CURRICULUM AND DETAILED SYLLABI

FOR

B.E. / B.Tech. DEGREE PROGRAMME

FIRST SEMESTER

FOR THE STUDENTS ADMITTED IN THE

ACADEMIC YEAR 2018-19 ONWARDS

THIAGARAJAR COLLEGE OF ENGINEERING

(A Government Aided ISO 9001:2008 certified Autonomous Institution affiliated to Anna University)

MADURAI – 625 015, TAMILNADU

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Credit Distribution

S.No	Category	Credits
A	**Foundation Courses**	
	Humanities and Social Science (HSS)	**12 -15**
	Basic Science (BS)	**21 -27**
	Engineering Science (ES)	**21 -27**
B	Professional Core Courses	**53**
C	**Elective Courses**	**36 - 45**
	Programme specific Elective	**15-21**
	Programme Elective for Expanded Scope	**6 – 12**
	General Elective	**6**
	Foundation Elective	**6**
D	Project work, seminar, internship in industry or at Higher Learning institutions	**12 – 15**
E	Mandatory Courses as per UGC/AICTE Guidelines (Not to be included for CGPA)	**Non Credit**
	Minimum Credits to be earned for the award of the Degree	**160 (from A to D) and the successful completion of Mandatory Courses**

- General electives are courses offered by different departments that do not have any prerequisites and could be of interest to students of any branch
- All students have to undertake co-curricular and extra-curricular activities that include activities related to NCC, NSS, Sports, Professional Societies, participation in identified activities which promote the growth of Departments and the College

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
B.E. / B.Tech. Degree Programmes

COURSES OF STUDY
(For the candidates admitted from 2018-19 onwards)

FIRST SEMESTER

Course Code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
18MA110	Engineering Calculus	BS	3	1	-	4
18PHA20/ 18PHB20/ 18PHC20	Physics	BS	3	-	-	3
18CHA30/ 18CHB30/ 18CHC30	Chemistry	BS	3	-	-	3
18EG140	English	HSS	2	-	-	2
18ES150	Engineering Exploration	ES	3	-	-	3
THEORY CUM PRACTICAL						
18ME160	Engineering Graphics	ES	3	-	2	4
PRACTICAL						
18EG170	English Laboratory	HSS	-	-	2	1
18PH180	Physics Laboratory	BS	-	-	2	1
18CH190	Chemistry Laboratory	BS	-	-	2	1
Total			**17**	**1**	**8**	**22**

BS : Basic Science
HSS : Humanities and Social Science
ES : Engineering Science

L : Lecture
T : Tutorial
P : Practical

Note:
1 Hour Lecture is equivalent to 1 credit
1 Hour Tutorial is equivalent to 1 credit
2 Hours Practical is equivalent to 1 credit

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015
B.E. / B.Tech. Degree Programme

SCHEME OF EXAMINATIONS
(For the candidates admitted from 2018-19 onwards)

FIRST SEMESTER

S.No.	Course Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
THEORY								
1	18MA110	Engineering Calculus	3	50	50	100	25	50
2	18PHA20/ 18PHB20/ 18PHC20	Physics	3	50	50	100	25	50
3	18CHA30/ 18CHB30/ 18CHC30	Chemistry	3	50	50	100	25	50
4	18EG140	English	3	50	50	100	25	50
5	18ES150	Engineering Exploration	3	50	50	100	25	50
THEORY CUM PRACTICAL								
6	18ME160	Engineering Graphics	3	50	50	100	25	50
PRACTICAL								
7	18EG170	English Laboratory	3	50	50	100	25	50
8	18PH180	Physics Laboratory						
9	18CH190	Chemistry Laboratory	3	50	50	100	25	50

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** Terminal Examination will be conducted for maximum marks of 100 and subsequently be reduced to 50 marks for the award of terminal examination marks

18MA110	ENGINEERING CALCULUS

Category	L	T	P	Credit
BS	3	1	0	4

Preamble

This course aims to convey to the student a sense of the utility of calculus and develop technical competence. This course is designed to implement the calculus through geometrically, numerically, algebraically and verbally. Students will apply the main tools for analyzing and describing the behavior of functions of single and multi variables: limits, derivatives, integrals of single and multi variables to solve complex engineering problems using analytical methods and MATLAB.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Understand the concept of functions, limits and continuity	Understand
CO2	Compute derivatives and apply in solving engineering problems	Apply
CO3	Employ partial derivatives to find maxima minima of functions of multi variables	Apply
CO4	Demonstrate and apply the techniques of integration	Apply
CO5	Apply integrals of multivariable to find areas enclosed between two curves and volume enclosed between surfaces	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M								
CO2	S	S	M	M								
CO3	S	S	S	M								
CO4	S	S	S	M								
CO5	S	S	S	M								
S- Strong; M-Medium; L-Low												

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	10	10	10	0
Understand	30	30	30	30
Apply	60	60	60	70
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1(CO1)

1. Define function and limit.
2. Estimate the value of $\lim_{x\to 0}\frac{\sin x}{\sin \pi x}$.
3. If $f(x)$ is continuous on $(-\infty,\infty)$, what can you say about its graph?

Course Outcome 2(CO2)

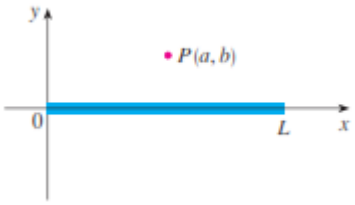
1. What is wrong with this equation $\frac{x^2+x-6}{x-2}=x+3$ and investigate why the equation $\lim_{x\to 2}\frac{x^2+x-6}{x-2}=\lim_{x\to 2}(x+3)$ is correct.
2. Between 0^oC and 30^0C, the volume V (in cubic centimeters) of 1 kg of water at a temperature T is given approximately by the formula V = 999.87 - 0.06426T + $0.0085043T^2$ - $0.0000679T^3$, Compute the temperature at which water has its maximum density.
3. The voltage, *v*, across a capacitor of capacitance, in series with a resistor of resistance, *v*, is given by $(t+1)e^{-1000t}$ where $C=1\mu F$, $E>0$, is a constant. Determine *i* where $i=C\frac{dv}{dt}$.

Course Outcome 3(CO3)

1. Define partial derivative of a function of two variables.
2. Suppose that the temperature at a point (x,y,z) in space is given by $T(x,y,z)=\frac{80}{1+x^2+2y^2+3z^2}$, where T is measured in degrees Celsius and (x,y,z) in meters. In which direction does the temperature increase fastest at the point $(1,1,-2)$? Identify the maximum rate of increase.
3. Compute the dimensions of the rectangular box with largest volume if the total surface area is given as 64 cm^2 .
4. Show that the Cobb-Douglas production function $P=bL^{\alpha}K^{\beta}$ satisfies the equation $L\frac{\partial P}{\partial L}+K\frac{\partial P}{\partial K}=\alpha\frac{P}{L}$.

Course Outcome 4(CO4)

1. State fundamental theorem of calculus.
2. Find the volume of the solid obtained by rotating the region bounded by $y=x^3$, $y=8$ and $x=0$ about the y axis.
3. A charged rod of length L produces an electric field at point P(a,b) given by $E(P)=\int_{-a}^{L-a}\frac{\lambda b}{4\pi\varepsilon_0(x^2+b^2)^{3/2}}dx$ where *λ* is the charge density per unit length on the rod and ε_0 is the free space permittivity (see the below figure). Evaluate the integral to determine an expression for the electric field E(P).



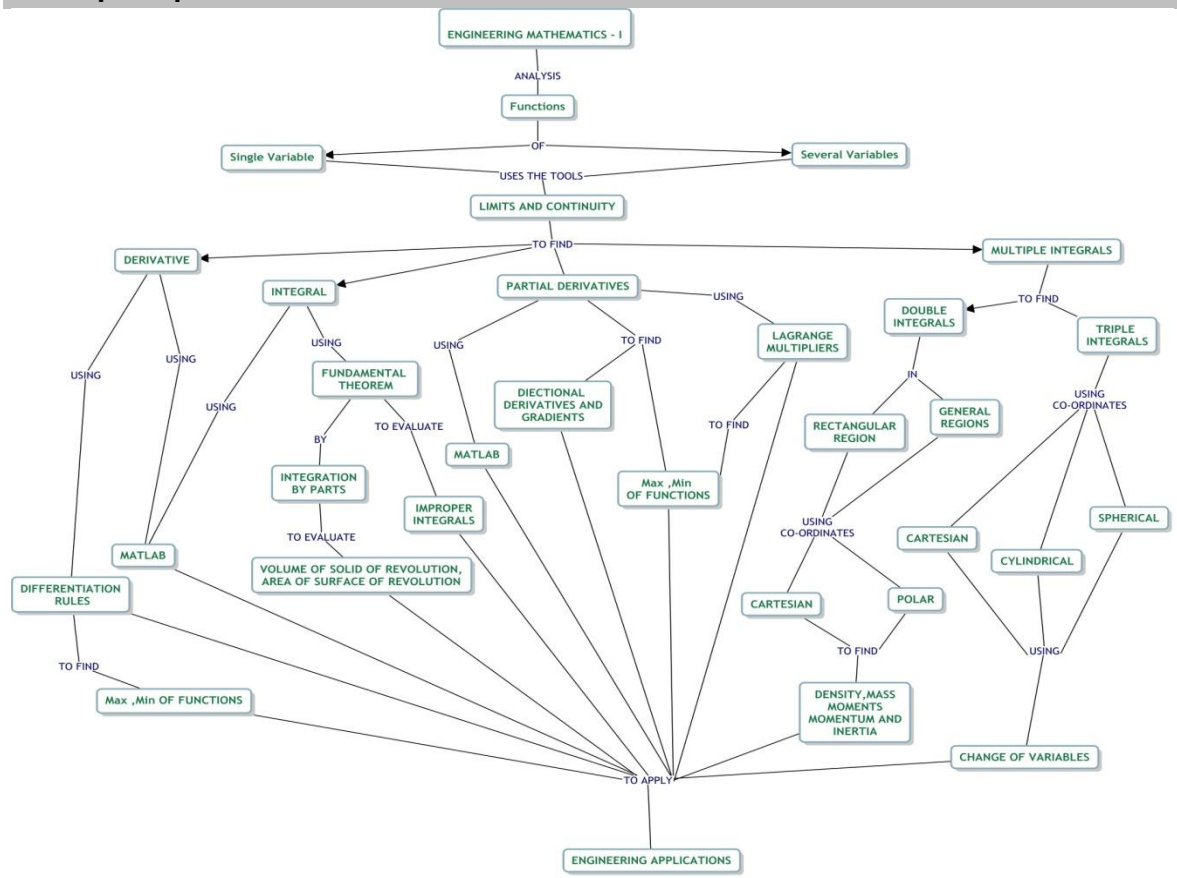
4. A cantilever beam of length *L*, fixed at one end and deflected by a distance *D* at the free end has strain energy *V* given by $V = \frac{EI}{2}\int_0^L \left(\frac{d^2y}{dx^2}\right)^2 dx$ where *EI* is the flexural rigidity. The deflection *y* at a distance *x* from the fixed end is given by $y = D\left[1-\cos\left(\frac{\pi x}{2L}\right)\right]$

   Find V .

Course Outcome 5(CO5)

1. Recall any three properties of double integrals
2. Calculate the static moments of homogeneous lamina with respect to the coordinate axes. The lamina is bounded by lines $\frac{x^2}{9}+\frac{y^2}{4}=1$, $2x+3y-6=0$.
3. Calculate the coordinates of the center of mass of homogeneous solid bounded by surfaces x=0, y = 0, z = 0, x +y = 1, $x^2 + y^2 = 1$.

Concept Map



Syllabus

DIFFERENTIAL CALCULUS (12 hours)

Representation of functions - New functions from old functions - Limit of a function - Continuity - Limits at infinity - Derivative as a function - Differentiation rules(formula and problems only) –The mean value theorem - Maxima and Minima of functions of one variable - Application problems in engineering – Application problems using MATLAB.

FUNCTIONS OF SEVERAL VARIABLES (12 hours)

Partial derivatives – Chain rule - Vector functions and their Derivatives - Directional derivatives and gradient vector - Maxima and minima of functions of two variables - Lagrange Multipliers - Application problems in engineering - Application problems using MATLAB.

INTEGRAL CALCULUS (12 hours)

Area under curves - The definite integrals – Fundamental theorem of calculus - Integration by parts - Volume of solid of revolution - Area of surface of revolution - Improper integrals - Application problems in engineering - Application problems using MATLAB

MULTIPLE INTEGRAL (12 hours)

Iterated integrals - Double integrals over general regions - Double integrals in polar coordinates - Applications of double integrals (density, mass, moments & moments of inertia problems only) - Triple integrals - Triple integrals in cylindrical coordinates - Triple integrals in spherical coordinates - Change of variables in multiple integrals - Application problems in engineering

Text Book

1) James Stewart, "Calculus Early Transcendentals", 7e, Cengage Learning, New Delhi, 2017.

DIFFERENTIAL CALCULUS:[Sections: 1.1, 1.3, 2.2,2.5,2.6,2.8, 3.1-3.6,4.1,4.2]
FUNCTIONS OF SEVERAL VARIABLES: Sections: 14.3, 14.5,13.1,13.2,14.6-14.8]
INTEGRAL CALCULUS: [Sections: 5.1-5.4,7.1, 6.2, 8.2 and 7.8]
MULTIPLE INTEGRAL: [Sections: 15.2-15.5, 15.7-15.10]

2) Lecture Notes on Engineering Mathematics-I Application Problems and Solution Manual, Department of Mathematics, Thiagarajar College of Engineering, Madurai.

Reference Books

1) Kuldeep Singh, "Engineering Mathematics Through Appplications",2e, Palgrave Macmillan, 2011.
2) Erwin Kreszig, "Advanced Engineering Mathematics",10th edition, Wiley, 2017.
3) George B. Thomas, " Thomas Calculus: early transcendentals ", Pearson, New Delhi, 2013.
4) R.K.Jain, S.R.K.Iyengar, ”Advanced Engineering Mathematics”5e, Narosa Publishing House, 2016.

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1	**DIFFERENTIAL CALCULUS**	
1.1	Representation of functions, New functions from old functions	1
1.2	Limits of a function	1
1.3	Continuity, Limits at infinity	1
1.4	Tutorial	1
1.5	Derivatives as a function, Differentiation rules	2

S.No	Topic	No. of Hours
1.6	The mean value theorem	1
1.7	Maxima and minima of function of one variable	1
1.8	Tutorial	1
1.9	Application problems in engineering	2
1.10	Application problems using MATLAB(Tutorial)	1
2	**FUNCTIONS OF SEVERAL VARIABLES**	
2.1	Partial derivatives, Chain rule	2
2.2	Vector functions and their derivatives	1
2.3	Tutorial	1
2.4	Directional derivatives, Gradient vector	1
2.5	Maxima and minima of functions of two variables	2
2.6	Lagrange Multipliers	1
2.7	Tutorial	1
2.8	Application problems in engineering	2
2.9	Application problems using MATLAB(Tutorial)	1
3	**INTEGRAL CALCULUS**	
3.1	Area under curves, The definite integrals, fundamental theorem of calculus	2
3.2	Integration by parts	1
3.3	Tutorial	1
3.4	volume of solid of revolution, area of surface of revolution	2
3.5	Improper integrals	2
3.6	Tutorial	1
3.7	Application problems in engineering	2
3.8	Application problems using MATLAB(Tutorial)	1
4	**MULTIPLE INTEGRAL**	
4.1	Iterated integrals	1
4.2	Double integrals over general regions	1
4.3	Double integrals in polar coordinates	1
4.4	Tutorial	1
4.5	Applications of double integrals	1
4.6	Triple integrals	2
4.7	Tutorial	1
4.8	Triple integrals in cylindrical coordinates	1
4.9	Triple integrals in spherical coordinates	1
4.10	Change of variables in multiple integrals	1
4.11	Tutorial	1
	Total	48

Course Designers

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18PHA20	PHYSICS (Common to Civil, Mechanical and Mechatronics)

Category	L	T	P	Credit
BS	3	0	0	3

Preamble

The course work aims in imparting fundamental knowledge of oscillations, waves and optics, and mechanics which are essential in understanding and designing mechanical systems and measuring devices.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Solve for the solutions and describe the behavior of a damped harmonic oscillator and waves	Apply
CO2	Explain the fundamentals of optical phenomena and its application.	Understand
CO3	Use the vector analytical techniques for analysis of forces and moments in mechanical systems	Apply
CO4	Demonstrate ability to utilize principles of vector mechanics to analyze weather systems	Understand
CO5	Explain the fundamental concepts of kinetics and kinematic of rigid bodies for analysis of practical problems.	Understand
CO6	Use the principles of angular velocity to study three dimensional motion of rigid bodies	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L					L	L		
CO2	M	L	L	-					L	L		
CO3	S	M	L	L					L	L		
CO4	M	L	L	-					L	L		
CO5	M	L	L	-					L	L		
CO6	S	M	L	L					L	L		
S- Strong; M-Medium; L-Low												

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	0
Understand	30	30	30	50
Apply	50	50	50	50
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. A 5.00×10^5 kg subway train is brought to a stop from a speed of 0.500 m/s in 0.400 m by a large spring bumper at the end of its track. What is the force constant k of the spring?
2. Show that the wave velocity of deep water waves is twice the group velocity.
3. Derive the law of reflection based on Fermats principle.

