



Bharatiya Vidya Bhavan's

Sardar Patel Institute of Technology

(Autonomous Institute Affiliated to University of Mumbai)

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

Department of CSE-DS

B.Tech. (Computer Science Engineering - DS) Syllabus (Semester I-IV)

2021 Iteration (w.e.f. 2021-25)



Department of CSE-DS

Nomenclature of the Courses

BSC	Basic Science Course	PC	Program Core
BSE	Basic Science Elective	PE	Program Elective
ESC	Engineering Science Course	MLC	Mandatory Learning Course
ESE	Engineering Science Elective	SCOPE	Skill Certification for Outcome based Professional Education
SBC	Skill Based Course	OE	Open Elective
ABL	Activity Based Learning	HSSE	Humanities and Social Science Elective
ABL-SEVA	Social Empowerment Through Various Activities	ABL-SATVA	Self- Accomplishment Through Various Activities

Abbreviations

L	Lecture Hour	O	Other Work (Self Study)
T	Tutorial Hour	E	Total Engagement in Hours
P	Laboratory Hour	C	Credit Assigned

Engagement and Credit Scheme

Sem I									
No	Type	Code	Course	L	T	P	O	E	C
1	BSC	MA101	Engineering Calculus	3	1	0	8	12	4
2	BSC	AS101	Engineering Physics	2	1	2	5	10	4
3	ESC	AS104	Engineering Graphics	1	0	2	2	05	2
4	ESC	ET101	Basic Electrical Engineering	3	0	2	6	11	4
5	ESC	CS101	Problem Solving using Imperative Programming	2	0	4	4	10	4
6	SBC	AS106	Skill Shop	0	0	2	0	02	1
7	ABL	SV1X/ ST1X	SEVA-I or SATVA-I	0	0	0	2	02	1
TOTAL				11	2	12	27	52	20

Sem II									
No	Type	Code	Course	L	T	P	O	E	C
1	BSC	MA102	Differential Equations and Complex Analysis	3	1	0	8	12	4
2	BSC	AS102	Engineering Chemistry	2	0	2	3	07	3
3	BSC	AS103	Biology for Engineers	2	0	0	3	05	2
4	ESC	AS105	Engineering Mechanics	2	0	2	4	08	3
5	ESC	CS102	Problem Solving using OOPs	2	0	4	4	10	4
6	ESC	EC101	Digital Systems and Microprocessors	3	0	2	5	10	4
7	SBC	AS107	Communication Skills	1	0	2	2	05	2
TOTAL				15	1	12	29	57	22



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Semester-I



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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Engineering Calculus	3	1	0	8	12	3	1	0	4
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		100		100		200		400
MA101		Laboratory		--		--		--		--

Pre-requisite Course Codes, if any.		
Course Objective: To develop mathematical skills for solving engineering problems.		
Course Outcomes (CO): <i>At the End of the course students will be able to:-</i>		
MA101.1	Differentiate a function partially.	
MA101.2	Find extreme values of a given function.	
MA101.3	Find the nth order derivative of a given function.	
MA101.4	Expand a given function as a power series.	
MA101.5	Calculate the value of integrals in one variable using different technique and solve multiple integrals in various coordinate systems.	
MA101.6	Calculate Area using double integration.	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA101.1	3											
MA101.2	3	1										
MA101.3	2											
MA101.4	2											
MA101.5	3											
MA101.6	2	1										

