

SCHEME OF TEACHING AND EVALUATION
B. Tech (All Branches except Biotech and CSBS) w.e.f. ACADEMIC YEAR 2023-24

SEMESTER: I/II

COURSE MODULE: PHYSICS/ CHEMISTRY GROUP				TEACHING HOURS/WEEK			WEIGHTAGE: EVALUATION			
COURSE			Credits	L	T	P	CIE	MSE	SEE	Total
Category of Courses	Title	Code								
DSC	Engineering Mathematics-I	TMA101	4	3	1	-	25	25	50	100
DSC	Fundamental of Computer & Introduction to Programming	TCS101	3	3	-	-	25	25	50	100
DSC	Engineering Physics	TPH101/201	3	3	-	-	25	25	50	100
DSC	Basic Electrical Engineering	TEE101/201	2	2	-	-	25	25	50	100
DSC	Basic Civil Engineering	TCE101/201	2	2	-	-	25	25	50	100
AEC	Professional Communication	THU101	2	2	-	-	25	25	50	100
DSC	Computer Lab- I	PCS151	2	-	-	4	25	25	50	100
DSC	Physics Lab	PPH151/251	1	-	-	2	25	25	50	100
DSC	Basic Electrical Engineering Lab.	PEE151/251	1	-	-	2	25	25	50	100
SEC	Workshop and Manufacturing Practices	PME151/251	3	1	-	4	25	25	50	100
VAC	General Proficiency-I /NCC/Yoga/ Sports /Cultural	GP101	1	-	-	2	-	-	100	100
VAC	Healthy Living & Fitness	THF101/201	0	1	-	-	-	-	100	100
Total			24	17	1	14	250	250	700	1200

SEMESTER: I/II

COURSE MODULE: CHEMISTRY /PHYSICS GROUP				TEACHING HOURS/WEEK			WEIGHTAGE: EVALUATION			
COURSE			Credits	L	T	P	CIE	MSE	SEE	Total
Category of Courses	Title	Code								
DSC	Engineering Mathematics-II	TMA201	4	3	1	-	25	25	50	100
DSC	Programming for Problem Solving	TCS201	3	3	-	-	25	25	50	100
DSC	Engineering Chemistry	TCH101/201	3	3	-	-	25	25	50	100
DSC	Basic Electronics Engineering	TEC101/201	3	3	-	-	25	25	50	100
AEC	Advanced Professional Communication	THU201	2	2	-	-	25	25	50	100
DSC	Computer Lab –II	PCS151/251	2	-	-	4	25	25	50	100
DSC	Chemistry Lab	PCH151/251	1	-	-	2	25	25	50	100
DSC	Basic Electronics Engineering Lab.	PEC151/251	1	-	-	2	25	25	50	100
SEC	Engg. Graphics and Design Lab.	PME153/253	3	1	-	4	25	25	50	100
VAC	General Proficiency-II /NCC/Yoga/ Sports /Cultural	GP201	1	-	-	2	-	-	100	100
VAC	Environmental Science	TEV101/201	0	2	-	-	-	-	100	100
Total			23	17	1	14	225	225	650	1100

SCHEME OF TEACHING AND EVALUATION
B. Tech (Biotech) w.e.f. ACADEMIC YEAR 2023-24

SEMESTER: I

COURSE MODULE: CHEMISTRY GROUP				TEACHING HOURS/WEEK			WEIGHTAGE: EVALUATION			
COURSE			Credits	L	T	P	CIE	MSE	SEE	Total
Category of Courses	Title	Code								
DSC	Fundamental of Computer & Introduction to Programming	TCS101	3	3	-	-	25	25	50	100
DSC	Engineering Chemistry	TCH101	3	3	-	-	25	25	50	100
DSC	Basic Electrical & Electronics Engineering	EEC101	4	3	1	-	25	25	50	100
AEC	Professional Communication	THU101	2	2	-	-	25	25	50	100
DSC	Computer Lab- I	PCS151	2	-	-	4	25	25	50	100
DSC	Chemistry Lab	PCH151	1	-	-	2	25	25	50	100
DSC	Basic Electrical & Electronics Engineering Lab.	EEC151	1	-	-	2	25	25	50	100
SEC	Engg. Graphics and Design Lab.	PME153	3	1	-	4	25	25	50	100
SEC	Fundamental of Medical Biotechnology	TBT101	3	2	1	-	25	25	50	100
VAC	General Proficiency-I /NCC/Yoga/ Sports /Cultural	GP101	1	-	-	2	-	-	100	100
VAC	Environmental Science	TEV101	0	2	-	-	-	-	100	100
Total			23	14	1	14	225	225	650	1100

SEMESTER II

COURSE MODULE: PHYSICS GROUP				TEACHING HOURS/WEEK			WEIGHTAGE : EVALUATION			
COURSE			Credits	L	T	P	CIE	MSE	SEE	Total
Category of Courses	Title	Code								
DSC	Programming for Problem Solving	TCS201	3	3	-	-	25	25	100	100
DSC	Engineering Physics	TPH201	3	3	-	-	25	25	50	100
DSC	Engineering Mathematics	TMA202	4	3	1	-	25	25	50	100
DSC	Advanced Organic Chemistry	TCH202	3	3	-	-	25	25	50	100
AEC	Advanced Professional Communication	THU201	2	2	-	-	25	25	50	100
SEC	Entrepreneurial Biotechnology	TBT201	3	2	1	-	25	25	50	100
DSC	Computer Lab –II	PCS251	2	-	-	4	25	25	50	100
DSC	Physics Lab	PPH251	1	-	-	2	25	25	50	100
VAC	General Proficiency-II /NCC/Yoga/ Sports /Cultural	GP201	1	-	-	2	-	-	100	100
VAC	Healthy Living & Fitness	THF201	0	1	-	-	-	-	50	100
Total			22	17	2	8	200	200	600	1000

SCHEME OF TEACHING AND EVALUATION
B. Tech (CSBS) w.e.f. ACADEMIC YEAR 2023-24

SEMESTER: I

COURSE MODULE: PHYSICS GROUP				TEACHING HOURS/WEEK			WEIGHTAGE: EVALUATION			
COURSE			Credits	L	T	P	CIE	MSE	SEE	Total
Category of Courses	Title	Code								
DSC	Discrete Mathematics	TTC101	4	3	1	-	25	25	50	100
DSC	Introductory Topics in Statistics, Probability and Calculus	TTC102	3	3	-	-	25	25	50	100
DSC	Fundamentals of Computer and Introduction to Programming	TCS101	3	3	-	-	25	25	50	100
DSC	Principles of Electrical Engineering	TTC104	2	2	-	-	25	25	50	100
DSC	Physics for Computing Science	TTC105	2	2	-	-	25	25	50	100
AEC	Business Communication & Value Science I	TTC106	2	1	-	2	25	25	50	100
DSC	Computer Lab- I	PCS151	2	-	-	4	25	25	50	100
DSC	Physics Lab	PTC105	1	-	-	2	25	25	50	100
DSC	Electrical Engineering Lab.	PTC104	1	-	-	2	25	25	50	100
SEC	Workshop and Manufacturing Practices	PME151	3	1	-	4	25	25	50	100
VAC	General Proficiency-I /NCC/Yoga/ Sports /Cultural	GP101	1	-	-	2	-	-	100	100
VAC	Healthy Living & Fitness	THF101	0	1	-	-	-	-	100	100
	Induction Program	NTC101	0	-	-	-	-	-	-	-
Total			24	17	1	16	250	250	700	1200

SEMESTER: II

COURSE MODULE: CHEMISTRY GROUP				TEACHING HOURS/WEEK			WEIGHTAGE: EVALUATION			
COURSE			Credits	L	T	P	CIE	MSE	SEE	Total
Category of Courses	Title	Code								
DSC	Linear Algebra	TTC201	4	3	1	-	25	25	50	100
DSC	Statistical Methods	TTC202	4	3	1	-	25	25	50	100
DSC	Fundamentals of Economics	TTC203	2	2	-	-	25	25	50	100
DSC	Programming for Problem Solving	TCS201	3	3	-	-	25	25	50	100
DSC	Principles of Electronics	TTC204	2	2	-	-	25	25	50	100
AEC	Business Communication & Value Science II	TTC205	2	2	-	-	25	25	50	100
DSC	Computer Lab –II	PCS251	2	-	-	4	25	25	50	100
DSC	Statistical Methods Lab	PTC202	1	-	-	2	25	25	50	100
DSC	Principles of Electronics Lab	PTC204	1	-	-	2	25	25	50	100
SEC	Engg. Graphics and Design Lab.	PME253	3	1	-	4	25	25	50	100
VAC	General Proficiency-II /NCC/Yoga/ Sports /Cultural	GP201	1	-	-	2	-	-	100	100
VAC	Environmental Science	TEV201	0	2	-	-	-	-	100	100
Total			25	18	2	14	250	250	700	1200

Category of courses			
DSC	Discipline Specific Core	VAC	Value Addition Course
SEC	Skill Enhancement Course	AEC	Ability Enhancement Course

DEPARTMRNT OF ALLIED SCIENCES (MATHEMATICS)

SEMESTER I

Name of Department: - Allied Sciences (Mathematics)

1. Subject Code: **TMA 101** course Title: **ENGINEERING MATHEMATICS-I**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **4**
6. Semester: **I**
7. Category of Course: **Discipline Specific Course**
8. Pre-requisite: Basic Knowledge of Mathematics

9. Course Outcome**:	<p>After completion of the course the students will be able to:</p> <p>CO1. Understand the concept of Matrices.</p> <p>CO2. Solve the system of linear equations.</p> <p>CO3. Understand the concept of differential calculus and apply to various discipline of Engineering.</p> <p>CO4. Analyze the maxima / minima values of function of two or more variables with its application to engineering.</p> <p>CO5. Solve the multiple integrals and apply to find the area and volumes.</p> <p>CO6. Utilize the vector calculus in different engineering systems.</p>
----------------------	---

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Matrices: Elementary row transformation, Rank of a matrix, linear dependency and independency, Consistency of a system of linear equations, Characteristic equation, Eigen values and Eigen vectors, symmetric and skew symmetric matrix, Diagonalization and their applications.	(11 Hrs)
2	Calculus-I: Higher order derivatives, Successive Differentiation, Leibnitz's	(09 Hrs)

	theorem, Limits, Continuity and Differentiability of two variables, Partial Differentiation, homogeneous functions, Euler's theorem, Expansion of function of severable variable using Taylor's and Maclaurin's theorems.	
3	Calculus-II Extrema (Maxima/ Minima) of functions of two variables, method of Lagrange's multipliers, Introduction of Jacobian, properties of Jacobian, Jacobian of implicit and explicit functions, functional dependence.	(07 Hrs)
4	Multiple Integrals Double and triple integrals, Change of order of integration, Beta and Gamma functions, Applications to area, volume, Dirichlet's integral.	(09 Hrs)
5	Vector Calculus Introduction to Vectors, Gradient, Divergence and Curl of a vector and their physical interpretation, Line, Surface and Volume integrals, Green's, Stoke's and Gauss's divergence theorems.	(09 Hrs)
	Total	(45 Hrs)

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1.	C. B. Gupta, S. R. Singh and Mukesh Kumar, "Engineering Mathematics for Semesters I and II" McGraw Hill Education	1 st	2015
2.	Ramana, B. V., "Higher Engineering Mathematics", Tata McGraw Hill publications,	6 th	2006
3.	R. K. Jain, S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publication,	5 th	2019
4.	Grewal, B. S., "Higher Engineering Mathematics", 40e, Khanna Publications, India.	44 th	2022
5.	Kreyszig, Erwin., "Advanced Engineering Mathematics", 9e, Wiley Publications.	9 th	2014.
6.	Tom M. Apostol 'Calculus' Volume 2 Wiley Publications.	2 nd	2022
	Reference Books		
1.	G. B. Thomas and R. L. Finney	9 th	2010
2.	Gorakh Prasad and Chandrika Prasad	11 th	1968

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
-----	--------------------	--

DEPARTMRNT OF ALLIED SCIENCES (MATHEMATICS)

SEMESTER II

Name of Department: - Allied Sciences (Mathematics)

1. Subject Code: **TMA 201** se Title: **ENGINEERING MATHEMATICS-II**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** l **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **3**
6. Semester: **II**
7. Category of Course: **Discipline Specific Course**
8. Pre-requisite: Basic Knowledge of Mathematics

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1. Solve the linear ordinary differential equations.</p> <p>CO2. Utilize the Laplace transforms in linear and simultaneous linear differential equations.</p> <p>CO3. Apply the Fourier series for signal analysis in various engineering discipline.</p> <p>CO4. Classify the partial differential equations and solve homogeneous partial differential equations with constant coefficients.</p> <p>CO5. Apply method of separation of variables to solve 1D heat, wave and 2D Laplace equations.</p> <p>CO6. Utilize Fourier transforms in Engineering.</p>
--------------------	---

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	<p>Differential equation</p> <p>Ordinary differential equation of first order (Exact and reducible), linear differential equations of nth order with constant coefficients, complementary functions and particular integrals, Euler Homogeneous differential equation, Method of variation of parameters and applications of ODE.</p>	(09 Hrs)
2	<p>Laplace Transform</p> <p>Introduction of Laplace Transform, Shifting Theorems Existence theorem and properties, Laplace transform of derivatives and integrals, Inverse Laplace transform, Laplace transform of periodic functions, Unit step function and Dirac delta function, Convolution theorem, Applications to solve simple linear and simultaneous linear differential</p>	(09 Hrs)

	equations.	
3	Partial differential equations- I Introduction to PDE, Formation of PDE, solution first order PDE, Lagrange's and Charpit's methods, standard form of first order PDE.	(09 Hrs)
4	Partial differential equations -II Solution of linear partial differential equations with constant coefficients of second order and their classifications: parabolic, hyperbolic and elliptic, Method of separation of variables for solving partial differential equations.	(09 Hrs)
5	Fourier series and Fourier Transform Periodic functions, Fourier series of periodic functions, Euler's formula, Fourier series having arbitrary period, Change of intervals, Even and odd functions, Half range sine and cosine series. Fourier Transform, Fourier Sine and Cosine Transform, Application of Fourier Transform.	(09 Hrs)
	Total	(45 Hrs)

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1.	C. B. Gupta, S. R. Singh and Mukesh Kumar, "Engineering Mathematics for Semesters I and II" McGraw Hill Education.	1 st	2015
2.	E. Kreyszig, Advanced Engineering Mathematics, Wiley India.	9 th	2014
3.	B. S. Grewal, Higher Engineering Mathematics, Khanna Publications.	44 th	2022
4.	Tom M. Apostol 'Calculus' Volume 2 Wiley Publications.	2 nd	2022
	Reference Books		
1.	C. Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya.	3 rd	2019
2.	R. K. Jain, S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publication.	5 th	2009

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
-----	--------------------	--

DEPARTMRNT OF ALLIED SCIENCES (MATHEMATICS)**SEMESTER II**

Name of Department: - Allied Sciences (Mathematics)

1. Subject Code: **TMA 202** Course Title: **ENGINEERING MATHEMATICS**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **4**
6. Semester: **II**
7. Category of Course: **Discipline Specific Course (DSC)**
8. Pre-requisite: Basic knowledge of mathematics

9. Course Outcome**:	After completion of the course the students will be able to: CO1. Understand the concept of Matrices and determinants. CO2. Identify and understand the significance of Differentiation and Integration in Bio Technology. CO3. Apply the linear differential equations in Biological system. CO4. Illustrate linear and nonlinear algebraic equations. CO5. Utilize the applications of probability and Statistics in Bio Technology. CO6. Use of Mathematics and their applications in Bio Technology.
----------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Matrix And Determinants: Definitions, type of matrices, properties of matrices, algebra of matrices (Addition, subtractions and multiplication), Determinants, Properties of determinants, Adjoint of matrix, Inverse of a matrix, System of linear equations, Eigen values and Eigen vectors for 2 x 2 matrix. Application of Matrices.	(09 Hrs)
2	Differentiation And Integration: Limit (L'Hospital Rule) and Continuity, Differentiation of Standard functions of one variable, Basic Rules of Differentiation (product rule, quotient rule, chain rule), Maxima and minima for one variable, Integration (Integration by part, Integration by substitution).	(09 Hrs)

3	Differential Equations: Introduction to Differential equations, Differential equations of first order and first degree. Variable separable method, Homogeneous differential equations, linear differential equations, Linear differential equations of second order with constant coefficients, complementary function and particular integral. Applications of Differential Equations.	(09 Hrs)
4	Numerical Solution of Linear and Non-Linear Equations: Numerical solution of linear and nonlinear algebraic equations (using Bisection method, Iterative method, Newton Raphson method), Numerical Integration (Trapezoidal and Simpson's rule)	(09 Hrs)
5	Probability: Basic probability and laws, sample space, event, and properties, conditional probability, Bayes' theorem.	(09 Hrs)
	Total	(45 Hrs)

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1.	C. B. Gupta, S. R. Singh and Mukesh Kumar, "Engineering Mathematics for Semesters I and II" Mc Graw Hill Education.	1 st	2015
2.	B. S. Grewal: Higher Engineering Mathematics, Khanna Publications.	44 th	2022
3.	D. C. Agarwal, M. Jha, S. K. Gupta, Remedial Mathematics, Shree Sai Prakashan Meerut.	1 st	2022
4.	Piskunov N: Differential & Integral calculus, Moscow Peace Puse.	1 st	1969
	Reference Books		
1.	A. R. Vashitha. Remedial Mathematics, Krishna Publications, Meerut.	5 th	2020
2.	R. K. Jain and S. R. K. Iyengar	5 th	2002

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
-----	--------------------	--

DEPARTMRNT OF ALLIED SCIENCES (MATHEMATICS)

SEMESTER I

Name of Department: - Allied Sciences (Mathematics)

1. Subject Code: **TTC-101** Course Title: **Discrete Mathematics**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** Lab **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **4**
6. Semester: **I**
7. Category of Course: **Discipline Specific Course (DSC)**
8. Pre-requisite: Basic Knowledge of Mathematics

9. Course Outcome**:	<p>After completion of the course the students will be able to:</p> <p>CO1. Define the Boolean Algebra and logic gates.</p> <p>CO2. Understand the concepts of Group, ring, integral domains and field.</p> <p>CO3. Demonstrate the counting principle, generating function and recurrence relation.</p> <p>CO4. Analyze different algorithms for trees and graphs.</p> <p>CO5. Elaborate the natural deduction and axiom systems.</p> <p>CO6. Utilize propositional calculus with their properties in computer science engineering.</p>
----------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Boolean algebra: Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.	(09 Hrs)
2	Abstract algebra: Set and relations, groups, abelian group, Finite and Infinite group, order of group, cyclic group, coset, Lagrang's theorem, ring, division ring, ring with unity, Integral domain, field.	(09 Hrs)
3	Combinatorics: Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.	(09 Hrs)

4	Graph Theory: Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem.	(09 Hrs)
5	Logic: Propositional calculus - propositions and connectives, syntax; Semantics - truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness.	(09 Hrs)
	Total	(45 Hrs)

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1.	Topics in Algebra, I. N. Herstein, John Wiley and Sons.	2 nd	1975
2.	Digital Logic & Computer Design, M. Morris Mano, Pearson	5 th	2011
3.	Elements of Discrete Mathematics, (Second Edition) C. L. LiuMcGraw Hill, New Delhi	4 th	2017
4.	Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan Press, London.	1 st	1976
5.	Mathematical Logic for Computer Science, L. Zhongwan, World Scientific, Singapore	2 nd	1998
	Reference Books		
1.	Introduction to linear algebra. Gilbert Strang.	5 th	2022
2.	Introductory Combinatorics, R. A. Brualdi, North-Holland, New York.	5 th	2019
3.	Graph Theory with Applications to Engineering and Computer Science, N. Deo, Prentice Hall, Englewood Cliffs.	1 st	2016
4.	Introduction to Mathematical Logic, (Second Edition), E. Mendelsohn, Van-Nostrand, London.	3 rd	2007

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
-----	--------------------	--

DEPARTMRNT OF ALLIED SCIENCES (MATHEMATICS)
SEMESTER I

Name of Department: - Allied Sciences (Mathematics)

**Statistics Probability and
Calculus**

1. Subject Code: **TTC-102** Course Title:
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** l **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **4**
6. Semester: **I**
7. Category of Course: Discipline Specific Course (DSC)
8. Pre-requisite: Basic Knowledge of Mathematics

9. Course Outcome**:	<p>After completion of the course the students will be able to:</p> <p>CO1. Understand business problems in appropriate statistical terms in order use data to make better decisions.</p> <p>CO2. Analyze the concept of probability with applications.</p> <p>CO3. Understand the concept of Inferential Statistics and applications in Business.</p> <p>CO4. Describe statistical methods and probability distribution.</p> <p>CO5. Demonstrate application of Moments.</p> <p>CO6. Demonstrate application of Double and triple Integral.</p>
----------------------	--

Ref: GEU/MATH-BOS/2023/01

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Introduction to Statistics: Definition of Statistics. Basic objectives. Applications in various branches of science with examples. Collection of Data: Internal and external data, Primary and secondary Data. Population and sample, Representative sample. Descriptive Statistics: Classification and tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - central tendency and dispersion. Bivariate data. Summarization, marginal and conditional frequency distribution.	(09 Hrs)
2	Probability: Concept of experiments, sample space, event. Definition of Probability. Conditional Probability, Bayes Theorem.	(09 Hrs)
3	Probability distributions: Discrete & continuous distributions, Binomial, Poisson and Geometric distributions, Uniform, Exponential, Normal, Chi-	(09 Hrs)

	square, t, F distributions.	
4	Expected values and moments: Mathematical expectation and its properties, Moments (including variance) and their properties, interpretation, Moment generating function.	(09 Hrs)
5	Calculus: Basic concepts of Differential and integral calculus, limit, continuity and differentiability for two variables, double and triple integral, change of order of Integration, Application of double and triple integral.	(09 Hrs)
	Total	(45 Hrs)

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1.	C. B. Gupta, S. R. Singh and Mukesh Kumar, “Engineering Mathematics for Semesters III and IV” McGraw Hill Education	1 st	2016
2.	Introduction of Probability Models, S. M. Ross, Academic Press, N.Y.	11 th	2014
3.	Fundamentals of Statistics, vol. I & II, A. Goon, M. Gupta and B. Dasgupta, World Press.	3 rd	1968
4.	Higher Engineering Mathematics, B. S. Grewal, Khanna Publication, Delhi.	43 rd	2015
	Reference Books		
1.	A first course in Probability, S. M. Ross, Prentice Hall.	9 th	2013
2.	Probability and Statistics for Engineers, (Fourth Edition), I. R. Miller, J.E. Freund and R. Johnson, PHI.	9 th	2017
3.	Introduction to the Theory of Statistics, A. M. Mood, F.A. Graybill and D.C. Boes, McGraw Hill Education.	3 rd	1974
4.	Advanced Engineering Mathematics, Peter V. O'Neil, Thomson Learning.	7 th	2010
5.	Advanced Engineering Mathematics, M. D. Greenberg, Pearson Education.	2 nd	1998

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
-----	--------------------	--

DEPARTMRNT OF ALLIED SCIENCES (MATHEMATICS)

SEMESTER II

Name of Department: - Allied Sciences (Mathematics)

1. Subject Code: **TTC-201** Course Title: **Linear Algebra**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** Lab **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **4**
6. Semester: **II**
7. Category of Course: Discipline Specific Course (DSC)
8. Pre-requisite: Basic Knowledge of Mathematics

9. Course Outcome**:	<p>After completion of the course the students will be able to:</p> <p>CO1. Understand the concept of Matrices and determinants.</p> <p>CO2. Discussion of rank, nullity and system of linear equations.</p> <p>CO3. Identify and understand the significance of Gram-Schmidt orthogonalization</p> <p>CO4. Explain the applications of Eigenvalues and Eigenvectors.</p> <p>CO5. Analyze the linear transformation of matrices.</p> <p>CO6. Demonstrate application of Image Processing and Machine Learning.</p>
----------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Elementary row transformation, Rank of a matrix, linear dependency and independency, Consistency of a system of linear equations, Characteristic equation, Eigen values and Eigen vectors, symmetric and skew symmetric matrix, Diagonalization and their applications, Gaussian elimination; LU Decomposition.	(09 Hrs)
2	Vector space, basis Dimension, subspace of vector space Orthogonality; Projections.	(09 Hrs)
3	Linear transformations rank and nullity theorem, Inverse of Linear Transformation .	(09 Hrs)
4	Inner product space ,orthogonality, projection, Gram-Schmidt orthogonalization and QR decomposition.	(09 Hrs)

5	Singular value decomposition and Principal component analysis Introduction to their applications in Image Processing and Machine Learning .	(09 Hrs)
	Total	(45 Hrs)

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1	Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers.	44 th	2015
2	C. B. Gupta, S. R. Singh and Mukesh Kumar, "Engineering Mathematics for Semesters I and II" McGraw Hill Education	1 st	2015
3	K. Holfman, R. Kunze , Linear Algebra	2 nd	2018
4	V. Krishnamurthy, V.P. Mainra, J.L. Arora	1 st	1976
	Reference Books		
1.	Advanced Engineering Mathematics, Peter V. O'Neil, Cengage Learning.	7 th	2010
2.	Advanced Engineering Mathematics, Michael. D. Greenberg, Pearson.	2 nd	1998
3.	Introduction to linear algebra, (Fifth Edition), Gilbert Strang, Wellesley-Cambridge Press.	5 th	2016
4.	Applied Mathematics (Vol. I & II), P. N. Wartikar & J. N. Wartikar, Pune Vidyarthi Griha Prakashan.	1 st	2019
5.	Digital Image Processing, R C Gonzalez and R E Woods, Pearson.	4 th	2017
6.	https://machinelearningmastery.com/introduction-matrices-machine-learning/		

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
-----	--------------------	--

DEPARTMRNT OF ALLIED SCIENCES (MATHEMATICS)

SEMESTER II

Name of Department: - Allied Sciences (Mathematics)

Statistical Methods

1. Subject Code: **TTC-202** Course Title:
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** Internal **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **4**
6. Semester: **II**
7. Category of Course: **Discipline Specific Course (DSC)**
8. Pre-requisite: Basic Knowledge of Mathematics

