mathematical derivation not to be asked in examination in any form.
f. Heat Radiation, Wien's law for black body radiation must not be introduced.
g. Energy band Gap theory can be introduced only as tool to classify the conductors, semiconductors and insulators with the help of conduction and valance band. Energy band theory must not be asked in exams. Hybridization of orbitals must not be introduced.

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GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering
Level: Diploma
Branch:
Course / Subject Code :
Course / Subject Name : Modern Physics

w. e. f. Academic Year:	2024
Semester:	1st
Category of the Course:	BSC

Prerequisite:	**10+**
Rationale:	Physics is branch of science mainly deals with interaction of energy and matter and considered as the mother of all engineering disciplines. Diploma engineers (technologists) have to deal with various materials while using/ maintaining machines. More over the basic knowledge of principles of physics helps diploma students to lay foundations of core engineering courses. The laws and principles of physics, formulae and knowledge of physical phenomena and physical properties provides a means of estimating the behavior of things before we design and observe them. This course of modern physics has been designed as per program requirements to help students to study the relevant core engineering courses. The complicated derivations have been avoided. This course will help the diploma engineers to use/apply the basic concepts and principles of physics solve well designed engineering problems and comprehend different technology based applications.

Course Outcome:
After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Use relevant instruments with precision to measure the dimension of given physical quantities in various engineering situations.	
02	Apply the concepts of electrostatics and capacitance for engineering applications.	
03	Use the concept of waves and ultrasonic for various engineering applications.	
04	Use the concepts of LASER and Fiber optics for various engineering applications.	
05	Use the concepts of semiconductor devices for engineering applications.	

Revised Bloom's Taxonomy (RBT)

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Program Name: Diploma in Engineering
Level: Diploma
Branch:
Course / Subject Code :
Course / Subject Name : Modern Physics

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	**T**	**PR**	**C**	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content		No. of Hours	% of Weightage
1.	1.a Explain physical quantities and their units. 1.b Convert unit of a given physical quantity in one system of units into another systems of units. 1.c Explain methods to measure the dimensions of given object by using relevant instruments. 1.d Estimate errors in the measurement. 1.e Apply the concept of least count, errors and significant figures to solve the given problems.	3.1 Measurement and units in engineering and science 3.2 Physical quantities: fundamental and derived quantities, 3.3 Systems of units: CGS, MKS and SI, Interco version of units MKS to CGS and vice versa, requirements of standard units and unit systems, 3.4 Principle, construction, working, applications of Vernier calipers and Micrometer screw gauge with their errors. 3.5 Accuracy, precision , error, estimation of errors: absolute error, relative error ,percentage error, rounding off, significant digits	7	19
2.	2.a Explain Coulomb's inverse square law and apply it on system of charges. 2.b Explain an electric field, electric flux, and electric	2.1 Charge & its unit, quantization of electric charge, conservation of electric charge, charging by friction and induction, Coulomb's law*	8	19

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	potential and potential difference. 2.c Explain the concepts of a capacitor, capacitance and working of parallel plate capacitor. 2.d Apply the concept of series and parallel combination of capacitors to solve problems in electrical circuits.	2.2 Electric field, Electric field Intensity (E=F/q), Electric field lines and its properties* 2.3 Electric flux, Electric potential V=W/q and potential difference* (No mathematical derivation), Electric potential from electric field (V = End) 2.4 Capacitor and its capacitance (C=Q/V), Working of parallel plate capacitor, formula $C = \varepsilon_0 \frac{A^*}{d}$ 2.5 Equivalent capacitance of capacitors in series and in parallel combinations. 2.6 Effect of dielectric material on the capacitance of parallel plate		
3.	3.a Explain wave and wave motion with example. 3.b Explain frequency, periodic time, amplitude, wave length and wave velocity. 3.c Distinguish between longitudinal and transverse waves. 3.d Explain ultrasonic waves, production and their properties 3.e List engineering and medical applications of ultrasonic waves.	3.1 Waves, wave motion and types of waves: longitudinal and transverse waves 3.2 Frequency, periodic time, amplitude, wave length and wave velocity and their relationship 3.3 Ultrasonic : Definitions of Audible sound, Infrasonic sound, Ultrasonic Sound, 3.4 Production of ultrasonic Methods: Piezo electric & Magnetostriction (Principle, Diagram, Construction, Working, Advantages and Disadvantages),properties of ultrasonic, 3.5 SONAR and NDT (flaw detection) as an applications of ultrasonic. 3.6 List applications of	9	14

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		ultrasonic waves in the field of engineering and medical		
4.	4.a Apply Snell's law to calculate refractive index of given medium 4.b Explain the phenomenon of total internal reflection 4.c Explain LASER and it's in engineering and medical applications. 4.d Explain construction and working principle of step index and graded index optical fibers. 4.e Comprehend engineering and medical applications of optical fiber.	4.1 Refraction, Refractive index , Absolute Refractive index, Relative Refractive index and Snell's law 4.2 Total internal reflection, critical angle and necessary conditions for total internal reflection 4.3 Application of total internal reflection in optical fiber 4.4 LASER*: characteristics of LASER, differences between LASER and ordinary light 4.5 List applications of LASER in engineering and medical field 4.6 Structure of Optical fiber, light propagation through optical fiber, acceptance angle and numerical aperture*(only formula) 4.7 Step index* and graded index* 4.8 List applications of optical fiber in engineering and medical field 4.9 Advantages of optical fiber over coaxial cable	9	22
5.	5.a Apply the concept of energy band gap to classify Conductor, Semiconductor and insulator 5.b Apply the concept impurity doping to the semiconductors 5.c Explain the P-N junction diode and its characteristics	5.1 Conductor, Semiconductor and insulator in reference to Energy band gap* 5.2 Intrinsic Semiconductors 5.3 Extrinsic Semiconductors: P & N type, electric conduction in N-type and P-type semiconductor, temperature dependence of	12	26

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	5.d Apply the concept of PN junction diode to the rectifiers. 5.e Apply the concept of reverse bias of Zener diode to the voltage regulator. 5.f Explain LED, Photo Diode and Solar cell 5.g Explain the logic Gates and Boolean algebra.	conductivity of semiconductor. 5.4 P -N Junction formation, Depletion Region 5.5 P-N Junction diode, forward and reverse bias characteristics 5.6 Application of Junction diode as rectifier: half wave, Full wave and Bridge rectifier 5.7 Zener diode as a voltage regulator 5.8 Principle, Construction, working and applications of LED, Photo diode, Solar cell* (FF) 5.9 Logic gates and its types: AND, OR, NOT, NAND, NOR, XOR and XNOR, De Morgan's first and second law, Boolean Algebra and Truth table		
Total			**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
26	**37**	**37**	**-**	**-**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering
Level: Diploma
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Course / Subject Code :
Course / Subject Name : Modern Physics

References/Suggested Learning Resources:
(a) Books:
1. Physics by NCERT, ISBN 81-7450-631-4
2. SEARS and ZEMANSKY'S University Physics with modern Physics by Hugh D. Young & Roger A. Freedman, Person Publication 14th Edition, USA, ISBN 10: 0-321-97361-5; ISBN 13: 978-0-321-97361-0, (Student edition)
3. Physics for Scientists and Engineers with Modern Physics by John W. Jewett & Raymond A. Serway, CENGAGE Learning, 2010, Boston, 10th edition, ISBN-10: 1337553298
4. University Physics (Volume I, II & III) (Open- source Material) by William Moebs, Samuel J. Ling & Jeff Sanny, OPENSTAX, 2016, Houston, Texas ISBN-13: 1-947172-20-4
5. PHYSICS for SCIENTISTS & ENGINEERS with Modern Physics by Douglas C. Giancoli, Pearson, 2015, 7th edition, Delhi, ISBN-13: 978-1292057125
6. Fundamentals of Physics by David Halliday, Robert Greensick, Jearl Walker, 12th Edition, Willey Publication, ISBN – 1119801141
7. The Physics in our Daily Lives by Umme Ammara, 1st edition, ISBN-10: 9388435214, ISBN-13: 978-9388435215
8. Physics in Daily Life With illustrations by JO HERMANS With illustrations by Wiebke Drenckhan, EDP Science Publication, 2012, ISBN: 978-2-7598-0705-5
9. Introductory Physics: Building Models to Describe Our World (Open-Source Material) by Ryan Martin, Emma Neary, Joshua Rinaldo & Olivia Woodman, Creative Commons license, 2019, GitHub
10. Concept of Physics (volume I & II) by H.C. Verma, Bharati Bhavan Publishers, 2017, 1st edition, New Delhi, ISSBN-13: 978- 8177091878
11. Introduction to Fiber optics by Ajoy Ghatak & K. Thyagarajan, Cambridge University Press India Pvt. Ltd., New Delhi, ISBN: 9780521577854
12. Semiconductor Physics and devices – Basic Principles by Donald A. Neamen, 4th edition, McGraw Hill, SBN 978-0-07-352958-5
13. The Feynman Lectures on Physics - Vol. I, II & III, by Feynman Richard P., Pearson Education, 2012, ISBN-10 : 9332580952, ISBN-13 : 978-9332580954
14. Conceptual Physics by Paul G. Hewitt, Pearson Education, 12 edition, ISBN-10: 9352861779 ISBN-13: 978-9352861774.

(b) Open source software and website:
1. https://phet.colorado.edu/
2. https://www.iitm.ac.in/academics/learning-for-all/national-programme
3. https://www.khanacademy.org/
4. https://vlab.amrita.edu/
5. https://www.amrita.edu/project/online-labs/
6. https://www.vlab.co.in/
7. https://iitb.vlabs.co.in/
8. https://vlab.amrita.edu/

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Course / Subject Name : Modern Physics

9. https://praxilabs.com/
10. https://www.compadre.org/osp/
11. https://www.instructables.com/
12. https://www.labster.com/simulation-courses
13. https://lab4u.co/en/home/
14. https://www.labxchange.org/
15. https://virtuallabs.merlot.org/vl_physics.html
16. https://www.ncbionetwork.org/iet/labsafety/
17. https://www.thephysicsaviary.com/Physics/Programs/Labs/find.php
18. https://sites.google.com/view/thephysicsaviary/all-labs?authuser=0
19. https://sciencelessonsthatrock.com/secondary-science-virtual-labs-html/
20. https://www.mheducation.com/highered/virtual-labs.html#virtuallabs
21. https://roqed.com/product-physics/

Android/iOS Applications:
1. Physics Lab: https://play.google.com/store/apps/details?id=com.civitas.quantumphysics&pli=1
2. Lab4u: https://play.google.com/store/apps/details?id=com.lab4u.lab4physics
3. Phet: https://play.google.com/store/apps/details?id=edu.colorado.phet.androidApp
4. Every Circuit: https://play.google.com/store/apps/details?id=com.everycircuit.free
5. Logic Circuit Simulator Pro:
    https://play.google.com/store/apps/details?id=com.duracodefactory.logiccircuitsimulatorpro
6. Micrometer screw:
    https://play.google.com/store/apps/details?id=com.priantos.micrometersimulator
7. Vernier Callipers: https://play.google.com/store/apps/details?id=com.vernier.tavifom

Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs.
1	Use Vernier calipers to measure the dimensions of a given object.	I	02
2	Use micrometer screw gauge to measure diameter of a given wire and determine volume of a given metallic piece.	I	02
3	Study the series-parallel connections of resistors.	II	02
4	Study parallel plate capacitor and its series-parallel combinations.	II	02
5	Use ultrasonic interferometer to determine the velocity of ultrasonic waves in different liquids.	III	02
6	Use electrical vibrator to find the frequency of AC mains.	III	02

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7	Determine the refractive index of given semi-circular glass block using TIR.	IV	02
8	Determine the value of the numerical aperture (NA) of given optical fiber.	IV	02
9	Study the I – V characteristics of PN junction diode.	V	02
10	Use PN junction diode to determine the energy band gap of a semiconductor.	V	02
11	Determine the breakdown voltage of Zener diode in reverse bias.	V	03
12	Use PN junction diode as a half wave, full wave and Bridge rectifier.	V	03
13	Determine the Fill factor (FF) of given solar cell.	V	03
14	Verify the truth table of logic gates OR, AND, NOT, NAND, NOR, XOR and XNOR gates.	V	01
	TOTAL		**30**

List of Laboratory/Learning Resources Required:

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Vernier caliper analog - least count- 0.02 mm	1
2	Micrometer screw gauge analog (0-25 mm) – least count 0.01mm	2
3	Resistors, Digital Multimeter, DC Ameter, Power supply (0-5 V DC)	3
4	Parallel plate capacitor (variable plate distance and area), Digital capacitance meter, capacitors of various capacities	4
5	Ultrasonic interferometer - gold plated quartz crystal, operating voltage - 220 Volt, display - analog, frequency - 2MHz with position control	5
6	Electrical Vibrator, uniform cord, weight pan, weight box, pulley, meter scale, sensitive balance	6
7	Semi-circular glass block, Laser light pen	7
8	Numerical aperture apparatus with optical fiber & LASER source.	8
9	PN Junction Diode Characteristics Apparatus	9
10	Energy band gap apparatus	10
11	Zener Diode Characteristics Apparatus	11
12	Diode Rectifier kit	12
13	Solar Cell kit	13
14	Logic Gate Trainer kit	14

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Suggested Project List:

a) Measurement: Measure physical quantities using smart phone applications.

b) Arduino: Physical quantities such as Voltage, Magnetic field, Temperature, Light, Sound and distance can be measured with the help of low-cost sensors and Arduino.

c) Prepare proto type Vernier calipers of given least count.

d) Unit Systems: Charts/Models of conversion from MKS to CGS and vice versa.

e) Electroscope: To detect presence of static charges, to determine the nature of electric charges, to compare the magnitudes of two different charges.

f) Coulomb's Torsion Balance: Conceptualize the relation of electrostatic force with distance and charge.

g) Electrostatic pom-pom set: A cheap demonstrator for electrostatic force made up of a metal rod mounted on an insulated plastic stand carries a round metal plate at its top and a fringe of colored nylon cords. These can even be used as a make shift charge sensor as long as you know the charge on one of your objects.

h) Paper Capacitor: Aluminum foil and tissue paper can be used to make cylindrical capacitor.

i) Variable capacitor: Two copper cylinders and plastic pipe can be used to make variable capacitor.

j) Dry Field Mapping Kit: Easily visualize electric fields generated by electrodes of your own design. Simply draw your electrodes, hook up a battery to generate the electric fields, and use a Multimeter or voltmeter to map out the equipotential surfaces.

k) Domino model: A model showing fundamental idea about wave and how it travels.

l) Shive Wave Machine: For demonstration of Frequency, Wavelength, wave velocity.

m) Wave Generator: model for generating transverse wave.

n) Powell's Wave machine: For demonstration of Frequency, Wavelength, wave velocity

o) Chladni's Plates: A model which provides a nice way to visualize the effects of vibrations on mechanical surfaces like flat sheet of metal mounted on a central stalk to a sturdy base. When the plate is made to vibrate, set up form complex but symmetrical patterns over its surface.

p) Slinky: A nice way to demonstrate transverse and longitudinal waves.

q) Mirascope: to demonstrate the Holographic effect using simple concept of reflection.

r) Paraxial Ray Optics Cloaking: A combination of four converging lenses creates an illusional 3D cloaking effect.

s) Hartle's Optical Disk: To demonstrate refraction and total internal reflection using LASER and 360° protractor.

t) Sugar and bending of light: prepare a solution of sugar and water to demonstrate bending of light (using semiconductor LASER).

u) Fiber optics: prepare an optical fiber cable using transparent flexible plastic tube, laser and water to demonstrate the property of optical fiber cable.

v) Semiconductor: Prepare the logic gate circuits.

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APPENDIX

a. Application level based numerical should be given at the time of instruction and assessment in each unit.
b. 'Definition' of units of fundamental physical quantities are only for information and not to be asked in examination in any form.
c. Students can be introduced to system of units other than SI, MKS, CGS unit systems but not to be asked in examinations.
d. Only scalar treatment is to be given to Coulomb's law. (No Vector Treatment)
e. Properties of electric field lines are constrained to only dipole (two charge) system of charges and must not be asked in exam.
f. Concept of Electric potential and potential difference requires no mathematical derivation. It can be explained with formula, units and applications.
g. For LASER, Principle, Construction and working must not be asked in exam...
h. For optical fiber, mathematical derivation of Numerical aperture and acceptance angle must not be asked in exam.
i. Types of Optical Fiber: Step index and Graded index (Only Single mode transmission)
j. Energy band Gap theory can be introduced only as tool to classify the conductors, semiconductors and insulators with the help of conduction and valance band. Energy band theory must not be asked in exams. Hybridization of orbitals must not be introduced.
k. For solar cell, the derivation of Fill factor is not required.
l. For logic gates, Karnaugh maps must not be asked in exam.

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GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering

Level: Diploma

Course / Subject Code:

Course / Subject Name: APPLIED CHEMISTRY

w. e. f. Academic Year:	2024-25
Semester	1st
Category of the Course:	Basic Science Courses (BSC)-02

Prerequisite:	Fundamental knowledge of Chemistry and basic Arithmetic for simple calculations.
Rationale:	Applied Chemistry deals with solving the various issues and problems of industries, the environment, and day-to-day life for the benefit of people at large, through applications of various concepts and principles of chemistry. Applied chemistry helps to develop and enhance the thinking capabilities of the diploma pass outs in line with the modern trends in engineering and technology through the inclusion of various creative activities/micro projects etc. Many global problems/issues and their in-depth understanding is addressed through the inclusion of topics of relevance like atomic structure, chemical bonding and solutions; electrochemistry; corrosion; water treatment; cement, glass and refractories; paints, varnishes and insulating materials; polymers, elastomers, adhesives and semiconductors in this course.

Course Outcome:

After Completion of the Course, Student will able to:

No.	Course Outcomes	RBT Level
01	*Apply* the principles of atomic structure, chemical bonding and solutions to solve various engineering problems.	R/U/A
02	*Solve* engineering problems using the concepts of electrochemistry and corrosion.	R/U/A
03	*Use* relevant water treatment methods to solve domestic and industrial problems.	R/U/A
04	*Select* appropriate engineering materials like cement, glass, refractories, paints, varnishes and insulating materials for industrial applications.	R/U/A
05	*Choose* various types of engineering materials like polymers, elastomers, adhesives and semiconductors for domestic and industrial applications.	R/U/A

Revised Bloom's Taxonomy (RBT)

GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering

Level: Diploma

Course / Subject Code:

Course / Subject Name: APPLIED CHEMISTRY

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	**T**	**PR**	**C**	**ESE (E)**	**PA/CA (M)**	**PA/CA (I)**	**ESE (V)**	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Atomic Structure, Chemical Bonding and Solutions** **Atomic Structure:** 1.1. Concepts of orbits and orbitals. 1.2. Pauli's exclusion principle, Hund's rule of maximum spin multiplicity, Aufbau rule. 1.3. Electronic configuration of elements having atomic number 1 to 30. **Chemical Bonding:** 1.4. Concept of chemical bond, Octet rule, Types of chemical bonds : 1.4.1 Ionic (Electrovalent) bond and its characteristics (Example NaCl.), 1.4.2 Covalent bond and its characteristics (examples–Non-polar covalent bond: H_2, O_2, N_2, CH_4; Polar covalent bond: HCl, H_2O, And NH3.), 1.4.3 Coordinate covalent (Dative) bond (examples – NH_4^+, H_3O^+), 1.4.4 Metallic bond and its characteristics, 1.4.5 Hydrogen bond, its types and significance, 1.4.6 Intermolecular force of attraction (van der Waals bond). 1.5. Structures of solids: Ionic solids, Molecular solids, Network solids, and Metallic solids. **Solutions:** 1.6. Definitions of solute, solvent, solution and concentration, Modes of expressing concentration of solutions – Molarity (M = mole/liter), Normality (N), Molality (m), mass percentage (%w/w), volume percentage (%v/v), mass by	08	17% (12 Marks)

	volume percentage (%w/v), mole fraction (χ), ppm (μg/mL).		

2.	**Electrochemistry**
	2.1. Arrhenius theory of ionization.
	2.2. Electronic concept of oxidation, reduction, and redox reactions.
	2.3. Degree of ionization (α) and the factors affecting on it.
	2.4. Concept of pH and pOH; pH scale for acids, bases and neutral solutions, Calculations of pH and pOH for dilute solutions of acids and bases, Importance of pH in various fields.
	2.5. Buffer solutions, Types of buffer solutions: Acidic buffers and Basic buffers, Applications of buffer solutions.
	2.6. Definition of Electrolytes, Non-electrolytes with suitable examples, Types of Electrolytes with examples.
	2.7. Construction, working, cell-reactions and symbolic representation of an Electrochemical cell.
	2.8. Conditions for a half-cell to be standard.
	2.9. Construction and working of Standard Hydrogen Electrode (SHE).
	2.10. Measurement of Standard half-cell potential / Standard electrode potential (E^o_R or EoL), Electrochemical/electromotive force (emf) series, Standard cell potential (E^o_{cell}).
	2.11. Construction of Electrolytic cell and Electrolysis.
	2.12. Faraday's Laws of Electrolysis.
	2.13. Industrial applications of electrolysis:
	    2.13.1 Electrometallurgy,
	    2.13.2 Electroplating,
	    2.13.3 Electro-refining.
		08	15%
			(11 Marks)

3.	**Corrosion of metals and its prevention** 3.1. Definition of Corrosion with example. 3.2. Dry or Chemical corrosion: Oxidation corrosion, Corrosion by other gases. 3.3. Wet or electrochemical corrosion: Liberation of H_2, Absorption of O_2. 3.4. Galvanic (Bimetallic) corrosion. 3.5. Concentration cell corrosion. 3.6. Pitting corrosion, Waterline corrosion and Crevice corrosion. 3.7. Factors affecting the rate of corrosion: Nature of the metal, Nature of surface film, Relative areas of the anodic and catholic	07	12% (8 Marks)

	parts, Purity of metal, Temperature, Humidity of air, Influence of ph. 3.8. Preventive measures for internal corrosion and External corrosion: Modification of environment, Modification of the properties of metal, Use of protective coatings, Anodic and catholic protection, Modification in design and choice of material.		