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
MA101.1						
MA101.2						
MA101.3						
MA101.4						
MA101.5						
MA101.6						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember ✓	Understand ✓	Apply ✓	Analyze	Evaluate	Create
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Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	Title	Partial Differentiation	1,2,3	10
	1.1	Partial derivatives of first and higher order. Partial derivatives of composite functions.		4
	1.2	Euler's theorem for homogeneous functions with two and three independent variables, deductions from Euler's theorem.		3
	1.3	Application of partial derivatives: i) Local Maxima and Minima of functions of two variables. ii) Lagrange's Method of undetermined multipliers.		3
2	Title	Successive Differentiation and Series	1,2,3	10
	2.1	Successive Differentiation: Proofs of nth derivatives of standard functions. Use of De Moivre's theorem and partial fractions to calculate nth derivatives of given functions.		3
	2.2	Leibnitz's Theorem on nth derivative of product of two functions		2
	2.3	Infinite series: 1) Maclaurian's series (without proof) and derivation of series of some standard functions using Maclaurin series. Expansion of functions in powers of x by using i) Standard series method ii) Method of differentiation and integration. 2) Taylor's series and applications.		5
3	Title	Integral Calculus (one variable)	1,2,3	8
	3.1	Gamma functions: properties of gamma functions and integrals reducible to gamma functions.		2
	3.2	Beta functions: properties, relation between Beta and Gamma functions, integrals reducible to Beta functions, Duplication formula.		4
	3.3	Differentiation under Integral sign: differentiating integrals with constant limits of integration for one parameter.		2
4	Title	Integral Calculus (multi variable)	1,2,3	14
	4.1	Tracing of curves. Sketching standard solids (Spheres, Ellipsoids, Cylinders, Cones, Tetrahedrons, planes)		2
	4.2	Double Integration: definition and evaluation. Evaluate by changing the order of integration and by changing to polar form.		7
	4.3	Application of double integral to finding area of given regions.		2
	4.4	Triple integration: definition and evaluation (Cartesian and cylindrical coordinates).		3
5	Self Study	1.1 Partial differentiation of implicit functions. 2.3 Series by method of Substitution 3.2 Proof of Duplication Formula 3.3 Differentiation under Integral sign using two parameters and variable limits 4.1 Finding lengths of curves in Cartesian and polar form	1,2,3	08
Total				42*



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***Total of 42 hours does not include self study hours.**

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Higher Engineering Mathematics	Forty Fourth	Dr. B. S. Grewal	Khanna Publications	2020

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Advanced Engineering Mathematics	Twenty Eighth	H.K Das	S. Chand	2014
2	Advanced Engineering Mathematics	Tenth	Erwin Kreysizg	John Wiley & Sons	2011
3	Advanced Engineering Mathematics	Fourth	Jain and Iyengar	Narosa Publications	2014



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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
BSC	Engineering Physics	2	1	2	5	10	2	1	1	4
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		300
		Laboratory		50		--		50		100
AS101										

Pre-requisite Course Codes, if any.	HSC level physics
Course Objective:	To provide the knowledge and methodology necessary for solving problems in the field of engineering
Course Outcomes (CO):	<i>At the End of the course students will be able to</i>
AS101.1	Illustrate the knowledge of basic concepts of semiconductor physics, lasers and quantum mechanics.
AS101.2	Solve the problems by applying the basics concepts of physics.
AS101.3	Use the Schrodinger equation to realize the concept of discreteness and quantum tunneling.
AS101.4	Explain the working of various LASERS and its practical applications.
AS101.5	To develop experimental skills and the practical abilities.
AS101.6	To develop an ability of understanding of concepts and principles of physics.
AS101.7	To comprehend importance of precision, accuracy of the experimental data.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS101.1	1											
AS101.2		1										
AS101.3		1										
AS101.4	1											
AS101.5				1								
AS101.6				1								
AS101.7												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
AS101.1							
AS101.2							
AS101.3							
AS101.4							
AS101.5							
AS101.6							
AS101.7							



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BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
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Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	Quantum Mechanics		
	1.1	de-Broglie hypothesis; experimental verification of de Broglie hypothesis; wave packet, group velocity and phase velocity; Wave function, Physical interpretation of wave function; Heisenberg's uncertainty principle; Electron diffraction experiment; Applications of uncertainty principle	1,2,3	09
	1.2	Schrodinger's time dependent wave equation, time independent wave equation; Application of time-independent Schrodinger equation - Particle trapped in one dimensional box and Potential barrier (Tunnelling), Harmonic oscillator (qualitative)	1,2,3	
2	Title	Physics of Semiconductors and Semiconductor devices		
	2.1	Conduction in metals and semiconductors; Fermi-Dirac distribution function and Fermi level in a conductor, insulator and semiconductor	5	13
	2.2	Intrinsic and extrinsic semiconductors; intrinsic conductivity and extrinsic conductivity; Law of mass action, charge neutrality condition; intrinsic carrier concentration, electron and hole concentration; Extrinsic carrier concentration as a function of temperature; Effect of impurity concentration and temperature on the Fermi Level; Hall Effect and its applications. Drift and Diffusion current density	5	
	2.3	Formation of a P-N junction, depletion region and barrier potential; Energy band structure of P-N Junction (unbiased, forward-bias, reverse-bias); concept of carrier current densities in p-n junction in equilibrium, forward bias and reverse bias; Breakdown mechanism - Zener effect and avalanche	5,6	
	1.4	P-N junction devices: LED, Zener diode, photoconductors, photovoltaic solar cells and Bipolar Junction Transistors	5,6	
3	Title	LASERS		
	3.1	Processes - Absorption of light, spontaneous emission, stimulated emission; Einstein's equations, Population inversion; metastable states; pumping and pumping schemes; optical resonance cavity	3,4	06
	3.2	Ruby and Helium Neon laser, semiconductor laser; Applications of laser in industry, medicine and holography. (construction & reconstruction of holograms)	3,4	