9. Course Outcome**:	<p>After completion of the course the students will be able to:</p> <p>CO1. Identify the appropriate choice of statistical tools and techniques</p> <p>CO2. Familiarize with correlation coefficient and regression coefficient.</p> <p>CO3. Explain testing of Hypothesis.</p> <p>CO4. Understand the application of some statistical tools and techniques in Business Decisions</p> <p>CO5. Analyze the mathematical models .</p> <p>CO6. Understand the concept of statistical models and its application in solving analytics problems</p>
----------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Sampling Techniques: Random sampling. Sampling from finite and infinite populations. Estimates and standard error (sampling with replacement and s without replacement), Sampling distribution of sample mean, stratified random sampling	(09 Hrs)
2	Linear Statistical Models: Scatter diagram. Linear regression and correlation. Least squares method. Rank correlation. Standard multiple regression models with emphasis on detection of collinearity, outliers, non-normality and autocorrelation, Validation of model assumptions. Multiple correlation, Analysis of variance (one way, two way with as well as without interaction)	(09 Hrs)
3	Estimation: Point estimation, criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation.	(09 Hrs)

4	Test of hypothesis: Concept & formulation, Type I and Type II errors, Neyman Pearson lemma, Procedures of testing.	(09 Hrs)
5	Non-parametric Inference: Comparison with parametric inference, Use of order statistics. Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test. Spearman's and Kendall's test. Basics of Time Series Analysis & Forecasting: Stationary, ARIMA Models: Identification, Estimation and Forecasting.	(09 Hrs)
	Laboratory R statistical programming language: Introduction to R, Functions, Control flow and Loops, Working with Vectors and Matrices, Reading in Data, Writing Data, Working with Data, Manipulating Data, Simulation, Linear model, Data Frame, Graphics in R	
	Total	(45 Hrs)

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1.	Probability and Statistics for Engineers (4th Edition), I.R. Miller, J.E. Freund and R. Johnson.	8 th	2015
2.	Fundamentals of Statistics (Vol. I & Vol. II), A. Goon, M. Gupta and B. Dasgupta	2 nd	2016
3.	The Analysis of Time Series: An Introduction, Chris Chatfield.	7 th	2019
	Reference Books		
1.	Introduction to Linear Regression Analysis, D.C. Montgomery & E. Peck	5 th	2013
2.	Introduction to the Theory of Statistics, A.M. Mood, F.A. Graybill & D.C. Boes.	3 rd	2017
3.	Applied Regression Analysis, N. Draper & H. Smith	3 rd	1998
4.	Hands-on Programming with R, - Garrett G. Grolemund	2 nd	2015
5.	R for Everyone: Advanced Analytics and Graphics, Jared P. Lander	1 st	2013

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
-----	--------------------	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I

Name of Department: - **Computer Science and Engineering**

1. Subject Code: **TCS 101** Course Title:

Course Title: **Fundamental of computer and introduction to programming**

2. Contact Hours: L: **3** T: **0** P: **0**

3. Examination Duration (Hrs): Theory **3** Practical **0**

4. Relative Weight: CIE **25** PRS **0** MSE **25** SEE **50** PRE **0**

5. Credits: **3**

6. Semester: **Ist**

7. Category of Course: **DSC**

8. Pre- requisite: **Basic Knowledge of Mathematics**

9. Course Outcome:	<ul style="list-style-type: none">• Learn the concepts of IT and understand the fundamentals of basic building blocks of computer science.• Understand basic data types and syntax of C programming.• Propose solution to problem by using tools like algorithm and flowcharts.• Analyze and select best possible solution for decision-based problems using decision making skills and develop the aptitude to solve iterative problems using different types of looping statements.• Implement complex problem as a collection of sub problems by applying modularization in applications using functions.• Apply and implement the concept arrays for providing solution to homogenous collection of data types.
---------------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	UNIT- I Generation of computers, Computer system memory hierarchy, Input/Output, RAM/ROM, Software & Hardware, Understand bit, byte, KB, MB, GB and their relations to each other, Operating System overview, Computer Networks Overview Algorithms and Flow Charts – Examples of Flow charts for loops and conditional statements	8
2	UNIT- 2 First C program - Hello world, How to open a command prompt on Windows	10

	<p>or Linux. How to read and print on screen - printf(),scanf(),getchar(), putchar()</p> <p>Variables and Data types - Variables, Identifiers, data types and sizes, type conversions, difference between declaration and definition of a variable, Constants</p> <p>Life of a C program (Preprocessing, Compilation, Assembly, Linking, Loading, Execution), Compiling from the command line, Macros,</p> <p>Operators – equality and assignment, Compound assignment operators, Increment and decrement operators, Performance comparison between pre and post increment/decrement operators, bitwise operators, Logical Operators, comma operator, precedence and associativity.</p>	
3	<p>UNIT- III</p> <p>Conditional statements: if statement, if-else statement, ternary statement or ternary operator, nested if-else statement, switch statement, Difference between performance of if else and switch, Advantages of if else and switch over each other</p> <p>Loops: ‘for’ loops, ‘while’ loops, ‘do while’ loops, entry control and exit control, break and continue, nested loops</p>	8
4	<p>UNIT- IV</p> <p>Functions: Function prototype, function return type, signature of a function, function arguments, call by value, Function call stack, Recursion v/s Iteration, passing arrays to functions,</p> <p>Storage classes: Automatic, Static, Register, External, Static and Dynamic linking implementation, C program memory (show different areas of C program memory and where different type of variables are stored), scope rules.</p>	7
5	<p>UNIT- V</p> <p>Arrays: Single-dimensional arrays, initializing arrays, computing address of an element in array, character arrays, segmentation fault, bound checking, Searching and Sorting.</p>	10
	Total	43

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Edition	Year of Publication/Reprint
	Text Books		
1.	Peter Prinz, Tony Crawford,"C in a Nutshell", Oreilly Publishers,	1st	2011
2.	Peter Norton, "Introduction to computers", TMH,	6th	2009
	E.Balagurusamy,"Programming in ANSI C",McGraw Hill	6th	2015
	Reference Books		
1.	Steve Oualline, "Practical C programming", Orielly	3rd	2011

	Publishers, 2011.		
2.	Brian W Kernighan, Dennis M Ritchie, "The C Programming Language", Prentice Hall, 1988. R3. Herbert Schildt, "C: The Complete Reference", 4th Edition. TMH, 2000.	2nd	2000
3.	Yashwant Kanetkar, "Let Us C", BPB Publication	8th	2007

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam / Lab Exam
-----	---------------------------	---

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER II

Name of Department: - **Computer Science and Engineering**

1. Subject Code: **TCS 201** Course Title:

Course Title: **Programming for Problem Solving**

2. Contact Hours: L: **3** T: **0** P: **0**

3. Examination Duration (Hrs): Theory **3** Practical **0**

4. Relative Weight: CIE **25** PRS **0** MSE **25** SEE **50** PRE **0**

5. Credits: **3**

6. Semester: **IIInd**

7. Category of Course : **DSC**

8. Pre-requisite: **Basic Knowledge of Mathematics and Computer Fundamentals**

9. Course Outcome:

- Learn and apply concepts of strings and multi-dimensional array for providing solutions to homogenous collection of data types
- Propose solution to problem by using tools like algorithm and flowcharts.
- Apply the concept of pointers to optimize memory management by overcoming the limitations of arrays.
- Process and analyze problems based on heterogeneous collection of data using structures.
- Apply concepts of file handling to implement data storage and retrieval tasks.
- Implement the basic real life problems using python

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	UNIT- I Multi-Dimensional Arrays- Initializing arrays , row major and column major form of an array, character strings and arrays, Strings – Declaration of strings, Initialization of strings using arrays and pointers, Standard library functions of string.	6
2	UNIT- 2 Pointers –Basic of pointers and addresses, Pointers and arrays, Pointer arithmetic, passing pointers to functions, call by reference. Accessing string through pointers.	10

	Dynamic memory management in C - malloc(), calloc(), realloc(), free(), memory leak, Dangling, Void, Null and Wild pointers Structures - Structures, array of structures, structure within structure, union, typedef, self-referential structure, pointer to structure	
3	UNIT- III File Handling - Opening or creating a file, closing a file, File modes, Reading and writing a text file using getc(), putc(), fprintf(), fscanf(), fgets(), fputs(), Reading and writing in a binary file, counting lines in a text file, Search in a text file, Random file accessing methods- feof(), fseek(), ftell() and rewind() functions.	8
4	UNIT- IV Introduction to Python- History of Python, Need of Python Programming, Python features, First Python Program, Running python Scripts, Variables, Reserved words, Lines and indentation, Quotations, Comments, Input output. Data Types, Operators and Expressions: Standard Data Types – Numbers, strings, Boolean, Operators – Arithmetic Operators, comparison Operators, assignment Operators, logical Operators, Bitwise Operators.	10
5	UNIT- V Control flow – if, if-elif-else, for, while, break, continue, pass, range(), nested loops. Functions – Handling functions in Python File Handling – Reading text file, writing text file, copying one file to another	10
	Total	44

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Edition	Year of Publication /Reprint
	Text Books		
1.	Peter Prinz, Tony Crawford, "C in a Nutshell", Oreilly Publishers,	1st	2011
2.	Yashwant Kanetkar, "Let Us C", BPB Publication	8th	2007
	Reference Books		
1.	<ul style="list-style-type: none"> Steve Oualline, "Practical C programming", Orielly Publishers, 2011. 	3rd	2011
2.	<ul style="list-style-type: none"> Brian W Kernighan, Dennis M Ritchie, "The C Programming Language", Prentice Hall, 1988. R3. Herbert Schildt, "C: The Complete Reference", 4th Edition. TMH, 2000. 	2nd	2000
3.	<ul style="list-style-type: none"> E. Balagurusamy, "Programming in ANSI C", McGraw Hill 	6th	2015

DEPARTMENT OF ALLIED SCIENCES -PHYSICS

SEMESTER I

Name of Department: - Allied Sciences (Physics)

1. Subject Code: TTC105 Course Title: Physics for Computing Science
2. Contact Hours: L: 2 T: 0 P: 0
3. Examination Duration (Hrs): T 2 y 0 Pra 0 al
4. Relative Weight: CIE 25 PRS 0 MSE 25 ESE 50 PRE 0
5. Credits: 2
6. Semester: I
7. Category of Course: DSc
8. **Pre-requisite:** Basic Knowledge of Physics for computer Science

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Define the basics of Oscillations.</p> <p>CO2: Extend the knowledge of Interference and Electromagnetism.</p> <p>CO3: Understand the basics of quantum mechanics.</p> <p>CO4: Discuss different crystallographic structures in solid state.</p> <p>CO5: Examine the basics of LASER, fiber optics and it their application.</p> <p>CO6: Explain the basics of Thermodynamics.</p>
---------------------------	---

10. **Details of the Course:**

UNIT	CONTENTS	Contact Hrs
Unit/Module-I	Oscillation: Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple spring-mass system. Resonance-definition, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators.	4
Unit/Module- II	Interference-principle of superposition-Young's experiment: Theory of interference fringes, types of interference, Fresnel's prism, Newton's rings, Diffraction, Difference between interference and diffraction, Fraunhofer diffraction at single slit, plane diffraction grating.	5
Unit/Module-III	Basic Idea of Electromagnetisms: Continuity equation for current	3

	densities, Maxwell's equation in vacuum and non-conducting medium.	
Unit/ Module-IV	Quantum Mechanics: Introduction, Planck's quantum theory, Matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, Physical significance of wave function, time independent and time dependent Schrödinger's wave equation, , Particle in a one dimensional infinite potential box	4
Unit/ Module-V	Crystallography: Basic terms-types of crystal systems, Bravais lattices, miller indices, d spacing, Atomic packing factor for SC, BCC, FCC and HCP structures, X-ray diffraction Semiconductor Physics: Conductor, Semiconductor and Insulator; Origin of Band Theory, Basic concept of Band theory,	3
Unit/ Module-VI	Laser and Fiber optics: Spatial and temporal coherence, Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Ruby Laser, CO ₂ and Neodymium YAG (Neodymium-doped Yttrium Aluminum Garnet); Properties of laser beams: mono-chromaticity, , directionality and brightness, laser speckles, applications of lasers in engineering. Fiber optics and Applications, Types of optical fibers.	5
Unit/ Module-VII	Thermodynamics: Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st law, second law of thermodynamics and concept of Engine, entropy, change in entropy in reversible and irreversible processes.	4
		28

Text Books:

S.No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication/ Reprint
1.	Ajoy Ghatak, "Optics", Tata Mc Graw Hill.	4 th Edition	2009
2.	N. Subrahmanyam Brijlal& M. N. Avadhanulu, "Optics:", S. Chand.	24 th Edition	2010
3.	A. Beiser, "Concepts of Modern Physics", Tata Mc Graw Hill.	5 th Edition	2001
4.	Resnick, Krane, Halliday, "Physics (vol I&II)", Wiley.	5 th Edition	2007
5.	N. David Mermin, Quantum computer Science, Cambridge University Press.	1 st Edition	2007
6.	Adam Smith, "The Beginner's guide to quantum computing & mechanics", A. Smith Media.	1 st Edition	2022

7.	Frank S Crawford Jr., "Waves", The McGraw Hill Companies	Volume 3	2008
8.	Leonid V. Azaroff, "Introduction to Solids", Tata Mc Graw Hill.	31 st reprint	2008
9.	R E Sonntag, "Fundamentals of Thermodynamics", Wiley Publishers	6 th Edition	2009
10.	P K Nag, "Basic and Applied Thermodynamics", McGraw Hill Education India	2 nd Edition	2014
	Reference Books		
1.	John R. Taylor, Chris D. Zafiratos, Michael A. Dubson, "Modern Physics", Pearson Education.	1 st Edition	2007
2.	Gerd Keiser, "Optic Fiber Communication", Tata Mc. Graw Hill.	5 th Edition	2017
3.	Alastair I M Rae, Jim Napolitano, "Quantum Mechanics" Wiley.	6 th Edition	2015
4.	David J. Griffiths, "Introduction to Electrodynamics", Prentice.	3 rd Edition	2011
5.	Charles P. Poole, Jr. Frank J. Owens, "Introduction to Nanotechnology", Wiley.		2017
6.	Hug D. Young & Roger A. Freedman, "University Physics", Edition, Pearson Publication.	12 th Edition	2008
7.	Alan Giambattista, Betty Mc. Carthy Richardson, Robert C Richardson, "Fundamentals of Physics", Tata Mc Graw Hill.	1 st Edition	2009
8.	Parag Lala, "Quantum computing", Tata Mc Graw Hill.	1 st Edition	2019
9.	Nielsen, "Quantum computation and quantum information", Cambridge University Press.	1 st Edition	2007
10.	SO Pillai, "Solid State Physics", New Age International Publishers	10 th Edition	2022
11.	M. Ali Omar, "Elementary Solid State Physics", Pearson Education	5 th edition	2009
12.	NK Bajaj, "The Physics of Waves and Oscillations", Tata Mc Graw Hill.	25 th reprint	2009
13.	YA Cengal, "Thermodynamics- An Engineering Approach", McGraw Hill Education India	Special Edition	2016

DEPARTMENT OF ALLIED SCIENCES -PHYSICS

Semester I

Name of Department: - Allied Sciences (Physics)

1. Subject Code: PTC105 Course Title: Physics Lab
2. Contact Hours: L: 0 T: 0 P: 2
3. Examination Duration (Hrs): T 0 y 2 Pra 2 l
4. Relative Weight: CIE 0 PRS 25 MSE 25 ESE 0 PRE 50
5. Credits: 1
6. Semester: I
7. Category of Course: dSc
8. Pre-requisite: Basic Knowledge of Experiments in Physics

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Find the variation of Magnetic field along the axis of current carrying coil and determine Hall coefficient and energy band gap (Four-probe method) of a semi-conductor.</p> <p>CO2: Understand the phenomena of photoelectric effect and determine the Plank's constant. Also calibrate analogue instruments and determine the specific resistance.</p> <p>CO3: Apply the methods of diffraction and Interference to determine the wavelength of Laser and sodium light (Monochromatic light) and resolving power of a grating.</p> <p>CO4: Determine the parameters of optical fiber. Also determine the Stefan's Constant</p>
---------------------------	--

10. **Details of the Course:** Students have to perform any 10 experiments:

Sl. No.	Contents	Contact Hours
	<ol style="list-style-type: none"> 1. To study the variation of Magnetic field with distance along the axis of circular current carrying coil and determine the radius of the coil using Stewart and Gee tangent galvanometer. 2. To study Hall Effect and determine Hall coefficient, Hall voltage, current density and carrier mobility of a given semi-conductor. 3. To determine Plank's constant by photoelectric method and study the variation of intensity with distance. 4. To determine the wavelength of given laser light by plane diffraction grating. 5. To determine of wavelength of monochromatic light by Newton's Ring experiment 	2

	<ol style="list-style-type: none"> 6. To determine the numerical aperture and acceptance angle of an Optical fiber 7. To determine the Stefan's Constant. 8. To determine the wavelength of monochromatic light using Fresnal's biprism experiment. 9. To determine the specific resistance of constantan wire using Carey Foster bridge. 10. To determine the energy band gap of a semiconductor by Four-probe method. 11. To determine the Resolving Power of a Plane Diffraction Grating. 12. To calibrate ammeter and voltmeter using a potentiometer. <p>Reference Books:</p> <ol style="list-style-type: none"> (i) Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House. (ii) Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers (iii) A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi. (iv) A Laboratory Manual of Physics for Undergraduate Classes, D.P.Khandelwal, 1985, Vani Publication. 	
--	---	--

DEPARTMENT OF ALLIED SCIENCES -PHYSICS

SEMESTER I / II

Name of Department: - Allied Sciences (Physics)

1. Subject Code: TPH 101/201 Course Title: Engineering Physics
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (Hrs): T 3 y 0 Pr 0 al
4. Relative Weight: CIE 25 PRS 0 MSE 25 SEE 50 PRE 0
5. Credits: 3
6. Semester: I/II
7. Category of Course: DSC
8. **Pre-requisite:** Basic Knowledge of Physics

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Define the wave nature of light through different phenomenon.</p> <p>CO2: Extend the knowledge of Laser, fiber optics and polarization in engineering problems.</p> <p>CO3: Understand the concept of theory of relativity.</p> <p>CO4: Discuss quantum theory of radiation and applications of Schrodinger wave equations.</p> <p>CO5: Examine the behavior of superconductors and quantum computers.</p> <p>CO6: Explain the Maxwell's equations and nanomaterials.</p>
---------------------------	---

10. Details of the Course:

UNIT	CONTENTS	Contact Hrs
Unit/Module-I	<p>Interference: Conditions of interference, Spatial and temporal coherence, Bi-prism, interference in wedge shaped film, Newton's rings.</p> <p>Diffraction: Fraunhofer diffraction at single slit and n-slits (Diffraction Grating). Rayleigh's criteria of resolution. Resolving power of grating.</p>	9
Unit/Module- II	<p>Polarization: Basic theory of double refraction, Malus law, Ordinary and Extra-ordinary ray, Production, and detection of plane, elliptically and circularly polarized light, specific rotation and polarimeters.</p> <p>Laser: Spontaneous and Stimulated emission of radiation, Einstein Coefficients, Principle of laser action. Construction and working of Ruby and He-Ne laser photovoltaic effect.</p> <p>Fiber Optics: Introduction to fiber optics; types of fiber, acceptance angle and cone angle, numerical aperture.</p>	9

Unit/Module-III	Special theory of relativity: Inertial and non-inertial frames, Galilean transformation, Michelson-Morley experiment (qualitatively), Einstein postulates of special theory of relativity, Lorentz transformation equations, length contraction, time dilation, variation of mass with velocity, mass-energy relation.	8
Unit/ Module-IV	Quantum Mechanics: Quantum concept and radiation, Wave particle duality (de-Broglie concept of matter waves), Heisenberg's uncertainty principle, wave function and its significance, Schrodinger's equations, Schrodinger's wave function for a particle confined in one dimensional infinite potential box (rigid box), Eigen values and Eigen functions. Quantum computers: Introduction to quantum computing, Principle, Nanocomputing, prospects and challenges.	8
Unit/ Module-V	Superconductivity: Essential properties of superconductors, zero resistivity, Type I, Type II superconductors and their properties. Electromagnetism: Displacement current, Maxwell's Equations in differential form. Nano Physics: Density of states, Nanostructures, fabrication, and characterization techniques (qualitatively).	8
	Total	42

Text Books:

S.No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication/ Reprint
1.	Ajoy Ghatak, "Optics", Tata Mc Graw Hill.	4 th Edition	2009
2.	N. Subrahmanyam Brijal& M. N. Avadhanulu, "Optics:", S. Chand.	24 th Edition	2010
3.	A. Beiser, "Concepts of Modern Physics", Tata Mc Graw Hill.	1 st Edition	
4.	Resnick, Krane, Halliday, "Physics (vol I&II)", Wiley.	5 th Edition	2007
5.	Robert Resnick, "Introduction to Special Relativity", Wiley Publishers.	1 st Edition	2007
6.	N. David Mermin, Quantum computer Science, Cambridge University Press.	1 st Edition	2007
7.	Adam Smith, "The Beginner's guide to quantum computing & mechanics", A. Smith Media.	1 st Edition	2022
	Reference Books	1 st Edition	
1.	John R. Taylor, Chris D. Zafiratos, Michael A. Dubson, "Modern Physics", Pearson Education.	1 st Edition	2007
2.	Gerd Keiser, "Optic Fiber Communication", Tata Mc. Graw Hill.	5 th Edition	2017
3.	Alastair I M Rae, Jim Napolitano, "Quantum Mechanics" Wiley.	6 th Edition	2015

4.	David J. Griffiths, "Introduction to Electrodynamics", Prentice.	3 rd Edition	2011
5.	Charles P. Poole, Jr. Frank J. Owens, "Introduction to Nanotechnology", Wiley.		2017
6.	Hug D. Young & Roger A. Freedman, "University Physics", Edition, Pearson Publication.	12 th Edition	2008
7.	Alan Giambattista, Betty Mc. Carthy Richardson, Robert C Richardson, "Fundamentals of Physics", Tata Mc Graw Hill.	1 st Edition	2009
8.	Parag Lala, "Quantum computing", Tata Mc Graw Hill.	1 st Edition	2019
9.	Nielsen, "Quantum computation and quantum information "Cambridge University Press.	1 st Edition	2007

Semester I/II

Name of Department: - Allied Sciences (Physics)

1. Subject Code: **PPH 151/251** Course Title: **Physics Lab**
2. Contact Hours: L: **0** T: **0** P: **2**
3. Examination Duration (Hrs): T **0** y **2** Pr **2** l
4. Relative Weight: CIE **0** PRS **25** MSE **25** SEE **0** PRE **50**
5. Credits: **1**
6. Semester: **I/II**
7. Category of Course: **DSC**
8. Pre-requisite: Basic Knowledge of Experiments in Physics

9. Course Outcome:	After completion of the course the students will be able to: CO1: Find the electrical and magnetic properties of materials and extend the knowledge of nanotechnology using electroplating. CO2: Understand the principle and characteristics of photo devices and optical fiber. CO3: Apply the methods of calibration to analog instruments. CO4: Determine the refractive index of liquid, wavelength of light and specific rotation of optically active substance through experiments based on phenomena of optics.
---------------------------	---

10. Details of the Course:

Sl. No.	Contents	Contact Hours
	Students have to perform any twelve experiments: 1. To determine the wavelength of monochromatic light by Newton's ring experiment. 2. To determine refractive index of transparent liquid by Newton's ring experiment. 3. To determine the specific resistance of the constantan wire using Carey- Foster's bridge. 4. To determine the wavelength of monochromatic light using Fresnel Biprism experiment	2

	<ol style="list-style-type: none"> 5. To determine the energy band gap of given semiconductor by Four-probe method. 6. (a) To determine the wavelengths of spectral line of Mercury light using plane transmission grating. (b) To determine the wavelengths of given Laser light using plane transmission grating. 7. To study the variation of magnetic field with distance along the axis of circular coil carrying current and to determine the radius of coil. 8. To determine the magnetic susceptibility of a paramagnetic substance by Quincke's method. 9. To determine the specific rotation of Sugar Solution using Half Shade Polarimeter. 10. To study the characteristics of Solar Cell 11. a) To calibrate Voltmeter by using potentiometer. b) To calibrate Ammeter by using potentiometer. 12. To determine Planck's constant by photoelectric method and study the variation of intensity with distance. 13. To determine the electro chemical equivalent of Copper. 14. To Verify Law of Malus. 15. To study Hall Effect and determine the hall voltage, hall coefficient, current density and carrier mobility of a given semiconductor. 16. To determine the numerical aperture and acceptance angle of an optical fiber. 17. To measure the refractive index of transparent liquid using Laser. 18. To determine the dielectric constant of air. 19. To determine wavelength of monochromatic light using Michelson interferometer. 	
--	--	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I and II

Name of Department: - **Chemistry**

1. Subject Code: **TCH101/201** Course Title: **Engineering Chemistry**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): **Theory 3 Practical 0**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **3**
6. Semester: **Autumn/Spring**
7. Subject Area:
8. Pre-requisite: **Basic Knowledge of Chemistry.**

9. Course Outcome:	<ul style="list-style-type: none"> acquire knowledge of structure and properties of molecules based on bonding and spectroscopic techniques understand the chemistry of purification of water and its industrial and domestic application classify various types of polymers and their applications Interpret and distinguish between the different types of conventional and non-conventional fuels apply the basic principles of electrochemistry in different electrochemical cells, corrosion control, fuel cells and industrial applications
---------------------------	--

10. Details of the Course:

UNIT	CONTENTS	Contact Hrs
Unit - I	MOLECULAR STRUCTURE AND SPECTROSCOPIC TECHNIQUES Molecular Orbital Theory, Formation of homo and heteronuclear diatomic molecules Hydrogen Bonding and its application Metallic Bonding (Band theory) and application to conductors, semiconductors and insulators Nanoscale Materials - Properties and applications Basic Principles of spectroscopy and its applications for molecular structure	8

Unit - II	WATER TECHNOLOGY Hardness of water: Causes, Types, Measurement, Boiler troubles: Sludges, Scales and Caustic Embrittlement Softening of water by L-S Process, Zeolite Process and Reverse Osmosis Process, Ion Exchange Process, Calgon Process Numerical Problems based on L-S Process, Zeolite Process and hardness of water. Introduction to the membrane concept for the treatment of microplastics from water	8
Unit -III	POLYMERS Polymers: Definition, degree of polymerization, functionality of monomer, Classification of polymers with examples, Types of polymerizations – addition and condensation polymerization with examples. Mechanism of addition polymerization. Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, preparation, properties, and applications of PVC and Bakelite Fibers: Characteristics of fibers – preparation, properties and applications of Nylon and Dacron. Conducting polymers: Characteristics and Classification of conducting polymers with examples. Biodegradable polymers: Concept and advantages – Preparation of Polylactic acid and poly vinyl alcohol and their applications. Liquid Crystalline Polymers: Characteristics, classification with examples and their applications.	8
Unit –IV	FUELS AND RENEWABLE SOURCE OF ENERGY Fuels Definition, Classification and Characteristics of a good fuel, Calorific value and its determination by Bomb Calorimeter, Numerical problems on Bomb Calorimeter, Composition and uses of Natural gas, CNG, LPG. Renewable Energy Sources: Solar energy, wind energy, hydroelectric and geothermal. Biofuels as alternative sources of energy (biomass, biogas).	8
Unit-V	ELECTROCHEMISTRY & ITS APPLICATIONS Electrode potential, standard electrode potential, factors affecting the electrode potential of a cell. Nernst equation: Electrochemical series and its application, Electrochemical cell: Daniel cell, Concentration cells, electrolyte concentration cell Numerical problems based on electrode potential and emf of a cell. Fuel Cells: Introduction, Principles, Classification, and application Corrosion its causes and effects, Theories of corrosion – Chemical & Electrochemical corrosion	10

	Total	42
--	--------------	-----------

11. Suggested Books:

Text Books:

1. [Sunita Rattan](#), “Comprehensive Engineering Chemistry”, S.K. Kataria & Sons Delhi, India, 2nd Edition (2009)
2. Shashi Chawala, “Theory and Practical’s of Engineering Chemistry”, Dhanpat Rai and Company, (Pvt) Ltd 3rd Edition (2012)
3. Jain & Jain “A text book of Engineering Chemistry,” Dhanpat Rai Publishing Company, 15th Edition New Delhi (2008)

Reference Books:

1. J.D. Lee, “Concise Inorganic Chemistry”, 5th Edition (1996)
2. K. L. Kapoor “A text book of Physical Chemistry” Vol. 5, Macmillan India, 1st Edition (2004)
3. Prof. K.N. Jayaveera, Dr.G.V.Subba Reddy and Dr.C. Ramachandraiah, “Chemistry for Engineers” McGraw Hill Higher Education Hyd.,(2009)
4. William Kemp, “Organic Spectroscopy”, Palgrave Foundations, (1991).
5. L.E.Foster, “Nanotechnology, Science Innovation & Opportunity”, Pearson Education, 2007.
6. Y.R. Sharma “Elementary Organic Spectroscopy: Principles and Chemical Applications”, 1st Edition,
7. F.W.Bill, Meyer, A Text book of Polymer Chemistry, 3rd Edition 2009,
8. Thirumala Chary and Laxminarayana, “Engineering Chemistry”, Scitech Publishers, Chennai (2016).