Course Outcome 2 (CO2):

1. Consider a lower energy level situated 200 cm^{-1} from the ground state. There are no other energy levels nearby. Determine the fraction of the population found in this level compared to the ground state population at a temperature of 300 K. Boltzmann's constant is equal to 1.38 x $10^{-23}JK^{-1}$.The conversion from cm^{-1} to joules is given by: $E(J) = 100hC\ E(cm^{-1})$, where h is Planck's constant (6.62 x 10^{-34}Js) and c is the speed of light in a vacuum (3 x $10^8 ms^{-1}$)
2. Explain the principle, construction and working of Mach-Zehnder interferometer.
3. What is a four level solid state laser? Discuss the principle and operation of Nd:YAG Laser.

Course Outcome 3 (CO3):

1. A 10, 000 lb aircraft is descending on a cylindrical helix. The rate of descent is $z^{\cdot} = -10$ft/s, the speed is v = 211 ft/s, and $\theta^{\cdot} = 3^o \approx 0.05$rad/s. This is standard for gas turbine powered aircraft. Find out the force on the aircraft and the radius of curvature of the path
2. Derive Newton's second law of motion in spherical and cylindrical coordinate systems.
3. A particle attached to a string of length 2 m is given an initial velocity of 6 m/s. The string is attached to a peg and, as the particle rotates about the peg, the string winds around the peg. By conservation of angular momentum, find the length of string wound around the peg when the velocity of the particle is 20 m/s?

Course Outcome 4 (CO4):

1. Consider a situation where a cricket player (fielder) slides to a stop on level ground. Using energy considerations (in non conservative forces),calculate the distance the 60 kg cricket player slides, given that his initial speed is 7 m/s and the force of friction against him is a constant 430 N.
2. Compute the centripetal force per unit mass on a spacecraft in an 820 km circular Polar orbit as it flies over the equator and the South pole.
3. Solve Newton's equations of motion in polar coordinates

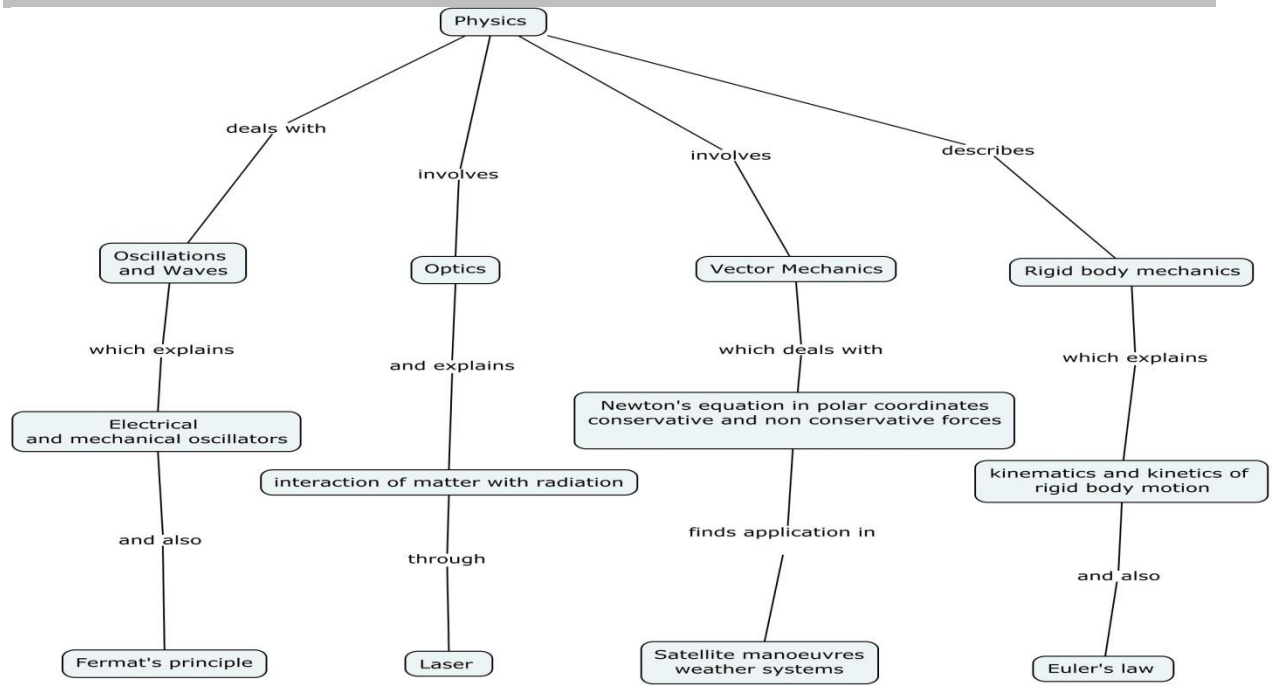
Course Outcome 5 (CO5):

1. A motor shaft attains a velocity of 1500 rpm in 3 seconds starting from rest. Assuming constant angular acceleration, find out the number of full revolution of the shaft during this period.
2. Derive Euler's equations of motion of a rigid body.
3. A cylinder of diameter 500 mm rolls down an inclined plane with uniform acceleration (of the center-of-mass) a = 0.1 m/s^2. At an instant t_0, the mass-center has speed v_0 = 0.5 m/s. (i) Find the angular speed ω and the angular acceleration $\omega^{\cdot}$ at t_0. (ii) How many revolutions does the cylinder make in the next 2 seconds?

Course Outcome 6 (CO6):

1. A solid right circular cone of base radius *r* and height *h* rolls on a flat surface without slipping. The centre of the circular base moves in a circular path around the z- axis (vertical axis passing through the tip of the cone) with a constant speed *v*. Determine the angular velocity and angular acceleration of the solid cone.
2. Derive an expression for angular velocity and its rate of change for three dimensional motion of a rigid body.
4. Discuss the conical motion of a rod with center of mass fixed.

Concept Map



Syllabus

Oscillations and Waves

Simple harmonic motion - Mechanical and Electrical simple harmonic oscillators - energy decay in a damped harmonic oscillator - Non-dispersive transverse and longitudinal waves in one dimension - Waves with dispersion - water waves- Acoustic waves- superposition of waves - wave groups and group velocity – Rayleigh criteria for limit of resolution and its applications to imaging.

Optics

Fermat's principle of stationary time - reflectance and transmittance - evanescent wave. Mach-Zehnder interferometer - Fraunhofer diffraction from a single slit and a circular aperture - Einstein's theory of matter radiation interaction and A and B coefficients –CO_2 – Nd-YAG lasers - applications of lasers.

Vector Mechanics of Particles

Transformation of scalars and vectors under Rotation transformation - Forces in Nature - Newton's laws and its completeness in describing particle motion - Solving Newton's equations of motion in polar coordinates -Conservative and non-conservative forces - curl of a force field -Conservation of Angular Momentum - Energy equation and energy diagrams – circular and elliptical orbits.- Applications to Satellite manoeuvres

Rigid Body Mechanics

Motion of a rigid body in the plane - Rotation in the plane - Kinematics in a coordinate system rotating and translating in the plane - Angular momentum about a point of a rigid body in planar motion - Euler's laws of motion - their independence from Newton's laws - Two-dimensional motion in terms of angular velocity vector, and its rate of change – Difference between 2D & 3D motion.

Text Book

1. Ian G.Main, Vibrations and waves in Physics -3rd edition, Cambridge University, Press, 1994.
2. M.K.Verma, Introduction to Mechanics, CRC Press, 2009.
3. JL Meriam and L.G. Kraige, Engineering Mechanics – Dynamics - 7th edition, Wiley,2015.
4. D. Kleppner and R. Kolenkow, An Introduction to Mechanics – 1st edition, McGraw Hill, 2009.

Reference Books

1. M.K.Harbola, Engineering Mechanics-2nd edition, Cengage Learning, 2012.
2. JL Synge & BA Griffiths, Principles of Mechanics, McGraw-Hill Book company Inc, 1949.
3. WT Thomson, Theory of Vibrations with Applications,-3rd edition, CBS Publishers, 2002.

Course Contents and Lecture Schedule

S No.	Topic	No. of Hours
1.	**Oscillations & Waves**	
1.1	Simple harmonic motion – Mechanical and Electrical simple harmonic oscillators.	2
1.2	Energy decay in a damped harmonic oscillator – Non-dispersive transverse and longitudinal waves in one dimension.	2
1.3	Waves with dispersion – water waves- Acoustic waves – superposition of waves – wave groups and group velocity.	1
1.4	Rayleigh criteria for limit of resolution and its applications to imaging	1
2	**Optics**	
2.1	Fermat's principle of stationary time - reflectance and transmittance - evanescent wave. Mach-Zehnder interferometer.	2
2.2	Fraunhofer diffraction from a single slit and a circular aperture .	1
2.3	Einstein's theory of matter radiation interaction and A and B coefficients .	1
2.4	CO_2 Laser.	1
2.5	Nd-YAG lasers Applications of lasers.	1
3.	**Vector Mechanics of Particles**	
3.1	Transformation of scalars and vectors under rotation transformation	2
3.2	Forces in Nature, Newton's laws and its completeness in describing particle motion	2
3.3	Solving Newton's equations of motion in polar coordinates	2
3.4	Conservative and non-conservative forces, curl of a force field, Conservation of angular momentum	2
3.5	Energy equation and energy diagrams, circular and elliptical orbits	2
3.6	Applications to Satellite manoeuvres	2
4.	**Rigid Body Mechanics**	

S No.	Topic	No. of Hours
4.1	Motion of a rigid body in the plane, Rotation in the plane	2
4.2	Kinematics in a coordinate system rotating and translating in the plane	2
4.3	Angular momentum about a point of a rigid body in planar motion	2
4.4	Euler's laws of motion, their independence from Newton's laws	2
4.5	Two-dimensional motion in terms of angular velocity vector, and its rate of change.	2
4.6	Distinction between 2D & 3D motion	2
	Total	**36**

Course Designers

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18PHB20	PHYSICS (Common to EEE and ECE)

Category	L	T	P	Credit
BS	3	0	0	3

Preamble

The course work aims in imparting fundamental knowledge of oscillations and waves and electromagnetic theory which are essential in understanding and explaining engineering devices.

Prerequisite

Basic course (No prerequisite)

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Solve for the solutions and describe the behavior of a damped harmonic oscillator and waves	Apply
CO2	Explain the fundamentals of optical phenomena and its application.	Understand
CO3	Understand the fundamentals of electrostatics and Calculation of electric field and electrostatic potential for a charge distribution	Apply
CO4	Explain bound charges due to electric polarization and estimation of vector potential through concepts of magneto statics.	Understand
CO5	Describe and make calculations of plane electromagnetic waves in homogeneous media and derive Poynting theorem	Understand
CO6	Learn the propagation of EM waves and its applications by solving physical problems and Energy and Momentum carried by electromagnetic waves through linear media.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L					L	L		
CO2	M	L	L	-					L	L		
CO3	S	M	L	L					L	L		
CO4	M	L	L	-					L	L		
CO5	M	L	L	-					L	L		
CO6	S	M	L	L					L	L		
S- Strong; M-Medium; L-Low												

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	50	50	50	50
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Assuming a car is 900 kg and has a suspension system that has a force constant $6.5x10^4$ N/m. The car hits a bump and bounces with an amplitude of 0.100 m. What is its maximum vertical velocity if no damping occurs?
2. Establish the connection between quality factor, width of response and energy dissipation.
3. State the Rayleigh's criteria for limit of resolution.

Course Outcome 2 (CO2):

1. Differentiate between laser light and ordinary light.
2. Predict the working of the CO2 laser without Helium gas in the mixture.
3. Explain the construction and working of Nd-YAG Laser

Course Outcome 3 (CO3):

1. Discuss the Continuous charge distribution and the electric field produced by it.
2. Derive Laplace's and Poisson's equation
3. Deduce Gauss' law.

Course Outcome 4 (CO4):

1. Summarize physical interpretation of bound charges
2. Define vector potential and give its significance.
3. Explain the magnetic field of a steady current and hence obtain Bio-Savart law .

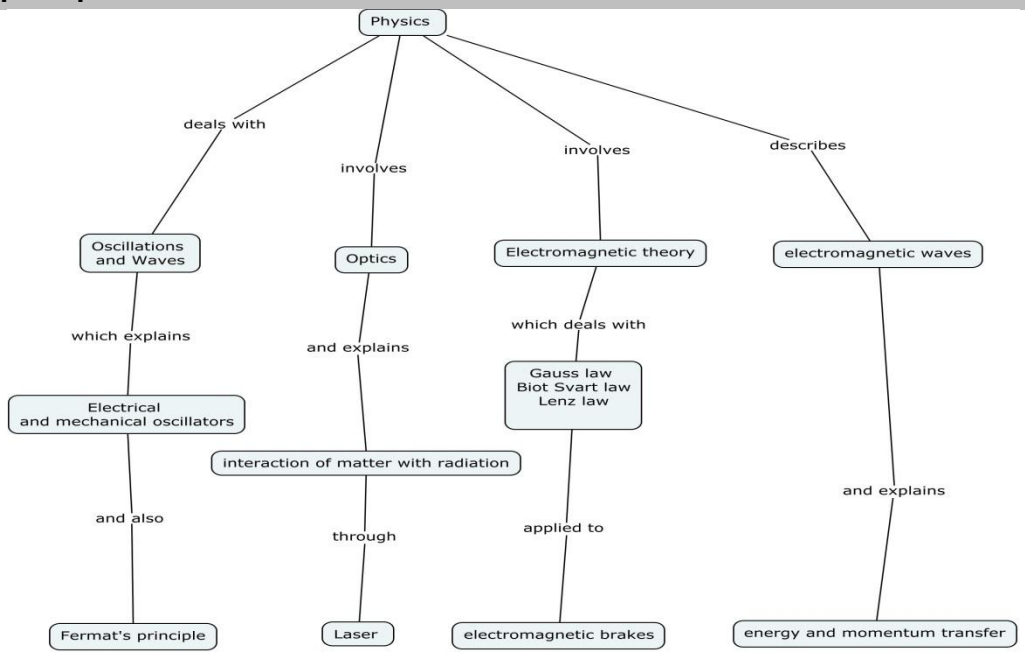
Course Outcome 5 (CO5):

1. Derive and interpret Continuity equation for current densities.
2. Write and explain the importance of Poynting vector
3. Deduce Faraday's law of electromagnetic from the Maxwell's equation

Course Outcome 6 (CO6):

1. Discuss the propagation of EM waves through vacuum.
2. Define and obtain expressions for transmission and reflection coefficients
3. Find the reflection and transmission coefficients of an electric field wave travelling in wave and incident normally on a boundary between air and a dielctric having Permeability $\mu 0$ and permittivity 4.74.