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4	Self Study	Interference of light in thin films having uniform thickness, Newton's rings, Applications of interference in anti-reflecting and highly reflecting thin films. Diffraction of light, Diffraction due to single slit, double slit and diffraction grating.		05*
Total (*Not included)				28

Laboratory Component

Sr. No.	Title of the Experiment*
1	Determination of energy band gap of a semiconductor
2	Study of I-V characteristics of a Zener diode
3	Determination of the type of semiconductor sample, concentration of charge carriers and its mobility using Hall Effect
4	Determination of Planck's constant using photo vacuum tube
5	Measurement of ultrasonic velocity in liquid medium using ultrasonic interferometer
6	Determination of radius of curvature using Newton's Rings
7	Determination of thickness of a thin foil or wire using the interference pattern of a wedge-shaped film
8	Determination of wavelengths of a mercury source and resolving power of a plane diffraction grating
9	Study of single slit diffraction
10	Determination of grating element of a diffraction grating using a laser source
11	Determination of the numerical aperture of an optical fibre
12	Uses of a Cathode-Ray Oscilloscope

*Students will perform any 10 of the above experiments**Text Books**

Sr. No.	Title	Edition	Authors	Publisher	Year
1	A Textbook of Engineering Physics	Eleventh	Dr. M.N. Avadhanulu & Dr. P. G. Kshirsagar	S. Chand	2018
2	Engineering Physics	First	D. K. Bhattacharya & Poonam Tandon	Oxford University Press	2015



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Sr. No.	Title	Edition	Authors	Publisher	Year
1	Concepts of Modern Physics	Sixth	Arthur Beiser	McGraw Hill Education	2009
2	Modern Physics	Third	Serway, Moses and Moyer	Thomson Learning	2005
3	Fundamentals of Physics	Tenth	Halliday and Resnick	Wiley	2013
4	Solid State Physics	Eighth	S. O. Pillai	New Age International Publishers	2018
5	Solid State Electronic Devices	Seventh	Ben G. Streetman and Sanjay Kumar Banerjee	Pearson Education	2016
6	Lasers: Fundamentals and Applications	Second	Ghatak and Thyagarajan	Springer	2011



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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(ESC)	Engineering Graphics	1	0	2	2	5	1	0	2	2
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		20		20		60		100
AS104		Laboratory		60		--		40		100

Pre-requisite Course Codes, if any.	Fundamentals up to 12 th science
Course Objective: To develop technical drawing and visualization skills using instrumental drawing and soft tool, required for design and modeling, in Engineering Applications and Solutions.	
Course Outcomes (CO): At the End of the course students will be able to	
AS104.1	Construct basic engineering curves.
AS104.2	Draw projections of points and lines.
AS104.3	Draw projections of regular solids inclined to both the reference planes.
AS104.4	Read the 3-dimensional view and draw the orthographic projections.
AS104.5	Read the 3-dimensional view and draw the sectional orthographic projections.
AS104.6	Read the orthographic projections and draw isometric view.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS104.1	3	3										3
AS104.2	3	3										3
AS104.3	3	3										3
AS104.4	3	3										3
AS104.5	3	3										3
AS104.6	3	3										3

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply√	Analyze	Evaluate	Create
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Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Unit1	Introduction to Engineering Drawing	1,2	4
	1.1	Introduction to Drawing Instruments, Types of Lines,		