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

Name of Department: **Chemistry**

1. Subject Code: **PCH151/251** Course Title: **Chemistry Practical**
2. Contact Hours: L: **0** T: **0** P: **2**
3. Examination Duration (Hrs). **Practical** **3**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **2**
6. Semester: **Autumn/Spring**
7. Subject Area: **DSC**
8. Pre-requisite: **Basic Knowledge of Experiments in Chemistry**

9. Course Outcomes:	<ul style="list-style-type: none"> Analyze the water and oil quality parameter. Understand the concept of viscosity, surface tension and their applications. Analyze the ores and bleaching powder sample Knowledge of pH metric and calorimetry and their application in industry.
----------------------------	---

10. Detailed Syllabus: Students must perform any twelve experiments:

UNIT	CONTENTS	CONTACT HRS
EXP- 1	To determine the alkalinity of the given water sample containing carbonate (CO_3^{2-}) ions and bicarbonate (HCO_3^-) ions by titrating it against standard HCl solution [N/10] using phenolphthalein and methyl orange as indicators.	2
EXP - 2	To determine the chloride ion (Cl^-) content in the given water sample by Argentometric method (Mohr's method) using N/50 AgNO_3 as a standard solution and potassium chromate (K_2CrO_4) as an internal indicator.	2

EXP-3	To determine the temporary and permanent hardness of given water sample by titrating it against standard solution of M/100 Ethylene Diamine Tetracetic Acid (EDTA) using Eriochrome black-T (EBT) as an internal indicator.	2
EXP-4	To determine the coefficient of viscosity of the given sample solution by Ostwald's viscometer (Viscosity of water = 0.0101 Poise).	2
EXP-5	To determine the ferrous ion (Fe^{++}) content in given sample solution of Mohr's salt ($\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$) by titrating it against standard N/30 potassium dichromate ($\text{K}_2\text{Cr}_2\text{O}_7$) solution by using potassium ferricyanide $\text{K}_3[\text{Fe}(\text{CN})_6]$ as an external indicator.	2
EXP - 6	To determine the surface tension of the given sample solution by drop number method	2
EXP - 7	To determine the acid value of oil	2
EXP - 8	To determine the strength of unknown HCl solution by titrating it against N/10 NaOH solution with the help of pH meter.	2
EXP - 9	Synthesis of phenol-formaldehyde resin	2
EXP – 10	To determine the alkalinity of the given water sample containing carbonate (CO_3^{2-}) ions and hydroxide (OH^-) ions by titrating it against standard HCl solution [N/10] using phenolphthalein and methyl orange as indicators.	2
EXP – 11	To determine the rate constant of a reaction	2
EXP – 12	To determine the Copper (Cu^{++}) ion content in the given sample of copper ore (blue vitriol) by titrating it against standard N/30 sodium thiosulphate solution using starch as indicator by Iodometric titration.	2
EXP - 13	Determination of adsorption isotherm of acetic acid on activated charcoal	2

Text Books:

- [Sunita Rattan](#), “Comprehensive Engineering Chemistry”, S.K. Kataria & Sons Delhi, India, 2nd Edition (2009)
- Shashi Chawala, “Theory and Practicals of Engineering Chemistry”, Dhanpat Rai and Company, India 3rd Edition (2012)

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

Name of Department: **CHEMISTRY**

1. Subject Code: TCH202 Course Title: Advanced Organic Chemistry
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (Hrs): Theory 3
4. Relative Weight: CWA 25 PRS 0 MSE 25 ESE 50 PRE 0
5. Credits: 3
6. Semester: Autumn/Spring
7. Subject Area: DSC
8. **Pre-requisite:** Basic and Advanced knowledge of Organic Chemistry

9. Course Outcomes:	<ul style="list-style-type: none"> understand the basic knowledge of different techniques of purification of organic compound explain the reaction mechanism in organic chemistry. illustrate concepts and knowledge on nanotechnology and its application Learn and apply the concepts of analytical chemistry for sample analysis discuss the knowledge of carbohydrates and their practical application to biotechnology and engineering.
----------------------------	---

10. Details of the Course:

UNIT	CONTENTS	Contact Hrs
Unit - I	PURIFICATION OF ORGANIC COMPOUNDS Crystallization sublimation, Distillation, Fractional distillation, distillation under reduced pressure, Steam distillation, Extraction with solvent, chromatography	4

Unit - II	<p>(a) STRUCTURE OF ORGANIC COMPOUNDS</p> <p>Nature of covalent bond and its orbital representation. Hybridization, bond energy, polarity of bond & dipole moment of molecules, Isomerism</p> <p>(b) ORGANIC REACTIONS AND THEIR MECHANISM</p> <p>Bond fission, Inductive effect, hyperconjugation, electromeric, resonance effects and their significance; Types of reagents: electrophiles & nucleophiles, Reaction intermediates: carbocation, carbanion, carbenes, and free radicals- generation, properties and stability,</p> <p>(c) Addition reactions, Substitution reactions, Elimination reactions in organic chemistry. Orientation in aromatic substitution reactions</p>	<p>5</p> <p>7</p> <p>7</p>
Unit - III	<p>(a) NANOMATERIALS</p> <p>Introduction, Green nanotechnology, Synthesis of nanoparticles and its applications</p> <p>(b) GREEN CHEMISTRY</p> <p>Introduction, Twelve Principles of Green Chemistry, Adverse effects of chemicals, Practice of Green Chemistry</p>	<p>3</p> <p>3</p>
Unit - IV	<p>Analytical Chemistry: Basics and its applications</p> <p>a. Definition of Qualitative and quantitative analysis, volumetric and gravimetric analysis.</p> <p>b. Principle of volumetric analysis. Concept of pH, buffer solution and Henderson equation. Concept of strength and concentration of solution, Normality, Molarity, Molality and interconversion of strength,</p> <p>c. Types of volumetric analysis: Acid-base, Complexometric, redox and precipitation titration (Principle and examples).</p> <p>d. Principle and applications of the following methods:</p> <p>Chromatography: Introduction, principle & application of chromatography. Paper chromatography, thin layer</p>	<p>8</p>

	chromatography, column chromatography: silica and gel filtration. Thermoanalytical methods: Thermogravimetric Analysis, Thermometric Titrations Electroanalytical techniques: Electrogravimetry, Polarography and Voltametric Methods. Atomic Spectroscopy: Principle and application of atomic absorption spectroscopy and flame photometry.	
Unit - V	CARBOHYDRATES Definition, Classification, General Properties. Preparation of Glucose, its physical and chemical properties, Killiani Fischer synthesis, Ruff degradation	5
	Total	42

Textbooks:

1. Morrison & Boyd "Organic Chemistry", 6th edition, Pearson education
2. I.L.Finar, Organic Chemistry (Vol. I & II) 5th Edition 2009, Pearson Publication
3. Bahl and Bahl, "Advanced Organic Chemistry" by S. Chand & Company Ltd.

Reference Books:

1. F.W.Bill Meyer, "Text book of Polymer Chemistry, 3rd Edition 2009, W.J.Wiley India
2. Advanced Organic Chemistry by Bernard Mille
3. Organic Structural Spectroscopy by Joseph Lambert, Scott Gronert, Herbert Shurvell, David Lightner and Robert Graham Cooks
4. L.E.Foster, "Nanotechnology, Science Innovation & Opportunity", Pearson Education, 2007.

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I & II

Name of Department: - **Department of Electrical Engineering**

1. Subject Code: **TEE101/201** Course Title: **Basic Electrical Engineering**
2. Contact Hours: L: **2** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **2**
6. Semester: **I / II**
7. Subject Area: **DSC**
8. Pre-requisite: Basic Knowledge of Physics and Mathematics

9. Course Outcome: After successful completion of this course, students will be able to:	CO1	Recall the concept of voltage, current, resistance and laws related to electricity with reference to the electrical circuits/systems.
	CO2	Understanding of fundamental laws and theorems used in the electrical circuits.
	CO3	Application of network theorems/laws in electrical circuit.
	CO4	Understanding of various electrical safety components and electrical wiring.
	CO5	Application of earthing/grounding.

10. Details of the Course:

Sl. No.	Content	Contact Hours
1	DC Circuit: Concepts of current, resistance, E.M.F., potential difference, Ohm's law, Simplifications of networks using series and parallel combinations and star-delta conversions, Kirchhoff's law, Superposition, Thevenin, Norton, Maximum Power Transfer theorem and their applications for network solutions.	10
2	Single Phase AC: Introduction of Single-Phase AC, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Single phase AC through R, L, C, and series combination of RLC.	10
3	Electrical Installations and Illumination: Wire and cables for internal wiring, switches and circuits (Two-way switch, staircase wiring, go down wiring, double pole double throw switch), type of electrical wiring, Switch Fuse Unit (SFU), MCB, MCCB, Earthing concept and methods of earthing.	4
	Total	24

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
	Text Books	
1.	D.P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.	2010
2.	D.C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.	2009
3.	V. N Mittle and Arvind Mittle, “Basic Electrical Engineering” Tata McGraw-Hill Education Pvt. Ltd. (2005)	2005
	Reference Books:	
1.	L.S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.	2011
2.	V.D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.	1989
3.	E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.	2010
4	L.S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.	2011

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
------------	---------------------------	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

Name of Department: **Department of Electrical Engineering**

1. Subject Code: **PEE 151/251** Course Title: **Basic Electrical Engineering Lab**
2. Contact Hours: L: **0** T: **0** P: **2**
3. Examination Duration (Hrs): **Theory** **0** **Practical** **2**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **1**
6. Semester: **I / II**
7. Subject Area: **DSC**
8. Pre-requisite: Basic Knowledge of Experiments in Physics

9. Course Outcome: After successful completion of this course, students will be able to:	CO1 Apply the knowledge of circuit laws and theorems and verify the knowledge through practical experimentation.
	CO2 Correlate the knowledge of theoretical concepts or phenomenon in context to the real time applications of AC systems (wiring/switches/lamps etc.) and make suitable assumptions to study it through lab experiment.
	CO3 Coordinate with team members to carry out the procedure with precision.
	CO4 Report the experimental results in a professional way with practical comments on the application to field/ industry requirements.

10. Details of the Course:

Sl. No.	Contents
1.	To verify the Kirchhoff's Voltage Law (KVL) in DC Circuit.
2.	To verify the Kirchhoff's Current Law (KCL) in DC Circuit
3.	To Verify Superposition Theorem in DC Circuit.
4.	To Verify Thevenin Theorem in DC Circuit.
5.	To Verify Norton Theorem in DC Circuit.
6.	To Verify Maximum Power Transfer Theorem in DC Circuit.
7.	To find out the meter constant of a single-phase energy meter
8.	To wire for a Stair-case arrangement using a two-way switch.
9.	To measure power in a single-phase ac circuit by using wattmeter.
10.	To draw the current versus frequency characteristics in RLC series circuit.
11.	To study various electrical accessories and machines parts (cut set model)

11.	Mode of Evaluation	Viva / Mid Term Lab Exam / End Term Lab Exam
------------	---------------------------	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I (Biotech Group)

Name of Department: - **Department of Electrical Engineering**

1.	Subject Code:	EEC 101	Course Title:	Basic Electrical & Electronics Engineering		
2.	Contact Hours:	L: 3	T: 1	P: 0		
3.	Examination Duration (Hrs):	Theory 3	Practical	0		
4.	Relative Weight:	CWA 25	PRS 0	MSE 25	ESE 50	PRE 0
5.	Credits:	4				
6.	Semester:	Autumn				
7.	Subject Area:	DSC				
8.	Pre-requisite:	Basic Knowledge of Mathematics and Physics				

9. Course Outcome: After successful completion of this course, students will be able to:	CO1 Recalling the concepts of basic electric circuits and remembering the theorems to solve DC Circuits. CO2 Summarize the various characteristics of AC Circuits. CO3 Applying the concepts of magnetic circuits to understand the basic characteristics of single-phase Transformer. CO4 Analyzing the basics of semiconductor devices used for electronic components. CO5 Evaluating the basic concept of PN junction diode and its applications in rectifier circuits and DC power supply. CO6 Compiling Bipolar Junction Transistor (BJT) from its basic concepts and various biasing circuits.
--	---

10. Details of the Course:

Sl. No.	Contents	Contact Hours
Unit -1	D.C. Network Theory: Circuit theory concepts-KCL, KVL, mesh and node analysis, Network Theorems-Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Star Delta transformation.	07
Unit -2	A.C. Circuit Analysis: Sinusoidal and phasor representation of voltage and current, single phase a.c. circuit behavior of resistance, inductance and capacitance and their combination in series & parallel, power factor, series parallel resonance and quality factor.	07
Unit -3	Magnetic Circuits:	06

	Introduction, series-parallel magnetic circuits comparison, Eddy currents and Hysteresis losses. Single Phase Transformer: Principle of operation, classification, phasor diagram at no load, efficiency and all-day efficiency of transformer.	
Unit -4	Semiconductor Basics: Insulators, semiconductors and metals, Mobility and conductivity, Intrinsic and extrinsic semiconductors and charge densities in semiconductors, Fermi Level, current components in semiconductors, continuity equation. Junction Diode and Its Applications: PN Junction diode – characteristic and analysis, Diode Models, Rectifiers and filter circuit: Half wave, full wave and Bridge rectifier circuits and their analysis, L, C and Pi filters, Zener Diode, Basic regulator supply using Zener diode, Design of Regulator circuits. .	10
Unit –5	TRANSISTORS: Construction and characteristics of bipolar junction, transistors (BJT's)- Comm. Base, Comm. emitter, Comm. Collector configuration, Transistor biasing and bias stabilization: - the operating point, stability factor, analysis of fixed base bias, collector to base bias, Emitter resistance bias circuit and self-bias circuit.	8
	Total Hours	38

11. Suggested Books:

Sl. No.	Name of Authors/Books/Publishers	Year of Publication / Reprint
1	D.P. Kothari and I. J. Nagrath, “ Basic Electrical Engineering ”, Tata McGraw Hill.	2010
2	D.C. Kulshreshtha, “ Basic Electrical Engineering ”, McGraw Hill.	2009
3	V. N Mittle and Arvind Mittle, “ Basic Electrical Engineering ” Tata McGraw-Hill Education Pvt. Ltd.	2005
4	Jacob Millmann & Halkias, “ Integrated Electronics ”, 2 nd Edition, TMH,	2010
5	Boylestad and L. Robert and Nashelsky Louis, “ Electronics Devices and Circuits Theory ”, 9th Edition., PHI/Pearson Education.	2010

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam / Lab Exam
------------	---------------------------	---

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

Name of Department: **Department of Electrical Engineering**

1. Subject Code: **EEC 151**

Course Title: **Basic Electrical & Electronics Engineering Lab**

2. Contact Hours: **L: 0 To P2**

3. Examination Duration (Hrs): **Theory 0 Practical 2**

4. Relative Weight: **CWA PRS MSE ESE PRE**

5. Credits: **1**

6. Semester: **Autumn**

7. Subject Area: **DSC**

8. Pre-requisite: Physics.

9. Course Outcomes:	CO1 Illustrate and Verification of various laws in DC circuit
	CO2 Illustrate and Verification of various theorems in DC circuit
	CO3 Demonstrate various types of diodes and their characteristics
	CO4 Analysis of various types of analog and digital electronic circuits

10. Details of the Course:

Sl. No.	Contents
1.	To verify Kirchhoff's voltage law (KVL) in D.C. circuits
2.	To verify Kirchhoff's current law (KCL) in D.C. circuits
3.	To verify superposition theorem for DC circuits.
4.	To verify Thevenin's theorem for DC circuits
5.	To verify Norton's theorem for DC circuits
6.	To verify maximum power transfer theorem in DC circuits.
7.	Study of PN junction diode and its characteristics
8.	Study of ZENER junction diode and its characteristics
9.	Study of half wave rectifier with and without capacitive filter
10.	Study of full wave rectifier with and without capacitive filter
11.	Study of BJT in CB /CE configuration
12.	Verification of basic and derived gates.
13.	Realization of basic gates through universal gates.

11.	Mode of Evaluation	Viva / Mid Term Lab Exam / End Term Lab Exam
------------	---------------------------	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I

Name of Department: - **Department of Electrical Engineering**

1. Subject Code: **TTC 104** Course Title: **Principles of Electrical Engineering**
2. Contact Hours: L: **2** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **2**
6. Semester: **I**
7. Subject Area: **DSC**
8. Pre-requisite: Basic Knowledge of Physics and Mathematics

9. Course Outcome: After successful completion of this course, students will be able to:	CO1	Recall the concept of voltage, current, resistance and laws related to electricity with reference to the electrical circuits/systems.
	CO2	Understanding of fundamental laws and theorems used in the electrical and magnetic circuits.
	CO3	Application of network theorems/laws in electrical and magnetic circuits.
	CO4	Understanding of various electrical safety components and electrical wiring.
	CO5	Application of earthing/grounding.
	CO6	Understanding of measuring devices and sensors

10. Details of the Course:

Sl. No.	Content	Contact Hours
1	Introduction: Concept of Potential difference, voltage, current, Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols in order to describe electric networks, voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff-s laws and applications to network solutions using mesh and nodal analysis, Concept of work, power, energy, and conversion of energy.	5
2	DC Circuits: Current-voltage relations of the electric network by mathematical equations to analyze the network (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem) Simplifications of networks using series-parallel, Star/Delta transformation. Superposition theorem.	6
3	AC Circuits: AC waveform definitions, form factor, peak factor, study of R-L, R-C,RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC	5

	Circuits (Δ - Δ & Δ - Δ).	
4	Magnetic Circuit and Single Phase Transformer: Magnetic circuit, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, efficiency and regulation.	4
5	Measurements and Sensors: Introduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems (Current & Single-phase power). Electrical Wiring and Illumination system, Types of Wiring System & Wiring Accessories, Necessity of earthing, Types of earthing, Safety devices & system.	4
	Total	24

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers
	Text Books
1.	<i>Electric Machinery</i> , (Sixth Edition) A. E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, Tata McGraw Hill.
2.	<i>A Textbook of Electrical Technology</i> , (vol. I), B. L. Theraja, Chand and Company Ltd., New Delhi.
3.	<i>Basic Electrical Engineering</i> , V. K. Mehta, S. Chand and Company Ltd., New Delhi.
4	<i>Theory and problems of Basic Electrical Engineering</i> , (Second Edition), J. Nagrath and Kothari, Prentice Hall of India Pvt. Ltd.
	Reference Books:
1.	<i>Basic of Electrical Engineering</i> , T. K. Nagsarkar and M. S. Sukhija, Oxford University Press. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
2.	<i>Introduction to Electrodynamics</i> , D. J. Griffiths, (Fourth Edition), Cambridge University Press.
3.	<i>Engineering Circuit Analysis</i> , William H. Hayt & Jack E. Kemmerly, McGraw-Hill Book Company Inc.
4	<i>Fundamentals of Electrical and Electronics Engineering</i> , Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd.

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
------------	---------------------------	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

Name of Department: **Department of Electrical Engineering**

1. Subject Code: **PTC 104** Course Title: **Electrical Engineering Lab**
2. Contact Hours: L: **0** T: **0** P: **2**
3. Examination Duration (Hrs): **Theory** **0** **Practical** **2**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **1**
6. Semester: **I**
7. Subject Area: **DSC**
8. Pre-requisite: Basic Knowledge of Experiments in Physics

9. Course Outcome: After successful completion of this course, students will be able to:	CO1 Apply the knowledge of circuit laws and theorems and verify the knowledge through practical experimentation.
	CO2 Correlate the knowledge of theoretical concepts or phenomenon in context to the real time applications of AC systems (wiring/switches/lamps etc.) and make suitable assumptions to study it through lab experiment.
	CO3 Coordinate with team members to carry out the procedure with precision.
	CO4 Report the experimental results in a professional way with practical comments on the application to field/ industry requirements.

10. Details of the Course:

Sl. No.	Contents
1.	To verify the Kirchhoff's Voltage Law (KVL) in DC Circuit.
2.	To verify the Kirchhoff's Current Law (KCL) in DC Circuit
3.	To Verify Superposition Theorem in DC Circuit.
4.	To Verify Thevenin Theorem in DC Circuit.
5.	To Verify Norton Theorem in DC Circuit.
6.	To Verify Maximum Power Transfer Theorem in DC Circuit.
7.	To find out the meter constant of a single-phase energy meter.
8.	To wire for a Stair-case arrangement using a two-way switch.
9.	To measure the power and power factor of a three-phase balanced circuit by using two wattmeter method.
10.	To draw the current versus frequency characteristics in RLC series circuit.
11.	To measure power in a single-phase ac circuit by using wattmeter.
12.	To study various electrical accessories and machines parts (cut set model)
11.	Mode of Evaluation Viva / Mid Term Lab Exam / End Term Lab Exam

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I/II

Name of Department: - Electronics and Communication Engineering

1. Subject Code: Course Title:
2. Contact Hours: L: T: P:
3. Examination Duration (Hrs): Theory Practical
4. Relative Weight: CIE MSE SEE
5. Credits:
6. Semester:
7. Category of Course:
8. Pre-requisite: Physics

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Remember operations on number systems and understand concepts of digital circuits.</p> <p>CO2: Understand the basics of semiconductors and PN junction diode.</p> <p>CO3: Apply the basics of PN junction diode in rectifier circuits and DC power supply.</p> <p>CO4: Analyze Bipolar Junction Transistor (BJT) from its basic concepts and biasing circuits.</p> <p>CO5: Evaluate the performance of operational amplifier (OP-amp) from its performance parameters like gain, CMRR, offset values etc.</p> <p>CO6: Design and develop various basic electronic circuits.</p>
---------------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Unit 1: Number Systems & Boolean Algebra: Number systems and their conversion, Logic gates, Boolean algebra, Implementation of basic gates using universal gates, Implementation of logic functions using basic gates & universal gates, SOP & POS form of logic expression, Canonical form, Conversion from SOP & POS form to canonical form, Simplification of Boolean function: Algebraic method, Karnaugh map method (two, three & four variable K-map with don't care condition).	10
2	Unit 2:	8

	Basics of Semiconductor Devices: Energy band theory: Classification of solids based on energy band diagram, Semiconductors; Intrinsic semiconductors, Extrinsic semiconductors– P-type and N-type, Electrons and holes in intrinsic and extrinsic semiconductors, Mobility and conductivity, Mass action law, Charge densities in semiconductors, Drift and diffusion current, P-N Junction; Formation of depletion region, V-I characteristics of P-N junction diodes, Diode breakdown mechanism.	
3	Unit 3: AC to DC Conversion: Introduction to DC power supply, Rectifiers circuit: Half wave, Center tapped full wave and Bridge rectifier circuits. Rectifier performance parameter analysis, Filter circuits: L, C, and Pi filters, Zener diode, Zener diode as a voltage regulator.	8
4	Unit 4: Basics of Bipolar Junction Transistor (BJT): Construction of bipolar junction transistors (BJT), NPN and PNP type transistor, Characteristics; Common base, Common emitter, Common collector configuration, Operating point.	8
5	Unit 5: Introduction to Operational Amplifiers: Introduction to integrated circuits; Advantages and limitations, Characteristics of an ideal Op-amp, Introduction of 741 IC. Inverting and non-Inverting Op-amp circuits, Summing amplifier, Difference amplifier, Voltage follower.	6
	Total	40

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Edition	Year of Publication / Reprint
	Textbooks		
1.	Jacob Millmann & Halkias, " <i>Integrated Electronics</i> ", TMH, 2 nd Edition, 2009.	2 nd	2009
2.	M. Morris Mano, Michael D. Ciletti, " <i>Digital Design</i> ", Pearson Education, 5 th Edition, 2012.	5 th	2012
	Reference Books		
1.	Boylestad and L. Robert and Nashelsky Louis, " <i>Electronics Devices and Circuits Theory</i> ", Pearson Education, 10 th Edition, 2009.	10 th	2009
2.	S. Salivahanan and S. Arivazhagan, " <i>Digital Circuits and Design</i> ", Oxford University Press, 5 th Edition, 2018.	5 th	2008

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
-----	---------------------------	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I/II

Name of Department: - Electronics and Communication Engineering

1. Subject Code: **PEC 151/251** Course Title: **Basic Electronics Engineering Lab**
2. Contact Hours: L: **0** T: **0** P: **2**
3. Examination Duration (Hrs.): Theory **0** Practical **3**
4. Relative Weight: CIE **25** MSE **25** SEE **50**
5. Credits: **1**
6. Semester: **First/Second**
7. Category of Course: **DC**
8. Pre-requisite: **Physics**