Concept Map



Syllabus

Oscillations and Waves (6 hours)

Simple harmonic motion - Mechanical and Electrical simple harmonic oscillators - energy decay in a damped harmonic oscillator - Non-dispersive transverse and longitudinal waves in one dimension - Waves with dispersion - water waves –Acoustic waves - superposition of waves - wave groups and group velocity – Rayleigh criteria for limit of resolution and its applications to imaging

Optics (6 hours)

Fermat's principle of stationary time - reflectance and transmittance - evanescent wave. Mach-Zehnder interferometer - Fraunhofer diffraction from a single slit and a circular aperture - Einstein's theory of matter radiation interaction and A and B coefficients $–CO_2$ – Nd-YAG lasers - applications of lasers.

Electromagnetic Theory (12 Hours)

Electrostatics: Introduction, Calculation of electric field and electrostatic potential for a charge distribution - Gauss' law, Divergence and curl of electrostatic field, Application: Faraday's cage and coffee-ring effect(qualitative only). Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; Solving simple electrostatics problems in presence of dielectrics.

Magnetostatics: Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem. Lenz's law; Electromagnetic breaking (qualitative only)

Electromagnetic waves (12 hours)

Continuity equation for current densities- Modifying equation for the curl of magnetic field – Energy in an electromagnetic field - Flow of energy and Poynting vector - Maxwell's equations- The wave equation- Plane electromagnetic waves in Vacuum– their transverse nature and Polarization ; relation between electric and magnetic fields of an electromagnetic

wave -Energy and Momentum carried by electromagnetic waves, Propagation through linear media-Normal incidence - problems.

Text Books

1. Ian G.Main, Vibrations and waves in Physics -3rd edition, Cambridge University Press,1994.
2. David J. Griffiths, Introduction to Electrodynamics, Prentice Hall, Second Indian edition,1981.
3. Paul Lorrain , Dale R. Corson , Francois Lorrain, Electromagnetic Fields and Waves, 3rd Edition, W.H. Freeman, 1990.
4. A.A. Rangwala,A.S. Mahajan, Electricity and Magnetism – 1st edition , McGraw Hill Education, 2004.

Reference

1. Halliday Resnick Krane, Physics Volume 2, Fifth edition, Wiley Publications, 2002.
2. W. Saslow, Electricity, Magnetism and light, Academic press 2005.
3. WT Thomson, Theory of Vibrations with Applications,-3rd edition, CBS Publishers, 2002.

Course Contents and Lecture Schedule

S No.	Topic	No. of Hours
1.	**Oscillations & Waves**	
1.1	Simple harmonic motion – Mechanical and Electrical simple harmonic oscillators.	2
1.2	Energy decay in a damped harmonic oscillator – Non-dispersive transverse and longitudinal waves in one dimension.	2
1.3	Waves with dispersion – water waves – Acoustic waves – superposition of waves – wave groups and group velocity.	1
1.4	Rayleigh criteria for limit of resolution and its applications to imaging.	1
2	**Optics**	
2.1	Fermat's principle of stationary time - reflectance and transmittance - evanescent wave. Mach-Zehnder interferometer.	2
2.2	Fraunhofer diffraction from a single slit and a circular aperture .	1
2.3	Einstein's theory of matter radiation interaction and A and B coefficients	1
2.4	CO_2 Laser	1
2.5	Nd-YAG lasers Applications of lasers.	1
3	**Electromagnetic Theory**	
3.1	Electrostatics: Introduction, Calculation of electric field and electrostatic potential for a charge distribution - Gauss' law – work done- Electric potential problems. Divergence and curl of electrostatic field	4
3.2	Applications: Faraday's cage and coffee-ring effect. Electrostatic field and potential of a dipole.	2
3.3	Bound charges due to electric polarization; Electric displacement; Solving simple electrostatics problems in presence of dielectrics.	2
3.4	Magnetostatics: Bio-Savart law, Divergence and curl of static magnetic field	2
3.5	vector potential and calculating it for a given magnetic field using Stokes'	2

S No.	Topic	No. of Hours
	theorem. Lenz's law; Electromagnetic breaking (qualitative only)	
4	**Electromagnetic waves**	
4.1	Continuity equation for current densities- Modifying equation for the curl of magnetic field –	2
4.2	Energy in an electromagnetic field - Flow of energy and Poynting vector - Maxwell's equations- The wave equation-	3
4.3	Plane electromagnetic waves in Vacuum– their transverse nature and Polarization	2
4.4	Relation between electric and magnetic fields of an electromagnetic wave	2
4.5	Energy and Momentum carried by electromagnetic waves, Propagation through linear media- Reflection and Transmission coefficients, problems.	3
	Total	**36**

Course Designers

1. Dr.S.Rajathi srphy@tce.edu
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4. Dr. A.L.Subramaniyan alsphy@tce.edu

18PHC20	PHYSICS (Common to CSE and IT)

Category	L	T	P	Credit
BS	3	0	0	3

Preamble

The course work aims in imparting fundamental knowledge of oscillations and waves and optics and quantum mechanics which are essential in understanding and explaining engineering devices.

Prerequisite

Basic course (No prerequisite)

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Solve for the solutions and describe the behavior of a damped harmonic oscillator and waves	Apply
CO2	Explain the fundamentals of optical phenomena and its application.	Understand
CO3	Explain the basic principles of Quantum mechanic	Understand
CO4	Use the principles of quantum mechanics to calculate observables on known wave functions	Apply
CO5	Solve Schrodinger equation for simple potentials ,scattering and related phenomena	Understand
CO6	identify and relate the Eigen value problems for energy, momentum, angular momentum and explain the idea of spin	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L					L	L		
CO2	M	L	L	-					L	L		
CO3	M	L	L	-					L	L		
CO4	S	M	L	L					L	L		
CO5	M	L	L	-					L	L		
CO6	S	M	L	L					L	L		
S- Strong; M-Medium; L-Low												

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	50	50	50	50
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1)

1. Assuming a car is 900 kg and has a suspension system that has a force constant 6.5×10^4 N/m. The car hits a bump and bounces with an amplitude of 0.100 m. What is its maximum vertical velocity if no damping occurs?
2. Establish the connection between quality factor, width of response and energy dissipation.
3. State the Rayleigh's criteria for limit of resolution.

Course Outcome 2 (CO2)

1. Find the ratio of population of two energy states in a Laser the transition between which is responsible for the emission of photons of wavelength6893A at a temperature of 300K.Comment on the type of emission based on the ration of population.
2. Analyze the role of mixture of gases for a CO_2 laser and predict the working of the laser without Helium gas in the mixture.
3. Differentiate between CO_2 laser and Nd-YAG Laser with respect to their construction and energy level diagram.

Course Outcome 3 (CO3)

1. List the properties of wave function.
2. Set up the time independent Schrodinger wave equation and explain the Eigen functions and Eigen values.
3. Describe an experiment to verify the uncertainty principle.

Course Outcome 4 (CO4)

1. Calculate the expectation value of the position of a particle trapped in a box of length 10A° wide.
2. Compute the smallest possible uncertainty in position of an electron moving with a Velocity of 3×10^7 m.
3. An electron is constrained to a one dimensional box of side 1nm.Calculate the first four Eigen values in electron volt.

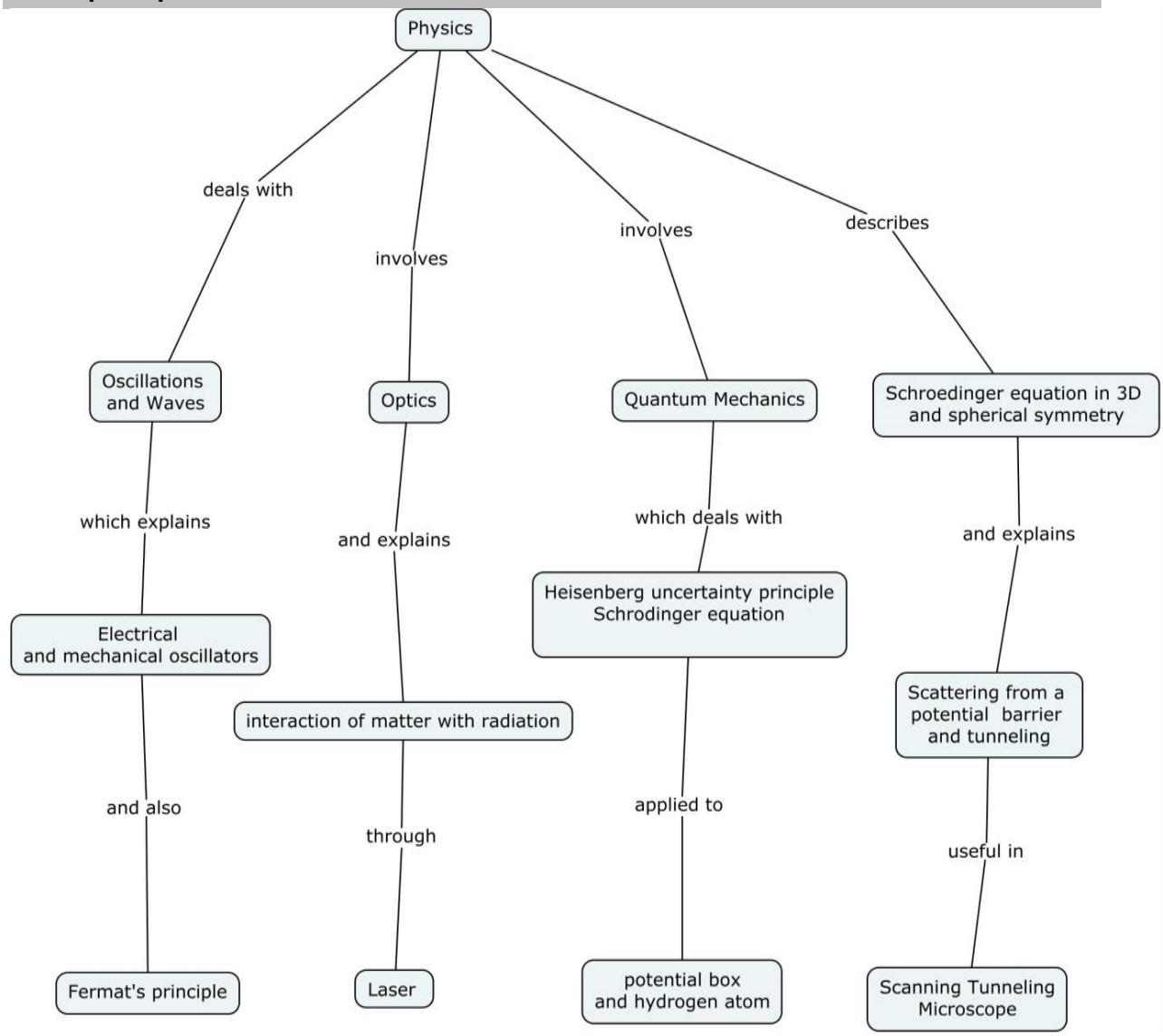
Course Outcome 5 (CO5)

1. Assuming the time independent Schrödinger wave equation, discuss the solution for a particle in a three dimensional potential well of infinite height.
2. Discuss the barrier tunneling phenomenon for a rectangular finite potential barrier of height V_o.
3. State the principle of STM and describe its working.

Course Outcome 6 (CO6)

1. Identify the degeneracies in hydrogen atom energy level based on the principle of quantum numbers.
2. Illustrate the vector model of orbital angular momentum
3. Given $\psi(x) = A\sin(kx)$. Find the Eigen values of the operator $O = \partial^2/\partial x^2$. Identify whether $\partial/\partial x$ is an Eigen operator

Concept Map



Syllabus

Oscillations and Waves: Simple harmonic motion - Mechanical and Electrical simple harmonic oscillators - energy decay in a damped harmonic oscillator - Non-dispersive transverse and longitudinal waves in one dimension - Waves with dispersion - water waves – Acoustic waves - superposition of waves - wave groups and group velocity – Rayleigh criteria for limit of resolution and its applications to imaging.

Optics : Fermat's principle of stationary time - reflectance and transmittance - evanescent wave. Mach-Zehnder interferometer - Fraunhofer diffraction from a single slit and a circular aperture - Einstein's theory of matter radiation interaction and A and B coefficients –CO_2 – Nd-YAG lasers - applications of lasers.

Introduction to Quantum mechanics

Wave nature of Particles, Time-dependent and time independent Schrodinger equation for wave function, Born interpretation, probability current, Expectation values, Free-particle wave function and wave-packets, Uncertainty principle – Derivation & Experiment. Solution

of stationary-state Schrodinger equation for one dimensional problems– particle in a box, Square-well potential, linear harmonic oscillator.

Applying the Schrodinger equation

Numerical solution of stationary-state - Schrodinger equation for three dimensional problems for different potentials and related examples - Angular momentum operator - Hydrogen atom ground-state, orbitals - interaction with magnetic field, spin. Scattering from a potential barrier and tunneling; related examples like alpha-decay, field ionization Schrodinger equation for spherically symmetric potentials and scanning tunneling microscope.

Text Books

1. Ian G. Main, Vibrations and waves in Physics -3rd edition, Cambridge University press, ,1994.
2. David .J. Griifiths, Introduction to quantum mechanics -2nd edition, Cambridge University press, 2017.
3. P M Mathews, K.Venkatesan, Quantum mechanics, 2 nd edition, Tata McGraw-Hill Education, 2010.

Reference

1. http.//nptel.ac.in/courses/115106066/Quantum mechanics Prof. S. Lakshmi Bala, IIT Madras.
2. http://nptel.ac.in/courses/115101010/ Quantum mechanics Prof. S. H.Patil, IIT Bombay.
3. http://nptel.ac.in/courses/115104096/ Introduction to quantum mechanics, Prof Manoj K.Harbola, IIT Kanpur

Course Contents and Lecture Schedule

S No.	Topic	No. of Hours
1.	**Oscillations & Waves**	
1.1	Simple harmonic motion – Mechanical and Electrical simple harmonic oscillators.	2
1.2	Energy decay in a damped harmonic oscillator – Non-dispersive transverse and longitudinal waves in one dimension.	2
1.3	Waves with dispersion – water waves – Acoustic Waves – superposition of waves – wave groups and group velocity.	1
1.4	Rayleigh criteria for limit of resolution and its applications to imaging.	1
2	**Optics**	
2.1	Fermat's principle of stationary time - reflectance and transmittance - evanescent wave. Mach-Zehnder interferometer.	2
2.2	Farunhofer diffraction from a single slit and a circular aperture.	1
2.3	Einstein's theory of matter radiation interaction and A and B coefficients.	1
2.4	CO_2 Laser.	1
2.5	Nd-YAG lasers -Applications of lasers.	1
3	**Introduction to Quantum mechanics**	
3.1	Wave nature of Particles, Time-dependent and time independent Schrodinger equation for wave function.	3
3.2	Born interpretation, probability current, Expectation values.	3
3.3	Free-particle wave function and wave-packets, Uncertainty principle –	3

S No.	Topic	No. of Hours
	Derivation & Experiment.	
3.4	Schrodinger equation for one dimensional problems– particle in a box, square-well potential, linear harmonic oscillator.	3
4	**Applying the Schrodinger equation**	
4.1	Numerical solution of stationary-state	1
4.2	Schrodinger equation for one dimensional problem for different potentials and related examples.	3
4.3	Angular momentum operator, Hydrogen atom ground-state, orbitals, interaction with magnetic field , spin	3
4.4	Scattering from a potential barrier and tunneling; related examples like alpha-decay, field ionization	3
4.5	Schrodinger equation for spherically symmetric potentials	1
4.6	Scanning tunneling microscope.	1
	Total	**36**

Course Designers

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3. Dr. A.L.Subramaniyan alsphy@tce.edu
4. Dr.T.Manichandran stmanichandran@tce.edu

18CHA30	CHEMISTRY (COMMON TO CIVIL, MECHANICAL AND MECHATRONICS)

Category	L	T	P	Credit
BS	3	0	0	3

Preamble

The objective of this course is to bestow a better understanding of basic concepts of chemistry and its applications on Civil, Mechanical and Mechatronics domain. It also imparts knowledge on properties of water and its treatment methods, spectroscopic techniques for material characterization, corrosion and protection of metals. This course also highlights preparation, properties and applications of polymer and composite materials. It also gives basic idea about adhesives and lubricants and their mechanisms.