4.	**Water treatment**
	 4.1 Sources of water, hard water and Soft water.
	 4.2 Types of hardness of water (Temporary/Carbonate harness and Permanent/Non-carbonate hardness), salts causing it and simple numerical based on it.
	 4.3 Units of hardness.
	 4.4 Problems caused by the use of hard water in boilers and its prevention:
	    4.4.1 Scale and sludge formation,
	    4.4.2 Priming and Foaming,
	    4.4.3 Caustic embrittlement,
	    4.4.4 Boiler Corrosion.
	 4.5 Water softening techniques:
	    4.5.1 Soda-lime process,
	    4.5.2 Zeolite (Permutit) process,
	    4.5.3 Ion-exchange/De-ionization process,
	    4.5.4 Reverse Osmosis (R.O.) process.
	 4.6 Treatment of Municipal drinking water:
	    4.6.1 Screening,
	    4.6.2 Sedimentation,
	    4.6.3 Coagulation,
	    4.6.4 Filtration,
	    4.6.5 Sterilization of water by Chlorination, Break-point (Free-residual) Chlorination.
	 4.7 Enlist Indian standard specifications of drinking water.
		06	14% (10 Marks)

5.	**Cement, Glass and Refractories** **Cement :** 5.1 Definition and Classification of Cement. 5.2 Manufacture of Portland cement. 5.3 Chemical Composition of Cement. 5.4 Chemical Constitution of Portland cement. 5.5 Setting and Hardening of Portland cement.	04	12% (8 Marks)

	Glass: 5.6 Definition and General Properties of Glass. 5.7 Manufacture of Glass. 5.8 Types of Glasses and their Applications. **Refractories:** 5.9 Definition and Characteristics of Refractory. 5.10 Applications of refractories. 5.11 Classification of refractories: Acid, Basic and Neutral refractories.		
6.	**Paints, Varnishes and Insulating Materials** **Paints:** 6.1 Definition of paints, the purpose of oil paints, characteristics of oil paints. 6.2 Ingredients of paints: Function and example of each ingredient. **Varnishes:** 6.3 Definition and Constituents of Varnishes. 6.4 Types of varnishes. 6.5 Differentiate between Paints and Varnishes. **Insulating Materials:** 6.4 Definition, Types and Properties of insulating materials. 6.5 Applications of Thermal, Acoustic, Waterproofing and Fireproofing insulating materials.	04	10% (7 Marks)
7.	**Polymers, Elastomers, Adhesives and Semiconductors** **Polymers:** 7.1 Definition of Monomer, Polymer, Polymerization, Degree of polymerization (n) and Repeating unit. 7.2 Classification of polymers based on Molecular structure: Linear polymers, Branched polymers, Cross-linked polymers. 7.3 Classification of polymers based on Monomer: Homo polymer, Co-polymer. 7.4 Classification of polymers based on Thermal behavior: Thermoplastic polymers and Thermosetting polymers. 7.5 Types of polymerizations: Addition polymerization and Condensation polymerization 7.6 Preparation (by simple reactions), Properties and Uses of some thermoplastic polymers and thermosetting polymers: Polyethylene (PE), Polypropylene (PP), Polyvinylchloride (PVC), PolyTetraFluoroEthylene (PTFE, Teflon, and Fluon), Polystyrene (PS), PolyAcryloNitrile (PAN), Bakelite, and Epoxy resins.	08	20% (14 Marks)

7.7   Biodegradable Polymers: Definition, Chemical composition and Uses of Poly–β–HydroxyButyrate–co–β–hydroxyl Valerate (PHBV), Nylon–2–nylon-6.

Elastomers (Rubbers):

7.8   Natural rubber and its Properties.

7.9   Vulcanization of rubber and its   Advantages.

7.10 Synthetic rubbers: Preparation (by simple reactions), Properties and Uses of Buna-S (GR-S or Styrene) rubber, Buna-N   (GR-A or Nitrile) rubber, Neoprene (GR-M) rubber.

Adhesives:

7.11 Definition and Characteristics of Adhesives.

7.12 Classification of Adhesives.

7.13 Applications of Adhesives.

Semiconductors:

7.14 Definition and Classification of Semiconductors.

7.15 Enlist Semiconductor Devices.

7.16 Elemental Semiconductors:
Intrinsic Semiconductors, Extrinsic Semiconductors (n-type Semiconductors, p-type Semiconductors).

Total	45	100% (70Marks)

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
24 Marks (35%)	32 Marks (45%)	14 Marks (20%)	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

<u>*Note*</u>*:* This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may slightly vary from above table.

References/Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Book	Author	Publication with the place, year and ISBN
1	Engineering Chemistry	Jain & Jain	Dhanpat Rai Publishing Co. (P) Ltd., New Delhi, 2015, ISBN: 93-521-6000-2
2	A Textbook of Engineering Chemistry	Dr S. S. Dara & Dr S. S. Umare	S. Chand & Co. (P) Ltd., New Delhi, 2014, ISBN: 81-219-0359-9
3	Textbook of Chemistry for Class XI & XII (Part-I & II)	NCERT	NCERT, New Delhi, 2017-18, Class-XI, ISBN: 81-7450-494-X (Part-I), 81- 7450-535-O (Part-II), Class-XII, ISBN: 81-7450-648-9(Part-I), 81-7450-716-7(Part-II)
4	Engineering Chemistry	Shikha Agarwal	Cambridge Uni. Press, New Delhi, 2019, ISBN: 978-1-108-72444-9
5	Understanding Chemistry	C. N. R. Rao	World scientific publishing Co., 2009, ISBN: 9789812836045
6	Engineering Chemistry	Dr. Vikram, S.	Wiley India Pvt. Ltd., New Delhi, 2013, ISBN: 9788126543342
7	Chemistry for Engineers	Rajesh Agnihotri	Wiley India Pvt. Ltd., 2014, ISBN: 9788126550784
8	Fundamental of Electrochemistry	V. S. Bagotsky	Wiley International N.J., 2005, ISBN: 9780471700586

(b) Open source software and website:
1. http://www.chemguide.co.uk/atommenu.html
2. https://www.visionlearning.com/
3. http://www.chem1.com/
4. https://www.wastewaterelearning.com/elearning/
5. https://www.capital-refractories.com/
6. https://www.wqa.org/
7. https://ncert.nic.in/
8. https://docslib.org/insulation-materials-science-and-application
9. http://www.olabs.edu.in/
10. http://chemcollective.org/activities/type_page/1
11. http://www.presentingscience.com/vac/corrosion/index.htm
12. https://vlab.amrita.edu/index.php?sub=2&brch=190

Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.

1	Prepare a standard solution of oxalic acid or potassium permanganate.	1
2	Prepare a solution of given concentration in terms of percentage weight by weight (% w/w) of a given compound.	1
3	Prepare a solution of given concentration in terms of percentage volume by volume (% v/v) of a given compound.	1
4	Prepare a solution of given concentration in terms of percentage weight by volume (% w/v) of a given compound.	1
5	Determine the strength of the given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.	1
6	Standardize potassium permanganate solution by standard oxalic acid solution and estimate ferrous ions.	2
7	Determine pH-Values of given samples of Solution by using Universal Indicator and pH-meter.	2
8	Determine emf of an electrochemical cell (Daniel cell).	2
9	Determine electrochemical equivalent of copper metal using Faraday's first law.	2
10	Determine the rate of corrosion for different metals in the given solution.	3
11	Determine the rate of corrosion for metal in the solutions of different ph.	3
12	Estimate total hardness of given water sample using standard EDTA solution.	4
13	Estimate alkalinity of given water sample using 0.01M sulphuric acid solution.	4
14	Determine Total Dissolved Solid (TDS) and Total Suspended Solid (TSS) in a given sample of water.	4
15	Determine the iron content in a given cement sample using a colorimeter.	5
16	Prepare Polystyrene and Bakelite. (Anyone)	7

<u>*Note:*</u>

i. **Practical Exercises** of **at least 28 Hrs**. *should be completed by the end of the term.*

ii. *More* **Practical Exercises** *can be designed and offered by the respective course teacher to develop the industry-relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

iii. *The following are some* **sample 'Process'** *and* **'Product' related skills** *(more may be added/deleted depending on the course) that occur in the above listed* **Practical Exercises** *of this course required which are embedded in the COs and ultimately the competency.*

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in	Maximum

			%	Marks for PA/CA (I)
➤		*"Process" related skills*		
1.		− Prepare experimental setup accurately. − Handling of apparatus/glassware for precise measurements.	20	5
2.		− Practice and adapt good and safe measuring techniques. − Record observations correctly.	20	5
3.		− Housekeeping. − Observance /Follow safety rules.	20	5
➤		*"Product" related skills*		
4.		− Does Calculations. − Interpret the Results and their Conclusion/s.	20	5
5.		− Prepare report of practical in prescribed format. − Viva-voce.	20	5
	Total		100	**25**

List of Laboratory Equipment's/Learning Resources Required:

No.	Equipment's / Instruments	Practical No.
1	Electronic Weighing Balance / Digital Weighing Balance (OR Analytical Balance)	1, 2, 4, 9, 10, 11, 14, 16
2	Digital pH meter	7, 11
3	Voltmeter	8
4	6 V Battery	9
5	Ammeter	9
6	Rheostat	9
7	Dryer	10, 11
8	Hot air oven	14
9	Vacuum Pumps with glass filter	14
10	Colorimeter	15
11	Hot plate with Magnetic stirrer	1, 5, 6, 7, 12, 14, 15

Suggested Project List:

1. Prepare a model of an atom with the help of a ball and stick or of any other items.

2. Prepare a PowerPoint animation that can explain the structure of an atom.

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3. Prepare a chart showing (1) Atomic number ($Z = e^- = p^+$) 1 to 30, (2) Name of the element, (3) Symbol, (4) Electronic configuration and (5) Condensed Electronic configuration of elements in tabular form.

4. Prepare a chart of the modern periodic table which gives information about the atomic number and mass number of different elements.

5. Prepare crystals of common salt from NaCl solution.

6. Form three groups of students in the class. Consider a hypothetical situation of exchanging/ sharing/giving of different items/belongings and demonstrate the type of ionic, covalent, and co-ordinate bonding amongst the students in a simulated situation. Present your findings.

7. Prepare a chart representing compounds and solutions which affect human life positively and negatively.

8. Classify the surrounding corrosion into dry corrosion and wet corrosion.

9. Collect different samples of utensils reinforced materials, iron, copper, brass, bronze, and other alloys. Place them in an open environment under tin shade. Observe the corrosive properties over a period of four weeks. Record your observations. Discuss the findings with your teacher and classmates.