9. Course Outcome:	After completion of the course the students will be able to: CO1: Identify and understand active & passive components along with various measuring instruments. CO2: Verify truth table of logic gates. CO3: Analyse the characteristics of diodes and transistors. CO4: Implement different electronics circuits using operational amplifier and logic gates.
---------------------------	---

10. Details of the Course:

Sl. No.	List of problems for which student should develop program and execute in the Laboratory	Contact Hours
1.	Familiarization of electronics measuring instrument and components.	2
2.	Measure the voltage and frequency using a DSO.	2
3.	Study and verification of the truth table for logic gates.	2
4.	To design and verify the truth table for logic gates using NOR gate.	2
5.	To design and verify the truth table for logic gates using NAND gate.	2
6.	Study V-I characteristics of PN junction diode and determine the static and dynamic resistance from the characteristic curve.	2
7.	Study of a Half wave rectifier circuit with and without capacitor filter.	2
8.	Study of a Centre tapped full wave rectifier circuit with and without capacitor filter.	2

9.	Study of a bridge full wave rectifier circuit with and without capacitor filter.	2
10.	Study V-I characteristics of Zener diode.	2
11.	Study the input and output characteristics of common base (CB) transistor.	2
12.	Study the input and output characteristics of common emitter (CE) transistor.	2
	Total	24
Innovative Experiments		
13.	Study the input and output characteristics of common collector (CC) transistor.	02
14.	Design and verification of Inverting and non-inverting amplifier using Op-Amp IC.	02
15.	As suggested by the concerned faculty/lab in charge.	02

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
-----	---------------------------	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I and II

Name of Department: - Mechanical Engineering

1. Subject Code: **PME 151/251** Course Title: **Workshop and Manufacturing Practices**
2. Contact Hours: L: **1** T: **0** P: **4**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** SEE **50** PRE **0**
5. Credits: **3**
6. Semester: **I**
7. Category of Course: **SEC**
8. Pre-requisite: **Basic Grammar**

9. Course Outcome**:	<p>After completion of the course the students will be able to:</p> <p>CO1: To identify various conventional, non-conventional and automated manufacturing techniques.</p> <p>CO2: To explain various manufacturing practices used for the production of work pieces in different shops like carpentry, welding, sheet metal etc.</p> <p>CO3: To apply the principles of manufacturing in fabrication of jobs.</p> <p>CO4: To analyze properties of different used for fabrication of jobs.</p> <p>CO5: To generate design for fabrication of jobs.</p>
-----------------------------	---

**** Describe the specific knowledge, skills or competencies the students are expected to acquire or demonstrate.**

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Introduction to Manufacturing Introduction to manufacturing, 3M's of manufacturing – man, machine and material, Types of manufacturing process, Manufacturing shops – machine shop, fitting shop, carpentry shop, welding shop, sheet metal shop, black smith shop, foundry shop, Introduction to advance manufacturing, Safety and precaution in workshop.	5

2	Machine Shop: Introduction to machining process, Measuring and marking tools used in machine shop, Part of lathe and drilling machine, Working principle of lathe and drilling, Tools use in lathe, Materials. 1. To make work piece using facing and turning operation. 2. To make work piece using step turning and thread making operation.	4
3	Foundry Shop: Introduction to foundry, Pattern material-wood, cast iron, brass, aluminum, waxes etc., Types of patterns, Types of tools, Moulding sands – green sand, dry sand, loam sand, facing sand, etc., Sand casting-Sand preparation, mould making, melting, pouring and cleaning. 3. To prepare mould of casting using a single piece pattern. 4. To prepare mould of casting using a split pattern.	4
4	Sheet Metal Shop: Introduction to sheet metal shop, Tools use in sheet metal shop, Types of operations, Fabrication of daily use items such as funnel tray, etc. 5. To make a funnel using sheet metal forming (Material: 24 SWG) of given dimensions. 6. To make a square tray using sheet metal forming (Material: 24 SWG) of given dimensions.	3
5	Fitting Shop: Introduction to fitting, Types of tools used in fitting shop for measuring, marking, cutting etc., callipers and Vernier calliper, materials used in tools. 7. To make a square piece of mild steel of given dimensions. 8. To make a fitting job of given profile and dimensions.	4
6.	Welding Shop: Introduction to welding, Classifications of joining process, Arc welding process-power source, electrodes, edge preparation, Different types of joints. Electric arc welding, Metal inert gas welding, Tungsten inert gas welding. 9. To prepare a butt (Single-V)/ fillet joint through electric arc welding. 10. To prepare a butt (Single-V)/ fillet joint through TIG/MIG welding.	
7.	Carpentry Shop: Introduction to carpentry shop, Wood and its type, Classification of timber, Seasoning and preservation of wood, Description and	

	<p>applications of the various tools used in carpentry, Different joints and their practical uses.</p> <p>11.To make corner-lap/ center – lap joint.</p> <p>12.To make a mild steel chisel/ nail.</p>	
8.	<p>Black smith shop:</p> <p>Introduction to black smithy shop, Tools used in black smithy shop, Types of operations, Properties of metal- ductility, malleability, strength, etc.</p> <p>13.To make a square of round mild steel bar.</p> <p>14.To make a mild steel chisel/ nail.</p>	
9.	<p>Non-conventional and Automated Manufacturing Techniques:</p> <p>15.Demonstration of Non-conventional fabrication techniques-3D Printing, Laser Cutting.</p> <p>16.Demonstration of Automated manufacturing techniques-CNC, Master CAM software, Application of Industrial Robot, Assemble line in Manufacturing Execution System.</p>	
	Total	30

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I and II

Name of Department: Mechanical Engineering

1. Subject Code: **PME 153-253** Course Title: **Engineering Graphics & Design**

2. Contact Hours: L: **1** T: **0** P: **4**

3. Examination Duration (Hrs): Theory **0** Practical **3**

4. Relative Weight: CWA **25** PRS **0** M **25** **50** **0**

5. Credits: **3**

6. Semester: **Autumn/Spring**

7. Subject Area: **DSC**

8. Pre-requisite: No prerequisites

9. Course Outcomes: Upon completion of this course, students will be able to

- CO1.** Construct Engineering drawings as per BIS conventions manually and using CAD software to prepare Orthographic projections of Points and Lines.
- CO2.** Use the knowledge of Orthographic projections to represent Engineering concepts of Planes.
- CO3.** Develop Projections of Solids and lateral surfaces of solids by analyzing the given problems.
- CO4.** Construct isometric drawings after analyzing the combination of simple solids

10. Detailed Syllabus

S.L. No.	CONTENTS	Contact Hrs
1	Introduction to Computer Aided Sketching Introduction, Drawing Instruments and their uses, BIS conventions, lettering, Dimensioning and free hand practicing. Computer screen, layout of the software, standard tool bar, and description of most commonly used tool bars, navigational tools. Coordinate system and reference planes. Definitions of HP, VP, RPP& LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity.	10

	Dimensioning, line convention, material conventions and lettering. Computer Aided Design(CAD) software: Modeling of parts and Assemblies.	
2	Orthographic projections of points, lines and planes: Introduction, Definitions - Planes of projection, reference line and conventions employed. First angle and Third angle projection. Projections of points in all the four quadrants. Projection of lines (located in first quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes (No application problems) Projection of planes: triangle, square, rectangle, pentagon, hexagon, and circle, planes in different positions by change of position method only (No problems on punched plates and composite plates.)	25
3	Projections of Solids: Projections of right regular prisms, pyramids and cones with axis inclined to both the planes. (Solids resting on HP only)	10
4	Development of lateral surfaces of solids: Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. Development of lateral surfaces of above solids, their truncations.	10
5	Isometric Projections: Principles of Isometric projection - Isometric Scale, Isometric Views, Conventions, Isometric views of planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice - Versa.	10
6	Demonstration of a Simple Team Design Project that Illustrates Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels.	10
CAD Softwares: 1. AUTOCAD 2. CREO 2.0		
Total		75

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
Text Books		
1.	Engineering Graphics- K.R. Gopalakrishna, 32 nd edition, - Subash Publishers, Bangalore.	2005
2.	Computer Aided Engineering Drawing – S. Trymbaka Murthy, - International Publishing house Pvt. Ltd., New Delhi, 3 rd revised edition.	2006
Reference Books		
1.	Engineering Drawing- N.D. Bhatt and V.M. Panchal, 48 th edition, Charotar publishing House, Gujarat.	2005

GRAPHIC ERA (DEEMED TO BE UNIVERSITY) DEHRADUN
SEMESTER I

Name of Department: **Biotechnology**

**FUNDAMENTALS OF
MEDICAL**

1. Subject Code: **TBT 101** Course Title:
2. Contact Hours: L: **2** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** SEE **50** PRE **0**
5. Credits: **3**
6. Semester: **I**
7. Subject Area: **SEC**
8. Pre-requisite: Basic Science.
9. Course Objectives: The objective of this course is to provide a basic understanding of biological mechanisms of living organisms from the perspective of engineers. In addition, the course is expected to encourage engineering students to think about solving biological problems with engineering tools.

10. Course Outcome:

Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Learn about human microflora and understand basic mechanism of action of various medically important bacterial microbes</p> <p>CO2: know basic mechanism of action of various medically important fungal and Viral infections and their diagnostic procedures.</p> <p>CO3: Understanding the concept of immune system and their correlation with Microbes.</p> <p>CO4: Utilize biotechnology tools in medical therapeutic and summarize the diagnostic techniques for common human diseases.</p> <p>CO5: understanding of good laboratory practices followed in medical biotechnology laboratory.</p>
------------------------	---

11. Details of the Course:

UNIT	Contents	Contact Hou

		rs
Unit - I	<p>Commensal & Pathogenic Bacteria Normal microflora of human body: Skin, Respiratory system and Genitourinary tracts. Source of infection, mode of spread and portals of entry. Common pathogenic bacteria: Introduction of morphology, characterization, pathogenicity, lab diagnosis, prophylaxis of <i>Staphylococcus</i>, <i>Streptococcus</i>, <i>Neisseria</i>, <i>Corynebacterium</i>, <i>Bacillus</i>, <i>Clostridium</i>, <i>Mycobacteria</i>, <i>Hemophilus</i>, <i>Escherichia coli</i>, <i>Pseudomonas</i>.</p>	8
Unit - II	<p>Introduction to Pathogenic Fungi & Viruses Fungi: Introduction to morphology, symptoms, lab diagnosis and prevention of Mycoses. Viruses: Morphology, pathogenicity, prophylaxis, Diagnosis of viruses: Herpes, viruses, Orthomyxxovirus, Polio viruses, Hepatitis viruses; Rabies viruses, Human immunodeficiency viruses, COVID -19 viruses.</p>	8
UNIT III	<p>Immunology Components of Immune system: Types of immunity, barriers of natural immunity, cells and organs of immune system, properties of antigen and antibody, interaction of antigens with various immune cells and organs, types of antibodies and their significance in host-pathogen interaction.</p>	8
Unit – IV	<p>Management and Quality Control of Medical Biotechnology Laboratory Specimen Collection: Collection of clinical specimens from patients, clinics, hospitals, for diagnosis and processing, training of medical biotechnologist to handle epidemics. Quality Control: Selective cultural media, identification by special tests, biochemical reactions and sero-typing of pathogenic bacteria. Antibiotic susceptibility testing, its interpretation and reporting. Hospital infection control: Quality control in diagnostic microbiology, National programmer for control of infectious diseases.</p>	10
Unit –V	<p>Applications of Medical Biotechnology Tools and techniques: Hybridoma technology, biopharming-subunit vaccines, DNA vaccines, recombinant vaccines, therapeutic enzymes, basic biomedical tools in diagnosis, treatment, prevention of diabetes (Insulin production), cancer (Detection of cancer antigens), transplantation.</p>	8
	TOTAL LECTURES	42

12. Suggested Books:

S.No.	Name of Authors/Books/Publishers	Year of Publication/ Reprint
	Text Books	
1.	Microbiology 10th Edition. Prescott, L.M.; Harley, J.P. and Klein, D.A. (2013) McGraw-Hill Education; USA.	2017
2.	Biology for Engineers. GK Suraishkumar, Oxford Higher Education, Oxford University Press.	2019
3.	Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004	2004
4.	Kuby Immunology. Thomas J. Kindt, Barbara A. Osborne,, Richard Goldsby. W. H. Freeman, 8 th edition	2018
5.	Ananthanarayan and Paniker's Textbook of Microbiology, The Orient Blackswan; 10th edition.	2017
	e- Resources	
1.	NDL..... https://ndl.iitkgp.ac.in/homestudy/science	2020
2.	https://epgp.inflibnet.ac.in/ (e PG-Pathshala)	2020
3.	http://ugcmoocs.inflibnet.ac.in/ (UGC Moocs)	2020
4.	https://swayam.gov.in/ (Swayam)	2020

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER II

Name of Department: - HUMANITIES AND SOCIAL SCIENCES

1.	Subject Code:	TTC 203	Course Title:	Fundamentals of Economics		
2.	Contact Hours:	L: 2	T: 0	P: 0		
3.	Examination Duration (Hrs):	Theory 3	Practical	0		
4.	Relative Weight:	CIE 25	PRS 0	MSE 25	SEE 50	PRE 0
5.	Credits:	2				
6.	Semester:	II				
7.	Category of Course:	DC				
8.	Pre-requisite:	Basic Knowledge of Economics				

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Define the basic principles of microeconomics and macroeconomics theory.</p> <p>CO2: Understand the efficiency and equity implications of market interference, including government policy.</p> <p>CO3: Demonstrate the factors determining gross domestic product, employment, the general level of prices, and interest rates in the economy.</p> <p>CO4: Analyze economic problems and prescribe solutions.</p> <p>CO5: Evaluate how economic concepts can be applied to analyze real life situations.</p> <p>CO6: Create ability to comprehend the interaction between domestic economy and the rest of the world.</p>
---------------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Principles of Demand and Supply - Supply Curves of Firms - Elasticity of Supply; Demand Curves of Households - Elasticity of Demand; Equilibrium and Comparative Statics (Shift of a Curve and Movement	8

	along the Curve); Welfare Analysis - Consumers' and Producers' Surplus - Price Ceilings and Price Floors.	
2	Consumer Behaviour - Axioms of Choice - Budget Constraints and Indifference Curves; Consumer's Equilibrium - Effects of a Price Change, Income and Substitution Effects -Derivation of a Demand Curve; Applications - Tax and Subsidies - Intertemporal Consumption - Suppliers' Income Effect.	9
3	Theory of Production - Production Function and Iso-quants - Cost Minimization; Cost Curves - Total, Average and Marginal Costs - Long Run and Short Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly and Monopolistic Competition.	9
4	National Income and its Components - GNP, NNP, GDP, NDP; Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector - Taxes and Subsidies; External Sector - Exports and Imports.	9
5	Money - Definitions; Demand for Money -Transactionary and Speculative Demand; Supply of Money - Bank's Credit Creation Multiplier; Integrating Money and Commodity Markets - IS, LM Model; Business Cycles and Stabilization - Monetary and Fiscal Policy - Central Bank and the Government; The Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment.	10
	Total	45

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1.	N. Gregory Mankiw- Economics: Principles and Applications, Cengage Learning India Private Limited.	4 th Edition	2007
2.	Karl E. Case and Ray C. Fair-Principles of Economics, Pearson Education Inc.	8 th Edition	2007
3.	H.L.Ahuja -Principles of Microeconomics,S Chand Publications.	22th Edition	2016

4.	F.Dornbusch & J. Startz- Macroeconomics, McGraw Hill.	7 th Edition	2010
5.	H.L. Ahuja- Macroeconomics Theory and Policy, S Chand Publications.	20 th Edition	2016
Reference Books			
1.	A.Koutsoyiannis- Modern Microeconomics, Macmillan Education U.K.	2 nd Edition	1979
2.	M. L. Jhingan -Macro Economic Theory, McGraw Hill.	13 th Edition	2016
3.	N.G. Mankiw- Macroeconomics, Worth Publishers.	7 th Edition	2010

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
-----	---------------------------	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I/II

Name of Department: - Environmental Science

1. Subject Code: **TEV 101/201** Course Title: **Environmental Science**
2. Contact Hours: L: **2** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **-** PRS **-** MSE **-** SEE **100** PRE **-**
5. Credits: **0**
6. Semester: **I**
7. Category of Course: **Value Addition Course**
8. Pre-requisite: **General Science**

9. Course Outcome**:	After completion of the course the students will be able to: 1. Create environmental awareness and knowledge. 2. Encourage participation in environmental conservation practices. 3. Develop critical thinking and apply those to the analysis of a problem or question related to the environment. 4. Evaluate impact of various human induced activities on the environment. 5. Design possible solutions to the real environmental problems. 6. Apply research and innovation related with different aspects of environmental science.
-----------------------------	---

10. Details of the Course:

S.No.	Contents	Contact Hours
1	Environmental Science and Ecosystem a. Definition of Environmental Science, multidisciplinary nature, Objective, scope and importance. b. Concept of an ecosystem, structure and function, energy flow, ecological succession, food chains, food webs, ecological pyramids. c. Introduction, types, characteristic features, structure and function of the following ecosystem:	8

	<ul style="list-style-type: none"> • Forest ecosystem • Grassland ecosystem • Desert ecosystem • Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) 	
2	<p>Natural Resources and Biodiversity</p> <p>a. Renewable and non- renewable resources.</p> <p>b. Natural resources and associated problems:</p> <ul style="list-style-type: none"> • Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests and tribal people. • Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams – benefits and problems, water conservation, rainwater harvesting, watershed management. • Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. • Food Resources: World food problems, Changes in land use by agriculture and grazing, Effects of modern agriculture, Fertilizer/ pesticide problems, Water logging and salinity • Energy Resources: Increasing energy needs, Renewable/ non renewable, Use of Alternate energy sources, urban problems related to energy, Case studies • Land Resources: Land as a resource, land degradation, man-induced land-slides, soil erosion and desertification, wasteland reclamation <p>c. Role of an individual in conservation of natural resources, equitable use of resources for sustainable lifestyles.</p> <p>d. Definition of biodiversity, levels of biodiversity, value of biodiversity, threats to biodiversity (habitat loss, poaching of wildlife, man-wildlife conflicts).</p> <p>e. Biodiversity at global, national and local levels, India as a biodiversity nation, biogeographical classification of India, hotspots of biodiversity.</p> <p>f. Endangered and endemic species of India.</p> <p>g. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.</p>	16
3	<p>Environmental Pollution</p> <p>a. Definition, causes, effects and control measures of Air Pollution, water pollution, soil pollution, marine pollution noise pollution, thermal pollution, nuclear hazards.</p>	8

	b. Solid waste Management: causes, effects and control measures of urban and industrial wastes. c. Role of an individual in prevention of pollution, pollution case studies, pollution case studies.	
4	Important Environmental and Social Issues, Management and Legislation a. Climate change, global warming, acid rain, Ozone layer depletion, nuclear accidents and holocaust. Case studies. b. Sustainable development, Resettlement and rehabilitation of people (its problems and concerns, case studies), Environmental ethics (issues and possible solutions), consumerism and waste products. c. Disaster management: floods, earthquake, cyclone and landslides. d. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act.	4
	Total	36

11. Suggested Books:

S.No.	Name of Authors/Books/Publishers/Place of Publication	Edition
	Textbooks	
1.	Deswal, S. & Deswal A.: A Basic Course in Environmental Studies; Dhanpat Rai & Co.	2013
2	Srivastava Smriti: Environmental Studies; Katson books.	2007
3.	Textbook for Environmental Studies	2004
	Reference Books	
1.	Joseph K. & Nagendran R.: Essentials of Environmental studies; Pearson Edition	2005
2.	Santra S. C., Environmental Science; Central Book Agency.	2011

12.	Mode of Evaluation	End Term Exam
-----	---------------------------	---------------

DEPARTMRNT OF ALLIED SCIENCES (MATHEMATICS)

SEMESTER I

Name of Department: - Allied Sciences (Mathematics)

1. Subject Code: **TMA 101** course Title: **ENGINEERING MATHEMATICS-I**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **4**
6. Semester: **I**
7. Category of Course: **Discipline Specific Course**
8. Pre-requisite: Basic Knowledge of Mathematics

9. Course Outcome**:

After completion of the course the students will be able to:

CO1. Understand the concept of Matrices.

CO2. Solve the system of linear equations.

CO3. Understand the concept of differential calculus and apply to various discipline of Engineering.

CO4. Analyze the maxima / minima values of function of two or more variables with its application to engineering.

CO5. Solve the multiple integrals and apply to find the area and volumes.

CO6. Utilize the vector calculus in different engineering systems.

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Matrices: Elementary row transformation, Rank of a matrix, linear dependency and independency, Consistency of a system of linear equations, Characteristic equation, Eigen values and Eigen vectors, symmetric and skew symmetric matrix, Diagonalization and their applications.	(11 Hrs)

2	Calculus-I: Higher order derivatives, Successive Differentiation, Leibnitz's theorem, Limits, Continuity and Differentiability of two variables, Partial Differentiation, homogeneous functions, Euler's theorem, Expansion of function of severable variable using Taylor's and Maclaurin's theorems.	(09 Hrs)
3	Calculus-II Extrema (Maxima/ Minima) of functions of two variables, method of Lagrange's multipliers, Introduction of Jacobian, properties of Jacobian, Jacobian of implicit and explicit functions, functional dependence.	(07 Hrs)
4	Multiple Integrals Double and triple integrals, Change of order of integration, Beta and Gamma functions, Applications to area, volume, Dirichlet's integral.	(09 Hrs)
5	Vector Calculus Introduction to Vectors, Gradient, Divergence and Curl of a vector and their physical interpretation, Line, Surface and Volume integrals, Green's, Stoke's and Gauss's divergence theorems.	(09 Hrs)
	Total	(45 Hrs)

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1.	C. B. Gupta, S. R. Singh and Mukesh Kumar, "Engineering Mathematics for Semesters I and II" McGraw Hill Education	1 st	2015
2.	Ramana, B. V., "Higher Engineering Mathematics", Tata McGraw Hill publications,	6 th	2006
3.	R. K. Jain, S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publication,	5 th	2019
4.	Grewal, B. S., "Higher Engineering Mathematics", 40e, Khanna Publications, India.	44 th	2022
5.	Kreyszig, Erwin., "Advanced Engineering Mathematics", 9e, Wiley Publications.	9 th	2014.
6.	Tom M. Apostol 'Calculus' Volume 2 Wiley Publications.	2 nd	2022
	Reference Books		
1.	G. B. Thomas and R. L. Finney	9 th	2010
2.	Gorakh Prasad and Chandrika Prasad	11 th	1968

DEPARTMRNT OF ALLIED SCIENCES (MATHEMATICS)

SEMESTER II

Name of Department: - Allied Sciences (Mathematics)

1. Subject Code: **TMA 201** Course Title: **ENGINEERING MATHEMATICS-II**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **3**
6. Semester: **II**
7. Category of Course: **Discipline Specific Course**
8. Pre-requisite: Basic Knowledge of Mathematics

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1. Solve the linear ordinary differential equations.</p> <p>CO2. Utilize the Laplace transforms in linear and simultaneous linear differential equations.</p> <p>CO3. Apply the Fourier series for signal analysis in various engineering discipline.</p> <p>CO4. Classify the partial differential equations and solve homogeneous partial differential equations with constant coefficients.</p> <p>CO5. Apply method of separation of variables to solve 1D heat, wave and 2D Laplace equations.</p> <p>CO6. Utilize Fourier transforms in Engineering.</p>
--------------------	---

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Differential equation Ordinary differential equation of first order (Exact and reducible), linear differential equations of nth order with constant coefficients, complementary functions and particular integrals, Euler Homogeneous differential equation, Method of variation of parameters and applications of ODE.	(09 Hrs)
2	Laplace Transform	(09 Hrs)

	Introduction of Laplace Transform, Shifting Theorems Existence theorem and properties, Laplace transform of derivatives and integrals, Inverse Laplace transform, Laplace transform of periodic functions, Unit step function and Dirac delta function, Convolution theorem, Applications to solve simple linear and simultaneous linear differential equations.	
3	Partial differential equations- I Introduction to PDE, Formation of PDE, solution first order PDE, Lagrange's and Charpit's methods, standard form of first order PDE.	(09 Hrs)
4	Partial differential equations -II Solution of linear partial differential equations with constant coefficients of second order and their classifications: parabolic, hyperbolic and elliptic, Method of separation of variables for solving partial differential equations.	(09 Hrs)
5	Fourier series and Fourier Transform Periodic functions, Fourier series of periodic functions, Euler's formula, Fourier series having arbitrary period, Change of intervals, Even and odd functions, Half range sine and cosine series. Fourier Transform, Fourier Sine and Cosine Transform, Application of Fourier Transform.	(09 Hrs)
	Total	(45 Hrs)

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1.	C. B. Gupta, S. R. Singh and Mukesh Kumar, "Engineering Mathematics for Semesters I and II" McGraw Hill Education.	1 st	2015
2.	E. Kreyszig, Advanced Engineering Mathematics, Wiley India.	9 th	2014
3.	B. S. Grewal, Higher Engineering Mathematics, Khanna Publications.	44 th	2022
4.	Tom M. Apostol 'Calculus' Volume 2 Wiley Publications.	2 nd	2022
	Reference Books		
1.	C. Prasad, Advanced Mathematics for Engineers, Prasad Mudralaya.	3 rd	2019
2.	R. K. Jain, S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publication.	5 th	2009

DEPARTMRNT OF ALLIED SCIENCES (MATHEMATICS)**SEMESTER II**

Name of Department: - Allied Sciences (Mathematics)

1. Subject Code: **TMA 202** Course Title: **ENGINEERING MATHEMATICS**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **4**
6. Semester: **II**
7. Category of Course: **Discipline Specific Course (DSC)**
8. Pre-requisite: Basic knowledge of mathematics

9. Course Outcome**:	After completion of the course the students will be able to: CO1. Understand the concept of Matrices and determinants. CO2. Identify and understand the significance of Differentiation and Integration in Bio Technology. CO3. Apply the linear differential equations in Biological system. CO4. Illustrate linear and nonlinear algebraic equations. CO5. Utilize the applications of probability and Statistics in Bio Technology. CO6. Use of Mathematics and their applications in Bio Technology.
----------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Matrix And Determinants: Definitions, type of matrices, properties of matrices, algebra of matrices (Addition, subtractions and multiplication), Determinants, Properties of determinants, Adjoint of matrix, Inverse of a matrix, System of linear equations, Eigen values and Eigen vectors for 2 x 2 matrix. Application of Matrices.	(09 Hrs)
2	Differentiation And Integration:	(09 Hrs)