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		Dimensioning Systems and Scaling as per IS conventions. First angle method of projection only		
	1.2	Basic construction of Cycloid and Involute.		
2	Unit2	Projections of Points and Lines	1	4
	2.1	Projection of points in all four quadrants		
	2.2	Projection of lines parallel to one principal reference plane.		
	2.3	Lines inclined to both the Reference Planes (Excluding Traces of lines).		
3	Unit3	Projections of solids (Regular solids like Prism, Pyramid, Cylinder, Tetrahedron, Hexahedron and Cone only)	1,2	7
	3.1	Projection of solid resting on plane (Single step projection)		
	3.2	Projection of solid such that base inclined to one reference plane (Two step projection)		
	3.3	Projection of solid such that base inclined to both reference planes (Three step projection/problem) (Exclude Spheres, Composite, Hollow solids and frustum of solids)		
4	Unit4	Orthographic Projections	1,2	Lab Sessions
	4.1	Orthographic views of a simple machine part as per the first angle method of projection recommended by I.S.		
	4.2	Full Sectional views of the Simple Machine parts.		
5	Unit5	Isometric Projections and views	2	Lab Sessions
	5.1	Isometric views (Natural scale only)		
6	Self Study	1.2 Construction of Engineering curves like ellipse, parabola, hyperbola, helix, other types of cycloid etc. by using different method of construction. 2.1 Projection of lines with traces, application-based problems on Projection of lines 3.1 Projections of cut solids with different cutting planes. 4.1 Solve more practice examples of orthographic views. Draw different views of a machine part/any object using third angle method of projection. (Axonometric view, oblique view, perspective etc.) 4.2 Half sectional orthographic views. 5.1 Development of surfaces of frustum of solid, and retaining part of the solid after cutting plane, reverse development of solid.	1,2,3	6*
Total (*Not included)				15



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Laboratory Component (Minimum 5 sheets are expected)

Sr. No	No of Sessions	Engineering AutoCAD Laboratory
1	2	Introduction to Auto-CAD: -Basic Draw and Modify Commands. Knowledge of setting up layers, Dimensioning, Hatching, plotting, and Printing. Auto-Cad Practice sheet-1
2	1	Auto-Cad Practice sheet-2
3	2	Introduction to Orthographic projections sheet-3
4	2	Orthographic projections sheet-4
5	2	Introduction to Sectional Orthographic projections sheet-5
6	2	Sectional Orthographic projections sheet-6
7	2	Introduction to Isometric Projection/View: - Isometric View of blocks with plain and cylindrical surfaces is using plain/natural scale only. (Exclude Spherical surfaces). Isometric Projection/View sheet-7
8	2	Isometric Projection/View sheet-8
Total	15	

Text Books:

Sr. No	Title	Edition	Authors	Publisher	Year
1	Engineering Drawing	53 rd	N D Bhatt	Charotar	2016
2	Engineering Drawing	3 rd	Dhananjay A Jolhe	Tata McGraw Hill	2011

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	AutoCAD 2017	--	Sham Tickoo	DreamTech Press, Delhi	2017
2	Engineering Drawing and Graphics	Fifth	K Venugopal	New Age International	2011



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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(ESC)	Basic Electrical Engineering	3	0	2	6	11	3	0	1	4
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		300
ET101		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.		Basic concepts of electric charge, current, voltage and Power
Course Objective: To impart a basic knowledge of electrical quantities, Circuits and components.		
Course Outcomes (CO): <i>At the End of the course students will be able to</i>		
ET101.1	Compute various electrical quantities of given dc circuit using circuit simplification techniques and various network theorems.	
ET101.2	To expose the students to different terms and concepts in AC Circuits at fundamental frequency and to expose them to basics of effects of harmonics in the waveforms	
ET101.3	To study the working principles of electrical machines and their applications	
ET101.4	To expose the students the fundamental concepts in Controllable Switch and Modulation based Power Conversion	
ET101.5	To study Electrical Parameters of the Batteries and their selection and design criteria for a specific application	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ET101.1												
ET101.2												
ET101.3												
ET101.4												
ET101.5												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
ET101.1							
ET101.2							
ET101.3							
ET101.4							
ET101.5							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
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Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs
1	Title	DC Circuits	1,2	10
	1.1	Electrical circuit elements (R, L and C), Voltage and current sources, Equivalent resistance of circuits, Simplification using delta-star and star-delta transformation.		
	1.2	Kirchoff's current and voltage laws, Analysis of simple circuits with dc excitation. Mesh analysis, Superposition, Thevenin, Norton and Maximum Power Transfer Theorems		
	1.3	Time-domain analysis of first-order DC Transients in RL and RC circuits.		
2	Title	AC Circuits	1,2	12
	2.1	Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Harmonics, Total Harmonic Distortion, Power supplied by Harmonic voltages and currents, Power factor in case of non-sinusoidal waveforms.		
	2.2	AC Analysis of series and parallel RLC Circuits with Resonance, Concept of Bandwidth and Q-factor,		
	2.3.	Three-phase balanced circuits, voltage and current relations in star and delta connections.		
3	Title	Electromagnetic and Electro-Mechanical Energy Converters	1,2	10
	3.1	Magnetically Coupled Coils, Self and Mutual Inductance and Dot Convention		
	3.1	Single Phase Transformer: Principle of Operation, Equivalent Circuits		
	3.2	Single Phase Transformer: Efficiency and Regulation		
	3.3	Introduction to Three-phase Transformers and Applications		
	3.4	Fundamental Principles of Rotating Machines, Characteristics of Induction motor and DC motor		
4	Title	Electric Power Converters	1,2	05
	4.1	Fundamental Principles of Buck, Boost and buck-boost DC-DC converters and their Transfer Characteristics, Duty Ratio Control		
	4.2	Single-phase voltage source inverters and PWM		
5	Title	Batteries: Electrical Characteristics and Applications		05
	5.1	Introduction to type of Batteries, Generalized Battery parameters such as SoC, DoD, Energy and Power Densities, Battery C-rating, etc. Comparison of Batteries, Charging and Discharging Characteristic		
	5.2	Selection and Sizing of Battery Packs for Specific Applications		