Prerequisite

Nil

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Identify the properties of water and its treatment methods	Understand
CO2	Summarize the Principles and Instrumentations of Spectroscopic techniques	Understand
CO3	Select the appropriate spectroscopic techniques for characterization of materials	Apply
CO4	Adapt the customized corrosion control methods	Apply
CO5	Dramatize the preparation, properties and applications of Engineering materials	Understand
CO6	Describe the mechanism of adhesion and lubrication	Understand

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1.	M	-	-	-	-	-	-	-	-	-	M	-
2.	M	L	L	-	-	-	-	-	-	-	-	-
CO3.	S	S	M	M	-	-	-	-	-	-	-	-
CO4.	S	S	M	M	-	-	L	-	-	-	L	-
CO5.	M	M	M	-	-	-	L	-	-	-	-	-
CO6.	M	-	L	-	-	-	-	-	-	-	-	-
S- Strong; M-Medium; L-Low												

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	40	40	40	40
Apply	40	40	40	40
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Course Level Assessment Questions

Course Outcome 1 (CO1):

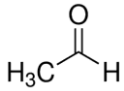
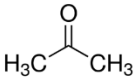
1. Distinguish between scale and sludge.
2. 100 ml of given water sample consumed 48 ml of EDTA during titration using EBT indicator. 35 ml of same EDTA consumed by 100 ml of standard hard water containing 1 mg of pure $CaCO_3$ per ml. Calculate the permanent, temporary and total hardness of given water sample in $CaCO_3$ equivalents.
3. Outline the steps involved in the waste water treatment process.

Course Outcome 2 (CO2):

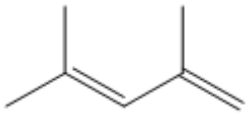
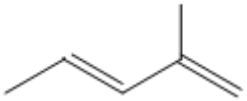
1. State Beer-Lambert law.
2. Write the selection rule in absorption spectroscopy.
3. Explain the procedure involved in finding the metals present in an alloy sample using ICP-OES.

Course Outcome 3 (CO3):

1. Compare the stretching frequencies of carbonyl functional groups in the following compounds

i)  (ii) 

2. Following Woodward-Fiesher- scott rules, it has been observed that the following compounds have absorption maximum at (i) 225 nm, (ii) 220 (iii) 230. Explain which is which.

a).  b).  c). 

3. Describe the function of different magnets available to generate magnetic field in MRI scanner.

Course Outcome 4 (CO4)

4. Illustrate the different forms of corrosion with appropriate mechanism
5. Dramatize suitable methods to prevent corrosion of iron bar used in construction.
6. Discuss in detail about the constituents and functions of paint.

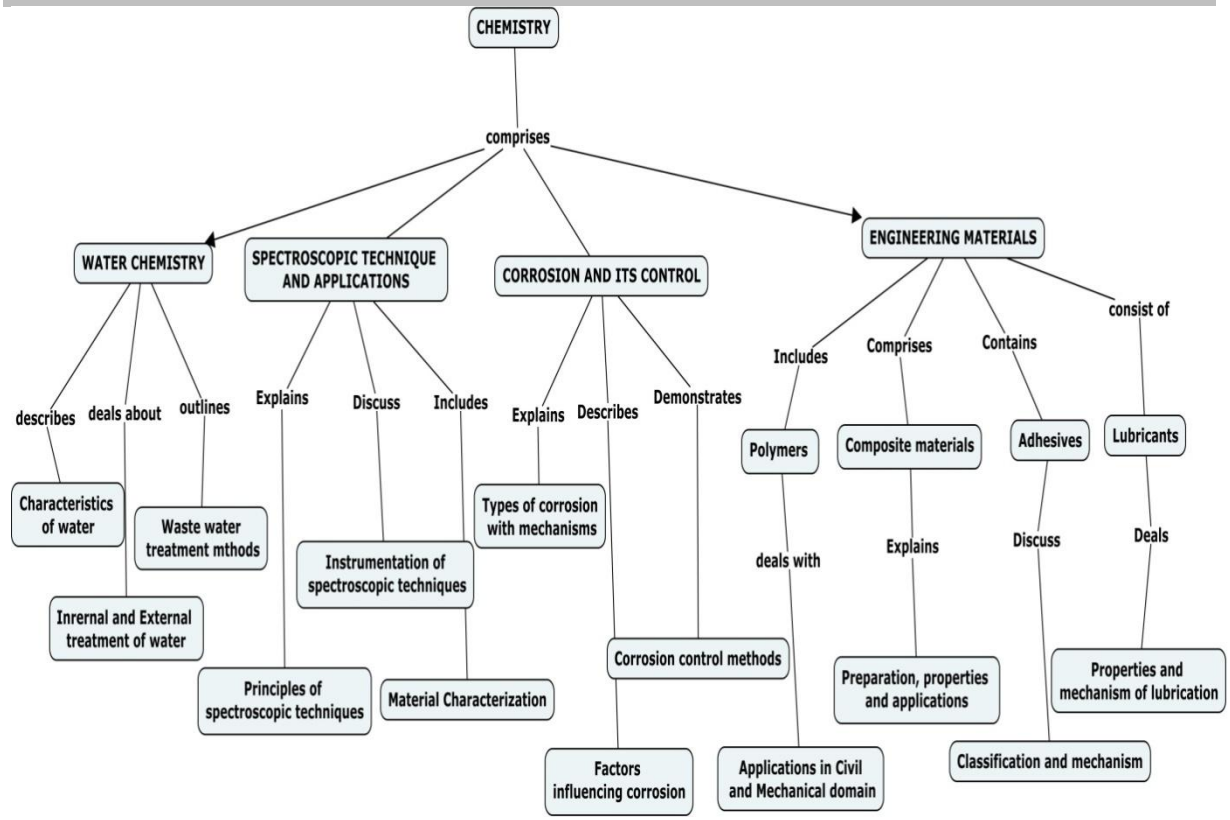
Course Outcome 5 (CO5)

1. Explain the application of composite materials in automobile engineering.
2. Demonstrate the applications of polymer in the enhancement of concrete properties.
3. Summarize the properties and application of reinforced composite materials.

Course Outcome 6 (CO6)

1. List the types of lubricant materials.
2. Identify the factors which influence the action of adhesive.
3. Discuss the mechanism of lubrication.

Concept Map



Syllabus

Water Chemistry : Water- sources-Hardness of water-types-Estimation of hardness of water by EDTA method. Disadvantages of hardwater -Boiler troubles- scale & sludge. Internal treatment methods. External treatment methods- zeolite, ion exchange. Desalination process- reverse osmosis, electrodialysis, multi stage flash distillation. Waste water treatment processes.

Spectroscopic technique and applications-Principles of spectroscopy and selection rules-Electronic spectroscopy, Fluorescence- applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules- Applications. Nuclear magnetic resonance and magnetic resonance imaging. Atomic Absorption Spectroscopy and Inductively Coupled Plasma-Optical Emission Spectroscopy- Principle, instrumentation and applications.

Corrosion and its prevention-Corrosion- causes- factors- types- chemical, electrochemical corrosion (galvanic, differential aeration), Corrosion of steel in various environments. Rate of corrosion. Corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Coatings – Metallic – Chromate conversion coating, electroplating – precious metal coating. Paints-constituents and function.

Engineering materials – Polymers - Introduction-classification-properties –applications in construction and manufacturing processes. Composite Materials: Introduction-Classification – Preparation, properties and applications. Fiber-Reinforced Composites-preparation, properties and applications..Adhesives- Introduction-classification-fundamental aspects – mechanism of adhesion- factors influencing adhesive action. Lubricants-introduction-classification-properties-functions-mechanism of lubrication.

Text Book

1. P.C. Jain and Monica Jain, A Textbook of Engineering Chemistry, DhanpatRai publications, New Delhi, 16th edition, 2015.
2. C. N. Banwelland E.M. McCash, "Fundamentals of Molecular Spectroscopy", Tata McGraw-Hill (India), 5th Edition, 2013.

Reference Books

1. S.S. Dara and S.S.Umare, "A Textbook of Engineering Chemistry", S.Chand & Company, 12th Edition, Reprint, 2013.
2. Shashi Chawla, " A text book of Engineering Chemistry", Dhanpat Rai & Co.(pvt) ltd, 3rd edition, reprint 2011.

Course Contents and Lecture Schedule

S. No.	Topic	No. of hours
1.0	**Water Chemistry**	
1.1	Introduction -Water- sources-Hardness of water-types	1
1.2	Estimation of hardness of water by EDTA method	2
1.3	Disadvantages of hard water -Boiler troubles- scale & sludge.	1
1.4	Internal treatment methods	1
1.5	External treatment methods- zeolite, ion exchange	1
1.6	Desalination process- reverse osmosis, electrodialysis, multi stage flash distillation	1
1.7	Waste water treatment processes	2
2.0	**Spectroscopic technique and applications**	
2.1	Introduction	1
2.2	Principles of spectroscopy and selection rules	1
2.3	Electronic spectroscopy, Fluorescence- applications in medicine.	1
2.4	Vibrational and rotational spectroscopy of diatomic molecules- Applications	2
2.5	Nuclear magnetic resonance and magnetic resonance imaging	2
2.6	Atomic Absorption Spectroscopy and Inductively Coupled Plasma- Optical Emission Spectroscopy- Principle, instrumentation and applications.	2
3.0	**Corrosion and its prevention**	
3.1	Corrosion- causes- factors-	1
3.2	types- chemical, electrochemical corrosion (galvanic, differential aeration), Corrosion of steel in various environments (Marine)	2
3.3	Rate of corrosion	1
3.4	Corrosion control - material selection and design aspects	1
3.5	electrochemical protection – sacrificial anode method and impressed current cathodic method	1
3.6	Coatings – Metallic - Chromate conversion coating, electroplating – precious metal coating.	2
3.7	Paints- constituents and function.	1
4.0	**Engineering materials**	

S. No.	Topic	No. of hours
4.1	Polymers - Introduction-classification-properties	1
4.2	Applications in construction and mechanical domains	1
4.3	Composite Materials: Introduction-Classification – Preparation, properties and applications of Polymer Matrix Composites,	1
4.4	Metal Matrix Composites, Ceramic Matrix Composites Carbon-Carbon Composites	2
4.5	Fiber-Reinforced Composites- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide fibers and nature-made composites, and applications.	2
4.6	Adhesives- Introduction-classification-fundamental aspects – mechanism of adhesion- factors influencing adhesive action	1
4.7	Lubricants-introduction-classification-properties-functions-mechanism of lubrication.	1
	Total	**36**

Course Designers:

1.	Dr. M.Kottaisamy	hodchem@tce.edu
2	Dr.(Mrs).K.Radha	krchem@tce.edu
2.	Dr.S.Rajkumar	rajkumarsubramanium@tce.edu
3.	Dr.M.Velayudham	mvchem@tce.edu

18CHB30	CHEMISTRY (Common to EEE and ECE)

Category	L	T	P	Credit
BS	3	0	0	3

Preamble

This course work aims in imparting fundamental knowledge of materials and their applications in electrical, electronics and communication engineering. This course provides exposure to the students regarding the characterization of materials by spectroscopic methods. This course also deals with the selection of materials based on their properties for application in energy storage, energy conversion and electronic devices. It also extends the importance of water and gives better understanding of Water treatment processes.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1.	Identify the properties of water and its treatment methods	Understand
CO2.	Summarize the Principles and Instrumentations of Spectroscopic Techniques	Understand
CO3.	Select the appropriate spectroscopic techniques for characteristics of materials	Apply
CO4.	Outline the importance of industrial electrochemical processes and protective coating	Understand
CO5.	Indicate the materials best suited for the construction of energy storage devices for different applications	Apply
CO6.	Identify the implications of material properties in the performance of electronic devices.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	L	-	-	-	-	-	-	-	-	L
CO2	M	M	L	-	-	-	-	-	-	-	-	-
CO3	S	S	L	-	-	-	-	-	-	-	-	-
CO4	M	M	M	M	-	-	L	-	-	-	-	L
CO5.	S	S	M	M	-	-	M	-	-	-	-	L
CO6	S	S	M	M	-	-	M	-	-	-	-	L
S- Strong; M-Medium; L-Low												

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	50	50	50	50
Analyze	_	_	_	_
Evaluate	_	_	_	_
Create	_	_	_	_

Course Level Assessment Questions

Course Outcome 1 (CO1):

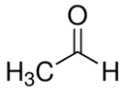
1. Distinguish between scale and sludge.
2. 100 ml of given water sample consumed 48 ml of EDTA during titration using EBT indicator. 35 ml of same EDTA consumed by 100 ml of standard hard water containing 1 mg of pure $CaCO_3$ per ml. Calculate the permanent, temporary and total hardness of given water samples in $CaCO_3$ equivalents.
3. Outline the steps involved in the waste water treatment process.

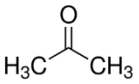
Course Outcome 2 (CO2):

4. State Beer-Lambert law.
5. Write the selection rule in absorption spectroscopy.
6. Explain the procedure involved in finding the metals present in an alloy sample using ICP-OES.

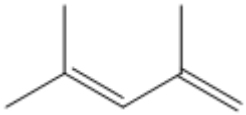
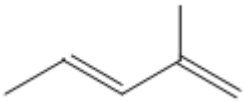
Course Outcome 3 (CO3):

1. Compare the stretching frequencies of carbonyl functional groups in the following compounds

i) 

(ii) 

2. Following Woodward-Fiesher- scott rules, it has been observed that the following compounds have absorption maximum at (i) 225 nm, (ii) 220 (iii) 230. Explain which is which.

a).  b).  c). 

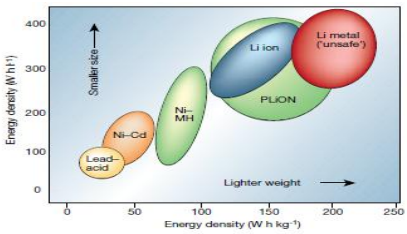
3. Describe the function of different magnets available to generate magnetic field in MRI scanner.

Course Outcome 4 (CO4)

1. Explain the drawbacks of gold electroplating.
2. Name the different types of electrolyte used in platinum electroplating.
3. Write the equations for hydrogen generation by electrolysis process under acidic and alkaline conditions.

Course Outcome 5 (CO5)

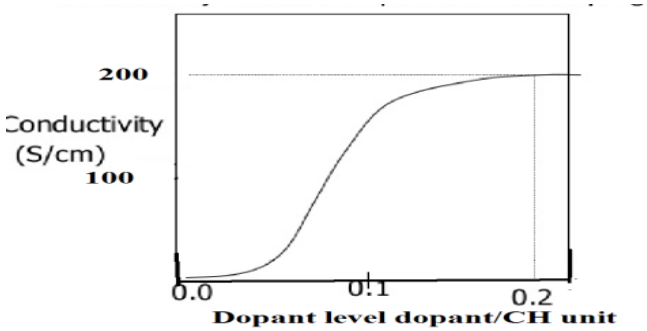
1. Illustrate the working principle, charging and discharging reactions in Lead acid battery.
2. With the help of comparative chart of different battery types, justify the reason for considering Lithium ion batteries as future power source.