	Limit (L'Hospital Rule) and Continuity, Differentiation of Standard functions of one variable, Basic Rules of Differentiation (product rule, quotient rule, chain rule), Maxima and minima for one variable, Integration (Integration by part, Integration by substitution).	
3	Differential Equations: Introduction to Differential equations, Differential equations of first order and first degree. Variable separable method, Homogeneous differential equations, linear differential equations, Linear differential equations of second order with constant coefficients, complementary function and particular integral. Applications of Differential Equations.	(09 Hrs)
4	Numerical Solution of Linear and Non-Linear Equations: Numerical solution of linear and nonlinear algebraic equations (using Bisection method, Iterative method, Newton Raphson method), Numerical Integration (Trapezoidal and Simpson's rule)	(09 Hrs)
5	Probability: Basic probability and laws, sample space, event, and properties, conditional probability, Bayes' theorem.	(09 Hrs)
	Total	(45 Hrs)

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1.	C. B. Gupta, S. R. Singh and Mukesh Kumar, "Engineering Mathematics for Semesters I and II" Mc Graw Hill Education.	1 st	2015
2.	B. S. Grewal: Higher Engineering Mathematics, Khanna Publications.	44 th	2022
3.	D. C. Agarwal, M. Jha, S. K. Gupta, Remedial Mathematics, Shree Sai Prakashan Meerut.	1 st	2022
4.	Piskunov N: Differential & Integral calculus, Moscow Peace Puse.	1 st	1969
	Reference Books		
1.	A. R. Vashitha. Remedial Mathematics, Krishna Publications, Meerut.	5 th	2020
2.	R. K. Jain and S. R. K. Iyengar	5 th	2002

DEPARTMRNT OF ALLIED SCIENCES (MATHEMATICS)

SEMESTER I

Name of Department: - Allied Sciences (Mathematics)

1. Subject Code: **TTC-101** Course Title: **Discrete Mathematics**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **4**
6. Semester: **I**
7. Category of Course: Discipline Specific Course (DSC)
8. Pre-requisite: Basic Knowledge of Mathematics

9. Course Outcome**:	<p>After completion of the course the students will be able to:</p> <p>CO1. Define the Boolean Algebra and logic gates.</p> <p>CO2. Understand the concepts of Group, ring, integral domains and field.</p> <p>CO3. Demonstrate the counting principle, generating function and recurrence relation.</p> <p>CO4. Analyze different algorithms for trees and graphs.</p> <p>CO5. Elaborate the natural deduction and axiom systems.</p> <p>CO6. Utilize propositional calculus with their properties in computer science engineering.</p>
----------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Boolean algebra: Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.	(09 Hrs)
2	Abstract algebra: Set and relations, groups, abelian group, Finite and Infinite group, order of group, cyclic group, coset, Lagrang's theorem, ring, division ring, ring with unity, Integral domain, field.	(09 Hrs)
3	Combinatorics: Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.	(09 Hrs)

4	Graph Theory: Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem.	(09 Hrs)
5	Logic: Propositional calculus - propositions and connectives, syntax; Semantics - truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness.	(09 Hrs)
	Total	(45 Hrs)

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1.	Topics in Algebra, I. N. Herstein, John Wiley and Sons.	2 nd	1975
2.	Digital Logic & Computer Design, M. Morris Mano, Pearson	5 th	2011
3.	Elements of Discrete Mathematics, (Second Edition) C. L. LiuMcGraw Hill, New Delhi	4 th	2017
4.	Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan Press, London.	1 st	1976
5.	Mathematical Logic for Computer Science, L. Zhongwan, World Scientific, Singapore	2 nd	1998
	Reference Books		
1.	Introduction to linear algebra. Gilbert Strang.	5 th	2022
2.	Introductory Combinatorics, R. A. Brualdi, North-Holland, New York.	5 th	2019
3.	Graph Theory with Applications to Engineering and Computer Science, N. Deo, Prentice Hall, Englewood Cliffs.	1 st	2016
4.	Introduction to Mathematical Logic, (Second Edition), E. Mendelsohn, Van-Nostrand, London.	3 rd	2007

DEPARTMENT OF ALLIED SCIENCES (MATHEMATICS)
SEMESTER I

Name of Department: - Allied Sciences (Mathematics)

**Statistics Probability and
Calculus**

1. Subject Code: **TTC-102** Course Title:
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** l **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **4**
6. Semester: **I**
7. Category of Course: Discipline Specific Course (DSC)
8. Pre-requisite: Basic Knowledge of Mathematics

9. Course Outcome**:	<p>After completion of the course the students will be able to:</p> <p>CO1. Understand business problems in appropriate statistical terms in order use data to make better decisions.</p> <p>CO2. Analyze the concept of probability with applications.</p> <p>CO3. Understand the concept of Inferential Statistics and applications in Business.</p> <p>CO4. Describe statistical methods and probability distribution.</p> <p>CO5. Demonstrate application of Moments.</p> <p>CO6. Demonstrate application of Double and triple Integral.</p>
----------------------	--

Ref: GEU/MATH-BOS/2023/01

10. Details of the Course:

Sl. No.	Contents	Contact Hours
---------	----------	---------------

1	Introduction to Statistics: Definition of Statistics. Basic objectives. Applications in various branches of science with examples. Collection of Data: Internal and external data, Primary and secondary Data. Population and sample, Representative sample. Descriptive Statistics: Classification and tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - central tendency and dispersion. Bivariate data. Summarization, marginal and conditional frequency distribution.	(09 Hrs)
2	Probability: Concept of experiments, sample space, event. Definition of Probability. Conditional Probability, Bayes Theorem.	(09 Hrs)
3	Probability distributions: Discrete & continuous distributions, Binomial, Poisson and Geometric distributions, Uniform, Exponential, Normal, Chi-square, t, F distributions.	(09 Hrs)
4	Expected values and moments: Mathematical expectation and its properties, Moments (including variance) and their properties, interpretation, Moment generating function.	(09 Hrs)
5	Calculus: Basic concepts of Differential and integral calculus, limit, continuity and differentiability for two variables, double and triple integral, change of order of Integration, Application of double and triple integral.	(09 Hrs)
	Total	(45 Hrs)

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1.	C. B. Gupta, S. R. Singh and Mukesh Kumar, "Engineering Mathematics for Semesters III and IV" McGraw Hill Education	1 st	2016
2.	Introduction of Probability Models, S. M. Ross, Academic Press, N.Y.	11 th	2014
3.	Fundamentals of Statistics, vol. I & II, A. Goon, M. Gupta and B. Dasgupta, World Press.	3 rd	1968
4.	Higher Engineering Mathematics, B. S. Grewal, Khanna Publication, Delhi.	43 rd	2015
	Reference Books		
1.	A first course in Probability, S. M. Ross, Prentice Hall.	9 th	2013
2.	Probability and Statistics for Engineers, (Fourth Edition), I. R. Miller, J.E. Freund and R. Johnson, PHI.	9 th	2017

3.	Introduction to the Theory of Statistics, A. M. Mood, F.A. Graybill and D.C. Boes, McGraw Hill Education.	3 rd	1974
4.	Advanced Engineering Mathematics, Peter V. O'Neil, Thomson Learning.	7 th	2010
5.	Advanced Engineering Mathematics, M. D. Greenberg, Pearson Education.	2 nd	1998

DEPARTMRNT OF ALLIED SCIENCES (MATHEMATICS)

SEMESTER II

Name of Department: - Allied Sciences (Mathematics)

1. Subject Code: **TTC-201** Course Title: **Linear Algebra**
2. Contact Hours: L: **3** T: **1** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **4**
6. Semester: **II**
7. Category of Course: **Discipline Specific Course (DSC)**
8. Pre-requisite: Basic Knowledge of Mathematics

9. Course Outcome**:	<p>After completion of the course the students will be able to:</p> <p>CO1. Understand the concept of Matrices and determinants.</p> <p>CO2. Discussion of rank, nullity and system of linear equations.</p> <p>CO3. Identify and understand the significance of Gram-Schmidt orthogonalization</p> <p>CO4. Explain the applications of Eigenvalues and Eigenvectors.</p> <p>CO5. Analyze the linear transformation of matrices.</p> <p>CO6. Demonstrate application of Image Processing and Machine Learning.</p>
----------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Elementary row transformation, Rank of a matrix, linear dependency and independency, Consistency of a system of linear equations, Characteristic equation, Eigen values and Eigen vectors, symmetric and skew symmetric matrix, Diagonalization and their applications, Gaussian elimination; LU Decomposition.	(09 Hrs)
2	Vector space, basis Dimension, subspace of vector space Orthogonality; Projections.	(09 Hrs)

3	Linear transformations rank and nullity theorem, Inverse of Linear Transformation .	(09 Hrs)
4	Inner product space ,orthogonality, projection, Gram-Schmidt orthogonalization and QR decomposition.	(09 Hrs)
5	Singular value decomposition and Principal component analysis Introduction to their applications in Image Processing and Machine Learning .	(09 Hrs)
	Total	(45 Hrs)

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1	Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers.	44 th	2015
2	C. B. Gupta, S. R. Singh and Mukesh Kumar, “Engineering Mathematics for Semesters I and II” McGraw Hill Education	1 st	2015
3	K. Holfman, R. Kunze , Linear Algebra	2 nd	2018
4	V. Krishnamurthy, V.P. Mainra, J.L. Arora	1 st	1976
	Reference Books		
1.	Advanced Engineering Mathematics, Peter V. O'Neil, Cengage Learning.	7 th	2010
2.	Advanced Engineering Mathematics, Michael. D. Greenberg, Pearson.	2 nd	1998
3.	Introduction to linear algebra, (Fifth Edition), Gilbert Strang, Wellesley-Cambridge Press.	5 th	2016
4.	Applied Mathematics (Vol. I & II), P. N. Wartikar & J. N. Wartikar, Pune Vidyarthi Griha Prakashan.	1 st	2019
5.	Digital Image Processing, R C Gonzalez and R E Woods, Pearson.	4 th	2017
6.	https://machinelearningmastery.com/introduction-matrices-machine-learning/		

DEPARTMRNT OF ALLIED SCIENCES (MATHEMATICS)

SEMESTER II

Name of Department: - Allied Sciences (Mathematics)

Statistical Methods

1. Subject Code: TTC-202 Course Title:
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (Hrs): Theory 3 l 0
4. Relative Weight: CIE 25 PRS 0 MSE 25 ESE 50 PRE 0
5. Credits: 4
6. Semester: II
7. Category of Course: Discipline Specific Course (DSC)
8. Pre-requisite: Basic Knowledge of Mathematics

9. Course Outcome**:	<p>After completion of the course the students will be able to:</p> <p>CO1. Identify the appropriate choice of statistical tools and techniques</p> <p>CO2. Familiarize with correlation coefficient and regression coefficient.</p> <p>CO3. Explain testing of Hypothesis.</p> <p>CO4. Understand the application of some statistical tools and techniques in Business Decisions</p> <p>CO5. Analyze the mathematical models .</p> <p>CO6. Understand the concept of statistical models and its application in solving analytics problems</p>
----------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Sampling Techniques: Random sampling. Sampling from finite and infinite populations. Estimates and standard error (sampling with replacement and s without replacement), Sampling distribution of sample mean, stratified random sampling	(09 Hrs)
2	Linear Statistical Models: Scatter diagram. Linear regression and correlation. Least squares method. Rank correlation. Standard multiple regression models with emphasis on detection of collinearity, outliers, non-normality and autocorrelation, Validation of model assumptions. Multiple correlation, Analysis of variance (one way, two way with as well	(09 Hrs)

	as without interaction)	
3	Estimation: Point estimation, criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation.	(09 Hrs)
4	Test of hypothesis: Concept & formulation, Type I and Type II errors, Neyman Pearson lemma, Procedures of testing.	(09 Hrs)
5	Non-parametric Inference: Comparison with parametric inference, Use of order statistics. Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test. Spearman's and Kendall's test. Basics of Time Series Analysis & Forecasting: Stationary, ARIMA Models: Identification, Estimation and Forecasting.	(09 Hrs)
	Laboratory R statistical programming language: Introduction to R, Functions, Control flow and Loops, Working with Vectors and Matrices, Reading in Data, Writing Data, Working with Data, Manipulating Data, Simulation, Linear model, Data Frame, Graphics in R	
	Total	(45 Hrs)

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1.	Probability and Statistics for Engineers (4th Edition), I.R. Miller, J.E. Freund and R. Johnson.	8 th	2015
2.	Fundamentals of Statistics (Vol. I & Vol. II), A. Goon, M. Gupta and B. Dasgupta	2 nd	2016
3.	The Analysis of Time Series: An Introduction, Chris Chatfield.	7 th	2019
	Reference Books		
1.	Introduction to Linear Regression Analysis, D.C. Montgomery & E. Peck	5 th	2013
2.	Introduction to the Theory of Statistics, A.M. Mood, F.A. Graybill & D.C. Boes.	3 rd	2017
3.	Applied Regression Analysis, N. Draper & H. Smith	3 rd	1998

4.	Hands-on Programming with R,- Garrett Grolemund	2 nd	2015
5.	R for Everyone: Advanced Analytics and Graphics, Jared P. Lander	1 st	2013

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I

Name of Department: - **Computer Science and Engineering**

1. Subject Code: **TCS 101** Course Title:

Course Title: **Fundamental of computer and introduction to programming**

2. Contact Hours: L: **3** T: **0** P: **0**

3. Examination Duration (Hrs): Theory **3** Practical **0**

4. Relative Weight: CIE **25** PRS **0** MSE **25** SEE **50** PRE **0**

5. Credits: **3**

6. Semester: **Ist**

7. Category of Course: **DSC**

8. Pre- requisite: **Basic Knowledge of Mathematics**

9. Course Outcome:

- Learn the concepts of IT and understand the fundamentals of basic building blocks of computer science.
- Understand basic data types and syntax of C programming.
- Propose solution to problem by using tools like algorithm and flowcharts.
- Analyze and select best possible solution for decision-based problems using decision making skills and develop the aptitude to solve iterative problems using different types of looping statements.
- Implement complex problem as a collection of sub problems by applying modularization in applications using functions.
- Apply and implement the concept arrays for providing solution to homogenous collection of data types.

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	UNIT- I Generation of computers, Computer system memory hierarchy, Input/Output, RAM/ROM, Software & Hardware, Understand bit, byte, KB, MB, GB and their relations to each other, Operating System overview, Computer Networks Overview Algorithms and Flow Charts – Examples of Flow charts for loops and	8

	conditional statements	
2	UNIT- 2 First C program - Hello world, How to open a command prompt on Windows or Linux. How to read and print on screen - printf(),scanf(),getchar(), putchar() Variables and Data types - Variables, Identifiers, data types and sizes, type conversions, difference between declaration and definition of a variable, Constants Life of a C program (Preprocessing, Compilation, Assembly, Linking, Loading, Execution), Compiling from the command line, Macros, Operators – equality and assignment, Compound assignment operators, Increment and decrement operators, Performance comparison between pre and post increment/decrement operators, bitwise operators, Logical Operators, comma operator, precedence and associativity.	10
3	UNIT- III Conditional statements: if statement, if-else statement, ternary statement or ternary operator, nested if-else statement, switch statement, Difference between performance of if else and switch, Advantages of if else and switch over each other Loops: ‘for’ loops, ‘while’ loops, ‘do while’ loops, entry control and exit control, break and continue, nested loops	8
4	UNIT- IV Functions: Function prototype, function return type, signature of a function, function arguments, call by value, Function call stack, Recursion v/s Iteration, passing arrays to functions, Storage classes: Automatic, Static, Register, External, Static and Dynamic linking implementation, C program memory (show different areas of C program memory and where different type of variables are stored), scope rules.	7
5	UNIT- V Arrays: Single-dimensional arrays, initializing arrays, computing address of an element in array, character arrays, segmentation fault, bound checking, Searching and Sorting.	10
	Total	43

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Edition	Year of Publication/Reprint
---------	----------------------------------	---------	-----------------------------

	Text Books		
1.	Peter Prinz, Tony Crawford,"C in a Nutshell", Oreilly Publishers,	1st	2011
2.	Peter Norton, "Introduction to computers", TMH,	6th	2009
	E.Balagurusamy,"Programming in ANSI C",McGraw Hill	6th	2015
	Reference Books		
1.	Steve Oualline, "Practical C programming", Orielly Publishers, 2011.	3rd	2011
2.	Brian W Kernighan, Dennis M Ritchie,"The C Programming Language", Prentice Hall, 1988. R3. Herbert Schildt," C: The Complete Reference", 4thEdition.TMH, 2000.	2nd	2000
3.	YashwantKanetkar,"Let Us C",BPB Publication	8th	2007

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam / Lab Exam
-----	---------------------------	---

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER II

Name of Department: - **Computer Science and Engineering**

1. Subject Code: **TCS 201** Course Title:

Course Title: **Programming for Problem Solving**

2. Contact Hours: L: **3** T: **0** P: **0**

3. Examination Duration (Hrs): Theory **3** Practical **0**

4. Relative Weight: CIE **25** PRS **0** MSE **25** SEE **50** PRE **0**

5. Credits: **3**

6. Semester: **IInd**

7. Category of Course : **DSC**

8. Pre- requisite: **Basic Knowledge of Mathematics and Computer Fundamentals**

9. Course Outcome:

- Learn and apply concepts of strings and multi-dimensional array for providing solutions to homogenous collection of data types
- Propose solution to problem by using tools like algorithm and flowcharts.
- Apply the concept of pointers to optimize memory management by overcoming the limitations of arrays.
- Process and analyze problems based on heterogeneous collection of data using structures.
- Apply concepts of file handling to implement data storage and retrieval tasks.
- Implement the basic real life problems using python

10. **Details of the Course:**

Sl. No.	Contents	Contact Hours
1	UNIT- I Multi-Dimensional Arrays- Initializing arrays , row major and column major form of an array, character strings and arrays, Strings – Declaration of strings, Initialization of strings using arrays and pointers, Standard library functions of string.	6
2	UNIT- 2 Pointers –Basic of pointers and addresses, Pointers and arrays, Pointer arithmetic, passing pointers to functions, call by reference. Accessing string through pointers. Dynamic memory management in C - malloc(), calloc(), realloc(), free(), memory leak,Dangling, Void, Null and Wild pointers Structures - Structures, array of structures, structure within structure, union, typedef, self-referential structure, pointer to structure	10
3	UNIT- III File Handling - Opening or creating a file, closing a file, File modes, Reading and writing a text file using getc(), putc(), fprintf(), fscanf(),fgets(), fputs(), Reading and writing in a binary file, counting lines in a text file, Search in a text file, Random file accessing methods- feof(), fseek(), ftell() and rewind() functions.	8
4	UNIT- IV Introduction to Python- History of Python, Need of Python Programming, Python features, First Python Program, Running python Scripts, Variables, Reserved words, Lines and indentation, Quotations, Comments, Input output. Data Types, Operators and Expressions: Standard Data Types – Numbers, strings, Boolean, Operators – Arithmetic Operators, comparison Operators, assignment Operators, logical Operators, Bitwise Operators.	10
5	UNIT- V Control flow – if, if-elif-else, for, while, break, continue, pass, range(), nested loops. Functions – Handling functions in Puthon File Handling – Reading text file, writing text file, copying one file to another	10
	Total	44

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Edition	Year of Publication /Reprint
	Text Books		
1.	Peter Prinz, Tony Crawford,"C in a Nutshell", Oreilly Publishers,	1st	2011
2.	Yashwant Kanetkar,"Let Us C",BPB Publication	8th	2007
	Reference Books		
1.	<ul style="list-style-type: none"> Steve Oualline, "Practical C programming", Orielly Publishers, 2011. 	3rd	2011
2.	<ul style="list-style-type: none"> Brian W Kernighan, Dennis M Ritchie,"The C Programming Language",Prentice Hall, 1988. R3. Herbert Schildt," C: The Complete Reference", 4thEdition.TMH, 2000. 	2nd	2000
3.	<ul style="list-style-type: none"> E.Balagurusamy,"Programming in ANSI C", McGraw Hill 	6th	2015

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam / Lab Exam
-----	---------------------------	---

DEPARTMENT OF ALLIED SCIENCES -PHYSICS

SEMESTER I

Name of Department: - Allied Sciences (Physics)

1. Subject Code: TTC105 Course Title: Physics for Computing Science
2. Contact Hours: L: 2 T: 0 P: 0
3. Examination Duration (Hrs): T 2 y P 0 ractical
4. Relative Weight: CIE 25 PRS 0 MSE 25 ESE 50 PRE 0
5. Credits: 2
6. Semester: I
7. Category of Course: DSc
8. **Pre-requisite:** Basic Knowledge of Physics for computer Science

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Define the basics of Oscillations.</p> <p>CO2: Extend the knowledge of Interference and Electromagnetism.</p> <p>CO3: Understand the basics of quantum mechanics.</p> <p>CO4: Discuss different crystallographic structures in solid state.</p> <p>CO5: Examine the basics of LASER, fiber optics and it their application.</p> <p>CO6: Explain the basics of Thermodynamics.</p>
---------------------------	---

10. Details of the Course:

UNIT	CONTENTS	Contact Hrs
Unit/Module-I	Oscillation: Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple spring-mass system. Resonance-definition, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators.	4
Unit/Module- II	Interference-principle of superposition-Young's experiment: Theory of interference fringes, types of interference, Fresnel's prism, Newton's rings, Diffraction, Difference between interference and diffraction, Fraunhofer diffraction at single slit, plane diffraction grating.	5

Unit/Module-III	Basic Idea of Electromagnetisms: Continuity equation for current densities, Maxwell's equation in vacuum and non-conducting medium.	3
Unit/ Module-IV	Quantum Mechanics: Introduction, Planck's quantum theory, Matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, Physical significance of wave function, time independent and time dependent Schrödinger's wave equation, , Particle in a one dimensional infinite potential box	4
Unit/ Module-V	Crystallography: Basic terms-types of crystal systems, Bravais lattices, miller indices, d spacing, Atomic packing factor for SC, BCC, FCC and HCP structures, X-ray diffraction Semiconductor Physics: Conductor, Semiconductor and Insulator; Origin of Band Theory, Basic concept of Band theory,	3
Unit/ Module-VI	Laser and Fiber optics: Spatial and temporal coherence, Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Ruby Laser, CO ₂ and Neodymium YAG (Neodymium-doped Yttrium Aluminum Garnet); Properties of laser beams: mono-chromaticity, , directionality and brightness, laser speckles, applications of lasers in engineering. Fiber optics and Applications, Types of optical fibers.	5
Unit/ Module-VII	Thermodynamics: Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st law, second law of thermodynamics and concept of Engine, entropy, change in entropy in reversible and irreversible processes.	4
		28

Text Books:

S.No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication/ Reprint
1.	Ajoy Ghatak, "Optics", Tata Mc Graw Hill.	4 th Edition	2009
2.	N. Subrahmanyam Brijlal& M. N. Avadhanulu, "Optics:", S. Chand.	24 th Edition	2010
3.	A. Beiser, "Concepts of Modern Physics", Tata Mc Graw Hill.	5 th Edition	2001
4.	Resnick, Krane, Halliday, "Physics (vol I&II)", Wiley.	5 th Edition	2007

5.	N. David Mermin, Quantum computer Science, Cambridge University Press.	1 st Edition	2007
6.	Adam Smith, "The Beginner's guide to quantum computing & mechanics", A. Smith Media.	1 st Edition	2022
7.	Frank S Crawford Jr., "Waves", The McGraw Hill Companies	Volume 3	2008
8.	Leonid V. Azaroff, "Introduction to Solids", Tata Mc Graw Hill.	31 st reprint	2008
9.	R E Sonntag, "Fundamentals of Thermodynamics", Wiley Publishers	6 th Edition	2009
10.	P K Nag, "Basic and Applied Thermodynamics", McGraw Hill Education India	2 nd Edition	2014
	Reference Books		
1.	John R. Taylor, Chris D. Zafiratos, Michael A. Dubson, "Modern Physics", Pearson Education.	1 st Edition	2007
2.	Gerd Keiser, "Optic Fiber Communication", Tata Mc. Graw Hill.	5 th Edition	2017
3.	Alastair I M Rae, Jim Napolitano, "Quantum Mechanics" Wiley.	6 th Edition	2015
4.	David J. Griffiths, "Introduction to Electrodynamics", Prentice.	3 rd Edition	2011
5.	Charles P. Poole, Jr. Frank J. Owens, "Introduction to Nanotechnology", Wiley.		2017
6.	Hug D. Young & Roger A. Freedman, "University Physics", Edition, Pearson Publication.	12 th Edition	2008
7.	Alan Giambattista, Betty Mc. Carthy Richardson, Robert C Richardson, "Fundamentals of Physics", Tata Mc Graw Hill.	1 st Edition	2009
8.	Parag Lala, "Quantum computing", Tata Mc Graw Hill.	1 st Edition	2019
9.	Nielsen, "Quantum computation and quantum information", Cambridge University Press.	1 st Edition	2007

10.	SO Pillai, "Solid State Physics", New Age International Publishers	10 th Edition	2022
11.	M. Ali Omar, "Elementary Solid State Physics", Pearson Education	5 th edition	2009
12.	NK Bajaj, "The Physics of Waves and Oscillations", Tata Mc Graw Hill.	25 th reprint	2009

DEPARTMENT OF ALLIED SCIENCES -PHYSICS

Sem

Name of Department: - Allied Sciences (Physics)

1. Subject Code: PTC105 Course Title: Physics Lab
2. Contact Hours: L: 0 T: 0 P: 2
3. Examination Duration (Hrs): T: 0 y: 2 Pra: 2
4. Relative Weight: CIE 0 PRS 25 MSE 25 ESE 0 PRE 50
5. Credits: 1
6. Semester: I
7. Category of Course: DSc
8. Pre-requisite: Basic Knowledge of Experiments in Physics

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Find the variation of Magnetic field along the axis of current carrying coil and determine Hall coefficient and energy band gap (Four-probe method) of a semi-conductor.</p> <p>CO2: Understand the phenomena of photoelectric effect and determine the Plank's constant. Also calibrate analogue instruments and determine the specific resistance.</p> <p>CO3: Apply the methods of diffraction and Interference to determine the wavelength of Laser and sodium light (Monochromatic light) and resolving power of a grating.</p> <p>CO4: Determine the parameters of optical fiber. Also determine the Stefan's Constant</p>
---------------------------	--

10. **Details of the Course:** Students have to perform any 10 experiments:

Sl. No.	Contents	Contact Hours
	<p>13. To study the variation of Magnetic field with distance along the axis of circular current carrying coil and determine the radius of the coil using Stewart and Gee tangent galvanometer.</p> <p>14. To study Hall Effect and determine Hall coefficient, Hall voltage, current density and carrier mobility of a given semi-conductor.</p> <p>15. To determine Plank's constant by photoelectric method and study the</p>	2