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6	Self Study	Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Elementary calculations for energy consumption and power factor improvement.	6*
Total (*Not Included)			42

Laboratory Component (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
01	Introduction to Electrical Measuring instruments, Lamp Loads, Inductor Loads and Capacitor Bank
02	Verification of Star-Delta and Delta-star Transformation with Kirchhoff's Laws
03	Verification of Thevenin's Norton's and Maximum Power Transfer Theorem
04	Verification of DC Transient equations in RL and RC Circuits
05	Experimental study of single-phase AC circuit with R-L and R-C Load with Measurement of Power and Power factor
06	Experimental study of R-L-C series Resonance. To plot resonance curve, To compute Bandwidth and Q-factor
07	Experiment on Magnetic Circuit Fundamentals
08	Loading of a transformer: measurement of primary and secondary voltages and currents, and power. To compute efficiency and regulation.
09	Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
10	Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed.
11	Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform.
12	Demonstration of V/F control of Induction motor
13	Experimental study of charge and Discharge characteristics of a Lead-acid Battery
14	Introduction to L.T. Switch gear

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Basic Electrical Engineering	Third	D.P. Kothari and I. J.	Tata McGraw Hill	2010
2	Electrical Technology	Twenty Third	B. L. Theraja	S. Chand Publications	2003



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Reference Books

Sr. No.	Title	Edition	Author	Publisher	Year
1	Basic Electrical Engineering	Second	D. C. Kulshreshtha	McGraw Hill	2019
2	Fundamentals of Electrical Engineering	Second	L. S. Bobrow	Oxford University Press	2011
3	Electrical and Electronics Technology	Third	E. Hughes	Pearson	2010
4	Electrical Engineering Fundamentals	Second	V. D. Toro	Prentice Hall India	1989
5	Elements of Power Electronics	Second	P. T. Krein	Oxford University Press	2015
6	Power Electronics: Converters, Application and Design	Second	Ned Mohan, T.M Undelands and W P Robbins	John Wiley and Sons. Inc.	1995
7	Electric Machinery	Sixth	A. E. Fitzgerald, C. Kingsley and S. D. Umans	McGraw-Hill	2003



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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(ESC)	Problem Solving using Imperative Programming	2	0	4	6	12	2	0	2	4
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		-		-		-		-
CS101		Laboratory		300		--		100		400

Pre-requisite Course Codes, if any.		
Course Objective: To develop problem solving skills using imperative programming.		
Course Outcomes (CO): <i>At the End of the course students will be able to</i>		
CS101.1	Explain the problem-solving aspects using various programming paradigms.	
CS101.2	Solve real world problems using imperative programming approach.	
CS101.3	Solve problems using control structures for real world problems.	
CS101.4	Solve problems using Arrays and Text processing.	
CS101.5	Develop modular code for a given problem.	
CS101.6	Solve real world problems using Structures and Unions	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS101.1	1											
CS101.2	2	2										
CS101.3	2	2										
CS101.4	2	2										
CS101.5	2	2										
CS101.6	2	2										

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
CS101.1	1	1	1				1
CS101.2	1	1	1			1	1
CS101.3	1	1	1			1	1
CS101.4	1	1	1			1	1
CS101.5	1	1	1			1	1
CS101.6	1	1	1			1	1