10. Collect three metallic strips of Cu, Al and Fe. Place them in different acidic and alkaline solutions of the same concentration. Observe and record the loss in weight of metals due to an acidic and alkaline environment. Discuss the findings with your teacher and classmates.

11. Prepare a model to demonstrate the application of electrolysis.

12. Collect water samples from different water sources and measure the hardness of the water.

13. Collect the water sample from different sources of ground and surface water (at least five). Explore the new and simplest softening and water treatment methods by creating the different assemblies and manipulative techniques.

14. Collect data of various cement, glass and semiconductors available in the market.

15. Make a table showing the availability of natural rubber in India and show places on the map of India.

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Course / Subject Name: APPLIED CHEMISTRY

16. Prepare a chart showing (1) name & formula of the Polymer, (2) name and formula of the Monomer/s used to prepare that polymer, (3) simple reaction equation for Preparation of polymer, (4) Properties in short and (5) Uses in tabular form.

17. Collect different polymers and prepare the chart/ PowerPoint based on their type, properties, and uses.

18. Classify Semiconductors with examples. Enlist Semiconductor Devices. Also collect Semiconductors.

Suggested Activities for Students:

1. Prepare a Power point presentation or animation showing different atomic structures and different types of chemical bonds.

2. Calculate pH of acid solutions and base solutions having different concentrations.

3. Prepare a chart showing different methods used for the prevention of corrosion.

4. Enlist the formulae to solve the numericals based on hardness of water. Calculate the Molecular mass of salts responsible for hardness of water. Show calculations for some numericals based on hardness of water.

5. Prepare a table showing general chemical composition of cement and glass with their applications.

6. Do market survey of different types of cement, glass and semiconductors and compare their properties and applications.

7. Do library survey regarding polymers, synthetic rubber, insulating materials and semiconductors used in different industries.

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Program Name: Diploma in Engineering

Level: Diploma

Course / Subject Code:

Course / Subject Name: Basic Chemistry

w. e. f. Academic Year:	2024-25
Semester	1st
Category of the Course:	Basic Science Courses (BSC)-02

Prerequisite:	Fundamental knowledge of Chemistry and basic Arithmetic for simple calculations.
Rationale:	The branch of applied science which deals with chemistry is known as Basic chemistry. The study of concepts and principles of Basic chemistry will aid the technicians in comprehending and solving engineering problems. Thus, a strong foundation in applied science will help the students in their self-development to cope up with the constant influx of innovations. There are numerous materials used in fabricating and manufacturing devices for the comfort of life. The selection, characterization, and suitability assessment of natural raw materials essentially requires principles and concepts of Basic Chemistry for technicians. Successful completion of this course content will enable technicians to understand, ascertain and analyze properties of natural raw materials required for producing economical and eco-friendly finished products through the inclusion of various creative activities/projects etc. Many global problems/issues and their in-depth understanding is addressed through the inclusion of topics of relevance like atomic structure, chemical bonding and solutions; electrochemistry; corrosion; water treatment; lubricants; polymers, elastomers, adhesives and semiconductors in this course.

Course Outcome:

After Completion of the Course, Student will able to:

No.	Course Outcomes	RBT Level
01	*Apply* the principles of atomic structure, chemical bonding and solutions to solve various engineering problems.	R/U/A
02	*Solve* engineering problems using the concepts of electrochemistry and corrosion.	R/U/A
03	*Use* relevant water treatment methods to solve domestic and industrial problems.	R/U/A
04	*Classify* organic compounds based on their functional groups.	R/U/A
05	*Choose* various types of engineering materials like lubricants, polymers, elastomers, adhesives and semiconductors for domestic and industrial applications.	R/U/A

Revised Bloom's Taxonomy (RBT)

GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering

Level: Diploma

Course / Subject Code:

Course / Subject Name: Basic Chemistry

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	**T**	**PR**	**C**	**ESE (E)**	**PA/CA (M)**	**PA/CA (I)**	**ESE (V)**	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Atomic Structure, Chemical Bonding and Solutions** **Atomic Structure:** 1.1. Concepts of orbits and orbitals. 1.2. Pauli's exclusion principle, Hund's rule of maximum spin multiplicity, Aufbau rule. 1.3. Electronic configuration of elements having atomic number 1 to 30. **Chemical Bonding:** 1.4. Concept of chemical bond, Octet rule, Types of chemical bonds : 1.4.1 Ionic (Electrovalent) bond and its characteristics (Example NaCl.), 1.4.2 Covalent bond and its characteristics (examples–Non-polar covalent bond: H_2, O_2, N_2, CH_4; Polar covalent bond: HCl, H_2O, And NH3.), 1.4.3 Coordinate covalent (Dative) bond (examples – NH_4^+, H_3O^+), 1.4.4 Metallic bond and its characteristics, 1.4.5 Hydrogen bond, its types and significance, 1.4.6 Intermolecular force of attraction (van der Waals bond). 1.5. Structures of solids: Ionic solids, Molecular solids, Network solids, and Metallic solids. **Solutions:** 1.6. Definitions of solute, solvent, solution and concentration, Modes of expressing concentration of solutions – Molarity (M = mole/liter), Normality (N), Molality (m), mass percentage (%w/w), volume percentage (%v/v), mass by	08	17% (12 Marks)

	volume percentage (%w/v), mole fraction (χ), ppm (μg/mL).		

2	**Electrochemistry**
	2.1. Arrhenius theory of ionization.
	2.2. Electronic concept of oxidation, reduction, and redox reactions.
	2.3. Degree of ionization (α) and the factors affecting on it.
	2.4. Concept of pH and pOH; pH scale for acids, bases and neutral solutions, Calculations of pH and pOH for acids and bases solutions of different concentrations, Importance of pH in various fields.
	2.5. Buffer solutions, Types of buffer solutions: Acidic buffers and Basic buffers, Applications of buffer solutions.
	2.6. Definition of Electrolytes, Non-electrolytes with suitable examples, Types of Electrolytes with examples.
	2.7. Construction, working, cell-reactions and symbolic representation of an Electrochemical cell.
	2.8. Conditions for a half-cell to be standard.
	2.9. Construction and working of Standard Hydrogen Electrode (SHE).
	2.10. Measurement of Standard half-cell potential / Standard electrode potential (E^{o}_{R} or EoL), Electrochemical/electromotive force (emf) series, Standard cell potential (E^{o}_{cell}).
	2.11. Construction of Electrolytic cell and Electrolysis.
	2.12. Faraday's Laws of Electrolysis.
	2.13. Industrial applications of electrolysis:
	    2.13.1 Electrometallurgy,
	    2.13.2 Electroplating,
	    2.13.3 Electro-refining.
		08	15%
			(11 Marks)

3	**Corrosion of metals and its prevention** 3.1. Definition of Corrosion with example. 3.2. Dry or Chemical corrosion: Oxidation corrosion, Corrosion by other gases. 3.3. Wet or electrochemical corrosion: Liberation of H_2, Absorption of O_2. 3.4. Galvanic (Bimetallic) corrosion. 3.5. Concentration cell corrosion. 3.6. Pitting corrosion, Waterline corrosion and Crevice corrosion. 3.7. Factors affecting the rate of corrosion: Nature of the metal, Nature of surface film, Relative areas of the anodic and catholic parts, Purity of metal, Temperature, Humidity of air, Influence of ph. 3.8. Preventive measures for internal corrosion and External	06	12% (8 Marks)

	corrosion: Modification of environment, Modification of the properties of metal, Use of protective coatings, Anodic and catholic protection, Modification in design and choice of material.		
4	**Water treatment**	07	14% (10 Marks)
	4.1 Sources of water, hard water and Soft water.		
	4.2 Types of hardness of water (Temporary/Carbonate harness and Permanent/Non-carbonate hardness), salts causing it and simple numericals based on it.		
	4.3 Units of hardness.		
	4.4 Problems caused by the use of hard water in boilers and its prevention:		
	4.4.1 Scale and sludge formation,		
	4.4.2 Priming and Foaming,		
	4.4.3 Caustic embrittlement,		
	4.4.4 Boiler Corrosion.		
	4.5 Water softening techniques:		
	4.5.1 Soda-lime process,		
	4.5.2 Zeolite (Permutit) process,		
	4.5.3 Ion-exchange/De-ionization process,		
	4.5.4 Reverse Osmosis (R.O.) process.		
	4.6 Treatment of Municipal drinking water:		
	4.6.1 Screening,		
	4.6.2 Sedimentation,		
	4.6.3 Coagulation,		
	4.6.4 Filtration,		
	4.6.5 Sterilization of water by Chlorination, Break-point (Free-residual) Chlorination.		
	4.7 Enlist Indian standard specifications of drinking water.		
5	**Basic concepts of Organic Chemistry:**	05	12% (8 Marks)
	5.1 Organic and Inorganic Compounds.		
	5.2 Tetravalency of Carbon.		
	5.3 Concept of Hybridization, Types of hybridization: sp, sp^2 and sp^3 hybridization with examples.		
	5.4 Sigma bonding and Pi bonding.		
	5.5 Classification of Organic compounds, IUPAC nomenclature of simple hydrocarbons.		
	5.6 Functional groups and its classification.		
	5.7 Isomerism and Homologous series.		
	5.8 Saturated Hydrocarbons and Unsaturated Hydrocarbons.		
	5.9 Source of hydrocarbons: Distillation of coal tar, Refining of petroleum.		

	5.10 Preparation, Properties and Uses of Alkane (Ethane), Alkene (Ethene/Ethylene), Alkyne (Ethane/Acetylene).		
6	**Lubricants** 6.1 Lubricants and Lubrication, Functions of lubricants. 6.2 Mechanism of Lubrication: Fluid lubrication, Boundary lubrication. 6.3 Classification of lubricants with examples: Solid, Semi-solid, Liquid and Synthetic lubricants. 6.4 Physical Properties of lubricants: Viscosity and Viscosity index, Flash point and Fire point, Cloud point and Pour point, Oiliness. 6.5 Chemical properties of lubricants: Saponification number, Neutralization number, Emulsification number. 6.6 Selection of lubricants for different types of Machinery like: Gears, Cutting tools, Steam turbine, Transformers. 6.7 Biodegradable lubricants.	03	10% (7 Marks)
7	**Polymers, Elastomers, Adhesives and Semiconductors** **Polymers:** 7.1 Definition of Monomer, Polymer, Polymerization, Degree of polymerization (n) and Repeating unit. 7.2 Classification of polymers based on Molecular structure: Linear polymers, Branched polymers, Cross-linked polymers. 7.3 Classification of polymers based on Monomer: Homo polymer, Co-polymer. 7.4 Classification of polymers based on Thermal behavior: Thermoplastic polymers and Thermosetting polymers. 7.5 Types of polymerizations: Addition polymerization and Condensation polymerization 7.6 Preparation (by simple reactions), Properties and Uses of some thermoplastic polymers and thermosetting polymers: Polyethylene (PE), Polypropylene (PP), PolyVinylChloride (PVC), PolyTetraFluoroEthylene (PTFE, Teflon, and Fluon), Polystyrene (PS), PolyAcryloNitrile (PAN), Bakelite, and Epoxy resins. 7.7 Biodegradable Polymers: Definition, Chemical composition and Uses of Poly–β–HydroxyButyrate–co–β–hydroxyl Valerate (PHBV), Nylon–2–nylon-6. **Elastomers (Rubbers):** 7.8 Natural rubber and its Properties. 7.9 Vulcanization of rubber and its Advantages. 7.10 Synthetic rubbers: Preparation (by simple reactions), Properties and Uses of Buna-S (GR-S or Styrene) rubber, Buna-N (GR-A or Nitrile) rubber, Neoprene (GR-M) rubber.	08	20% (14 Marks)

	Adhesives: 7.11 Definition and Characteristics of Adhesives. 7.12 Classification of Adhesives. 7.13 Applications of Adhesives. **Semiconductors:** 7.14 Definition of Semiconductors. 7.15 Enlist semiconductor devices. 7.16 Elemental Semiconductors: Intrinsic Semiconductors, Extrinsic Semiconductors (n-type Semiconductors, p-type Semiconductors).		
	Total	**45**	**100%** **(70 Marks)**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
24 Marks (35%)	32 Marks (45%)	14 Marks (20%)	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

<u>*Note*</u>: This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may slightly vary from above table.