3. Illustrate H_2-O_2 fuel cell construction and explain associated electrochemical reactions.

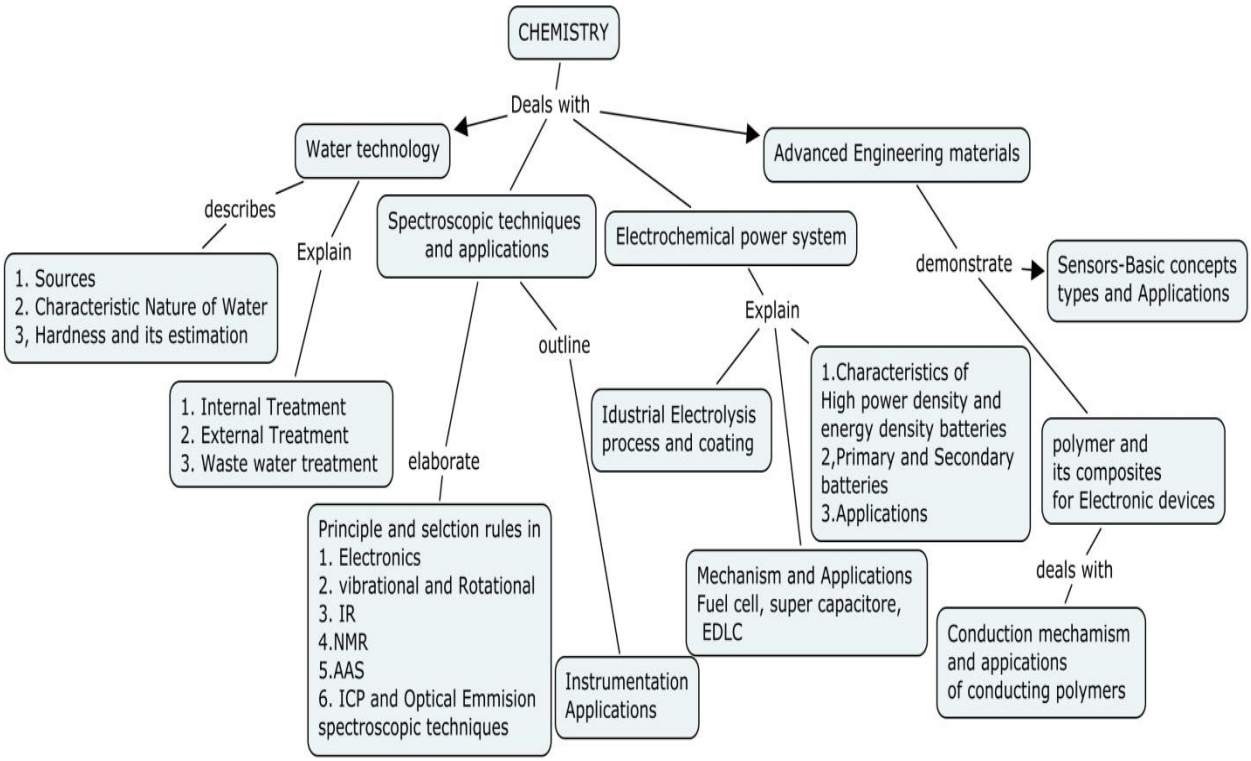
Course Outcome 6 (CO6)

1. Explain the conduction mechanism of polyaniline as a host for enzyme in biosensor.
2. In the following profile, identify the reason why the conductivity of polymer has been increased with dopant level.



3. Identify the suitable bio sensing materials for the detection of glucose in human blood serum.

Concept Map



Syllabus

Water Chemistry: Water- sources-Hardness of water-types-Estimation of hardness of water by EDTA method. Disadvantages of hardwater -Boiler troubles- scale & sludge.Internal treatment methods. External treatment methods- zeolite, ion exchange. Desalination process- reverse osmosis, electrodialysis, multi stage flash distillation. Waste water treatment processes.

Spectroscopic technique and applications -Principles of spectroscopy and selection rules- Electronic spectroscopy, Fluorescence- applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules- Applications. Nuclear magnetic resonance and magnetic resonance imaging. Atomic Absorption Spectroscopy and Inductively Coupled Plasma-Optical Emission Spectroscopy- Principle, instrumentation and applications.

Electrochemical power system-Electrochemistry–Basics - Industrial electrolytic process – Water electrolysis – Hydrogen generator- Electroplating - Decorative and functional coating- Value added coatings and Electroless process of making printed circuit board- Materials for Energy storage: Batteries **-** High energy density and Power density batteries -Operational characteristics – Primary and Secondary batteries– Fuel cells – Basic concept and types - Advantages and Disadvantages of fuel cell-Hydrogen Economy-Hydrogen storage- Super capacitors.

Advanced Engineering materials: Polymers and its composites for Electronic devices - Dielectric, mechanical and electrical properties-chemical methods for tailoring the properties- Conducting polymers – principle and preparation method-conduction mechanism–application of polymer and its composites in communication and flexible electronic devices - Frequency selective surfaces-Sensing properties of materials-concept-Applications

Text Book

1. P.C. Jain and Monica Jain, A Textbook of Engineering Chemistry, DhanpatRai publications, New Delhi, 16th edition, 2015.
2. C. N. Banwell and E.M. McCash, Fundamentals of Molecular Spectroscopy, TataMcGraw-Hill (India), 5th Edition, 2013.

Reference Books

1. A.J. Bard and L.R. Faulkner, Electrochemical Methods, Fundamentals and Application. Wiley,2001
2. 2.Y.R.Sharma, Elementary Organic Spectroscopy, S. Chand, 2007.
3. 3.ShashiChawla, A text book of Engineering Chemistry, Dhanpat Rai& Co.(pvt) Ltd, 3rd Edition, reprint 2013

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1.0	**Water Chemistry**	
1.1	Introduction -Water- sources-Hardness of water-types	1
1.2	Estimation of hardness of water by EDTA method	2
1.3	Disadvantages of hard water -Boiler troubles- scale & sludge.	1
1.4	Internal treatment methods	1
1.5	External treatment methods- zeolite, ion exchange	1
1.6	Desalination process- reverse osmosis, electrodialysis, multi stage flash distillation	1
1.7	Waste water treatment processes	2
2.0	**Spectroscopic technique and applications**	
2.1	Introduction	1
2.2	Principles of spectroscopy and selection rules	1
2.3	Electronic spectroscopy, Fluorescence- applications in medicine.	1
2.4	Vibrational and rotational spectroscopy of diatomic molecules- Applications	2

S.No	Topic	No. of Hours
2.5	Nuclear magnetic resonance and magnetic resonance imaging	2
2.6	Atomic Absorption Spectroscopy and Inductively Coupled Plasma-Optical Emission Spectroscopy- Principle, instrumentation and applications.	2
3.0	**Electrochemical power system**	
3.1	Industrial electrolytic process – Water electrolysis – Hydrogen generator-Decorative and functional coating-Electroplating Protective coating (Zn and Ni);	**2**
3.2	Value added coatings (Au, Pt).and Electroless process of making printed circuit board	**1**
3.3	High energy density and Power density batteries-Operational characteristics – Primary (Zn/MnO_2 or Zn/Ag_2O) and Secondary batteries (Pb- acid and Lithium ion/polymer batteries)	**2**
3.4	Fuel cells – Basic concept and types Proton exchange membrane FC-Methanol FC-solid oxide FC- (principle only)	**2**
3.5	Advantages and Disadvantages of fuel cell-Hydrogen Economy-Hydrogen storage- Super capacitors – EDLC and Hybrid type (principle only)	**2**
4.0	**Advanced Engineering materials**	
4.1	Dielectric, mechanical and electrical properties-chemical methods for tailoring the properties-Doping-Functionalization-core/shell nanostructure	**2**
4.2	Conducting polymers – principle and preparation method-conduction mechanism-(conjugated polymers- conjugated doped polymers)	**2**
4.3	application of polymer and its composites in sensors, light emitting diodes. telecommunications, power transmissions	**2**
4.4	antistatic coatings, conducting adhesives, artificial nerves - EMI shielding, Frequency selective surfaces	**1**
4.5	Sensing properties of materials-concept-Applications- Electronic sensors in Environmental monitoring process	**2**
	Total	**36**

Course Designers:

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18CHC30	CHEMISTRY (Common to CSE and IT)

Category	L	T	P	Credit
BS	3	0	0	3

Preamble

The objective of this course is to bestow the better understanding of basic concepts of chemistry and its applications in Computer Science and Engineering and Information Technology. This course provides exposure on corrosion and its protection in computer components. It also imparts knowledge on properties and application of nano-materials in data storage devices. Besides, it highlights properties of water and its treatment methods, spectroscopic techniques for material characterization, properties and applications of polymers.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO 1.	Identify the properties of water and its treatment methods	Understand
CO 2.	Summarize the principles and instrumentations of spectroscopic techniques	Understand
CO 3.	Select the appropriate spectroscopic techniques for characteristics of materials	Apply
CO 4.	Adapt the suitable corrosion control methods	Apply
CO 5.	Describe the preparation, properties and applications of polymers and nanomaterials.	Understand
CO 6.	Discuss the significance of nanomaterials in computer peripherals and data storage devices	Understand

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	-	-	-	-	-	-	-	-	-	L	-
CO2	M	L	L	-	-	-	-	-	-	-	-	-
CO3.	S	S	M	M	-	-	-	-	-	-	-	-
CO4.	S	S	M	M	-	-	L	-	-	-	L	-
CO5.	M	M	M	M	-	-	L	-	-	-	-	-
CO6.	M	M	M	M	L	-	M	-	-	-	-	-

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	40	40	40	40
Apply	40	40	40	40
Analyze	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Course Level Assessment Questions

Course Outcome 1 (CO1):

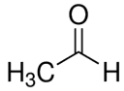
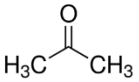
1. Distinguish between scale and sludge.
2. 100 ml of given water sample consumed 48 ml of EDTA during titration using EBT indicator. 35 ml of same EDTA consumed by 100 ml of standard hard water containing 1 mg of pure $CaCO_3$ per ml. Calculate the permanent, temporary and total hardness of given water samples in $CaCO_3$ equivalents.
3. Outline the steps involved in the waste water treatment process.

Course Outcome 2 (CO2):

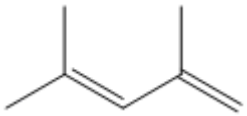
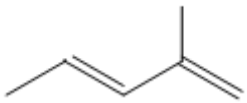
1. State Beer-Lambert law.
2. Write the selection rule in absorption spectroscopy.
3. Explain the procedure involved in finding the metals present in an alloy sample using ICP-OES.

Course Outcome 3 (CO3):

1. Compare the stretching frequencies of carbonyl functional groups in the following compounds

i)  (ii) 

2. Following Woodward-Fiesher- scott rules, it has been observed that the following compounds have absorption maximum at (i) 225 nm, (ii) 220 (iii) 230. Explain which is which.

a).  b).  c). 

3. Describe the function of different magnets available to generate magnetic field in MRI scanner.

Course Outcome 4 (CO4):

1. Linear polarisation of steel specimen (0.1 x 0.1 cm^2) kept in 4% aqueous NaCl solution is studied. It gives corrosion current I_{corr} = 50 µA/cm^2.Equivalent weight and density of steel are 55.85 g/mol and 8.05 g/ cm^3 respectively. Calculate the rate of corrosion of steel in mm/year.
2. Demonstrate causes and control measures of corrosion in computer peripherals and electronic devices.
3. Explain the factors influencing rate of corrosion.

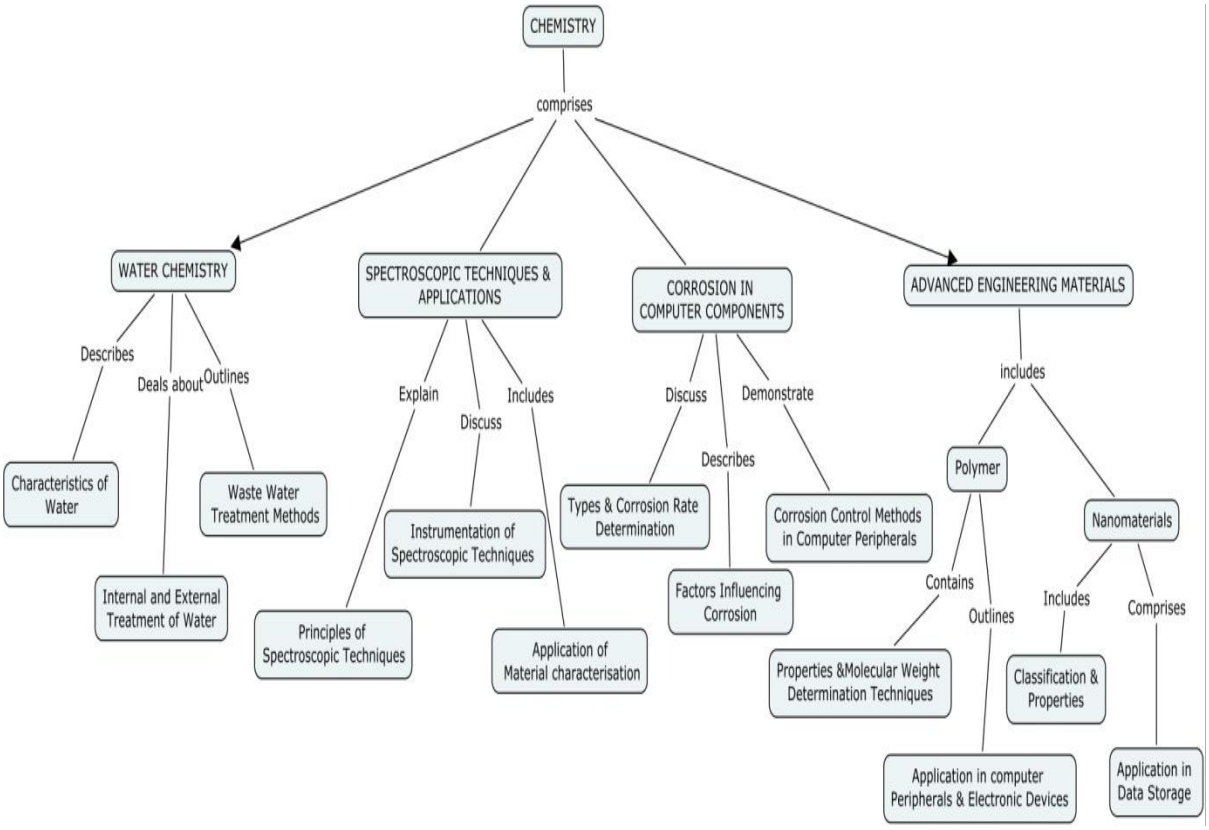
Course Outcome 5 (CO5):

1. Demonstrate the mechanism of conducting polymer of poly acetylene.
2. Explain the application of polymer material application in display devices.
3. Compare OLED vs LCD in display properties.

Course Outcome 6 (CO6):

1. Recall the classification of nanomaterials
2. Explain size dependent properties on nanomaterials
3. Describe the role of nanomaterials in data storage devices.

Concept Map



Syllabus

Water Chemistry:

Water- sources-Hardness of water-types-Estimation of hardness of water by EDTA method. Disadvantages of hardwater -Boiler troubles- scale & sludge. Internal treatment methods. External treatment methods- zeolite, ion exchange. Desalination process- reverses osmosis, electrodialysis, multi stage flash distillation. Waste water treatment processes.