	<p>variation of intensity with distance.</p> <p>16. To determine the wavelength of given laser light by plane diffraction grating.</p> <p>17. To determine of wavelength of monochromatic light by Newton's Ring experiment</p> <p>18. To determine the numerical aperture and acceptance angle of an Optical fiber</p> <p>19. To determine the Stefan's Constant.</p> <p>20. To determine the wavelength of monochromatic light using Fresnal's biprism experiment.</p> <p>21. To determine the specific resistance of constantan wire using Carey Foster bridge.</p> <p>22. To determine the energy band gap of a semiconductor by Four-probe method.</p> <p>23. To determine the Resolving Power of a Plane Diffraction Grating.</p> <p>24. To calibrate ammeter and voltmeter using a potentiometer.</p> <p>Reference Books:</p> <p>(v) Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House.</p> <p>(vi) Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers</p> <p>(vii) A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.</p> <p>(viii) A Laboratory Manual of Physics for Undergraduate Classes, D.P.Khandelwal, 1985, Vani Publication.</p>	
--	---	--

DEPARTMENT OF ALLIED SCIENCES -PHYSICS

SEMESTER I / II

Name of Department: - Allied Sciences (Physics)

1. Subject Code: TPH 101/201 Course Title: Engineering Physics
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (Hrs): T 3 y Pr 0 al
4. Relative Weight: CIE 25 PRS 0 MSE 25 SEE 50 PRE 0
5. Credits: 3
6. Semester: I/II
7. Category of Course: DSC
8. **Pre-requisite:** Basic Knowledge of Physics

9.	Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Define the wave nature of light through different phenomenon.</p> <p>CO2: Extend the knowledge of Laser, fiber optics and polarization in engineering problems.</p> <p>CO3: Understand the concept of theory of relativity.</p> <p>CO4: Discuss quantum theory of radiation and applications of Schrodinger wave equations.</p> <p>CO5: Examine the behavior of superconductors and quantum computers.</p> <p>CO6: Explain the Maxwell's equations and nanomaterials.</p>
----	------------------------	---

10. **Details of the Course:**

UNIT	CONTENTS	Contact Hrs
Unit/Module-I	<p>Interference: Conditions of interference, Spatial and temporal coherence, Bi-prism, interference in wedge shaped film, Newton's rings.</p> <p>Diffraction: Fraunhofer diffraction at single slit and n-slits (Diffraction Grating). Rayleigh's criteria of resolution. Resolving power of grating.</p>	9
Unit/Module- II	<p>Polarization: Basic theory of double refraction, Malus law, Ordinary and Extra-ordinary ray, Production, and detection of plane, elliptically and circularly polarized light, specific rotation and polarimeters.</p> <p>Laser: Spontaneous and Stimulated emission of radiation, Einstein Coefficients,</p>	9

	<p>Principle of laser action. Construction and working of Ruby and He-Ne laser photovoltaic effect.</p> <p>Fiber Optics: Introduction to fiber optics; types of fiber, acceptance angle and cone angle, numerical aperture.</p>	
Unit/Module-III	<p>Special theory of relativity: Inertial and non-inertial frames, Galilean transformation, Michelson-Morley experiment (qualitatively), Einstein postulates of special theory of relativity, Lorentz transformation equations, length contraction, time dilation, variation of mass with velocity, mass-energy relation.</p>	8
Unit/ Module-IV	<p>Quantum Mechanics: Quantum concept and radiation, Wave particle duality (de-Broglie concept of matter waves), Heisenberg's uncertainty principle, wave function and its significance, Schrodinger's equations, Schrodinger's wave function for a particle confined in one dimensional infinite potential box (rigid box), Eigen values and Eigen functions.</p> <p>Quantum computers: Introduction to quantum computing, Principle, Nanocomputing, prospects and challenges.</p>	8
Unit/ Module-V	<p>Superconductivity: Essential properties of superconductors, zero resistivity, Type I, Type II superconductors and their properties.</p> <p>Electromagnetism: Displacement current, Maxwell's Equations in differential form.</p> <p>Nano Physics: Density of states, Nanostructures, fabrication, and characterization techniques (qualitatively).</p>	8
	Total	42

Text Books:

S.No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication/ Reprint
1.	Ajoy Ghatak, "Optics", Tata Mc Graw Hill.	4 th Edition	2009
2.	N. Subrahmanyam Brijlal & M. N. Avadhanulu, "Optics:", S. Chand.	24 th Edition	2010
3.	A. Beiser, "Concepts of Modern Physics", Tata Mc Graw Hill.	1 st Edition	
4.	Resnick, Krane, Halliday, "Physics (vol I&II)", Wiley.	5 th Edition	2007
5.	Robert Resnick, "Introduction to Special Relativity", Wiley Publishers.	1 st Edition	2007
6.	N. David Mermin, Quantum computer Science, Cambridge University Press.	1 st Edition	2007

7.	Adam Smith, "The Beginner's guide to quantum computing & mechanics", A. Smith Media.	1 st Edition	2022
	Reference Books	1 st Edition	
1.	John R. Taylor, Chris D. Zafiratos, Michael A. Dubson, "Modern Physics", Pearson Education.	1 st Edition	2007
2.	Gerd Keiser, "Optic Fiber Communication", Tata Mc. Graw Hill.	5 th Edition	2017
3.	Alastair I M Rae, Jim Napolitano, "Quantum Mechanics" Wiley.	6 th Edition	2015
4.	David J. Griffiths, "Introduction to Electrodynamics", Prentice.	3 rd Edition	2011
5.	Charles P. Poole, Jr. Frank J. Owens, "Introduction to Nanotechnology", Wiley.		2017
6.	Hug D. Young & Roger A. Freedman, "University Physics", Edition, Pearson Publication.	12 th Edition	2008
7.	Alan Giambattista, Betty Mc. Carthy Richardson, Robert C Richardson, "Fundamentals of Physics", Tata Mc Graw Hill.	1 st Edition	2009
8.	Parag Lala, "Quantum computing", Tata Mc Graw Hill.	1 st Edition	2019
9.	Nielsen, "Quantum computation and quantum information "Cambridge University Press.	1 st Edition	2007

Semester I/II

Name of Department: - Allied Sciences (Physics)

1. Subject Code: PPH 151/251 Course Title: Physics Lab
2. Contact Hours: L: 0 T: 0 P: 2
3. Examination Duration (Hrs): T: 0 y: 2 Practical
4. Relative Weight: CIE 0 PRS 25 MSE 25 SEE 0 PRE 50
5. Credits: 1
6. Semester: I/II
7. Category of Course: DSC
8. Pre-requisite: Basic Knowledge of Experiments in Physics

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Find the electrical and magnetic properties of materials and extend the knowledge of nanotechnology using electroplating.</p> <p>CO2: Understand the principle and characteristics of photo devices and optical fiber.</p> <p>CO3: Apply the methods of calibration to analog instruments.</p> <p>CO4: Determine the refractive index of liquid, wavelength of light and specific rotation of optically active substance through experiments based on phenomena of optics.</p>
---------------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
	<p>Students have to perform any twelve experiments:</p> <p>20. To determine the wavelength of monochromatic light by Newton's ring experiment.</p> <p>21. To determine refractive index of transparent liquid by Newton's ring experiment.</p>	2

	<p>22. To determine the specific resistance of the constantan wire using Carey-Foster's bridge.</p> <p>23. To determine the wavelength of monochromatic light using Fresnel Biprism experiment</p> <p>24. To determine the energy band gap of given semiconductor by Four-probe method.</p> <p>25. (a) To determine the wavelengths of spectral line of Mercury light using plane transmission grating. (b) To determine the wavelengths of given Laser light using plane transmission grating.</p> <p>26. To study the variation of magnetic field with distance along the axis of circular coil carrying current and to determine the radius of coil.</p> <p>27. To determine the magnetic susceptibility of a paramagnetic substance by Quincke's method.</p> <p>28. To determine the specific rotation of Sugar Solution using Half Shade Polarimeter.</p> <p>29. To study the characteristics of Solar Cell</p> <p>30. a) To calibrate Voltmeter by using potentiometer. b) To calibrate Ammeter by using potentiometer.</p> <p>31. To determine Planck's constant by photoelectric method and study the variation of intensity with distance.</p> <p>32. To determine the electro chemical equivalent of Copper.</p> <p>33. To Verify Law of Malus.</p> <p>34. To study Hall Effect and determine the hall voltage, hall coefficient, current density and carrier mobility of a given semiconductor.</p> <p>35. To determine the numerical aperture and acceptance angle of an optical fiber.</p> <p>36. To measure the refractive index of transparent liquid using Laser.</p> <p>37. To determine the dielectric constant of air.</p> <p>38. To determine wavelength of monochromatic light using Michelson interferometer.</p>	
--	---	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I and II

Name of Department: - **Chemistry**

4. Subject Code: **TCH101/201** Course Title: **Engineering Chemistry**
5. Contact Hours: L: **3** T: **0** P: **0**
6. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **3**
9. Semester: **Autumn/Spring**
10. Subject Area:
11. Pre-requisite: **Basic Knowledge of Chemistry.**

9. Course Outcome:	<ul style="list-style-type: none"> acquire knowledge of structure and properties of molecules based on bonding and spectroscopic techniques understand the chemistry of purification of water and its industrial and domestic application classify various types of polymers and their applications Interpret and distinguish between the different types of conventional and non-conventional fuels apply the basic principles of electrochemistry in different electrochemical cells, corrosion control, fuel cells and industrial applications
---------------------------	--

12. Details of the Course:

UNIT	CONTENTS	Contact Hrs
Unit - I	MOLECULAR STRUCTURE AND SPECTROSCOPIC TECHNIQUES Molecular Orbital Theory, Formation of homo and heteronuclear diatomic molecules Hydrogen Bonding and its application Metallic Bonding (Band theory) and application to conductors, semiconductors and insulators Nanoscale Materials - Properties and applications Basic Principles of spectroscopy and its applications for	8

	molecularstructure	
Unit - II	WATER TECHNOLOGY Hardness of water: Causes, Types, Measurement, Boiler troubles: Sludges, Scales and Caustic Embrittlement Softening of water by L-S Process, Zeolite Process and Reverse OsmosisProcess, Ion Exchange Process, Calgon Process Numerical Problems based on L-S Process, Zeolite Process and hardnessof water. Introduction to the membrane concept for the treatment of microplasticsfrom water	8
Unit -III	POLYMERS Polymers: Definition, degree of polymerization, functionality of monomer,Classification of polymers with examples, Types of polymerizations – addition and condensation polymerization with examples. Mechanism of addition polymerization. Plastics: Definition and characteristics- thermoplastic and thermosettingplastics, preparation, properties, and applications of PVC and Bakelite Fibers: Characteristics of fibers – preparation, properties and applicationsof Nylon and Dacron. Conducting polymers: Characteristics and Classification of conductingpolymers with examples. Biodegradable polymers: Concept and advantages – Preparation ofPolylactic acid and poly vinyl alcohol and their applications. Liquid Crystalline Polymers: Characteristics, classification with examples and their applications.	8
Unit –IV	FUELS AND RENEWABLE SOURCE OF ENERGY Fuels Definition, Classification and Characteristics of a good fuel, Calorific value and its determination by Bomb Calorimeter, Numerical problems on Bomb Calorimeter, Composition and uses of Natural gas, CNG, LPG. Renewable Energy Sources: Solar energy, wind energy, hydroelectric and geothermal. Biofuels as alternative sources of energy (biomass, biogas).	8
Unit-V	ELECTROCHEMISTRY & ITS APPLICATIONS Electrode potential, standard electrode potential, factors affecting the electrode potential of a cell. Nernst equation: Electrochemical series and its application, Electrochemical cell: Daniel cell, Concentration cells, electrolyteconcentration cell	10

	Numerical problems based on electrode potential and emf of a cell. Fuel Cells: Introduction, Principles, Classification, and application Corrosion its causes and effects, Theories of corrosion – Chemical & Electrochemical corrosion	
	Total	42

13. Suggested Books:

Text Books:

1. [Sunita Rattan](#), “ Comprehensive Engineering Chemistry”, S.K. Kataria& Sons Delhi, India, 2nd Edition (2009)
2. Shashi Chawala , “Theory and Practical’s of Engineering Chemistry”, Dhanpat Rai and Company, (Pvt) Ltd 3rd Edition (2012)
3. Jain & Jain “A text book of Engineering Chemistry,” Dhanpat Rai Publishing Company, 15th Edition New Delhi (2008)

Reference Books:

9. J.D. Lee, “ Concise Inorganic Chemistry”, 5th Edition (1996)
10. K. L. Kapoor “A text book of Physical Chemistry” Vol. 5 , Macmillan India, 1st Edition (2004)
11. Prof. K.N. Jayaveera, Dr.G.V.Subba Reddy and Dr.C. Ramachandraiah, “Chemistry for Engineers” McGraw Hill Higher Education Hyd.,(2009)
12. William Kemp, “Organic Spectroscopy”, Palgrave Foundations, (1991).
13. L.E.Foster, “Nanotechnology, Science Innovation & Opportunity”, Pearson Education, 2007.
14. Y.R. Sharma “Elementary Organic Spectroscopy: Principles and Chemical Applications”, 1st Edition,
15. F.W.Bill, Meyer, A Text book of Polymer Chemistry, 3rd Edition 2009,
16. Thirumala Chary and Laxminarayana, “Engineering Chemistry”, Scitech Publishers, Chennai (2016).

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

Name of Department: **Chemistry**

9.	Subject Code:	PCH151/251	Course Title:	Chemistry Practical
10.	Contact Hours:	L: 0	T: 0	P: 2
11.	Examination Duration (Hrs).	Practical 3		
12.	Relative Weight:	CWA 25	PRS 0	MSE 25 ESE 50 PRE 0
13.	Credits:	2		
14.	Semester:	Autumn/Spring		
15.	Subject Area:	DSC		
16.	Pre-requisite: Basic Knowledge of Experiments in Chemistry			

9. Course Outcomes:	<ul style="list-style-type: none"> Analyze the water and oil quality parameter. Understand the concept of viscosity, surface tension and their applications. Analyze the ores and bleaching powder sample Knowledge of pH metric and calorimetry and their application in industry.
----------------------------	---

10. Detailed Syllabus: Students must perform any twelve experiments:

UNIT	CONTENTS	CONTACT HRS
EXP- 1	To determine the alkalinity of the given water sample containing carbonate (CO_3^{2-}) ions and bicarbonate (HCO_3^-) ions by titrating it against standard HCl solution [N/10] using phenolphthalein and methyl orange as indicators.	2
EXP - 2	To determine the chloride ion (Cl^-) content in the given water sample by Argentometric method (Mohr's method) using N/50 AgNO_3 as a standard solution and potassium chromate (K_2CrO_4) as an internal indicator.	2

EXP-3	To determine the temporary and permanent hardness of given water sample by titrating it against standard solution of M/100 Ethylene Diamine Tetracetic Acid (EDTA) using Eriochrome black-T (EBT) as an internal indicator.	2
EXP-4	To determine the coefficient of viscosity of the given sample solution by Ostwald's viscometer (Viscosity of water = 0.0101 Poise).	2
EXP-5	To determine the ferrous ion (Fe^{++}) content in given sample solution of Mohr's salt ($\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$) by titrating it against standard N/30 potassium dichromate ($\text{K}_2\text{Cr}_2\text{O}_7$) solution by using potassium ferricyanide $\text{K}_3[\text{Fe}(\text{CN})_6]$ as an external indicator.	2
EXP - 6	To determine the surface tension of the given sample solution by drop number method	2
EXP - 7	To determine the acid value of oil	2
EXP - 8	To determine the strength of unknown HCl solution by titrating it against N/10 NaOH solution with the help of pH meter.	2
EXP - 9	Synthesis of phenol-formaldehyde resin	2
EXP – 10	To determine the alkalinity of the given water sample containing carbonate (CO_3^{2-}) ions and hydroxide (OH^-) ions by titrating it against standard HCl solution [N/10] using phenolphthalein and methyl orange as indicators.	2
EXP – 11	To determine the rate constant of a reaction	2
EXP – 12	To determine the Copper (Cu^{++}) ion content in the given sample of copper ore (blue vitriol) by titrating it against standard N/30 sodium thiosulphate solution using starch as indicator by Iodometric titration.	2
EXP - 13	Determination of adsorption isotherm of acetic acid on activated charcoal	2

Text Books:

- [Sunita Rattan](#), “Comprehensive Engineering Chemistry”, S.K. Kataria & Sons Delhi, India, 2nd Edition (2009)
- Shashi Chawala, “Theory and Practicals of Engineering Chemistry”, Dhanpat Rai and Company, India 3rd Edition (2012)

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

Name of Department: **CHEMISTRY**

9.	Subject Code:	TCH202	Course Title:	Advanced Organic Chemistry
10.	Contact Hours:	L: 3	T: 0	P: 0
11.	Examination Duration (Hrs):	Theory 3		
12.	Relative Weight:	CWA 25	PRS 0	MSE 25 ESE 50 PRE 0
13.	Credits:	3		
14.	Semester:	Autumn/Spring		
15.	Subject Area:	DSC		
16.	Pre-requisite: Basic and Advanced knowledge of Organic Chemistry			

9. Course Outcomes:	<ul style="list-style-type: none"> understand the basic knowledge of different techniques of purification of organic compound explain the reaction mechanism in organic chemistry. illustrate concepts and knowledge on nanotechnology and its application Learn and apply the concepts of analytical chemistry for sample analysis discuss the knowledge of carbohydrates and their practical application to biotechnology and engineering.
----------------------------	---

10. Details of the Course:

UNIT	CONTENTS	Contact Hrs
Unit - I	PURIFICATION OF ORGANIC COMPOUNDS Crystallization sublimation, Distillation, Fractional distillation, distillation under reduced pressure, Steam distillation, Extraction with solvent, chromatography	4

Unit - II	<p>(a) STRUCTURE OF ORGANIC COMPOUNDS</p> <p>Nature of covalent bond and its orbital representation. Hybridization, bond energy, polarity of bond & dipole moment of molecules, Isomerism</p> <p>(b) ORGANIC REACTIONS AND THEIR MECHANISM</p> <p>Bond fission, Inductive effect, hyperconjugation, electromeric, resonance effects and their significance; Types of reagents: electrophiles & nucleophiles, Reaction intermediates: carbocation, carbanion, carbenes, and free radicals- generation, properties and stability,</p> <p>(c) Addition reactions, Substitution reactions, Elimination reactions in organic chemistry. Orientation in aromatic substitution reactions</p>	<p>5</p> <p>7</p> <p>7</p>
Unit - III	<p>(a) NANOMATERIALS</p> <p>Introduction, Green nanotechnology, Synthesis of nanoparticles and its applications</p> <p>(b) GREEN CHEMISTRY</p> <p>Introduction, Twelve Principles of Green Chemistry, Adverse effects of chemicals, Practice of Green Chemistry</p>	<p>3</p> <p>3</p>
Unit - IV	<p>Analytical Chemistry: Basics and its applications</p> <p>e. Definition of Qualitative and quantitative analysis, volumetric and gravimetric analysis.</p> <p>f. Principle of volumetric analysis. Concept of pH, buffer solution and Henderson equation. Concept of strength and concentration of solution, Normality, Molarity, Molality and interconversion of strength,</p> <p>g. Types of volumetric analysis: Acid-base, Complexometric, redox and precipitation titration (Principle and examples).</p> <p>h. Principle and applications of the following methods:</p> <p>Chromatography: Introduction, principle & application of chromatography. Paper chromatography, thin layer</p>	<p>8</p>

	chromatography, column chromatography: silica and gel filtration. Thermoanalytical methods: Thermogravimetric Analysis, Thermometric Titrations Electroanalytical techniques: Electrogravimetry, Polarography and Voltametric Methods. Atomic Spectroscopy: Principle and application of atomic absorption spectroscopy and flame photometry.	
Unit - V	CARBOHYDRATES Definition, Classification, General Properties. Preparation of Glucose, its physical and chemical properties, Killiani Fischer synthesis, Ruff degradation	5
	Total	42

Textbooks:

- Morrison & Boyd "Organic Chemistry", 6th edition, Pearson education
- I.L.Finar, Organic Chemistry (Vol. I & II) 5th Edition 2009, Pearson Publication
- Bahl and Bahl, "Advanced Organic Chemistry" by S. Chand & Company Ltd.

Reference Books:

- F.W.Bill Meyer, "Text book of Polymer Chemistry, 3rd Edition 2009, W.J. Wiley India
- Advanced Organic Chemistry by Bernard Mille
- Organic Structural Spectroscopy by Joseph Lambert, Scott Gronert, Herbert Shurvell, David Lightner and Robert Graham Cooks
- L.E.Foster, "Nanotechnology, Science Innovation & Opportunity", Pearson Education, 2007.

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I & II

Name of Department: - **Department of Electrical Engineering**

1. Subject Code: **TEE101/201** Course Title: **Basic Electrical Engineering**
2. Contact Hours: L: **2** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **2**
6. Semester: **I / II**
7. Subject Area: **DSC**
8. Pre-requisite: Basic Knowledge of Physics and Mathematics

9. Course Outcome: After successful completion of this course, students will be able to:	CO1	Recall the concept of voltage, current, resistance and laws related to electricity with reference to the electrical circuits/systems.
	CO2	Understanding of fundamental laws and theorems used in the electrical circuits.
	CO3	Application of network theorems/laws in electrical circuit.
	CO4	Understanding of various electrical safety components and electrical wiring.
	CO5	Application of earthing/grounding.

10. Details of the Course:

Sl. No.	Content	Contact Hours
1	DC Circuit: Concepts of current, resistance, E.M.F., potential difference, Ohm's law, Simplifications of networks using series and parallel combinations and star-delta conversions, Kirchhoff's law, Superposition, Thevenin, Norton, Maximum Power Transfer theorem and their applications for network solutions.	10
2	Single Phase AC: Introduction of Single-Phase AC, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Single phase AC through R, L, C, and series combination of RLC.	10
3	Electrical Installations and Illumination: Wire and cables for internal wiring, switches and circuits (Two-way switch,	4

	staircase wiring, go down wiring, double pole double throw switch), type of electrical wiring, Switch Fuse Unit (SFU), MCB, MCCB, Earthing concept and methods of earthing.	
	Total	24

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
	Text Books	
1.	D.P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.	2010
2.	D.C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.	2009
3.	V. N Mittle and Arvind Mittle, “Basic Electrical Engineering” Tata McGraw-Hill Education Pvt. Ltd. (2005)	2005
	Reference Books:	
1.	L.S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.	2011
2.	V.D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.	1989
3.	E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.	2010
4	L.S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.	2011

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
------------	---------------------------	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

Name of Department: **Department of Electrical Engineering**

1. Subject Code: **PEE 151/251** Course Title: **Basic Electrical Engineering Lab**
2. Contact Hours: L: **0** T: **0** P: **2**
3. Examination Duration (Hrs): **Theory** **0** **Practical** **2**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **1**
6. Semester: **I / II**
7. Subject Area: **DSC**
8. Pre-requisite: Basic Knowledge of Experiments in Physics

9. Course Outcome: After successful completion of this course, students will be able to:	CO1 Apply the knowledge of circuit laws and theorems and verify the knowledge through practical experimentation.
	CO2 Correlate the knowledge of theoretical concepts or phenomenon in context to the real time applications of AC systems (wiring/switches/lamps etc.) and make suitable assumptions to study it through lab experiment.
	CO3 Coordinate with team members to carry out the procedure with precision.
	CO4 Report the experimental results in a professional way with practical comments on the application to field/ industry requirements.

10. Details of the Course:

Sl. No.	Contents
1.	To verify the Kirchhoff's Voltage Law (KVL) in DC Circuit.
2.	To verify the Kirchhoff's Current Law (KCL) in DC Circuit
3.	To Verify Superposition Theorem in DC Circuit.
4.	To Verify Thevenin Theorem in DC Circuit.
5.	To Verify Norton Theorem in DC Circuit.
6.	To Verify Maximum Power Transfer Theorem in DC Circuit.
7.	To find out the meter constant of a single-phase energy meter
8.	To wire for a Stair-case arrangement using a two-way switch.
9.	To measure power in a single-phase ac circuit by using wattmeter.
10.	To draw the current versus frequency characteristics in RLC series circuit.
11.	To study various electrical accessories and machines parts (cut set model)

11.	Mode of Evaluation	Viva / Mid Term Lab Exam / End Term Lab Exam
------------	---------------------------	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I (Biotech Group)

Name of Department: - **Department of Electrical Engineering**

9.	Subject Code:	EEC 101	Course Title:	Basic Electrical & Electronics Engineering		
10.	Contact Hours:	L: 3	T: 1	P: 0		
11.	Examination Duration (Hrs):	Theory 3	Practical	0		
12.	Relative Weight:	CWA 25	PRS 0	MSE 25	ESE 50	PRE 0
13.	Credits:	4				
14.	Semester:	Autumn				
15.	Subject Area:	DSC				
16.	Pre-requisite:	Basic Knowledge of Mathematics and Physics				

9. Course Outcome: After successful completion of this course, students will be able to:	CO1 Recalling the concepts of basic electric circuits and remembering the theorems to solve DC Circuits.
	CO2 Summarize the various characteristics of AC Circuits.
	CO3 Applying the concepts of magnetic circuits to understand the basic characteristics of single-phase Transformer.
	CO4 Analyzing the basics of semiconductor devices used for electronic components.
	CO5 Evaluating the basic concept of PN junction diode and its applications in rectifier circuits and DC power supply.
	CO6 Compiling Bipolar Junction Transistor (BJT) from its basic concepts and various biasing circuits.