References/Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Book	Author	Publication with the place, year and ISBN
1	Engineering Chemistry	Jain & Jain	Dhanpat Rai Publishing Co. (P) Ltd., New Delhi, 2015, ISBN: 93-521-6000-2
2	A Textbook of Engineering Chemistry	Dr S. S. Dara & Dr S. S. Umare	S. Chand & Co. (P) Ltd., New Delhi, 2014, ISBN: 81-219-0359-9
3	Textbook of Chemistry for Class XI & XII (Part-I & II)	NCERT	NCERT, New Delhi, 2017-18, Class-XI, ISBN: 81-7450-494-X (Part-I), 81- 7450-535-O (Part-II), Class-XII, ISBN: 81-7450-648-9(Part-I), 81-7450-716-7(Part-II)
4	Engineering Chemistry	Shikha Agarwal	Cambridge Uni. Press, New Delhi, 2019, ISBN: 978-1-108-72444-9
5	Understanding Chemistry	C. N. R. Rao	World scientific publishing Co., 2009, ISBN: 9789812836045
6	Engineering Chemistry	Dr. Vikram, S.	Wiley India Pvt. Ltd., New Delhi, 2013, ISBN: 9788126543342
7	Chemistry for Engineers	Rajesh Agnihotri	Wiley India Pvt. Ltd., 2014, ISBN: 9788126550784
8	Fundamental of Electrochemistry	V. S. Bagotsky	Wiley International N.J., 2005, ISBN: 9780471700586

(b) Open source software and website:

1. http://www.chemguide.co.uk/atommenu.html
2. https://www.visionlearning.com/
3. http://www.chem1.com/
4. https://www.wastewaterelearning.com/elearning/
5. https://www.wqa.org/
6. https://ncert.nic.in/
7. http://www.olabs.edu.in/
8. http://chemcollective.org/activities/type_page/1
9. http://www.presentingscience.com/vac/corrosion/index.htm
10. https://vlab.amrita.edu/index.php?sub=2&brch=190

Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.
1	Prepare a standard solution of oxalic acid or potassium permanganate.	1
2	Prepare a solution of given concentration in terms of percentage weight by weight (% w/w) of a given compound.	1
3	Prepare a solution of given concentration in terms of percentage volume by volume (% v/v) of a given compound.	1
4	Prepare a solution of given concentration in terms of percentage weight by volume (% w/v) of a given compound.	1
5	Determine the strength of the given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.	1
6	Standardize potassium permanganate solution by standard oxalic acid solution and estimate ferrous ions.	2
7	Determine pH-Values of given samples of Solution by using Universal Indicator and pH-meter.	2
8	Determine emf of an electrochemical cell (Daniel cell).	2
9	Determine electrochemical equivalent of copper metal using Faraday's first law.	2
10	Determine the rate of corrosion for different metals in the given solution.	3
11	Determine the rate of corrosion for metal in the solutions of different ph.	3
12	Estimate total hardness of given water sample using standard EDTA solution.	4
13	Estimate alkalinity of given water sample using 0.01M sulphuric acid solution.	4
14	Determine Total Dissolved Solid (TDS) and Total Suspended Solid (TSS) in a given sample of water.	4
15	Determine the viscosity of the lubricating oil using a Redwood viscometer.	6
16	Determine the Acid value of the given lubricating oil.	6
17	Determine the Saponification value of the given lubricating oil.	6
18	Determine flash point and fire point of the given lubricating oil using Pensky Martens/Cleveland open cup/Able's flashpoint apparatus.	6
19	Prepare Polystyrene and Bakelite. (Anyone)	7

Note:

_i._ **Practical Exercises** of **at least 28 Hrs**. should be completed by the end of the term.

_ii._ More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry-relevant skills/outcomes to match the COs. The above table is only a suggestive list.

iii. The following are some **sample 'Process'** and **'Product' related skills** (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %	Maximum Marks for PA/CA (I)
➤	_"Process" related skills_		
1.	– Prepare experimental setup accurately. –Handling of apparatus/glassware for precise measurements.	20	5
2.	– Practice and adapt good and safe measuring techniques. – Record observations correctly.	20	5
3.	– Housekeeping. – Observance /Follow safety rules.	20	5
➤	_"Product" related skills_		
4.	– Does Calculations. – Interpret the Results and their Conclusion/s.	20	5
5.	– Prepare report of practical in prescribed format. – Viva-voce.	20	5
Total		100	**25**

List of Laboratory Equipment's required:

These major equipment's/instruments required to develop PrOs are given below with broad specifications to facilitate procurement of them by the administrators/management of the institutes. This will ensure the conduction of practice in all institutions across the state in a proper way so that the desired skills are developed in students.

No.	Equipment's / Instruments	Practical No.

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Program Name: Diploma in Engineering
Level: Diploma
Course / Subject Code:
Course / Subject Name: Basic Chemistry

1	Electronic Weighing Balance / Digital Weighing Balance (OR Analytical Balance)	1, 6, 7, 8, 11, 13, 14, 16
2	Hot plate with Magnetic stirrer	3
3	Digital pH meter	4, 8
4	Voltmeter	5
5	6 V Battery	6
6	Ammeter	6
7	Rheostat	6
8	Dryer	7, 8
9	Hot air oven	11
10	Vacuum Pumps with glass filter	11
11	Redwood viscometer No.1	12
12	Stop watch	12
13	Pensky-Marten's apparatus OR Cleveland open cup OR Abel's flashpoint apparatus	15

Suggested Project List:

1. Prepare a model of an atom with the help of a ball and stick or of any other items.
2. Prepare a PowerPoint animation that can explain the structure of an atom.
3. Prepare a chart showing (1) Atomic number ($Z = e^- = p^+$) 1 to 30, (2) Name of the element, (3) Symbol, (4) Electronic configuration and (5) Condensed Electronic configuration of elements in tabular form.
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11. Prepare a model to demonstrate the application of electrolysis.

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Program Name: Diploma in Engineering
Level: Diploma
Course / Subject Code:
Course / Subject Name: Basic Chemistry

12. Collect water samples from different water sources and measure the hardness of the water.

13. Collect the water sample from different sources of ground and surface water (at least five). Explore the new and simplest softening and water treatment methods by creating the different assemblies and manipulative techniques.

14. Collect samples of petrol, kerosene, diesel, any edible oil, coconut oil. Find out the flash point and fire point, cloud point and pour point, and viscosity of the same. Compare the properties and justify their use in relevant applications.

15. Depending on the type of machinery, the load applied, speed of the machine, heat generated, etc., select the appropriate lubricant which can be applied to the machinery. Discuss with your teachers and classmates and present the same.

16. Make a table showing the availability of natural rubber in India and show places on the map of India.

17. Prepare a chart showing (1) name & formula of the Polymer, (2) name and formula of the Monomer/s used to prepare that polymer, (3) simple reaction equation for Preparation of polymer, (4) Properties in short and (5) Uses in tabular form.

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Suggested Activities for Students:

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2. Calculate pH of acid solutions and base solutions having different concentrations.

3. Prepare a chart showing different methods used for the prevention of corrosion.

4. Enlist the formulae to solve the numericals based on hardness of water. Calculate the Molecular mass of salts responsible for hardness of water. Show calculations for some numericals based on hardness of water.

5. Prepare a table showing the points of differences between organic compounds and inorganic compounds.

6. Do market survey of different types of lubricating oils and compare their physical properties and chemical properties.

7. Do library survey regarding polymers, synthetic rubbers, adhesives and semiconductors used in different industries.

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GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering

Level: Diploma

Course / Subject Code:

Course / Subject Name: ENGINEERING CHEMISTRY

w. e. f. Academic Year:	2024-25
Semester	1st
Category of the Course:	Basic Science Courses (BSC)-02

Prerequisite:	Fundamental knowledge of Chemistry and basic Arithmetic for simple calculations.
Rationale:	The background of chemistry allows engineers to get the most out of raw elements in creating fuels, drugs, new and modern materials, construction materials, etc. needed in wide variety of engineering and technological applications. The in-depth comprehension of concepts and chemical reactions involved in chemistry would be applicable in solving the problems of engineering in spectrum of engineering branches like, Electrical Engineering, Power Electronics Engineering, Biomedical Engineering, etc. The deep understanding of various topics/ subtopics of Engineering Chemistry course would enable the diploma engineers to understand and solve the various engineering problems, developments and breakthrough in engineering and technology in a very systematic and scientific way. Engineering chemistry helps to develop and enhance the thinking capabilities of the diploma pass outs in line with the modern trends in engineering and technology through the inclusion of various creative activities/micro projects etc. Many global problems/issues and their in-depth understanding is addressed through the inclusion of topics of relevance like atomic structure, chemical bonding and solutions; electrochemistry; corrosion; fuels; lubricants, polymers, elastomers, insulating materials and semiconductors; electrochemical energy sources in this course.