Spectroscopic technique and applications:

Principles of spectroscopy and selection rules- Electronic spectroscopy, Fluorescence-applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules-Applications. Nuclear magnetic resonance and magnetic resonance imaging. Atomic Absorption Spectroscopy and Inductively Coupled Plasma-Optical Emission Spectroscopy-Principle, instrumentation and applications.

Corrosion in computer components:

Introduction -types of corrosion-electrochemical analysis-Polarization and Impedance - Rate of corrosion determination- influencing factors in corrosion-corrosion degradation in computer peripherals, electronic devices -control measures-self protecting corrosion products –Pilling Bed worth rule- precious metal coating and impact-salt spray- electroless plating-Printed Circuit Board (PCB) manufacturing.

Advanced Engineering Materials:

Polymers – introduction – structure- property relationship of polymer -conducting polymers – properties and applications in biosensors, organic light emitting diodes.Polymers in telecommunications, power transmission and liquid crystalline display devices, flexible

electronic devices. Polymer composite–classification and applications in computer components. **Nanomaterials**: Difference between nano and bulk materials- classifications-size dependent properties. Data storage materials – properties and applications.

Text Book

1. P.C. Jain and Monica Jain, A Textbook of Engineering Chemistry, DhanpatRai publications, New Delhi, 16th edition, 2015.
2. C. N. Banwelland E.M. McCash, "Fundamentals of Molecular Spectroscopy", Tata McGraw-Hill (India), 5th Edition, 2013.

Reference Books

1. Shashi Chawla, " A text book of Engineering Chemistry", Dhanpat Rai & Co.(pvt) ltd 3rd edition, reprint 2011.
2. Mars Fontana, "Corrosion Engineering, Mc Graw Hill Education 3rd edition reprint, 2017.R.V.Gadag, A. Nityananda Shetty "Engineering Chemistry" I.K. international Publishing Pvt Ltd. 3rd edition 2014.

Course Contents and Lecture Schedule

S. No.	Topic	No. of hour
1.0	**Water Technology**	
1.1	Introduction -Water- sources-Hardness of water-types	1
1.2	Estimation of hardness of water by EDTA method	2
1.3	Disadvantages of hardwater -Boiler troubles- scale & sludge.	1
1.4	Internal treatment methods	1
1.5	External treatment methods- zeolite, ion exchange	1
1.6	Desalination process- reverse osmosis, electrodialysis, multi stage flash distillation	1
1.7	Waste water treatment processes	2
2.0	**Spectroscopic techniques and applications**	
2.1	Introduction	1
2.2	Principles of spectroscopy and selection rules	1
2.3	Electronic spectroscopy, Fluorescence- applications in medicine.	1
2.4	Vibrational and rotational spectroscopy of diatomic molecules-Applications	2
2.5	Nuclear magnetic resonance and magnetic resonance imaging	2
2.6	Atomic Absorption Spectroscopy and Inductively Coupled Plasma-Optical Emission Spectroscopy- Principle, instrumentation and applications.	2
3.0	**Corrosion in computer components**	
3.1	Types of corrosion, Electrochemical analysis – polarisation and impedance	2
3.2	Rate of corrosion determination	1
3.3	Factors influencing corrosion-local heat generation	2
3.4	Corrosion in computer peripherals and electronic devices	1
3.5	Corrosion control methods and precious metal coating	2
3.6	Printed Circuit Board Manufacturing	1

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S. No.	Topic	No. of hour
4.0	**Advanced Engineering Materials**	
4.1	Polymers - Structure property relationship of polymer	2
4.2	Conducting polymers – synthesis, properties and applications in biosensors and OLED	3
4.3	Polymer composites – classification and applications in computer components.	1
4.4	Nanomaterials – classification and size dependent properties	1
4.5	Properties of Data storage nanomaterials	2
	Total	**36**

Course Designers:

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2. Dr. V. Velkannan velkannan@tce.edu
3. Dr. S. Sivailango drssilango@tce.edu

18EG140	ENGLISH	Category	L	T	P	Credit
		HSS	2	0	0	2

Preamble

The course aims at developing communication skills in English essential for understanding and expressing the ideas in different academic, social, and professional contexts. The students acquire the skills of listening, speaking, reading, and writing competencies in English language, making them employable in the globalised scenario.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Recall the basics of language in terms of vocabulary, grammar, pronunciation, syntax and semantics.	Remember
CO2	Understand the grammatical nuances and use them accordingly in respective contexts.	Understand
CO3	Read and comprehend the content in English in general and technical contexts as well.	Understand
CO4	Write with coherence and cohesion effectively.	Apply
CO5	Apply the language in established structure with precision in social and professional contexts.	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1.										S		S
CO2.										S		M
CO3.										S		S
CO4.										S		S
CO5.										S		S

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	-	-	-	-
Understand	15	15	30	30
Apply	35	35	70	70
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

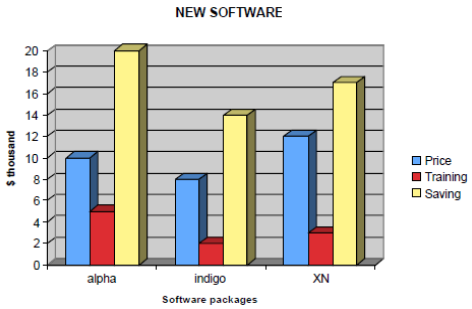
Course Level Assessment Questions

Course Outcomes 1, 2 and 3

1. Rewrite as directed.
   a) Write a basic definition of a " mobile".
   b)Combine the following sentences to bring out the "Purpose and Function".
   The coal gas is compressed. Condensation in the gas mains can be avoided.
   c) Expand the following nominal compounds: i) car race ii) race car
   d) Combine the following sentences using a relative clause.
   Smart meters are small computers. They provide real-time information on how much electricity is being used by each customer.
   e) Combine the following sentences to bring out the "Cause and Effect"
   Sand is mixed with the cement. It prevents the excessive shrinkage during drying.
   f) Give the words for the following transcriptions
   i**)** /tekˈnɒl.ə.dʒi/ **ii)** /prəˌnʌn*t* .siˈeɪ.ʃən/
   g) Write down the phonetic symbols of the letters underlined. i).**Th**ick ii) Plea**s**ure
   h) Syllabify the word and underline the stressed syllable: Communication
   i) Frame question tags for the following sentence: Don't open your books
   j) Fill in the blank with the correct form of the verb given in brackets.
   Tamil Nadu's share of students in the IITs and NITs _____ (register) a considerable drop in the recent years.
2. Read the following passage and answer the following (different types of) questions**.**
   - Descriptive questions for eliciting short answers
   - True or false
   - Sentence Completion
   - Synonyms/meaning of the words in the text

Course Outcomes 4 & 5

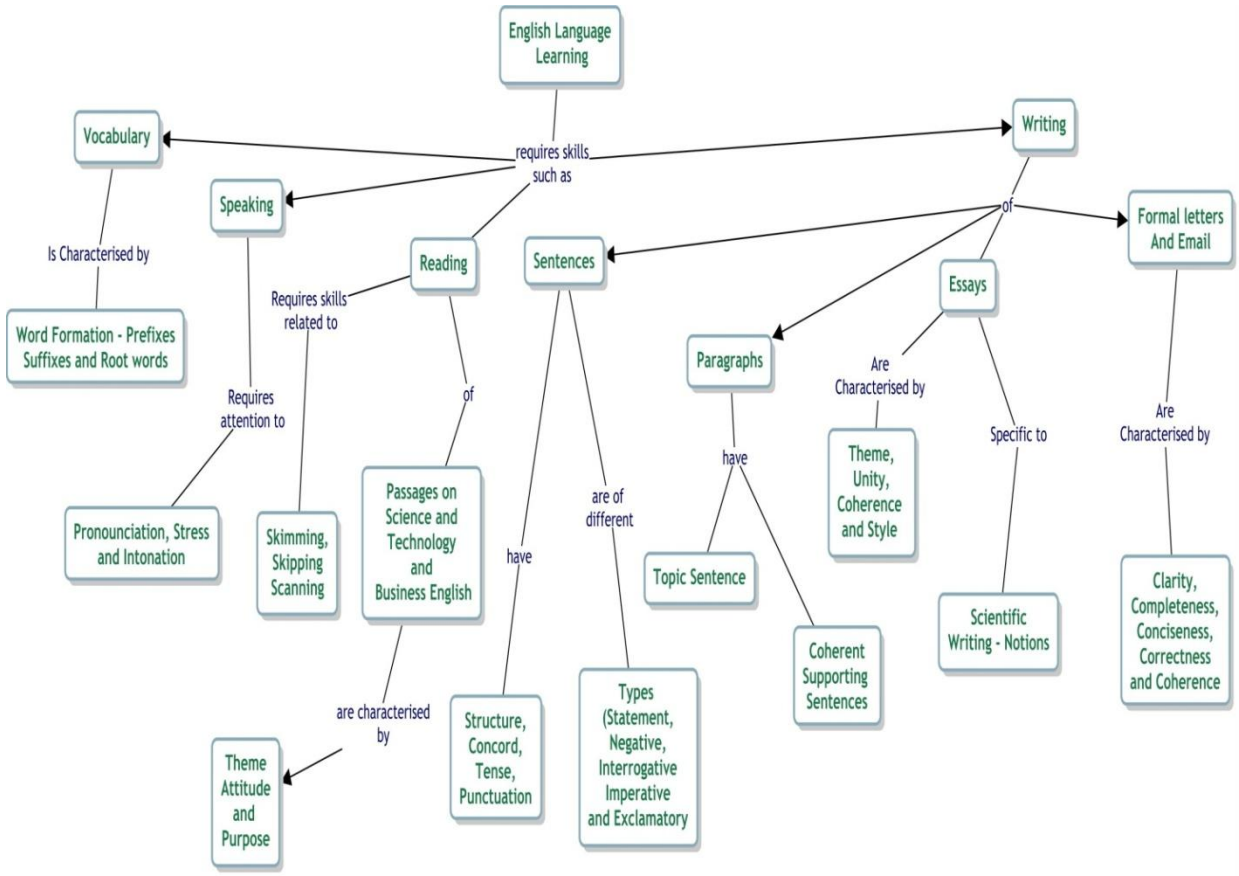
1. Write a paragraph in about 100-150 words on E-learning
2. Write a paragraph in about 100-150 words on Plastics
3. Write an e-mail to a company requesting permission to attend in-plant training for a fortnight.
4. Draft a letter to a company requesting you to undergo in-plant training there, inventing necessary details, in proper format.
5. Prepare a set of 10 instructions on how to draw money from an ATM.
6. Prepare a set of 12 recommendations to keep our environment clean.
7. Make notes of the passage given in appropriate format with a title andsummarize in about 100 words.
8. Interpret the following graphic data in about 150 words



9. Write an essay in about 250 words on 'The Impact of Technology on Nature'

10. Write an essay in about 250 words on 'Green Engineering')

Concept Map:



Syllabus:

MODULE- I

Basics of language – Phonetics - Phonemes, Syllables and Stress, Vocabulary – Word Analysis, Prefix, Suffix, Roots, Parts of Speech, Sentence Patterns.

MODULE- II

Basics of grammar – Tenses, Subject-Verb Agreement, Impersonal Passive Voice, Relative Clauses; Notions for Technical English – Noun Compounds, Classifications and Definitions, Cause and Effect, Purpose and Function, Numerical Adjectives, Reading Comprehension – Skimming, Scanning, Skipping (as tested in BEC Vantage Level)

MODULE-III

Writing with coherence and cohesion, Summarizing, Note-Making, Interpretation of Graphics, Writing Instructions and Recommendations, Paragraph and Essay Writing.

MODULE-IV

Writing with correct spelling, punctuation and grammar, Blog writing, E-mail Writing (BEC Vantage Writing-Unit I) – Formal Letters by students for Bonafide Certificate/Permission.

Suggested Reading:

Books:

1. Murphy, Raymond, English Grammar in Use with Answers; Reference and Practice for Intermediate Students, Cambridge: CUP, 2004
2. Jones, Daniel. An English Pronouncing Dictionary, Cambridge: CUP, 2006

3. Brook-Hart,Guy. Cambridge English- Business Benchmark-Upper Intermediate, CUP,2014.
4. Dhanavel, S.P. English and Communication Skills for Students of Science & Engineering, Orient BlackSwan, Chennai: 2016.
5. Swan, Michael. Practical English Usage.4th Edn. OUP. 2016.

Websites:

1. http://www.englishclub.com
2. http://owl.english.purdue.edu
3. https://www.oxfordonlineenglish.com
4. www.bbclearningenglish.com

Course Contents and Lecture Schedule

S.No	Topic	No. of Hours
1.	Introduction	1
2.	Sentence Patterns	1
3.	Tenses	2
4.	Subject-Verb Agreement	1
5.	Phonetics – Consonants, Vowels, Dipthongs	1
6.	Phonetics – Syllable and Stress	1
7.	Word Formation – Prefixes, Suffixes and Root Words	1
8.	Reading Comprehension - I (Skipping, Skimming, and Scanning)	1
9.	Note-Making and Summarizing	1
10.	Writing Instructions and Recommendations	1
11.	Tutorials	1
12.	Defining and Non-Defining Relative Clauses	1
13.	Impersonal Passive Voice	2
14.	Notions of Technical English – Noun Compounds, Definitions, Cause & Effect, Purpose and Function, Numerical Adjectives	1
15.	Paragraph / Essay Writing- Topic and Supporting Sentences, Coherence	2
16.	E-Mail Writing – (BEC Vantage Writing Task I)	1
17.	Formal Letters by students for Bonafide Certificate/Permission	1
18.	Interpretation of Graphics	1
19.	Reading Comprehension – II (As tested in BEC Writing Task III)	2
20.	Tutorials	1
Total		**24**

Course Designers:

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3 Mr. R. Vinoth vino@tce.edu
4 Dr. R. K. Jaishree Karthiga jai@tce.edu

18ES150	ENGINEERING EXPLORATION

Category	L	T	P	Credit
ES	1	2	-	3

Preamble

The course Engineering Exploration provides an introduction to the engineering field. It is designed to help the student to learn about engineering and how it affects our everyday lives. On the successful completion of the course, students will be to explain how engineering is different from science and technology and how science, mathematics and technology are an integral part of engineering design.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1. Explain technological & engineering development, change and impacts of engineering	Understand
CO2. Draw a product in enough detail that others can accurately build it and write specification sheet for a given product	Apply
CO3. Complete initial steps (Define a problem, list criteria and constraints, brainstorm potential solutions and document the ideas) in engineering design process	Apply
CO4. Draw sketches to a design problem and provide a trade-off matrix	Apply
CO5. Communicate possible solutions through drawings and prepare project report	Apply
CO6. Use reverse engineering to suggest improvements in a tool design	Apply
CO7. Apply the concept of engineering fundamentals in Civil, Mechanical, Electrical and Computer Engineering	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	M	L	-	-	-	-	-	-	-	-	-	-
C02	S	M	L	-	-	-	-	-	-	-	-	-
C03	S	M	L	-	-	-	-	-	-	-	-	-
C04	S	M	L	-	-	-	-	-	-	-	-	-
C05	S	M	L	-	-	-	-	-	-	-	-	-
C06	S	M	L	-	-	-	-	-	-	-	-	-
C07	S	M	L	-	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

Assessment Pattern

S.No	Bloom's category	Continuous Assessment Tests			End Semester Examinations
		1	2	3	
1	Remember	20	20	20	20
2	Understand	20	20	20	20
3	Apply	60	60	60	60
4	Analyze	0	0	0	0

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5	Evaluate	0	0	0	0
6	Create	0	0	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. What is the role of Engineer?
2. How do you believe the growth of engineering has impacted the product that we have today?
3. Select an engineering product, list the specifications and constraints that must be considered when designing the product. Make a list of tradeoff.