12. Details of the Course:

Sl. No.	Contents	Contact Hours
Unit -1	D.C. Network Theory: Circuit theory concepts-KCL, KVL, mesh and node analysis, Network Theorems-Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Star Delta transformation.	07
Unit -2	A.C. Circuit Analysis: Sinusoidal and phasor representation of voltage and current, single phase a.c. circuit behavior of resistance, inductance and capacitance and their combination in series & parallel, power factor, series parallel resonance and quality factor.	07
Unit -3	Magnetic Circuits:	06

	Introduction, series-parallel magnetic circuits comparison, Eddy currents and Hysteresis losses. Single Phase Transformer: Principle of operation, classification, phasor diagram at no load, efficiency and all-day efficiency of transformer.	
Unit -4	Semiconductor Basics: Insulators, semiconductors and metals, Mobility and conductivity, Intrinsic and extrinsic semiconductors and charge densities in semiconductors, Fermi Level, current components in semiconductors, continuity equation. Junction Diode and Its Applications: PN Junction diode – characteristic and analysis, Diode Models, Rectifiers and filter circuit: Half wave, full wave and Bridge rectifier circuits and their analysis, L, C and Pi filters, Zener Diode, Basic regulator supply using Zener diode, Design of Regulator circuits. .	10
Unit –5	TRANSISTORS: Construction and characteristics of bipolar junction, transistors (BJT's)- Comm. Base, Comm. emitter, Comm. Collector configuration, Transistor biasing and bias stabilization: - the operating point, stability factor, analysis of fixed base bias, collector to base bias, Emitter resistance bias circuit and self-bias circuit.	8
	Total Hours	38

13. Suggested Books:

Sl. No.	Name of Authors/Books/Publishers	Year of Publication / Reprint
1	D.P. Kothari and I. J. Nagrath, “ Basic Electrical Engineering ”, Tata McGraw Hill.	2010
2	D.C. Kulshreshtha, “ Basic Electrical Engineering ”, McGraw Hill.	2009
3	V. N Mittle and Arvind Mittle, “ Basic Electrical Engineering ” Tata McGraw-Hill Education Pvt. Ltd.	2005
4	Jacob Millmann & Halkias, “ Integrated Electronics ”, 2 nd Edition, TMH,	2010
5	Boylestad and L. Robert and Nashelsky Louis, “ Electronics Devices and Circuits Theory ”, 9th Edition., PHI/Pearson Education.	2010

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam / Lab Exam
------------	---------------------------	---

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

Name of Department: **Department of Electrical Engineering**

10. Subject Code: **EEC 151**

Course Title:

Basic Electrical & Electronics Engineering Lab

11. Contact Hours: **L:** **0**

To

P2

12. Examination Duration (Hrs):

Theory0

Practical

2

13. Relative Weight:

CWA

PRS

MSE

ESE

PRE

14. Credits:

1

15. Semester:

Autumn

16. Subject Area:

DSC

17. Pre-requisite: Physics.

18. Course Outcomes:	CO1	Illustrate and Verification of various laws in DC circuit
	CO2	Illustrate and Verification of various theorems in DC circuit
	CO3	Demonstrate various types of diodes and their characteristics
	CO4	Analysis of various types of analog and digital electronic circuits

10. Details of the Course:

Sl. No.	Contents
1.	To verify Kirchhoff's voltage law (KVL) in D.C. circuits
2.	To verify Kirchhoff's current law (KCL) in D.C. circuits
3.	To verify superposition theorem for DC circuits.
4.	To verify Thevenin's theorem for DC circuits
5.	To verify Norton's theorem for DC circuits
6.	To verify maximum power transfer theorem in DC circuits.
7.	Study of PN junction diode and its characteristics
8.	Study of ZENER junction diode and its characteristics
9.	Study of half wave rectifier with and without capacitive filter
10.	Study of full wave rectifier with and without capacitive filter
11.	Study of BJT in CB /CE configuration
12.	Verification of basic and derived gates.
13.	Realization of basic gates through universal gates.

11.	Mode of Evaluation	Viva / Mid Term Lab Exam / End Term Lab Exam
------------	---------------------------	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I

Name of Department: - **Department of Electrical Engineering**

1. Subject Code: **TTC 104** Course Title: **Principles of Electrical Engineering**
2. Contact Hours: L: **2** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **2**
6. Semester: **I**
7. Subject Area: **DSC**
8. Pre-requisite: Basic Knowledge of Physics and Mathematics

9. Course Outcome: After successful completion of this course, students will be able to:	CO1	Recall the concept of voltage, current, resistance and laws related to electricity with reference to the electrical circuits/systems.
	CO2	Understanding of fundamental laws and theorems used in the electrical and magnetic circuits.
	CO3	Application of network theorems/laws in electrical and magnetic circuits.
	CO4	Understanding of various electrical safety components and electrical wiring.
	CO5	Application of earthing/grounding.
	CO6	Understanding of measuring devices and sensors

10. Details of the Course:

Sl. No.	Content	Contact Hours
1	Introduction: Concept of Potential difference, voltage, current, Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols in order to describe electric networks, voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff-s laws and applications to network solutions using mesh and nodal analysis, Concept of work, power, energy, and conversion of energy.	5
2	DC Circuits: Current-voltage relations of the electric network by mathematical equations to analyze the network (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem) Simplifications of networks using series-parallel, Star/Delta transformation. Superposition theorem.	6
3	AC Circuits: AC waveform definitions, form factor, peak factor, study of R-L, R-C,RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC	5

	Circuits (Δ - Δ & Δ - Δ).	
4	Magnetic Circuit and Single Phase Transformer: Magnetic circuit, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, efficiency and regulation.	4
5	Measurements and Sensors: Introduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems (Current & Single-phase power). Electrical Wiring and Illumination system, Types of Wiring System & Wiring Accessories, Necessity of earthing, Types of earthing, Safety devices & system.	4
	Total	24

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers
	Text Books
1.	<i>Electric Machinery</i> , (Sixth Edition) A. E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, Tata McGraw Hill.
2.	<i>A Textbook of Electrical Technology</i> , (vol. I), B. L. Theraja, Chand and Company Ltd., New Delhi.
3.	<i>Basic Electrical Engineering</i> , V. K. Mehta, S. Chand and Company Ltd., New Delhi.
4	<i>Theory and problems of Basic Electrical Engineering</i> , (Second Edition), J. Nagrath and Kothari, Prentice Hall of India Pvt. Ltd.
	Reference Books:
1.	<i>Basic of Electrical Engineering</i> , T. K. Nagsarkar and M. S. Sukhija, Oxford University Press. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
2.	<i>Introduction to Electrodynamics</i> , D. J. Griffiths, (Fourth Edition), Cambridge University Press.
3.	<i>Engineering Circuit Analysis</i> , William H. Hayt & Jack E. Kemmerly, McGraw-Hill Book Company Inc.
4	<i>Fundamentals of Electrical and Electronics Engineering</i> , Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd.

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
------------	---------------------------	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

Name of Department: **Department of Electrical Engineering**

1.	Subject Code:	PTC 104	Course Title:	Electrical Engineering Lab							
2.	Contact Hours:	L: 0	T: 0	P: 2							
3.	Examination Duration (Hrs):	Theory	0	Practical	2						
4.	Relative Weight:	CWA	25	PRS	0	MSE	25	ESE	50	PRE	0
5.	Credits:	1									
6.	Semester:	I									
7.	Subject Area:	DSC									
8.	Pre-requisite:	Basic Knowledge of Experiments in Physics									

9. Course Outcome: After successful completion of this course, students will be able to:	CO1	Apply the knowledge of circuit laws and theorems and verify the knowledge through practical experimentation.
	CO2	Correlate the knowledge of theoretical concepts or phenomenon in context to the real time applications of AC systems (wiring/switches/lamps etc.) and make suitable assumptions to study it through lab experiment.
	CO3	Coordinate with team members to carry out the procedure with precision.
	CO4	Report the experimental results in a professional way with practical comments on the application to field/ industry requirements.

10. Details of the Course:

Sl. No.	Contents
1.	To verify the Kirchhoff's Voltage Law (KVL) in DC Circuit.
2.	To verify the Kirchhoff's Current Law (KCL) in DC Circuit
3.	To Verify Superposition Theorem in DC Circuit.
4.	To Verify Thevenin Theorem in DC Circuit.
5.	To Verify Norton Theorem in DC Circuit.
6.	To Verify Maximum Power Transfer Theorem in DC Circuit.
7.	To find out the meter constant of a single-phase energy meter.
8.	To wire for a Stair-case arrangement using a two-way switch.
9.	To measure the power and power factor of a three-phase balanced circuit by using two wattmeter method.
10.	To draw the current versus frequency characteristics in RLC series circuit.
11.	To measure power in a single-phase ac circuit by using wattmeter.
12.	To study various electrical accessories and machines parts (cut set model)
11.	Mode of Evaluation
	Viva / Mid Term Lab Exam / End Term Lab Exam

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I/II

Name of Department: - Electronics and Communication Engineering

1. Subject Code: Course Title:
2. Contact Hours: L: T: P:
3. Examination Duration (Hrs): Theory Practical
4. Relative Weight: CIE MSE SEE
5. Credits:
6. Semester:
7. Category of Course:
8. Pre-requisite: Physics

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Remember operations on number systems and understand concepts of digital circuits.</p> <p>CO2: Understand the basics of semiconductors and PN junction diode.</p> <p>CO3: Apply the basics of PN junction diode in rectifier circuits and DC power supply.</p> <p>CO4: Analyze Bipolar Junction Transistor (BJT) from its basic concepts and biasing circuits.</p> <p>CO5: Evaluate the performance of operational amplifier (OP-amp) from its performance parameters like gain, CMRR, offset values etc.</p> <p>CO6: Design and develop various basic electronic circuits.</p>
---------------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	<p>Unit 1: Number Systems & Boolean Algebra:</p> <p>Number systems and their conversion, Logic gates, Boolean algebra, Implementation of basic gates using universal gates, Implementation of logic functions using basic gates & universal gates, SOP & POS form of logic expression, Canonical form, Conversion from SOP & POS form to canonical form, Simplification of Boolean function: Algebraic method, Karnaugh map method (two, three & four variable K-map with don't care condition).</p>	10

2	Unit 2: Basics of Semiconductor Devices: Energy band theory: Classification of solids based on energy band diagram, Semiconductors; Intrinsic semiconductors, Extrinsic semiconductors– P-type and N-type, Electrons and holes in intrinsic and extrinsic semiconductors, Mobility and conductivity, Mass action law, Charge densities in semiconductors, Drift and diffusion current, P-N Junction; Formation of depletion region, V-I characteristics of P-N junction diodes, Diode breakdown mechanism.	8
3	Unit 3: AC to DC Conversion: Introduction to DC power supply, Rectifiers circuit: Half wave, Center tapped full wave and Bridge rectifier circuits. Rectifier performance parameter analysis, Filter circuits: L, C, and Pi filters, Zener diode, Zener diode as a voltage regulator.	8
4	Unit 4: Basics of Bipolar Junction Transistor (BJT): Construction of bipolar junction transistors (BJT), NPN and PNP type transistor, Characteristics; Common base, Common emitter, Common collector configuration, Operating point.	8
5	Unit 5: Introduction to Operational Amplifiers: Introduction to integrated circuits; Advantages and limitations, Characteristics of an ideal Op-amp, Introduction of 741 IC. Inverting and non-Inverting Op-amp circuits, Summing amplifier, Difference amplifier, Voltage follower.	6
	Total	40

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Edition	Year of Publication / Reprint
	Textbooks		
1.	Jacob Millmann & Halkias, " <i>Integrated Electronics</i> ", TMH, 2 nd Edition, 2009.	2 nd	2009
2.	M. Morris Mano, Michael D. Ciletti, " <i>Digital Design</i> ", Pearson Education, 5 th Edition, 2012.	5 th	2012
	Reference Books		
1.	Boylestad and L. Robert and Nashelsky Louis, " <i>Electronics Devices and Circuits Theory</i> ", Pearson Education, 10 th Edition, 2009.	10 th	2009
2.	S. Salivahanan and S. Arivazhagan, " <i>Digital Circuits and Design</i> ", Oxford University Press, 5 th Edition, 2018.	5 th	2008

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I/II

Name of Department: - Electronics and Communication Engineering

1. Subject Code: **PEC 151/251** Course Title: **Basic Electronics Engineering Lab**
2. Contact Hours: L: **0** T: **0** P: **2**
3. Examination Duration (Hrs.): Theory **0** Practical **3**
4. Relative Weight: CIE **25** MSE **25** SEE **50**
5. Credits: **1**
6. Semester: **First/Second**
7. Category of Course: **DC**
8. Pre-requisite: **Physics**

9. Course Outcome:	After completion of the course the students will be able to: CO1: Identify and understand active & passive components along with various measuring instruments. CO2: Verify truth table of logic gates. CO3: Analyse the characteristics of diodes and transistors. CO4: Implement different electronics circuits using operational amplifier and logic gates.
---------------------------	---

10. Details of the Course:

Sl. No.	List of problems for which student should develop program and execute in the Laboratory	Contact Hours
13.	Familiarization of electronics measuring instrument and components.	2
14.	Measure the voltage and frequency using a DSO.	2
15.	Study and verification of the truth table for logic gates.	2
16.	To design and verify the truth table for logic gates using NOR gate.	2
17.	To design and verify the truth table for logic gates using NAND gate.	2
18.	Study V-I characteristics of PN junction diode and determine the static and dynamic resistance from the characteristic curve.	2
19.	Study of a Half wave rectifier circuit with and without capacitor filter.	2

20.	Study of a Centre tapped full wave rectifier circuit with and without capacitor filter.	2
21.	Study of a bridge full wave rectifier circuit with and without capacitor filter.	2
22.	Study V-I characteristics of Zener diode.	2
23.	Study the input and output characteristics of common base (CB) transistor.	2
24.	Study the input and output characteristics of common emitter (CE) transistor.	2
	Total	24
Innovative Experiments		
13.	Study the input and output characteristics of common collector (CC) transistor.	02
14.	Design and verification of Inverting and non-inverting amplifier using Op-Amp IC.	02
15.	As suggested by the concerned faculty/lab in charge.	02

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
-----	---------------------------	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I and II

Name of Department: - Mechanical Engineering

1. Subject Code: **PME 151/251** Course Title: **Workshop and Manufacturing Practices**
2. Contact Hours: L: **1** T: **0** P: **4**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** SEE **50** PRE **0**
5. Credits: **3**
6. Semester: **I**
7. Category of Course: **SEC**
8. Pre-requisite: **Basic Grammar**

- | | |
|-----------------------------|---|
| 9. Course Outcome**: | <p>After completion of the course the students will be able to:</p> <p>CO1: To identify various conventional, non-conventional and automated manufacturing techniques.</p> <p>CO2: To explain various manufacturing practices used for the production of work pieces in different shops like carpentry, welding, sheet metal etc.</p> <p>CO3: To apply the principles of manufacturing in fabrication of jobs.</p> <p>CO4: To analyze properties of different used for fabrication of jobs.</p> <p>CO5: To generate design for fabrication of jobs.</p> |
|-----------------------------|---|

**** Describe the specific knowledge, skills or competencies the students are expected to acquire or demonstrate.**

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Introduction to Manufacturing Introduction to manufacturing, 3M's of manufacturing – man, machine and material, Types of manufacturing process, Manufacturing shops – machine shop, fitting shop, carpentry shop, welding shop, sheet metal shop, black smith shop, foundry shop, Introduction to advance manufacturing, Safety and precaution in workshop.	5
2	Machine Shop: Introduction to machining process, Measuring and marking tools	4

	<p>used in machine shop, Part of lathe and drilling machine, Working principle of lathe and drilling, Tools use in lathe, Materials.</p> <p>17. To make work piece using facing and turning operation.</p> <p>18. To make work piece using step turning and thread making operation.</p>	
3	<p>Foundry Shop: Introduction to foundry, Pattern material-wood, cast iron, brass, aluminum, waxes etc., Types of patterns, Types of tools, Moulding sands – green sand, dry sand, loam sand, facing sand, etc., Sand casting-Sand preparation, mould making, melting, pouring and cleaning.</p> <p>19. To prepare mould of casting using a single piece pattern.</p> <p>20. To prepare mould of casting using a split pattern.</p>	4
4	<p>Sheet Metal Shop: Introduction to sheet metal shop, Tools use in sheet metal shop, Types of operations, Fabrication of daily use items such as funnel tray, etc.</p> <p>21. To make a funnel using sheet metal forming (Material: 24 SWG) of given dimensions.</p> <p>22. To make a square tray using sheet metal forming (Material: 24 SWG) of given dimensions.</p>	3
5	<p>Fitting Shop: Introduction to fitting, Types of tools used in fitting shop for measuring, marking, cutting etc., callipers and Vernier calliper, materials used in tools.</p> <p>23. To make a square piece of mild steel of given dimensions.</p> <p>24. To make a fitting job of given profile and dimensions.</p>	4
6.	<p>Welding Shop: Introduction to welding, Classifications of joining process, Arc welding process-power source, electrodes, edge preparation, Different types of joints. Electric arc welding, Metal inert gas welding, Tungsten inert gas welding.</p> <p>25. To prepare a butt (Single-V)/ fillet joint through electric arc welding.</p> <p>26. To prepare a butt (Single-V)/ fillet joint through TIG/MIG welding.</p>	
7.	<p>Carpentry Shop: Introduction to carpentry shop, Wood and its type, Classification of timber, Seasoning and preservation of wood, Description and applications of the various tools used in carpentry, Different joints and their practical uses.</p>	

	27.To make corner-lap/ center – lap joint. 28.To make a mild steel chisel/ nail.	
8.	Black smith shop: Introduction to black smithy shop, Tools used in black smithy shop, Types of operations, Properties of metal- ductility, malleability, strength, etc. 29.To make a square of round mild steel bar. 30.To make a mild steel chisel/ nail.	
9.	Non-conventional and Automated Manufacturing Techniques: 31.Demonstration of Non-conventional fabrication techniques-3D Printing, Laser Cutting. 32.Demonstration of Automated manufacturing techniques-CNC, Master CAM software, Application of Industrial Robot, Assemble line in Manufacturing Execution System.	
	Total	30

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I and II

Name of Department: Mechanical Engineering

11. Subject Code: **PME 153-253** Course Title: **Engineering Graphics & Design**

12. Contact Hours: L: **1** T: **0** P: **4**

13. Examination Duration (Hrs): Theory **0** Practical **3**

14. Relative Weight: CWA **25** PRS **0** M **25** **50** **0**

15. Credits: **3**

16. Semester: **Autumn/Spring**

17. Subject Area: **DSC**

18. Pre-requisite: No prerequisites

19. Course Outcomes: Upon completion of this course, students will be able to

- CO5.** Construct Engineering drawings as per BIS conventions manually and using CAD software to prepare Orthographic projections of Points and Lines.
- CO6.** Use the knowledge of Orthographic projections to represent Engineering concepts of Planes.
- CO7.** Develop Projections of Solids and lateral surfaces of solids by analyzing the given problems.
- CO8.** Construct isometric drawings after analyzing the combination of simple solids

20. Detailed Syllabus

S.L. No.	CONTENTS	Contact Hrs
1	Introduction to Computer Aided Sketching Introduction, Drawing Instruments and their uses, BIS conventions, lettering, Dimensioning and free hand practicing. Computer screen, layout of the software, standard tool bar, and description of most commonly used tool bars, navigational tools. Coordinate system and reference planes. Definitions of HP, VP, RPP& LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation	10

	of lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line convention, material conventions and lettering. Computer Aided Design(CAD) software: Modeling of parts and Assemblies.	
2	Orthographic projections of points, lines and planes: Introduction, Definitions - Planes of projection, reference line and conventions employed. First angle and Third angle projection. Projections of points in all the four quadrants. Projection of lines (located in first quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes (No application problems) Projection of planes: triangle, square, rectangle, pentagon, hexagon, and circle, planes in different positions by change of position method only (No problems on punched plates and composite plates.)	25
3	Projections of Solids: Projections of right regular prisms, pyramids and cones with axis inclined to both the planes. (Solids resting on HP only)	10
4	Development of lateral surfaces of solids: Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. Development of lateral surfaces of above solids, their truncations.	10
5	Isometric Projections: Principles of Isometric projection - Isometric Scale, Isometric Views, Conventions, Isometric views of planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice - Versa.	10
6	Demonstration of a Simple Team Design Project that Illustrates Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels.	10
CAD Softwares: 3. AUTOCAD 4. CREO 2.0		
Total		75

12. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
Text Books		
1.	Engineering Graphics- K.R. Gopalakrishna, 32 nd edition, - Subash Publishers, Bangalore.	2005
2.	Computer Aided Engineering Drawing – S. Trymbaka Murthy, - International Publishing house Pvt. Ltd., New Delhi, 3 rd revised edition.	2006
Reference Books		
1.	Engineering Drawing- N.D. Bhatt and V.M. Panchal, 48 th edition, Charotar publishing House, Gujarat.	2005

GRAPHIC ERA (DEEMED TO BE UNIVERSITY) DEHRADUN
SEMESTER I

Name of Department: **Biotechnology**

**FUNDAMENTALS OF
MEDICAL**

13. Subject Code: **TBT 101** Course Title:

14. Contact Hours: L: **2** T: **1** P: **0**

15. Examination Duration (Hrs): Theory **3** Practical **0**

16. Relative Weight: CIE **25** PRS **0** MSE **25** SEE **50** PRE **0**

17. Credits: **3**

18. Semester: **I**

19. Subject Area: **SEC**

20. Pre-requisite: Basic Science.

21. Course Objectives: The objective of this course is to provide a basic understanding of biological mechanisms of living organisms from the perspective of engineers. In addition, the course is expected to encourage engineering students to think about solving biological problems with engineering tools.

22. Course Outcome:

Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Learn about human microflora and understand basic mechanism of action of various medically important bacterial microbes</p> <p>CO2: know basic mechanism of action of various medically important fungal and Viral infections and their diagnostic procedures.</p> <p>CO3: Understanding the concept of immune system and their correlation with Microbes.</p> <p>CO4: Utilize biotechnology tools in medical therapeutic and summarize the diagnostic techniques for common human diseases.</p> <p>CO5: understanding of good laboratory practices followed in medical biotechnology laboratory.</p>
------------------------	---

23. Details of the Course:

UNIT	Contents	Contact Hours

Unit - I	Commensal & Pathogenic Bacteria Normal microflora of human body: Skin, Respiratory system and Genitourinary tracts. Source of infection, mode of spread and portals of entry. Common pathogenic bacteria: Introduction of morphology, characterization, pathogenicity, lab diagnosis, prophylaxis of <i>Staphylococcus</i> , <i>Streptococcus</i> , <i>Neisseria</i> , <i>Corynebacterium</i> , <i>Bacillus</i> , <i>Clostridium</i> , <i>Mycobacteria</i> , <i>Hemophilus</i> , <i>Escherichia coli</i> , <i>Pseudomonas</i> .	8
Unit - II	Introduction to Pathogenic Fungi & Viruses Fungi: Introduction to morphology, symptoms, lab diagnosis and prevention of Mycoses. Viruses: Morphology, pathogenicity, prophylaxis, Diagnosis of viruses: Herpes, viruses, Orthomyxxovirus, Polio viruses, Hepatitis viruses; Rabies viruses, Human immunodeficiency viruses, COVID -19 viruses.	8
UNIT III	Immunology Components of Immune system: Types of immunity, barriers of natural immunity, cells and organs of immune system, properties of antigen and antibody, interaction of antigens with various immune cells and organs, types of antibodies and their significance in host-pathogen interaction.	8
Unit – IV	Management and Quality Control of Medical Biotechnology Laboratory Specimen Collection: Collection of clinical specimens from patients, clinics, hospitals, for diagnosis and processing, training of medical biotechnologist to handle epidemics. Quality Control: Selective cultural media, identification by special tests, biochemical reactions and sero-typing of pathogenic bacteria. Antibiotic susceptibility testing, its interpretation and reporting. Hospital infection control: Quality control in diagnostic microbiology, National programmer for control of infectious diseases.	10
Unit –V	Applications of Medical Biotechnology Tools and techniques: Hybridoma technology, biopharming-subunit vaccines, DNA vaccines, recombinant vaccines, therapeutic enzymes, basic biomedical tools in diagnosis, treatment, prevention of diabetes (Insulin production), cancer (Detection of cancer antigens), transplantation.	8
	TOTAL LECTURES	42

24. Suggested Books:

S.No.	Name of Authors/Books/Publishers	Year of Publication/ Reprint
	Text Books	
1.	Microbiology 10th Edition. Prescott, L.M.; Harley, J.P. and Klein, D.A. (2013) McGraw-Hill Education; USA.	2017
2.	Biology for Engineers. GK Suraishkumar, Oxford Higher Education, Oxford University Press.	2019
3.	Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004	2004
4.	Kuby Immunology. Thomas J. Kindt, Barbara A. Osborne,, Richard Goldsby. W. H. Freeman, 8 th edition	2018
5.	Ananthanarayan and Paniker's Textbook of Microbiology, The Orient Blackswan; 10th edition.	2017
	e- Resources	
1.	NDL.... https://ndl.iitkgp.ac.in/homestudy/science	2020
2.	https://epgp.inflibnet.ac.in/ (e PG-Pathshala)	2020
3.	http://ugcmoocs.inflibnet.ac.in/ (UGC Moocs)	2020
4.	https://swayam.gov.in/ (Swayam)	2020

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER II

Name of Department: - HUMANITIES AND SOCIAL SCIENCES

1. Subject Code: **TTC 203** Course Title: **Fundamentals of Economics**
2. Contact Hours: L: **2** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **25** PRS **0** MSE **25** SEE **50** PRE **0**
5. Credits: **2**
6. Semester: **II**
7. Category of Course: **DC**
8. Pre-requisite: Basic Knowledge of Economics

9. Course Outcome:	<p>After completion of the course the students will be able to:</p> <p>CO1: Define the basic principles of microeconomics and macroeconomics theory.</p> <p>CO2: Understand the efficiency and equity implications of market interference, including government policy.</p> <p>CO3: Demonstrate the factors determining gross domestic product, employment, the general level of prices, and interest rates in the economy.</p> <p>CO4: Analyze economic problems and prescribe solutions.</p> <p>CO5: Evaluate how economic concepts can be applied to analyze real life situations.</p> <p>CO6: Create ability to comprehend the interaction between domestic economy and the rest of the world.</p>
---------------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	Principles of Demand and Supply – Supply Curves of Firms – Elasticity of Supply; Demand Curves of Households – Elasticity of Demand; Equilibrium and Comparative Statics (Shift of a Curve and Movement	8

	along the Curve); Welfare Analysis – Consumers’ and Producers’ Surplus – Price Ceilings and Price Floors.	
2	Consumer Behaviour – Axioms of Choice – Budget Constraints and Indifference Curves; Consumer’s Equilibrium – Effects of a Price Change, Income and Substitution Effects -Derivation of a Demand Curve; Applications – Tax and Subsidies – Intertemporal Consumption – Suppliers’ Income Effect.	9
3	Theory of Production – Production Function and Iso-quants – Cost Minimization; Cost Curves – Total, Average and Marginal Costs – Long Run and Short Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly and Monopolistic Competition.	9
4	National Income and its Components – GNP, NNP, GDP, NDP; Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector – Taxes and Subsidies; External Sector – Exports and Imports.	9
5	Money – Definitions; Demand for Money -Transactionary and Speculative Demand; Supply of Money – Bank’s Credit Creation Multiplier; Integrating Money and Commodity Markets – IS, LM Model; Business Cycles and Stabilization – Monetary and Fiscal Policy – Central Bank and the Government; The Classical Paradigm – Price and Wage Rigidities – Voluntary and Involuntary Unemployment.	10
	Total	45

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers/Place of Publication	Edition	Year of Publication / Reprint
	Textbooks		
1.	N. Gregory Mankiw- Economics: Principles and Applications, Cengage Learning India Private Limited.	4 th Edition	2007
2.	Karl E. Case and Ray C. Fair-Principles of Economics, Pearson Education Inc.	8 th Edition	2007
3.	H.L.Ahuja -Principles of Microeconomics,S Chand Publications.	22 th Edition	2016
4.	F.Dornbusch & J. Startz- Macroeconomics, McGraw Hill.	7 th Edition	2010