Course Outcome:

After Completion of the Course, Student will able to:

No.	Course Outcomes	RBT Level
01	*Apply* the principles of atomic structure, chemical bonding and solutions to solve various engineering problems.	R/U/A
02	*Solve* engineering problems using the concepts of electrochemistry and corrosion.	R/U/A
03	*Use* relevant fuels and lubricants for domestic and industrial applications.	R/U/A
04	*Choose* various types of engineering materials like polymers, elastomers, insulating materials and semiconductors for domestic and industrial applications.	R/U/A

05	*Select* various types of electrochemical devices for domestic and industrial applications.	R/U/A

*Revised Bloom's Taxonomy (RBT)

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	**T**	**PR**	**C**	**ESE (E)**	**PA/CA (M)**	**PA/CA (I)**	**ESE (V)**	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Atomic Structure, Chemical Bonding and Solutions** **Atomic Structure:** 1.1. Concepts of orbits and orbitals. 1.2. Pauli's exclusion principle, Hund's rule of maximum spin multiplicity, Aufbau rule. 1.3. Electronic configuration of elements having atomic number 1 to 30. **Chemical Bonding:** 1.4. Concept of chemical bond, Octet rule, Types of chemical bonds : 1.4.1 Ionic (Electrovalent) bond and its characteristics (Example NaCl.), 1.4.2 Covalent bond and its characteristics (examples–Non-polar covalent bond: H_2, O_2, N_2, CH_4; Polar covalent bond: HCl, H_2O, And NH3.), 1.4.3 Coordinate covalent (Dative) bond (examples – NH_4^+, H_3O^+), 1.4.4 Metallic bond and its characteristics, 1.4.5 Hydrogen bond, its types and significance, 1.4.6 Intermolecular force of attraction (van der Waals bond). 1.5. Structures of solids: Ionic solids, Molecular solids, Network solids, and Metallic solids.	08	17% (12 Marks)

	Solutions: 1.6. Definitions of solute, solvent, solution and concentration, Modes of expressing concentration of solutions – Molarity (M = mole/litre), Normality (N), Molality (m), mass percentage (%w/w), volume percentage (%v/v), mass by volume percentage (%w/v), mole fraction (χ), ppm (μg/mL).		

2.	**Electrochemistry**
	2.1. Arrhenius theory of ionization.
	2.2. Electronic concept of oxidation, reduction, and redox reactions.
	2.3. Degree of ionization (α) and the factors affecting on it.
	2.4. Concept of pH and pOH; pH scale for acids, bases and neutral solutions, Calculations of pH and pOH for dilute solutions of acids and bases, Importance of pH in various fields.
	2.5. Buffer solutions, Types of buffer solutions: Acidic buffers and Basic buffers, Applications of buffer solutions.
	2.6. Definition of Electrolytes, Non-electrolytes with suitable examples, Types of Electrolytes with examples.
	2.7. Construction, working, cell-reactions and symbolic representation of an Electrochemical cell.
	2.8. Conditions for a half-cell to be standard.
	2.9. Construction and working of Standard Hydrogen Electrode (SHE).
	2.10. Measurement of Standard half-cell potential / Standard electrode potential (E^o_R or EoL), Electrochemical/electromotive force (emf) series, Standard cell potential (E^o_{cell}).
	2.11. Construction of Electrolytic cell and Electrolysis.
	2.12. Faraday's Laws of Electrolysis.
	2.13. Industrial applications of electrolysis:
	    2.13.1 Electrometallurgy,
	    2.13.2 Electroplating,
	    2.13.3 Electro-refining.
		07	15%
			(11 Marks)

3.	**Corrosion of metals and its prevention** 3.1. Definition of Corrosion with example. 3.2. Dry or Chemical corrosion: Oxidation corrosion, Corrosion by other gases. 3.3. Wet or electrochemical corrosion: Liberation of H_2, Absorption of O_2. 3.4. Galvanic (Bimetallic) corrosion.	05	12% (8 Marks)

	3.5. Concentration cell corrosion.		
	3.6. Pitting corrosion, Waterline corrosion and Crevice corrosion.		
	3.7. Factors affecting the rate of corrosion: Nature of the metal, Nature of surface film, Relative areas of the anodic and catholic parts, Purity of metal, Temperature, Humidity of air, Influence of ph.		
	3.8. Preventive measures for internal corrosion and External corrosion: Modification of environment, Modification of the properties of metal, Use of protective coatings, Anodic and catholic protection, Modification in design and choice of material.		
4.	**Fuels and Combustion** 4.1 Definition and Classification of Fuels. 4.2 Calorific values and their Units. 4.3 Determination of Calorific value using a Bomb Calorimeter. 4.4 Characteristics of a good fuel. 4.5 Comparison between solid, liquid, and gaseous fuels. 4.6 Theoretical calculation of HCV and LCV of fuel using Dulong's formula. 4.7 Solid fuels: Coal, Classification of coal, Proximate and ultimate analysis of coal. 4.8 Liquid fuels: Petroleum, Origin of petroleum and classification of petroleum, Refining of petroleum, Petrol and Diesel-fuel rating (Octane and Cetane numbers), Power alcohol and Bio-diesel, Chemical composition. 4.9 Calorific values and Applications of LPG, CNG, and Biogas.	06	14% (10 Marks)
5.	**Lubricants** 5.1 Lubricants and Lubrication, Functions of lubricants. 5.2 Mechanism of Lubrication: Fluid lubrication, Boundary lubrication. 5.3 Classification of lubricants with examples: Solid, Semi-solid, Liquid and Synthetic lubricants. 5.4 Physical Properties of lubricants: Viscosity and Viscosity index, Flash point and Fire point, Cloud point and Pour point, Oiliness. 5.5 Chemical properties of lubricants: Saponification number, Neutralization number, Emulsification number. 5.6 Selection of lubricants for different types of Machinery like: Gears, Cutting tools, Steam turbine, Transformers. 5.7 Biodegradable lubricants.	06	10% (7 Marks)

6.	**Polymers, Elastomers, Insulating Materials and** **Semiconductors**	08	20% (14 Marks)
	Polymers:		
	6.1 Definition of Monomer, Polymer, Polymerization, Degree of polymerization (n) and Repeating unit.		
	6.2 Classification of polymers based on Molecular structure: Linear polymers, Branched polymers, Cross-linked polymers.		
	6.3 Classification of polymers based on Monomer: Homo polymer, Co-polymer.		
	6.4 Classification of polymers based on Thermal behavior: Thermoplastic polymers and Thermosetting polymers.		
	6.5 Types of polymerizations: Addition polymerization and Condensation polymerization		
	6.6 Preparation (by simple reactions), Properties and Uses of some thermoplastic polymers and thermosetting polymers: Polyethylene (PE), Polypropylene (PP), PolyVinylChloride (PVC), PolyTetraFluoroEthylene (PTFE, Teflon, and Fluon), Polystyrene (PS), PolyAcryloNitrile (PAN), Bakelite, and Epoxy resins.		
	6.7 Biodegradable Polymers: Definition, Chemical composition and Uses of Poly–β–HydroxyButyrate–co–β–hydroxyl Valerate (PHBV), Nylon–2–nylon-6.		
	Elastomers (Rubbers):		
	6.8 Natural rubber and its Properties.		
	6.9 Vulcanization of rubber and its Advantages.		
	6.10 Synthetic rubbers: Preparation (by simple reactions), Properties and Uses of Buna-S (GR-S or Styrene) rubber, Buna-N (GR-A or Nitrile) rubber, Neoprene (GR-M) rubber.		
	Insulating Materials:		
	6.11 Definition, Types and Properties of Insulating Materials.		
	6.12 Applications of Thermal and Electrical insulating materials.		
	Semiconductors:		
	6.13 Definition and Classification of Semiconductors.		
	6.14 Enlist Semiconductor devices.		
	6.15 Elemental Semiconductors : Intrinsic Semiconductors, Extrinsic Semiconductors (n-type Semiconductors, p-type Semiconductors).		
7.	**Electrochemical Energy Sources**	05	12% (8 Marks)
	7.1 Batteries: An electrochemical source of energy, Types of Batteries: Primary, Secondary and Fuel batteries.		
	7.2 Construction and Working of Dry cell.		

	7.3	Construction and Working of Lead-acid storage cell.		
	7.4	Construction and Working of Nickel-Cadmium battery/cell.		
	7.5	Fuel cells: Definition and Characteristics, Construction and Working of Hydrogen-Oxygen fuel cell.		
	7.6	Biochemical Fuel cells.		
	7.7	Solar Cells.		
	Total		**45**	**100% (70Marks)**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
24 Marks (35%)	32 Marks (45%)	14 Marks (20%)	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Note: *This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may slightly vary from above table.*

References/Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Book	Author	Publication with the place, year and ISBN
1	Engineering Chemistry	Jain & Jain	Dhanpat Rai Publishing Co. (P) Ltd., New Delhi, 2015, ISBN: 93-521-6000-2
2	A Textbook of Engineering Chemistry	Dr S. S. Dara & Dr S. S. Umare	S. Chand & Co. (P) Ltd., New Delhi, 2014, ISBN: 81-219-0359-9
3	Textbook of Chemistry for Class XI & XII (Part-I & II)	NCERT	NCERT, New Delhi, 2017-18, Class-XI, ISBN: 81-7450-494-X (Part-I), 81- 7450-535-O (Part-II), Class-XII, ISBN: 81-7450-648-9(Part-I), 81-7450-716-7(Part-II)
4	Engineering Chemistry	Shikha Agarwal	Cambridge Uni. Press, New Delhi, 2019, ISBN: 978-1-108-72444-9
5	Understanding Chemistry	C. N. R. Rao	World scientific publishing Co., 2009, ISBN: 9789812836045

6	Engineering Chemistry	Dr. Vikram, S.	Wiley India Pvt. Ltd., New Delhi, 2013, ISBN: 9788126543342
7	Chemistry for Engineers	Rajesh Agnihotri	Wiley India Pvt. Ltd., 2014, ISBN: 9788126550784
8	Fundamental of Electrochemistry	V. S. Bagotsky	Wiley International N.J., 2005, ISBN: 9780471700586

(b) Open source software and website:

1. http://www.chemguide.co.uk/atommenu.html
2. https://www.visionlearning.com/
3. http://www.chem1.com/
4. http://www.em-ea.org/
5. https://ncert.nic.in/
6. http://www.onlinelibrary.wiley.com/
7. http://www.rsc.org/
8. https://docslib.org/insulation-materials-science-and-application
9. http://www.olabs.edu.in/
10. http://chemcollective.org
11. http://chemcollective.org/activities/type_page/1
12. http://www.presentingscience.com/vac/corrosion/index.htm
13. https://vlab.amrita.edu/index.php?sub=2&brch=190

Suggested Course Practical List: (30 Hours)

Sr.No.	Practical Outcomes (PrOs)	Unit No.
1	Prepare a standard solution of oxalic acid or potassium permanganate.	1
2	Prepare a solution of given concentration in terms of percentage weight by weight (% w/w) of a given compound.	1
3	Prepare a solution of given concentration in terms of percentage volume by volume (% v/v) of a given compound.	1
4	Prepare a solution of given concentration in terms of percentage weight by volume (% w/v) of a given compound.	1
5	Determine the strength of the given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.	1
6	Standardize potassium permanganate solution by standard oxalic acid solution and estimate ferrous ions.	2
7	Determine pH-Values of given samples of Solution by using Universal Indicator and pH-meter.	2
8	Determine emf of an electrochemical cell (Daniel cell).	2, 7