Course Outcome 2 (CO2):

1. List the steps of a design problem.
2. Identify the problem you see in the product you used in your daily life.
3. Determine the design constraint and criteria for a problem.
4. Create an isometric drawing of a design.

Course Outcome 3 (CO3):

1. List the five factors when considering development problem.
2. Imagine you have noticed the car you are riding is making a squeaking noise from the engine compartment. Define the problem with your vehicle. Classify the potential problem.
3. Imagine you are hired by your local city to develop a new public transportation.
    a. Define the problem.
    b. List the criteria and constraint.
    c. List the potential solution.

Course Outcome 4 (CO4):

1. Imagine you are an engineer who is designing a portable sitting device; you need to design a chair that will be portable that will fit in the trunk of the car which hold 100 kg individual and will be easily produced. Create sketches using a four step process to this design problem.
2. Imagine you are an engineer who develops method to automatically sort books at college library. Develop possible sketches and list potential solution and give the tradeoff matrix.
3. How can your research improve the design?

Course Outcome 5 (CO5):

1. What details are able to show with the perspective drawing?
2. What is the difference between mockup and prototype?
3. List five different question engineers must ask about function of the design.

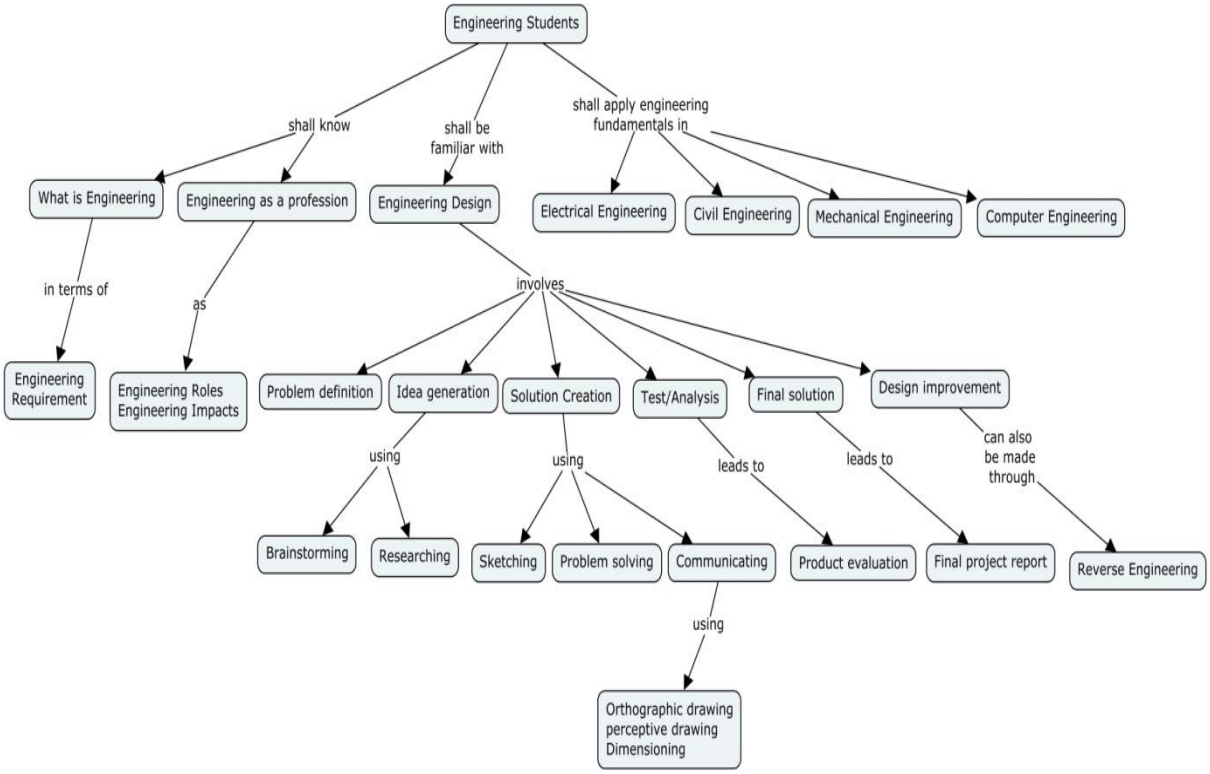
Course Outcome 6 (CO6):

1. Select a product to analyze with respect to function, fit, aesthetics, safety and environment impact. Write a summary on evaluation of the product. If you would like make changes to the design list the changes.
2. What design components should be reconsidered in reverse engineering processes? Why?
3. What are the benefits of reverse engineering?

Course Outcome 7 (CO7):

1. Explain ohms law and list the related formulas.
2. What role do you think the range selection plays in the accuracy of the measurements?
3. Why it is important for a civil engineer to study structural forces?
4. Describe the differences between fluids used in hydraulics and pneumatics.

Concept Map



Syllabus

What is Engineering: Engineering Requirement, Knowledge within Engineering disciplines, Engineering advancements **Engineering Design:** Problem definition, idea generation through brainstorming and researching, solution creation through evaluating and communicating, text/analysis, final solution and design improvement. **Defining problems and Brainstorming:** Researching design, sketching problem solving **Communicating solution**: Dimensioning orthographic drawing, perspective drawing **Modeling and Testing final output:** Product evaluation, reverse engineering, final project report. **Civil Engineering:** Structural forces structural analysis, bridge design components, structural design **Mechanical Engineering:** Types of motion, mechanical power system, mechanical power formula, mechanical design. **Electrical Engineering:** Reading analog multimeter, measuring current, voltage and resistance, electricity from chemicals, solar cells, magnets, Ohms law and watts law, circuit identification and circuit calculation, resistor color code, continuity **Computer Engineering:** Logic gates, algorithms, computer architecture, binary code

Reference Books

1. Ryan A.Brown, Joshua W.Brown and Michael Berkihiser: "Engineering Fundamentals: Design, Principles, and Careers", Goodheart-Willcox Publisher, Second Edition, 2014.
2. Saeed Moaveni ,"Engineering Fundamentals: An Introduction to Engineering", Cengage learning, Fourth Edition, 2011.

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1.	**What is Engineering**	
1.1	Engineering Requirement	1
1.2	Knowledge within Engineering disciplines,	1
1.3	Engineering advancements	1
2	**Engineering Design**	
2.1	Problem definition,	1
2.2	idea generation through brainstorming and researching	1
2.3	solution creation through evaluating and communicating,	1
2.4	text/analysis	1
2.5	final solution and design improvement	1
3	**Defining problems and Brainstorming:**	
3.1	Researching design	1
3.2	sketching problem solving	2
4	**Communicating solution**	
4.1	Dimensioning orthographic drawing	1
4.2	perspective drawing	1
5	**Modeling and Testing final output**	
5.1	Product evaluation	1
5.2	reverse engineering	1
5.3	final project report	1
6	**Civil Engineering**	
6.1	Structural forces structural analysis	2
6.2	bridge design components	2
6.3	structural design	1
7	**Mechanical Engineering**	
7.1	Types of motion	2
7.2	mechanical power system	1
7.3	mechanical power formula	1
7.4	mechanical design	1
8	**Electrical Engineering:**	
8.1	Reading analog multimeter, measuring current, voltage and resistance	1
8.2	electricity from chemicals, solar cells, magnets,	1
8.3	Ohms law and watts law, circuit identification and circuit calculation	1
8.4	resistor color code, continuity	2

No.	Topic	No. of Lectures
9	**Computer Engineering**	
9.1	Logic gates, algorithms,	1
9.2	computer architecture,	2
9.3	binary code	2
	Total	36

Course Designers:

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2. Dr. S.Baskar sbeee@tce.edu

18ME160	ENGINEERING GRAPHICS

Category	L	T	P	Credit
ES	3	0	2	4

Preamble

Engineering Graphics is referred as language of engineers. An engineer needs to understand the physical geometry of any object through its orthographic or pictorial projections. The knowledge on engineering graphics is essential in proposing new product designs through drawings and in reading or understanding existing drawings. This course covers orthographic and pictorial projections, sectional views, development of surfaces and use of computer aided drafting tools.

Prerequisite

NIL

Course Outcomes

On successful completion of the course, students will be able to

CO1	Draw conic Sections such as ellipse, parabola, hyperbola and rectangular hyperbola.	Apply
CO2	Draw the orthographic projections (Elevation and Plan) of straight lines inclined to both reference planes.	Apply
CO3	Draw the orthographic projections (Elevation, Plan and End view) of plane surfaces inclined to both reference planes	Apply
CO4	Draw the orthographic projections (Elevation and Plan) of regular solids (Prisms, Pyramids, Cylinder and Cone) with axis inclined to any one reference plane.	Apply
CO5	Draw the orthographic projections (Elevation and Plan) of sectioned solids (Prisms, Pyramids, Cylinder and Cone) with axis perpendicular to horizontal plane and true shape of the sections.	Apply
CO6	Draw the development of surfaces (base and lateral) of sectioned regular solids (Prisms, Pyramids, Cylinder and Cone).	Apply
CO7	Draw the isometric projections of regular solids and combined solids (Prisms, Pyramids, Cylinder, Cone and sphere) and of solid parts from the orthographic views.	Apply
CO8	Develop computer-aided 3D models for the given part drawing (2D/3D) and draw orthographic views for the 3D model with appropriate dimensioning using CAD package. (Continuous Assessment only)	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1.	S	M	S	M	M	_	_	_	M	M	_	_
CO2.	S	M	S	M	M	_	_	_	M	M	_	_
CO3.	S	M	S	M	M	_	_	_	M	M	_	_
CO4.	S	M	S	M	M	_	_	_	M	M	_	_
CO5.	S	M	S	M	M	_	_	_	M	M	_	_
CO6.	S	M	S	M	M	_	_	_	M	M	_	_
CO7.	S	M	S	M	M	_	_	_	M	M	_	_
CO8.	S	M	S	M	S	_	_	_	M	M	_	_

Assessment Pattern

Bloom's Category	Continuous Assessment Test	Terminal Examination
Remember	0	0
Understand	0	0
Apply	100	100
Analyse	0	0
Evaluate	0	0
Create	0	0

Course Level Assessment Questions

Course Outcome 1 (CO1)

1. Draw an ellipse if the distance of focus from the directrix is 70 mm and the eccentricity is ¾.
2. Draw a parabola if the distance of focus from the directrix is 60 mm.

Course Outcome 2 (CO2)

2. One end "A" of a straight line AB 85 mm long is 10 mm above HP and 15 mm in front of VP. The line is inclined to HP at 40° and inclined to VP at 30°. Draw the projections.
3. A line CD has its end "C" 20 mm above HP and 25 mm in front of VP. The other end "D" is 45 mm above HP and 40 mm in front of VP. The distance between the end projectors is 60 mm. Draw its projections and find its true length.

Course Outcome 3 (CO3)

1. A semi circular plate of 80 mm diameter has its straight edge on V.P and inclined at 30° to H.P. The surface of the plate is inclined at 45° to V.P. Draw the projections of the plate.
2. A thin rectangular plate of 60 x 40 mm size has its shorter edge on H.P and inclined 30° to V.P. Draw the projections of the plate when its top view is a square of 40 mm side.

Course Outcome 4 (CO4)

1. A hexagonal prism of side of base 35 mm and axis length 80 mm rests on HP on one of its rectangular faces such that its axis is inclined to VP by 45°. Draw its elevation and plan.
2. A square pyramid of base side 40 mm and axis 75 mm long is resting on one of its base edges in such a way that one of its triangular faces is perpendicular to both HP and VP. Draw its front view and top view.

Course Outcome 5 (CO5)

1. A cone of base 75 mm diameter and axis 80 mm long is resting on its base on H.P. It is cut by a section plane perpendicular to VP, inclined at 45° to H.P and cutting the axis at a point 35 mm from the apex. Draw the front view, sectional top view and true shape of the section.
2. A hexagonal pyramid, base 30 mm side and axis 65 mm long is resting on its base on HP with two edges of the base parallel to V.P. It is cut by a section plane perpendicular to V.P and inclined 45° to H.P, intersecting the axis at a point 25 mm above the base. Draw the front view, sectional top view and true shape of the section.

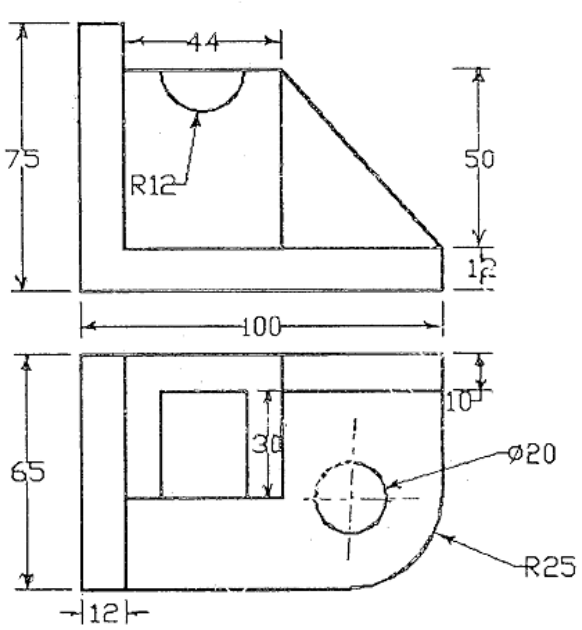
Course Outcome 6 (CO6)

1. A cone of base diameter 60 mm and axis 70 mm long is resting on its base on H.P. A section plane perpendicular to H.P and V.P cuts the cone at a distance of 10 mm from the axis. Draw the development of the cut solid.

2. A pentagonal prism of base side 30 mm and axis height 75 mm is resting on its base on HP such that rectangular face is parallel to V.P. It is cut by a cutting plane perpendicular to V.P and 30° inclined to H.P. It meets the axis 15 mm below the top base. Draw the development of the cut prism.

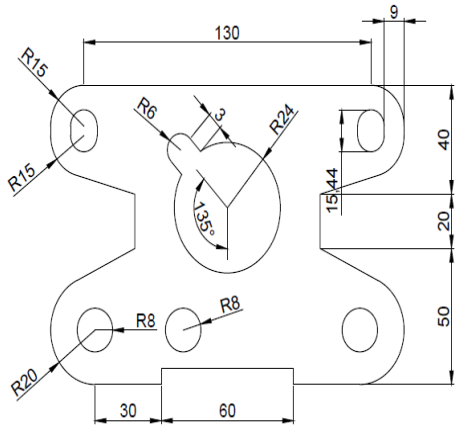
Course Outcome 7 (CO7)

1. Draw the isometric projection of hexagonal prism of base side 40 mm and height 60 mm with a right circular cone of base diameter 50 mm and altitude 50 mm resting on its top such that the axes of both solids are collinear and vertical.
2. Draw the isometric view of the part with the following orthographic views.