6.	H.L. Ahuja- Macroeconomics Theory and Policy, S Chand Publications.	20 th Edition	2016
	Reference Books		
1.	A.Koutsoyiannis- Modern Microeconomics, Macmillan Education U.K.	2 nd Edition	1979
2.	M. L. Jhingan -Macro Economic Theory, McGraw Hill.	13 th Edition	2016
3.	N.G. Mankiw- Macroeconomics, Worth Publishers.	7 th Edition	2010

12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam
-----	---------------------------	--

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I/II

Name of Department: - Environmental Science

1. Subject Code: **TEV 101/201** Course Title: **Environmental Science**
2. Contact Hours: L: **2** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CIE **-** PRS **-** MSE **-** SEE **100** PRE **-**
5. Credits: **0**
6. Semester: **I**
7. Category of Course: **Value Addition Course**
8. Pre-requisite: **General Science**

9. Course Outcome**:	After completion of the course the students will be able to: 1. Create environmental awareness and knowledge. 2. Encourage participation in environmental conservation practices. 3. Develop critical thinking and apply those to the analysis of a problem or question related to the environment. 4. Evaluate impact of various human induced activities on the environment. 5. Design possible solutions to the real environmental problems. 6. Apply research and innovation related with different aspects of environmental science.
-----------------------------	---

10. Details of the Course:

S.No.	Contents	Contact Hours
1	Environmental Science and Ecosystem a. Definition of Environmental Science, multidisciplinary nature, Objective, scope and importance. b. Concept of an ecosystem, structure and function, energy flow, ecological succession, food chains, food webs, ecological pyramids. c. Introduction, types, characteristic features, structure and	8

	<p>function of the following ecosystem:</p> <ul style="list-style-type: none"> • Forest ecosystem • Grassland ecosystem • Desert ecosystem • Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) 	
2	<p>Natural Resources and Biodiversity</p> <p>a. Renewable and non- renewable resources.</p> <p>b. Natural resources and associated problems:</p> <ul style="list-style-type: none"> • Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests and tribal people. • Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams – benefits and problems, water conservation, rainwater harvesting, watershed management. • Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. • Food Resources: World food problems, Changes in land use by agriculture and grazing, Effects of modern agriculture, Fertilizer/ pesticide problems, Water logging and salinity • Energy Resources: Increasing energy needs, Renewable/ non renewable, Use of Alternate energy sources, urban problems related to energy, Case studies • Land Resources: Land as a resource, land degradation, man-induced land-slides, soil erosion and desertification, wasteland reclamation <p>c. Role of an individual in conservation of natural resources, equitable use of resources for sustainable lifestyles.</p> <p>d. Definition of biodiversity, levels of biodiversity, value of biodiversity, threats to biodiversity (habitat loss, poaching of wildlife, man-wildlife conflicts).</p> <p>e. Biodiversity at global, national and local levels, India as a biodiversity nation, biogeographical classification of India, hotspots of biodiversity.</p> <p>f. Endangered and endemic species of India.</p> <p>g. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.</p>	16
3	<p>Environmental Pollution</p> <p>a. Definition, causes, effects and control measures of Air Pollution, water pollution, soil pollution, marine pollution noise pollution, thermal pollution, nuclear hazards.</p> <p>b. Solid waste Management: causes, effects and control measures</p>	8

	<p>of urban and industrial wastes.</p> <p>c. Role of an individual in prevention of pollution, pollution case studies, pollution case studies.</p>	
4	<p>Important Environmental and Social Issues, Management and Legislation</p> <p>a. Climate change, global warming, acid rain, Ozone layer depletion, nuclear accidents and holocaust. Case studies.</p> <p>b. Sustainable development, Resettlement and rehabilitation of people (its problems and concerns, case studies), Environmental ethics (issues and possible solutions), consumerism and waste products.</p> <p>c. Disaster management: floods, earthquake, cyclone and landslides.</p> <p>d. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act.</p>	4
	Total	36

11. Suggested Books:

S.No.	Name of Authors/Books/Publishers/Place of Publication	Edition
	Textbooks	
1.	Deswal, S. & Deswal A.: A Basic Course in Environmental Studies; Dhanpat Rai & Co.	2013
2	Srivastava Smriti: Environmental Studies; Katson books.	2007
3.	Textbook for Environmental Studies	2004
	Reference Books	
1.	Joseph K. & Nagendran R.: Essentials of Environmental studies; Pearson Edition	2005
2.	Santra S. C., Environmental Science; Central Book Agency.	2011

GRAPHIC ERA (DEEMED TO BE UNIVERSITY), DEHRADUN

SEMESTER I

Name of Department: - Professional Communication

- | | | | | | | | | | |
|----|-----------------------------|----------------------------|---------------|-----------------------------------|----------|------------|-----------|------------|-----------|
| 1. | Subject Code: | THU 101 | Course Title: | Professional Communication | | | | | |
| 2. | Contact Hours: LTP: | 2 | 0 | 0 | | | | | |
| 3. | Examination Duration (Hrs): | Theory | 3 | 0 | | | | | |
| 4. | Relative Weight: | CWA | 25 | PRS | 0 | MSE | 25 | ESE | 50 |
| 5. | Credits: | 2 | | | | | | | |
| 6. | Semester: | Autumn | | | | | | | |
| 7. | Subject Area: | Ability Enhancement | | | | | | | |
| 8. | Pre-requisite: | Basic Grammar | | | | | | | |

9. Course Outcome:	<ul style="list-style-type: none">• Comprehend grammatical rules so that it is easier to converse and write in correct English.• Enhance their speaking skills through improvement in their vocabulary.• Develop an understanding of effective nonverbal expressions and speaking skills which will instill in them the confidence of a good speaker.• Demonstrate advanced interpersonal communication, business etiquette and relationship building skills.• Use the skills and knowledge of communication in their professional life and in career building exercise.
---------------------------	--

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1	FUNCTIONAL GRAMMAR Sentence correction based on Nouns, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction, Modals and Tenses	10
2	REMEDIAL ENGLISH Subject-Verb Agreement, Modifiers, Avoiding Indianism	4
3	VERBAL COMMUNICATION Introduction to effective communication, Evolution, Principles, Barriers, Communication based on Formality, Media and Party, Role play: Mock Sessions	5

4	NON-VERBAL COMMUNICATION Characteristics, Components: Paralanguage, Kinesics and Proxemics	5
5	CORPORATE COMMUNICATION Memo writing, Notice and Report writing, Agenda and Minutes of the meeting	6
	Total	30

11. Suggested Books:

SL. No.	Name of Authors/Books/Publishers	Year of Publication/Re print
	Textbooks	
1.	Chetananand Singh, <i>English Is Easy</i> , BSC Publishing Co. Pvt. Ltd. III Edition	2018
2.	Sanjay Kumar and Pushp Lata, <i>Communication Skills</i> , Oxford University Press, II Edition	2015
3.	R. P. Singh, <i>Professional Communication</i> , Oxford University Press	2015 (Impression: 2022)
	Reference Books	
1.	Wren & Martin (Dr. N.D.V. Prasada Rao), <i>English Grammar and Composition</i> , Blackie Let Publishing (S. Chand), Multicolor Edition	2022
2.	Technical Communication by Meenakshi Raman and Sangeeta Sharma-Oxford University Press, IV Edition	2022
12.	Mode of Evaluation	Test / Quiz / Assignment / Mid Term Exam / End Term Exam

Course Title: Advanced Professional Communication

Subject Code: THU-201

1. Contact Hours: 30 hours

	L	T	P:
2. Semester: II	2	0	0

3. Mode of Examination: Written

Course Outcomes: After completion of the course students will be able to:

- CO1. Understand the significance of impressive and word limited writing.
- CO2. Apply the writing skills into writing for employment and for corporate communication.
- CO3. Evaluate and assess the speaking patterns of self and others to excel in interviews and extemporaneous speaking.
- CO4. Analyse the impact of interpersonal skills in communication.
- CO5. Create a distinctive idea of listening and negotiating by applying the oral and verbal communication skills

	CONTENTS	Practical work	Contact Hrs
	Unit – I <i>Writing Skills</i> Précis writing: Do's and don'ts Paragraph Writing –Descriptive, Imaginative, Analytical and informative (150 words) Story Writing (300 words)	1) Exercises to be given to instill in the students the précis skills. 2) Making it mandatory for students to read good easy books, autobiographies, newspaper	6
	Unit II <i>Technical Writing</i> CV/Resume Job Application Letter E-mails	1) Teach the students the components that make a CV. 2) Elucidate the importance of writing a perfect cover letter. 3) Making the students understand the need of emails.	5
	Unit III	1) Mock interview sessions to be conducted as	6

	<p>Soft Skills-I</p> <p>Interviews- definition, purpose, preparation, types, do's and don'ts simulation exercise Extempore speaking: simulation exercises Transitive/linking words. JAM session: simulation exercise</p>	<p>part of practical exercise. Giving students the feedback of their limitations.</p> <p>2) Showing some good videos on interview, available on net.</p> <p>3) Making all students to deliver a talk of their choice. This must be done as a surprise class task, to assess the speakers' ability to speak. Corrections to be done without discouraging the speakers.</p> <p>4) Hold JAM competition at class level, Reward the good speakers and organize inter-departmental sessions to encourage maximum participation. Every student must be encouraged to speak in JAM.</p>	
	<p>Unit IV</p> <p>Soft Skills-II</p> <p>Group discussion: definition, purpose, organization, do's and don'ts, qualities judged, types of topics, simulation exercise Presentation skills: process, components, principles, effective skills, methods of speaking, audience analysis, importance.</p>	<p>1) Group discussion sessions must be done regularly. Urge each student to give his/her opinions on the subject being discussed. Let there be peer evaluation of the performance. Allot marks at the end of each GD Session. This will encourage the students to speak.</p> <p>2) Apprise the students of the methods of delivery of any presentation along with the different styles of starting a ppt.</p>	8
	<p>Unit V</p> <p>Soft Skills-III</p> <p>Listening Skills: Importance, barriers to effective listening, approaches, being better listeners. Negotiation Skills: Importance, approaches, preparations, role plays (Laboratory component)</p>	<p>1) Make the students aware of the importance of listening and negotiating in communication.</p>	5
	Total		30

Textbooks:

- Technical Communication by Meenakshi Raman and Sangeeta Sharma- Oxford University Press
- Professional communication by R.P. Singh –Oxford
- Business communication by M.K. Sehgal and Vandana Khetrapal-Excel books
- Technical communication by Malti Agarwal- Krishna Educational

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

Semester 1

Business Communication & Value Science - I

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

Course ID:

1.6 (Year 1 Semester 1)

	Leadership Oriented Learning (LOL)		
Nature of Course		Behavioral	
Pre requisites		Basic Knowledge of high school English	
Course Objectives:			
1	Understand what life skills are and their importance in leading a happy and well-adjusted life		
2	Motivate students to look within and create a better version of self		
3	Introduce them to key concepts of values, life skills and business communication		
Course Outcomes:			
Upon completion of the course, students shall have ability to			
C1.6.1	Recognize the need for life skills and values		[U]
C1.6.2	Recognize own strengths and opportunities		[U]
C1.6.3	Apply the life skills to different situations		[AP]
C1.6.4	Understand the basic tenets of communication		[U]
C1.6.5	Apply the basic communication practices in different types of communication		[AP]
Course Contents:			
<ul style="list-style-type: none">• Overview of the course with immersion activity• Overview of biz communication• Self-awareness, confidence and communication• Essentials of Business communication			

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

Semester 1

<ul style="list-style-type: none">• Application of communication skills• Application of Life Skills• Assignment			
Total Hours:			65
Text Books:			
	There are no prescribed texts for Semester 1 – there will be handouts and reference links shared.		
Reference Books:			
1	English vocabulary in use – Alan Mc’carthy and O’dell		
2	APAART: Speak Well 1 (English language and communication)		
3	APAART: Speak Well 2 (Soft Skills)		
4	Business Communication – Dr. Saroj Hiremath		
Web References:			
1	Train your mind to perform under pressure- Simon sinek https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-under-pressure-capture-your-flag/		
2	Brilliant way one CEO rallied his team in the middle of layoffs https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-before-numbers.html		
3	Will Smith's Top Ten rules for success https://www.youtube.com/watch?v=bBsT9omTeh0		
Online Resources:			
1	https://www.coursera.org/learn/learning-how-to-learn		
2	https://www.coursera.org/specializations/effective-business-communication		
Assessment Methods & Levels (based on Blooms’ Taxonomy)			
Formative assessment (Max. Marks:20)			
Course Outcome	Bloom’s Level	Assessment Component	Marks
C1.6.1	Understand	Immersion (interview)	5
C1.6.2	Understand	Create Resume	4

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

Semester 1

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

Lesson Plan

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

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

Semester 1

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

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

Semester 1

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

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

Semester 1

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

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

Semester 1

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

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

Semester 2

Semester II

BUSINESS COMMUNICATION & VALUE SCIENCE – II

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 3 Hrs./Week	Semester Examination: 50 marks	4
Practical: 7 Hrs. / Week	Continuous Assessment: Yes	
Lab: 7 Hrs. / Week	Term Work: 50 marks	

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

Semester 2

Course ID:

1.6 (Year 1 Semester 2)

	Leadership Oriented Learning (LOL)	
Nature of Course	Behavioral	
Pre requisites	Basic Knowledge of English (verbal and written) Completion of all units from Semester 1	
Course Objectives:		
1	Develop effective writing, reading, presentation and group discussion skills.	
2	Help students identify personality traits and evolve as a better team player.	
3	Introduce them to key concepts of a) Morality b) Behavior and beliefs c) Diversity & Inclusion	
Course Outcomes: Upon completion of the course, students shall have ability to:		
C2.6.1	Understand tools of structured written communication	[U]
C2.6.2	Use tools of structured written communication	[AP]
C2.6.3	Use electronic/social media to share concepts and ideas	[AP]
C2.6.4	Develop materials to create an identity for an organization dedicated to a social cause	[C]
C2.6.5	Understand the basics of presentation	[U]
C2.6.6	Apply effective techniques to make presentations.	[AP]
C2.6.7	Assess presentations based on given criteria	[E]
C2.6.8	Understand tools for quick reading.	[U]
C2.6.9	Apply the basic concept of speed reading, skimming and scanning.	[AP]
C2.6.10	Identify individual personality types and role in a team.	[U]
C2.6.11	Recognize the concepts of outward behavior and internal behavior	[AP]

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

Semester 2

C2.6.12	Understand the basic concepts of Morality and Diversity	[U]
C2.6.13	Create communication material to share concepts and ideas	[C]
C2.6.14	Argue on a topic based on morality and diversity	[E]
C2.6.15	Articulate opinions on a topic with the objective of influencing others	[C]
C2.6.16	Organize an event to generate awareness and get support for a cause	[C]

Course Contents:

- Identification of common errors in written communication and ways of rectification
- Understanding speed reading techniques – Skimming and Scanning
- Application of reading and writing skills
- Analyzing personality traits and team player style
- Understanding the concepts of Morality, Diversity and Inclusion
- Application of these concepts
- Creation of communication material
- Experiencing diversity and organizing events to support inclusion
- Assignment – Assimilation of concepts and present them effectively

Total Hours: 61

Text Books:

There are no prescribed texts for Semester 2 – there will be handouts and reference links shared.

Reference Books:

1	Guiding Souls : Dialogues on the purpose of life; Dr. A.P.J Abdul Kalam ;Publishing Year-2005; Co-author--Arun Tiwari
2	The Family and the Nation; Dr. A.P.J Abdul Kalam; Publishing year: 2015; Co-author: Acharya Mahapragya
3	The Scientific India: A twenty First Century Guide to the World around Us; Dr. A.P.J Abdul Kalam; Publishing year: 2011; Co-author- Y.S.Rajan
4	Forge Your Future: Candid, Forthright, Inspiring ; Dr. A.P.J Abdul Kalam; Publishing year: 2014
5	Abundance: The Future is Better Than You Think; Peter H. Diamandis and Steven Kotler; Published: 21 Feb, 2012; Publisher: Free Press
6	Start With Why: How Great Leaders Inspire Everyone to Take Action; Simon Sinek; Published: 6 October 2011; Publisher: Penguin

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

Semester 2

7	Advertising & IMC: Principles and Practice; Sandra Moriarty, Nancy D. Mitchell, William D. Wells; Published: 15 June 2016; Publisher: Pearson Education India
---	---

Web References:

1	ETHICS FUNDAMENTALS AND APPROACHES TO ETHICS https://www.eolss.net/Sample-Chapters/C14/E1-37-01-00.pdf
2	A Framework for Making Ethical Decisions https://www.brown.edu/academics/science-and-technology-studies/framework-making-ethical-decisions
3	Five Basic Approaches to Ethical Decision- http://faculty.winthrop.edu/meelerd/docs/rolos/5_Ethical_Approaches.pdf

Online Resources:

1	https://youtu.be/CsaTslhSDI
2	https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M
3	https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y
4	https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtu.be
5	https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtu.be

Assessment Methods & Levels (based on Bloom's Taxonomy)

Formative assessment (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C1.6.1	Understand	Immersion (interview)	5
C1.6.2	Understand	Create CV	4
C1.6.3	Apply	Group Assignment- Form an NGO	5
C1.6.4	Understand	Group activities	3
C1.6.5	Create	Create and present a street play to articulate and amplify the social cause.	3

Summative Assessment based on End Semester Project

Bloom's Level		
Understand		50
Apply		

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

Semester 2

Analyze	Written Assessment, project and group discussion	
---------	--	--

Lesson Plan

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
1			Icebreaker. 1) Participate in 'Join Hands Movement'. Individual identification of social issues.2) Each Individual chooses one particular social issue which they would like to address. 3) Class to be divided in teams for the entire semester. All activities to be done in teams and the grades, credit points will be captured in the leader board in the class room.4) Theory to introduce the participant Slam book to be used for capturing individual learning points and observations.	Group discussion, Practical	60 Minutes
1	Understand tools of structured written communication	Understand	Research on the social cause each group will work for.	Practical (practical)	90 Minutes
1	Use tools of structured written communication	Understand	Class discussion- Good and Bad Writing. Common errors, punctuation rules, use of words.	PPT, Theory and Practical	90 Minutes
			Group Practical – As a group, they will work on the social		

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

Semester 2

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
1			issue identified by them. Research, read and generate a report based on the findings. (Apply the learning and recap from the session)	Formative evaluation	70 Minutes
1	Create communication material to share concepts and ideas	Create	Practical: Plan and design an E Magazine. Apply and assimilate the knowledge gathered from Sem-1 till date. Share objective & guideline. All members to contribute an article to the magazine, trainer to evaluate the content.	Practical (Practical)	120 Minutes
1	Understand tools for Lucid writing	Understand	Lucid Writing: Encourage the students to go through the links given about Catherine Morris and Joanie McMahon's writing techniques.	Theory and Discussion	30 mins
1	Create communication material to share concepts and ideas	Create	Create the magazine	Practical (Lab)	90 Minutes
1		Understand	SATORI – Participants share the personal take away acquired from GD, writing and reading skills activities captured in their handbook. Share the most important learning points from the activities done so far and how that learning has brought a change.	Theory/Discussion	60 Minutes

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

Semester 2

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
1	Use electronic/social media to share concepts and ideas	Apply	Launching an E Magazine.	Practical (Lab)	120 Minutes
1			Quiz Time	Summative Evaluation for Unit	60 Minutes
Unit 2					
2	Develop materials to create an identity for an organization dedicated to a social cause	Create	Each group will form an NGO. Create Vision, Mission, Value statement, tagline and Design a logo.	Practical and Practical	90 Minutes
2	Understand the basics of presentation	Understand	Introduction to basic presentation skills & ORAI app	Theory and video	60 Minutes
2	Apply effective techniques to make presentations.	Apply	Groups to present their NGOs. Apply the learning gathered from session 2. Presentation to be recorded by the groups. feedback from the audience/ Professor	Formative evaluation	60 Minutes
2	Assess presentation based on given criteria	Evaluate	Group to come back and share their findings from the recording. Post work-individual write up to be written and evaluated for the E- magazine	Sharing of learning, written Practical and formative evaluation	60 Minutes & 60 Minutes
2	Create communication material to	Create	Prepare and publish the Second episode of the E Magazine.		

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

Semester 2

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
	share concepts and ideas Use electronic/social media to share concepts and ideas	Apply		Practical (Lab)	120 minutes
2	Understand the tools for speed reading. Apply the basic concepts of speed reading, skimming and scanning.	Understand Apply	Speed Reading session: Introduction to skimming and scanning; practice the same.	Theory and Practical	30 Minutes
2		Understand	SATORI – Join the dots- Participants to connect their learning gathered from AIP Unit-2 with their existing curriculum	Share the most important learning points	60 Minutes
2			Quiz Time	Summative Evaluation for Unit	60 Minutes
Unit 3					
3	Develop materials to create an identity for an organization dedicated to a social cause	Create	Ad campaign- Brain storming session- Students to discuss and explore the means of articulating and amplifying the	Discussion	60 Minutes

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

Semester 2

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			social issue their NGOs are working for.		
3	Create communication material to share concepts and ideas.	Create	Design a skit- a) write the script articulating the message of their respective NGOs. Read out the script. (Skit time- 5 minutes). Feedback of Theory.	Practical based learning. Formative evaluation by Theory	a) 30 Minutes b) 60 Minutes
3	Use electronic/social media to share concepts and ideas	Apply Apply	Promote the play through a social media and gather your audience. Enact the play. Capture the numbers of likes and reviews. Theory to assign grades to individual team.	Practical based learning Formative Evaluation	Lab Time: 90 Minutes Class Time: 60 Minutes
3	Identify individual personality types and role in a team.	Understand	(1) Theory to find out from the participants their views, observations and experiences of working in a team (2) Intro of Dr. Meredith Belbin and his research on team work and how individuals contribute.	Discussion and Theory	60 Minutes
3	Identify individual personality types and role in a team.	Understand	Cont. (3) Belbin's 8 Team Roles and Lindgren's Big 5 personality traits. (4) Belbin's 8 team player styles	Practical based learning followed by a presentation	40 Minutes
	Identify individual				

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

Semester 2

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
3	personality types and role in a team.	Understand	(1) Team Falcon Practical to identify individual personality traits with Belbin's 8 team player styles	Practical based learning followed by a presentation.	(1 &2) 40 Minutes
3	Recognize the concepts of outward behavior and internal behavior	Understand	(2) Similar personality types to form groups (3) Groups present their traits.	Presentation	(3) 60 minutes
3	Create communication material to share concepts and ideas. Use the electronic/social media to share concepts and ideas	Create Apply	Prepare and publish the third episode of the E Magazine.	Practical	60 Minutes
3		Understand Understand	SATORI – (join the dots with participants personal life) Participants share the personal take away acquired from working in teams, GD, learning about presentations, presenting their NGOs	Share the most important learning points from the activities done so far. Participants talk about the changes they perceive in themselves	60 Minutes
3			Quiz Time	Summative Evaluation for Unit	60 Minutes
Unit 4					
	Understand the basic concepts		Ten minutes of your time – a short film on diversity. Play		

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

Semester 2

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
4	of Morality and Diversity	Understand	the video (link to be attached in the FG)	Video & discussion	30 Minutes
4	Understand the basic concepts of Morality and Diversity	Understand	Discuss key take away of the film. Theory to connect the key take away of the film to the concept of empathy.	Practical	30 Minutes
4	Understand the basic concepts of Morality and Diversity	Understand	Touch the target (Blind man) - Debriefing of the Practical. Film: "The fish and I" by Babak Habibifar" (1.37mins)	Practical and discussion	60 Minutes
4	Create communication material to share concepts.	Create	Groups to create a story – 10 minutes of a person's life affected by the social issue groups are working on. Narrate the story in first person. Feedbacks to be shared by the other groups.	Practical, sharing and Practical	120 Minutes
4	Understand the basic concepts of Morality and Diversity	Understand	Research on a book, incident or film based on the topic of your respective NGO	Research and written Practical	120 Minutes
4	Create communication material to share concepts.	Create	Write a review in a blog on the topics they are covering in their research. Theory will give grades to each team.	Written Practical and Formative Evaluation	60 Minutes

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

Semester 2

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
4	Understand the basic concepts of Morality and Diversity	Understand	Session on Diversity & Inclusion- Different forms of Diversity in our society.	PPT, Theory, discussion	60 Minutes
4	Create communication material to share concepts.	Create	Teams to video record interviews of people from diverse groups (Ask 5 questions). Share the recordings in FB	Practical	120 Minutes
4	Argue on a topic based on morality and diversity	Evaluate	Debate on the topic of diversity with an angle of ethics, morality and respect for individual (In the presence of an external moderator). Groups will be graded by the professor.	Practical and formative evaluation	60 Minutes
4	Articulate opinions on a topic with the objective of influencing others	Create	Prepared speech- Every student will narrate the challenges faced by a member of a diverse group in 4 minutes (speech in first person). Theory to give feedback to each student.	Practical and formative Evaluation	90 Minutes
4	Understand the basic concepts of Morality and Diversity	Understand	Discussion on TCS values, Respect for Individual and Integrity.	PPT, Theory, Practical and discussion	60 Minutes
4	Create communication material to share concepts and ideas.	Create Apply	Prepare and publish the final episode of the E Magazine.	Practical	120 Minutes

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

Semester 2

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
	Use the electronic/social media to share concepts and ideas				
4		Understand	SATORI –Participants share the personal take away acquired from working in teams, GD, learning about presentations and understanding diversity inclusion.	Discussion	60 Minutes
4	Use tools of structured written communication	Apply	Revisit your resume Include your recent achievements in your resume.	Submit it to the Professor	Lab time-30 Minutes
4			Quiz Time	Summative Evaluation for Unit	60 Minutes
4	Organize an event to generate awareness and get support for a cause	Create	Project- 1) Each team to look for an NGO/ social group in the city which is working on the issue their college group is supporting. 2) Spend a day with the NGO/ social group to understand exactly how they work and the challenges they face. 3) Render voluntary service to the group for one day 4) Invite the NGO/ social group to address their university students for couple of hours. Plan the entire event, decide a	Field work: Formative Evaluation	7 Hours

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

Semester 2

Unit No	Objective	Bloom's Level	Content	Type of Class	Duration
			suitable venue in the university, gather audience, invite faculty members etc. (they need to get their plan ratified their professor). Outcome-- Host an interactive session with the NGO spokesperson 5) The groups to present their experience of a day with the NGO and inspire students to work for the cause.		
TOTAL					61 hours
	Assessment	Understand	Written Assessment of 20 marks		
		Create	Project of 20 marks (E-Magazine 4 editions)		
		Analyze, Create	Focus Group Discussion 10 marks		