9	Determine electrochemical equivalent of copper metal using Faraday's first law.	2
10	Determine the rate of corrosion for different metals in the given solution.	3
11	Determine the rate of corrosion for metal in the solution of different ph.	3
12	Determine the calorific value of solid or liquid fuel using a bomb calorimeter.	4
13	Determine the percentage of moisture content in the given sample of coal by proximate analysis.	4
14	Determine the ash content of the given sample of coal by proximate analysis.	4
15	Determine the viscosity of the lubricating oil using a Redwood viscometer.	5
16	Determine the Acid value of the given lubricating oil.	5
17	Determine the Saponification value of the given lubricating oil.	5
18	Determine flash point and fire point of the given lubricating oil using Pensky Martens/Cleveland open cup/Able's flashpoint apparatus.	5
19	Prepare Polystyrene and Bakelite. (Any one)	6

i. **Practical Exercises** of **at least 30 Hrs**. should be completed by the end of the term.

ii. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry-relevant skills/outcomes to match the COs. The above table is only a suggestive list.

iii. The following are some **sample 'Process'** and **'Product' related skills** (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %	Maximum Marks for PA/CA (I)
➤	*"Process" related skills*		
1.	– Prepare experimental setup accurately. – Handling of apparatus/glassware for precise measurements.	20	5
2.	– Practice and adapt good and safe measuring techniques. – Record observations correctly.	20	5
3.	– Housekeeping. – Observance /Follow safety rules.	20	5
➤	*"Product" related skills*		
4.	– Does Calculations. – Interpret the Results and their Conclusion/s.	20	5

5.	− Prepare report of practical in prescribed format. − Viva-voce.	20	5
	Total	100	**25**

List of Laboratory Equipment's required:

No.	Equipment's / Instruments	Practical No.
1	Electronic Weighing Balance / Digital Weighing Balance (OR Analytical Balance)	1, 6, 7, 8, 9, 10, 13, 14, 16
2	Digital pH meter	4, 8
3	Voltmeter	5
4	6 V Battery	6
5	Ammeter	6
6	Rheostat	6
7	Dryer	7, 8
8	Hot air oven	9, 10
9	Hot plate with Magnetic stirrer	3
10	Bomb Calorimeter	9
11	Muffle furnace	11
12	Redwood viscometer No.1	12
13	Stop watch	12
14	Pensky-Marten's apparatus OR Cleveland open cup OR Abel's flashpoint apparatus	15

Suggested Project List:

1. Prepare a model of an atom with the help of a ball and stick or of any other items.

2. Prepare a PowerPoint animation that can explain the structure of an atom.

3. Prepare a chart showing (1) Atomic number ($Z = e^- = p^+$) 1 to 30, (2) Name of the element, (3) Symbol, (4) Electronic configuration and (5) Condensed Electronic configuration of elements in tabular form.

4. Prepare a chart of the modern periodic table which gives information about the atomic number and mass number of different elements.

5. Prepare crystals of common salt from NaCl solution.

6. Form three groups of students in the class. Consider a hypothetical situation of exchanging/ sharing/giving of different items/belongings and demonstrate the type of ionic, covalent, and co-ordinate bonding amongst the students in a simulated situation. Present your findings.

7. Prepare a chart representing compounds and solutions which affect human life positively and negatively.

8. Classify the surrounding corrosion into dry corrosion and wet corrosion.

9. Collect different samples of utensils reinforced materials, iron, copper, brass, bronze, and other alloys. Place them in an open environment under tin shade. Observe the corrosive properties over a period of four weeks. Record your observations. Discuss the findings with your teacher and classmates.

10. Collect three metallic strips of Cu, Al and Fe. Place them in different acidic and alkaline solutions of the same concentration. Observe and record the loss in weight of metals due to an acidic and alkaline environment. Discuss the findings with your teacher and classmates.

11. Prepare a model to demonstrate the application of electrolysis.

12. Collect fuel samples from different sources and prepare a chart showing their calorific values and uses.

13. Collect samples of petrol, kerosene, diesel, any edible oil, coconut oil. Find out the flash point and fire point, cloud point and pour point, and viscosity of the same. Compare the properties and justify their use in relevant applications.

14. Depending on the type of machinery, the load applied, speed of the machine, heat generated, etc., select the appropriate lubricant which can be applied to the machinery. Discuss with your teachers and classmates and present the same.

15. Make a table showing the availability of natural rubber in India and show places on the map of India.

16. Prepare a chart showing (1) name & formula of the Polymer, (2) name and formula of the Monomer/s used to prepare that polymer, (3) simple reaction equation for Preparation of polymer, (4) Properties in short and (5) Uses in tabular form.

17. Collect different polymers and prepare the chart/ PowerPoint based on their type, properties, and uses.

18. Do mapping of energy resources in India.

19. Collect data of various electrochemical cells (batteries) used in equipment's and devices and available in the market and prepare a report on it.

20. Classify Semiconductors with examples. Enlist Semiconductor Devices. Also collect Semiconductors.

Suggested Activities for Students:

1. Prepare a Power point presentation or animation showing different atomic structures and different types of chemical bonds.

2. Calculate pH of acid solutions and base solutions having different concentrations.

3. Prepare a chart showing different methods used for the prevention of corrosion.

4. Show theoretical calculations of HCV and LCV of fuel using Dulong's formula.

5. Do market survey of different types of lubricating oils and compare their physical properties and chemical properties.

6. Do library survey regarding polymers, synthetic rubbers, insulating materials and semiconductors used in different industries.

7. Do market survey of different batteries and differentiate primary and secondary batteries.

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GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering
Level: Diploma
Course / Subject Code:
Subject Name: Communication Skills in English

w. e. f. Academic Year:	2024-25
Semester:	1st
Category of the Course:	HSMC-1

Prerequisite:	Basic knowledge of English
Rationale:	Language is the most commonly used medium of self-expression in all spheres of human life – personal, social and professional. English language has become a dire need to deal successfully in the globalized and competitive market. Competency in English is need of the hour, not only for Indian industry, but also worldwide, where diploma engineers have the employable opportunity. Therefore, the basic English skills- listening, speaking, reading and writing have become almost mandatory for employability. This course intends to make the students to develop comprehension skills, improve vocabulary, use proper grammar, acquire writing skills, correspond with others and enhance skills in spoken English. Further, it is expected that each polytechnic will provide conducive environment for acquiring proficiency in communication skills among the students through English language.

Course Outcome:

After Completion of the Course, the student will able to:

No	Course Outcomes
01	Use strategies to minimize barriers of effective communication.
02	Construct grammatically correct sentences.
03	Develop reading and listening skills in terms of fluency and comprehensibility.
04	Compose different types of written communication.
05	Communicate orally in a given situation with a purpose.

GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering

Level: Diploma

Course / Subject Code:

Subject Name: Communication Skills in English

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	**T**	**PR**	**C**	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
2	0	2	3	70	30	20	30	150

Course Content:

Unit No.	Contents	No. of Hours	% of Weightage

1.	**Theory of Communication**
	  1.1 Concept of Effective Communication and Communication Skills
	  1.2 Basic Communication Models(S+E+C+D+R+N+F)
	  1.3 Level of Communication: Upward and Downward
	  1.4 Types of Communication: Verbal, Non-Verbal, Visual
	         Interpersonal, Intrapersonal,
	         Extra personal and Mass
	1.5 Barriers of Effective Communication
		06	14 Marks 20%

2.	**Grammar**
	2.1 Parts of Speech: Noun, Verb, Pronoun, Adjective, Adverb,
	         Preposition, Conjunction, Interjection
	2.2 Tenses: Present: Simple, Continuous, Perfect, Perfect Continuous
	         Past: Simple, Continuous, Perfect
	         Future: Simple
	2.3 Modal Auxiliaries: Can, Could, May, Might, Must, Shall, Will,
	         Should, Would, Ought to, Need
	2.4 Subject-Verb Agreement
	2.5 Basic Sentence Patterns of English: SV, SVO, SVA, SVC
		10	28 Marks 40%

3.	**Prose and Poetry**
	3.1 Prose
	    The Leopard- Ruskin Bond
	3.2 Short Story
	    After Twenty Years- O Henry
	3.3 Poetry
	• Stopping by Woods on Snowy Evening-Robert Frost
		06	14 Marks 20

4.	**Techniques of Writing** 4.1 Email Writing: Format&Types: (Inquiry, Reply to Inquiry, Order, Complaint) 4.2 Paragraph Writing (Approximately in150 words) **Suggested Topics:** Paragraph on: Festivals, Nature and Environment, Famous Personalities, Favorite Sports, Friends and Family members.	08	14 Marks 20%
	Total	**30**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
17	**29**	**24**	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

S. No.	Title of Book	Author	Publication with place, year and ISBN
1.	Living English Structures	W. S. Allen	Pearson Education India 1992 ISBN: 9788131728499
2.	Essentials of English Grammar and Composition	N. K. Agrawal	Goyal Brothers Prakash an 2015 ISBN :8183896162
3.	English Grammar at Glance	M. Gnanamurali	S. Chand & Co. Ltd. 2010 ISBN : 9788121929042
4.	Effective English	E. Suresh Kumar & Others	Pearson 2010 ISBN : 9788131731000
5.	English Communication for Polytechnics	S. Chandrashekhar & Others	Orient BlackSwan 2013 ISBN : 8125037462
6.	English Fluency Step 1 & 2	-	Macmillan 2010 ISBN : 9781405003650 9781405003667
7.	Active English Dictionary	-	Longman 1991 ISBN : 8131707865
8.	The Pronunciation of English	Daniel Jones	Cambridge: Cambridge University Press, 4th Edition 1956 ISBN : 0521093694
9.	Ed. English Pronouncing Dictionary	James Hartman & et al.	Cambridge: Cambridge University Press.17th Edition 2006 ISBN : 0521680867
10.	Effective Communication Skills	Kulbhushan Kumar	Khanna Publishing House, New Delhi (Revised Ed. 2018) ISBN : 9789382609940
11.	Better English Pronunciation	J.D.O'Connor	Cambridge: Cambridge University Press 1982 ISBN : 0521231523
12.	An English Grammar: Comprehending Principles and Rules	Lindley Murray	Franklin Classics (10 October 2018). ISBN : 0342097008

S. No.	Title of Book	Author	Publication with place, year and ISBN
13.	Examine your English	Margaret M. Maison	Orient Longman: New Delhi, 1964 ISBN : 812500176X
14.	A Practice Course in English Pronunciation	J.Sethi& et al	New Delhi: Prentice Hall, 2004 ISBN : 9788120325944
15.	Technical Communication: A Practical Approach.	Pfeiffer, William Sanborn and T.V.S Padmaja	Delhi: Pearson, 2007. ISBN : 9788131700884

(b) Open-source software and website:
- https://learnenglish.britishcouncil.org
- http://www.free-english-study.com/
- http://www.english-online.org.uk/course.htm
- http://www.english-online.org.uk/
- http://www.talkenglish.com/
- http://www.learnenglish.de/
- https://www.cambridgeenglish.org/exams-and-tests/linguaskill/
- https://dictionary.cambridge.org/dictionary/english/
- https://www.oxfordlearnersdictionaries.com/definition/academic/