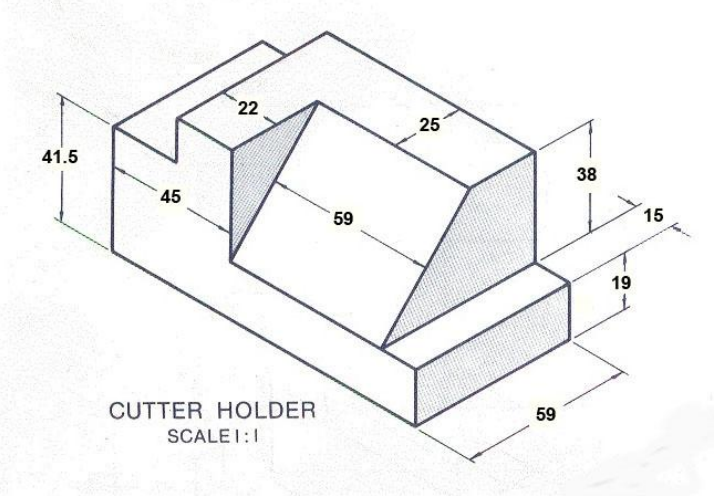


Course Outcome 8 (CO8)

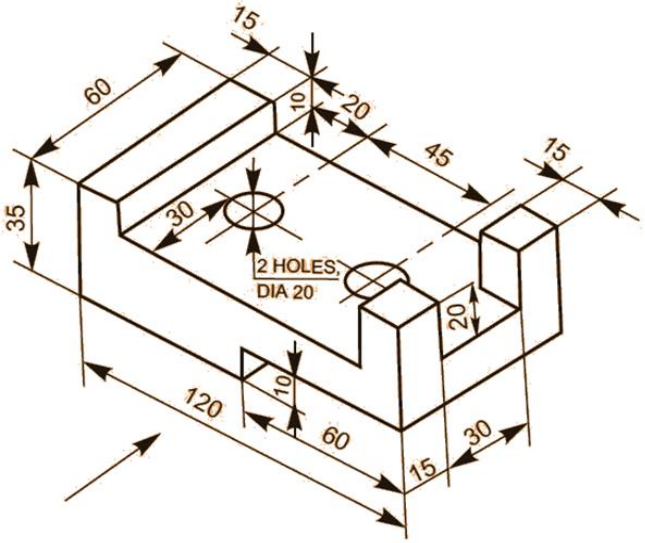
1. Develop a 2D model using CAD package for the given figure.



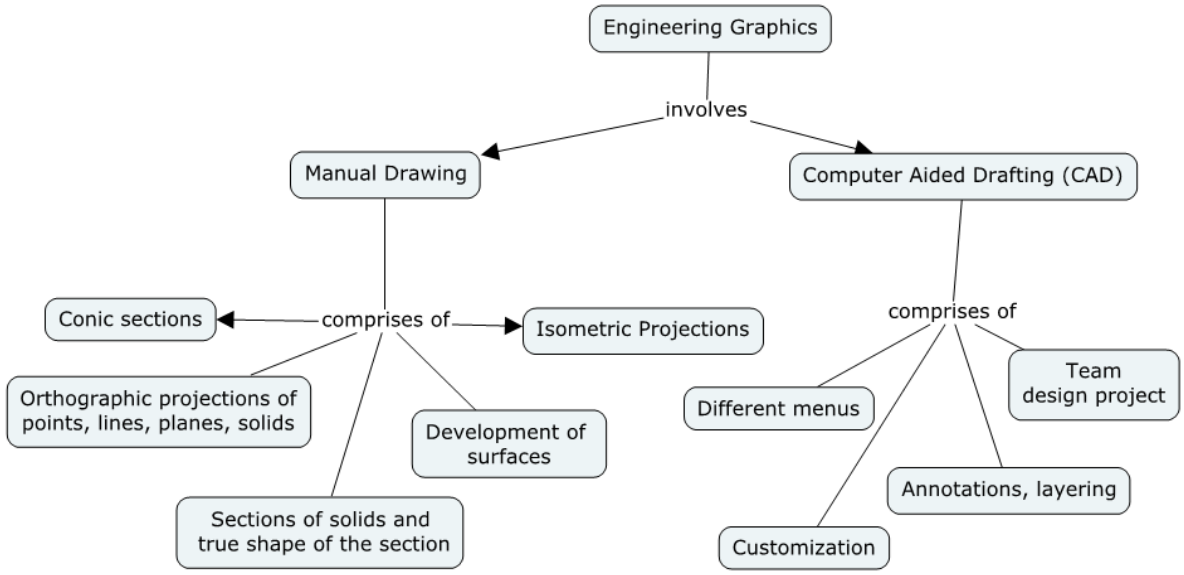
2. Develop a 3D model using CAD package for the given part drawing.



2. Draw the orthographic views for the given 3D model with appropriate dimensioning using CAD package.



Concept Map



Syllabus

Introduction- Significance of engineering graphics, Use of drawing instruments –Standards, Lettering, numbering and dimensioning, Principles of orthographic projections, First angle projection, Scales.

Conic Sections - Construction of ellipse, parabola, hyperbola (Eccentricity Method only) and rectangular hyperbola.

Projection (Elevation and Plan) of points located in all quadrants.

Projection (Elevation and Plan) of straight lines inclined to both reference planes - Determination of true lengths and true inclinations by rotating line method.

Projection (Elevation, Plan and End view) of planes inclined to both reference planes by rotating object method.

Projection (Elevation and Plan) of regular solids (Prisms, Pyramids, Cylinder and cone) by rotating object method when the axis is inclined to one of the reference planes.

Projection (Elevation and Plan) of sectioned solids (Prisms, Pyramids, Cylinder and cone) and true shape of the sections, when the axis of the solid is perpendicular to horizontal plane.

Development of surfaces (base and lateral) **of sectioned regular solids** (Prisms, Pyramids, Cylinder and Cone).

Isometric projection – Principle, isometric scale, Isometric views and Isometric projections of single solid and combined solids (Prisms, Pyramids, Cylinder, Cone and sphere) when the axis is vertical. **Conversion of orthographic projections** (Elevation, Plan and End view) of solid parts / engineering components into isometric view.

Computer Aided Drafting (For Continuous Assessment only)**:**

Overview of Computer Graphics, list of computer technologies, impact on graphical communication. Demonstrating knowledge of the theory of CAD software such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area

(Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects. Setting up of units and drawing limits.
Drawing geometric entities such as lines, arcs and circles in isometric views. Development of 3D wire-frame and shaded models. Dimensioning – Guidelines – ISO and ANSI standards for coordinate dimensioning - Defining local coordinate systems – Dimensioning in iso-metric and orthographic views.

Text Book

1. Bhatt N.D., Panchal V.M. and Ingle P.R., (2014) “Engineering Drawing”, Charotar Publishing House.

Reference Books

1. Natarajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
2. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008
3. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2008.
4. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
5. Shah M.B, and Rana B.C (2008) “Engineering Drawing and Computer Graphics”, Pearson Education.
6. (Corresponding set of) CAD Software Theory and User Manuals.

Course Contents and Lecture Schedule

Sl.No	Topic	Lecture Hours	Practice Hours
1	**Introduction**- Significance of engineering graphics, Use of drawing instruments –Standards, Lettering, numbering and dimensioning, Principles of orthographic projections, First angle projection, Scales.	2	1
2	**Conic Sections** - Construction of Ellipse, Parabola, hyperbola and rectangular hyperbola (Eccentricity Method only).	2	3
3	**Projection (Elevation and Plan) of points** located in all quadrants.	2	1
4	**Projection (Elevation and Plan) of straight lines** inclined to both reference planes - Determination of true lengths and true inclinations by rotating line method.	4	2
5	**Projection (Elevation, Plan and End view) of planes** inclined to both reference planes by rotating object method.	5	2
6	**Projection (Elevation and Plan) of regular solids** (Prisms, Pyramids, Cylinder and cone) by rotating object method when the axis is inclined to one of the reference planes.	5	3
7	**Projection (Elevation and Plan) of sectioned solids** (Prisms, Pyramids, Cylinder and cone) and true shape of the sections, when the axis of the solid is perpendicular to horizontal plane.	4	2
8	**Development of surfaces** (base and lateral) **of sectioned regular solids** (Prisms, Pyramids, Cylinder and Cone).	4	2

9	**Isometric projection** – Principle, isometric scale, Isometric views and Isometric projections of single solid and combined solids (Prisms, Pyramids, Cylinder, Cone and sphere) when the axis is vertical. **Conversion of orthographic projections** (Elevation, Plan and End view) of solid parts / engineering components into isometric view.	4	2
10	**Computer Aided Drafting** (For Continuous Assessment only)**:** **10.1** Overview of Computer Graphics, list of computer technologies, impact on graphical communication. Demonstrating knowledge of the theory of CAD software such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects. Setting up of units and drawing limits.	1	1
	10.2 Drawing geometric entities such as lines, arcs and circles in isometric views. Development of 3D wire-frame and shaded models. Dimensioning – Guidelines – ISO and ANSI standards for coordinate dimensioning - Defining local coordinate systems – Dimensioning in iso-metric and orthographic views.	3	5
	TOTAL	**36**	**24**

Question Pattern for Terminal Examination

Question Number	Description	Type	Marks
1	Conic sections	Either or type	10
2	Projection of lines	Either or type	15
3	Projection of planes	Either or type	15
4	Projection of solids	Either or type	15
5	Section of solids	Either or type	15
6	Development of surfaces	Either or type	15
7	Isometric projections of combined solids Or Orthographic views to isometric view	Either or type	15
Total			**100**

Marks Allocation for Continuous Assessment:

Sl. No	Description	Marks
1	Plates (Drawing sheets) submission	20
2	Computer Aided Drafting (CAD) Exercises	15
3	Continuous Assessment Test (CAT)	15
Total		**50**

Note:

1. One test or two tests will be conducted locally by respective faculty-in- charge during regular class hours to account for continuous assessment test (CAT) marks.
2. Terminal examination (3 hrs) will be conducted centrally by the office of controller of examinations.

Course Designers

1. Dr. A.Samuel Raja samuel1973@tce.edu
2. Prof. M.Kannan mknmech@tce.edu

18EG170	ENGLISH LABORATORY	Category	L	T	P	Credit
		HSS	0	0	2	1

Preamble

This practical course enables the students to develop and evaluate their basic English language skills in Language Lab, equipped with English Software, through individualized learning process and immediate feedback, and facilitates students with the need-based student-centric presentation sessions in a multi-media driven classroom environment.

Prerequisite

NIL

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Pronounce words intelligibly through listening and watching contents on social, technical and day-to-day conversations and respond to questions related to them	Apply
CO2	Apply appropriate lexicon in various contexts, by differentiating variations pertaining to spelling, pronunciation, meaning and grammar	Apply
CO3	Comprehend passages on various topics like general, business and science at various levels	apply
CO4	Read texts in newspapers, magazines, and articles on a variety of issues with clarity to understand and to be understood	Apply
CO5	Prepare and present on a topic to a group of audience with ICT and other educational aids	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										**S**		**S**
CO2										**S**		**M**
CO3										**S**		**S**
CO4										**S**		**M**
CO5										**S**		**S**

Assessment Pattern

Internal: No Continuous Assessment Test will be conducted

Students' performance will be assessed in the classroom as given below

- Spoken Task - General / Technical Presentation / BEC Speaking Tests II: 25 Marks
- Listening Task - Answering questions : 25 Marks

External: Tested on Phonetics, Grammar, and Vocabulary in the lab for 1 hour : 80 Marks

Submission of Students Record on Practical Tasks in the Class and Lab : 20 Marks

List of Experiments

S.No	Topic	Hours
	LAB ACTIVITES	
1	Listening	2
2	Vocabulary	2
3	Grammar	2
4	Phonetics	2
5	Reading Comprehension – I (General)	2
6	Reading Comprehension – II (BEC Vantage Level)	2
	CLASSROOM ACTIVITIES	
7	Reading Practice (Extensive Reading)	2
8	English through Audios & Videos (Note-Taking & answering questions)	2
9	Presentation - I	2
10	Presentation - II	2
11	Revision	2
12	Model Test	2
	Total	24

Software Used:

1. Business English Certificate-Vantage- Practice Software
2. English Software

Extensive Reading: (Not for Terminal Exam, Prescribed only for Spoken Tasks)

1. Khera, Shiv, You Can Win, Macmillan Books, New York, 2003.

Teaching Resources and Websites:

1. Oxford / Cambridge Online English Videos
2. Free Video Downloads from Youtube
3. https://learningenglish.voanews.com/
4. https://www.ted.com/talkshttp://
5. www.esl-galaxy.com/video.htm

Course Designers:

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3 Mr. R. Vinoth vino@tce.edu
4 Dr. R. K. Jaishree Karthiga jai@tce.edu

18PH180	PHYSICS LABORATORY	Category	L	T	P	Credit
		BS	0	0	2	1

Preamble

This course ensures that students learn to apply the basic physics concepts and carry out the experiments to determine the various physical parameters related to the material

- Learn the necessary theory to understand the concept involved in the experiment.
- Acquire the skills to carry out the experiment.
- Tabulate the observed data and use the formula to evaluate the required quantities.
- Plot the data in a graph and use it for calculation.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Analyze mechanical ,electrical oscillations and determine their resonance frequency	Apply
CO2	Analyze the diffraction and interference patterns for characterization	Apply
CO3	Determine the numerical aperture and bending loss in optical fiber	Apply
CO4	Determine the Planck's constant by using LEDs	Apply
CO5	Plot the VI characteristics of solar cell	Apply
CO6	Determine the time constant of an RC circuit	Apply
CO7	Determine the reversibility of classical and quantum logic gates	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	-	-	-	-	-	-	-	-
CO2	S	S	S	S	-	-	-	-	-	-	-	-
CO3	S	S	S	S	-	-	-	-	-	-	-	-
CO4	S	S	S	S	-	-	-	-	-	-	-	-
CO5	S	S	S	S	-	-	-	-	-	-	-	-
CO6	S	S	S	S	-	-	-	-	-	-	-	-
CO7	S	S	S	S	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

List of Experiments

OSCILLATIONS AND WAVES

1. Torsion pendulum- Determination of Moment of inertia of a disc
2. Compound pendulum –Determination of acceleration due to gravity

OPTICS

3. Spectrometer-Determination of Refractive index of the material of the prism.
4. Laser Diffraction – Determination of wavelength of Laser and particle size in a thin film.
5. Air wedge –Determination of diameter of wire by interference principle.
6. Fiber optics-Determination of numerical aperture and bending losses.

QUANTUM MECHANICS

7. Photoelectric effect-Determination of Planck's constant
8. Solar cell-Plotting and studying of V-I characteristic
9. Study of Classical and quantum Logic gates.

ELECTROMAGNETIC THEORY

10. RC circuit –Determination of time constant
11. LCR Circuit- Determination of resonant frequency

Course Designers:

1. Dr. R. Vasuki rvphy@tce.edu
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4. Dr. A.L.Subramaniyan alsphy@tce.edu
5. Dr.D.Ravindran drphy@tce.edu

18CH190	CHEMISTRY LABORATORY

Category	L	T	P	Credit
BS	0	0	2	1

Preamble

This course aims to provide the students, a basic practical knowledge in chemistry. The objective of this course is to develop intellectual and psychomotor skills of the students by providing hands on experience in quantitative, electrochemical and photo-chemical analysis.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Estimate the chemical water quality parameters of sample water	Apply
CO2	Demonstrate the rate of corrosion of steel by weight loss method	Apply
CO3	Estimate the strength of acidic solution and pH of soil by conductometric and pH metric titrations	Apply
CO4	Illustrate the strength of oxidisable materials present in given sample by potentiometric method	Apply
CO5	Adapt colorimetric method for determination of iron in water	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	-	-	-	L	-	L	-	-	-
CO2	S	S	M	-	-	-	L	-	L	-	-	-
CO3	S	S	M	-	-	-	L	-	M	-	-	-
CO4	S	M	-	-	-	-	-	-	-	-	-	-
CO5	S	S	M	-	-	-	L	-	-	-	-	-

List of Experiments

A. Quantitative analysis

1. Estimation of Total hardness of water
2. Estimation of Ca^{2+} and Mg^{2+} individual hardness of water samples
3. Estimation of alkalinity of water sample
4. Estimation of COD of industrial effluent
5. Estimation of Chloride in a water sample
6. Estimation of rate of corrosion of steel by weight loss method

B. Electrochemical and photochemical analysis

1. Conductometry Titration (Strong acid vs Strong base)
2. Potentiometric redox Titration ($K_2Cr_2O_7$ vs FAS, $KMnO_4$ vs FAS)
3. Determination of pH of soil by pH metric titration
4. Estimation of iron content of water sample using colorimeter

Course Designers:

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Passed in Board of Studies on 14.07.2018 Approved in 56th Academic Council Meeting on 21.07.2018