Sr.No.	Practical Outcomes (PrOs)	CO	Approx. Hrs. required
1.	Develop listening skills through listening to recorded lectures, poems, interviews and speeches.	Co1,Co3	04*
2.	Use antonyms and synonyms effectively in oral and written forms.	Co3,Co4	04*
3.	Use grammatically correct sentence	Co2,Co5	02
4.	Communicate ideas effectively and fluently in oral and written communication.	Co1,Co2, Co3,Co5	02*
5.	Articulate vowels, consonants and diphthongs correctly.	Co1,Co5	02*
6.	Speak with appropriate intonation, voice modulation, pitch, speed and volume.	Co1,Co5	02
7.	Participate in conversations (GD /meetings etc.)	Co1,Co3, Co5	04*

8.	Deliver the presentation effectively in the class.	Co1,Co3, Co5	04*
9.	Communicate effectively through verbal and non-verbal means of communication.	Co1,Co3, Co5	04*
10.	Practice online exercises for listening and reading comprehension.	Co3,Co5	02*
	Total		**30**

Suggested Course Practical List: ------

Note: The above practical outcomes (PrOs) are the sub-components of the COs.*Some of the **PrOs** marked '*' are compulsory, as they are crucial for that particular CO. These PrOs need to be attained at least at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.*

List of Laboratory/Learning Resources Required:

These major equipment/instruments and Software required to develop PrOs are given below with broad specifications to facilitate procurement of them by the administrators/management of the institutes. This will ensure conduction of practical in all institutions across the state in proper way so that the desired skills are developed in students.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1.	Computer systems windows 7 or above with internet connectivity	All
2.	Headphones with speakers	All
3.	LCD Projector	All
4.	Language lab software	All

Suggested Project List:

Suggestive list of micro-projects is given here. This should relate highly with competency of the course and the COs.Similar micro-projects could be added by the concerned course teacher:

A) Book review – students should read a book and then write his reviews about the book and present it in the class.

b) Presentation – Prepare a presentation regarding current problems of environment and present it in the class,

c) Mock interviews. – Interviews conducted by students and for the students.

d) Skit or role play- write the script and present it in the class

(Can be asked to take topic related to environment and pollution)

e) Find out 20 new words out of a given story, write its synonym and use the word in your own sentence.

f) Draft a story according to a given picture.

g) You are in the village fair. Describe what is happening around you in present continuous tense.
(Celebration of Annual Day – past tense. etc)

h) Write a paragraph about your first day in college.

Suggested Activities for Students:

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

- The experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency.

- Initiating a conversation with a new comer to your college.

- Assignments using Internet. (Online Listening/Speaking/Vocabulary based exercises and uploading their score, etc. (Teacher can decide how to use various online platforms for evaluation purpose.

- Self-learning Activities using mobile apps/internet

- Discuss current affairs in English with your friends.

- Read storybooks and learn new words and sentence structures.

- Write a brief report on current environmental issues.

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GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering
Level: Diploma
Branch: All
Course / Subject Code :
Course / Subject Name : Sports & Yoga

w. e. f. Academic Year:	2024-25
Semester:	1st
Category of the Course:	MNC-AU-02

1.   RATIONALE

Physical activity is vital to the holistic development of students, fostering their physical, social and emotional health. Sports and Yoga are essential part of our life for good health and peace of mind. Yoga is considered itself as a sport which plays through your own physical ability. Yoga provides you all the benefits that you are willing to have from generic sports like badminton, football, cricket, etc. Yoga is the application of physical postures, control of breath, purification and relaxation of mind / body and spiritual principles aimed at bringing greater unity and balance to the mind and body. The use of breathing techniques known as *Pranayama* enables a person to focus on breath and helps to calm and still the mind and cultivate concentration ability. *Pranayama* can also help to energise and revitalize the body.

2.   COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Apply sports and yoga activities to keep the body physically and mentally fit.**

3.   COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the following Course Outcomes (COs) achievement:

a) Practice physical activities and yoga for strength, flexibility and relaxation.
b) Use techniques for increasing concentration and decreasing anxiety for stronger academic performance.
c) Perform yoga exercises in various combination and forms.
d) Improve personal fitness through participation in sports and yoga activities.
e) Follow sound nutritional practices for maintaining good health and physical performance.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	CA	ESE	CA	ESE	
0	0	2	0	0	0	50	0	50

This is designed to facilitate attainment of COs holistically, as there is no examination.

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **CA** - Continuous Assessment; **ESE** -End Semester Examination.

5.   SUGGESTED PRACTICAL EXERCISES
The following practical outcomes (PrOs) are the sub-components of the COs. *Some of the **PrOs** marked '***'** are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.*

Sr.No	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1.	Perform following Yoga Asanas under the guidance of yoga trainer :- • Surya Namesake (Sun Salutation) • Tadasana (Mountain pose) • Vrikshasana (Tree pose) • Vajrasan (Hand under foot pose) • Pada-hastasana (Hand under foot pose) • Ushtrasana (Camel pose) • Dhanurashana.(Bow Pose) • Bhjangasana (Snake pose) • Halasana (Plough pose) • Shavasana/Yoga Nidra • Bhastrikai pranayama • Kapalbhati Pranayam • Anulom Vilom pranayama • Bhramari Pranayam	III	12*
2.	Participate in any sports activities of your choice : • Indoor sports/games (Badminton, Chess, Carrom, Table Tennis) • Outdoor sports/games (Cricket, Kabaddi, , Volley ball, Basketball, Football, Hockey)	IV	14
3.	Prepare report on any sports events including associated rules, playground specification, rules for judgment, etc.)	IV	02*
	Total		**28**

*Note More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

*i. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.*

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %
	-Not applicable-	Nil

6.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practical's in all institutions across the state.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	.Yoga Mats/ BlanketsStraps Block s Bolste rs Chairs Meditation cushions Eye pillows (tissues or washable cloth to cover them)Mat cleaning wipes Strong floorings Temperature control, fans, portable heaters (if needed) Chime, bells, or gong (for bringing people out of corpse pose, or silent meditation) Essential oil diffuserYoga CD's CD player Lighting system that allows for dimming Effective sound system Salt lamp – they purify air and look lovely Sandbags	1
2	Sports and games accessories as per the decision of college.	2

7.   AFFECTIVE DOMAIN OUTCOMES

The following *sample* Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this course competency.

a) Follow safe practices.
b) Practice good housekeeping.
c) Demonstrate working as a leader/a team member.
d) Maintain tools/accessories/ equipment.
e) Follow ethical practices.

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

  i.   'Valuing Level' in 1st year
  ii. 'Organization Level' in 2nd year.
  iii. 'Characterization Level' in 3rd year.

8.   UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of cOs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
Unit – I **Introduction to Physical fitness**	1a. Explain importance of physical education. 1b. Describe importance of Physical Fitness & Wellness 1c. Explain the components of physical fitness. 1d. Demonstrate healthy life style. 1e. Prevent health threats by Changing life style.	1.1 Aims & Objectives of Physical Education 1.2 Changing trends in Physical Education 1.3 Meaning & Importance of Physical Fitness & Wellness 1.4 Components of Physical fitness 1.5 Components of health related fitness 1.6 Components of wellness 1.7 Preventing health threats through lifestyle change 1.8 Concept of positive lifestyle
Unit – II **Fundamentals of Anatomy & Physiology in sports & yoga**	2a. Explain importance of anatomy and physiology. 2b. Describe effects of exercise in various body systems. 2c. Describe concept of correct posture. 2e. Explain corrective Measures for posture deformities.	2.1 Anatomy, physiology and its importance. 2.2 Effect of exercise on various body system i.e. circulatory system, respiratory system, neuro- muscular system 2.3 Concept and advantages of correct posture. 2.4 Posture deformities and corrective Measures.
Unit– III **Yoga & Pranayama**	3.1 Explain importance of yoga. 3.2 Perform various pranayama for increasing concentration. 3.3 Use meditation and other relaxation techniques for improving	3.1 Meaning & Importance of Yoga Asanas, Pranayama & Meditation 3.2 Yoga & related Asanas - Sukhasana, Tadasana, Padmasana & Shashankasana 3.3 Relaxation techniques for improving concentration - Yog-Nidra

	concentration.	
Unit– IV **Sports/ games**	4.1 Describe various warming exercises. 4.2 Select any game/sports of your choice. 4.3 Explain latest rules of any game/sports. 4.4 Describe specifications of play fields and related sports equipment.	4.1 Warming up and limbering down exercises 4.2 Tournaments- Knock out, League/ Round Robin & combination 4.3 Following sub topics related to any one Game/Sport of choice of student out of: Badminton, Chess, Carrom, Table Tennis, Cricket, and Kabaddi, Volley ball, Basketball, Football, Hockey, etc. 4.4 History of the Game/Sport. 4.5 Latest General Rules of the Game/Sport. 4.6 Specifications of Play Fields and Related Sports Equipment. 4.7 Effect of anxiety & fear on sports Performance.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching /Practical Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Physical fitness					
II	Fundamentals of Anatomy & Physiology in sports & yoga	**- Not Applicable -**				
III	Yoga & Pranayama					
IV	Sports/games					
Total						

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student- related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

a) Prepare a list of specifications for various tools/equipment/machines used in gymnasium/indoor sports complex.
b) Undertake a market survey of local dealers for procurement of sports items/ equipment/machines.
c) Visit the sports shop and collect all relevant information about any sport item and submit the detailed report.
d) Download video clips showing correct practices for yogasanas, pranayam and any sports/games.
e) Prepare a chart showing different types of yogasanas.
f) Prepare a chart showing different types of pranayama.

g) Prepare a chart showing the field details of any sports/games.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (*MOOCs*) may be used to teach various topics/subtopics.
b) About *20% of the topics/sub-topics* which are relatively simpler or descriptive in nature is to be given to the students for *self-learning*, but to be assessed using different assessment methods.
c) With respect to *section No.10*, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
f) Arrange visit to nearby yoga center and sports complex and use of videos/animations for understanding various steps, processes related to the activities.

12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Modern Trends and Physical Education class 11 & class 12	Ajmer Singh	Kalyani Publication, New Delhi ISBN : 9789327264319
2	Light on Yoga	B.K.S. Iyengar	Thomson's Publication, New Delhi ISBN: 8172235011
3	Health and Physical Education	V.K.Sharma	NCERT Books; Class11,12 Saraswati House Publication, New Delhi
4.	Yoga and Stress Management	Acharya Yatendra	Fingerprint Publishing ISBN: 938905303X
5.	Patanjali Yoga Sutras	Swami Vivekananda	Fingerprint Publishing ISBN: 9389567351
6.	Pranayama Rahasya	Ramdev	Patanjali-Divya Prakashan,Haridar ISBN: 978-8189235017
7.	Yoga its Philosophy & Practice	Ramdev	Divya Prakash an, Haridwar

SOFTWARE/LEARNING WEBSITES

https://youtu.be/dAqQqmaI9vY
https://youtu.be/c8hjhRqIwHE
https://youtu.be/MrR04m1zoJ8
https://youtu.be/P-jwGj7YqNM
https://youtu.be/3p4r_ad2Y7g
https://youtu.be/mndOIVCwFss
https://youtu.be/J68MR3dBzto