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create
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Department of CSE-DS

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	Introduction to Problem Solving and Programming Paradigms		
	1.1	What is a Problem, Problem Solving Aspect, Top-Down Design, Implementation of Algorithms, Characteristics of a good algorithm, what is a computer program, real life examples of programming, Computer based applications of programming, Steps followed in Program Development, Characteristics of good Program	3,4	2
	1.2	Overview of Programming Paradigms - Declarative and Imperative, Problem-solving using Algorithm and Flowcharts,	3,4	2
2	Title	Basic Elements of Computer Programming and Control flow		
	2.1	Variables, keywords, Data types, Operators: Arithmetic, Relational and Logical, Assignment, Unary, Conditional, Bitwise, Expression, Statements.	1,2	1
	2.2	Branching Structures: if statement, if-else statement, multi-way decision, switch statement, continue statement, break statement Iterative Structures: while, do-while, for, nested loops	1,2	3
	2.3	Problem solving using Control Structures for real world problems	1,2,4	2
3	Title	Problem Solving using Array Techniques		
	3.1	Introduction to Arrays: Declaration, Definition, accessing array elements, one-dimensional array, two-dimensional array, array of characters, Strings	1,2	2
	3.2	Classical Problem Solving using Arrays like Array Order Reversal, Array Counting or Histogramming, Finding the maximum number in a set.	1,2,4	2
	3.3	Text Processing problems like finding length, keyword search, finding anagrams	1,2,4	2
4	Title	Problem Solving using Modular Approach		
	4.1	Defining a Function, accessing a Function, Function Prototype, Passing Arguments to a Function, call by value, pointers and call by reference, Recursion	1,2	4
	4.2	Problem solving using Functions and Recursive applications	1,2,4	3
5	Title	Structures and Unions		
	5.1	Structures and Union: Declaration, Initialization, structure within structure, Array of Structure, Operation on structures, Concept of Union, Difference between structure and union,	1,2	3
	5.2	Real world problems using Structures and Unions	1,2,4	2
6	Self Study	File handling: Types of File, File operation- Opening, Closing, Creating, Reading, Processing File, Command line arguments, Dynamic Memory Allocation	1,2,4	4*
Total (* not counted in total hours)				28

**Sardar Patel Institute of Technology**

(Autonomous Institute Affiliated to University of Mumbai)

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

Department of CSE-DS**Laboratory Component (Minimum 10 Laboratory experiments are expected)****Note: All problems should be implemented using C language.**

Sr. No.	Title of the Experiment
1	Use the formatted input/output statements, operators and expressions of C language
2	Apply various control structures to solve given problems.
3	Apply the concept of functions to incorporate modularity.
4	Demonstrate the use of one-dimensional arrays to solve a given problem.
5	Demonstrate the use of two-dimensional arrays to solve a given problem.
6	Apply the concept of recursion to solve a given problem.
7	Implement various text processing problems.
8	Apply the concepts of structures/union to solve a given problem.
9	Demonstrate the use of pointers to solve a given problem.
10	Implement various operations on files to solve a given problem.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Programming with C	Fourth	Byron Gottfried	McGraw Hill (Schaum's outline series)	2018
2	The C programming Language	Second	Kernighan , Ritchie	Pearson	2015
3	Foundations of Programming Languages	Second	Kent D. Lee	Springer	2017
4	How to Solve it by Computer	First	R.G. Dromey	Prentice Hall India	1998

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Let Us C	Sixteenth	Yashavant Kanetkar	BPB	2017
2	Programming Language Concepts	Third	Carlo Ghezzi, Mehdi Jazayeri	John Wiley & Sons	2008
3	Computer Programming in C	Second	V. Rajaraman & Neeharika Adabala	PHI Learning, Eastern Economy Edition,	2014



Sardar Patel Institute of Technology

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Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(SBC)	Skill Shop	0	0	2	0	02	0	0	1	1
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		--		--		--		--
AS106		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.

Course Objective: To equip the students with the fundamental skills involved in the creation of simulated and physical design.

Course Outcomes (CO): *At the End of the course students will be able to*

AS106.1 Operate basic electronic equipment and instruments.

AS106.2 Make PCB designs in simulations.

AS106.3 Assemble, disassemble and troubleshoot computer hardware and network peripherals.

AS106.4 Fabricate basic jobs in traditional trades.

AS106.5 Design a 3D model and translate it to a 3D printed component.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS106.1												
AS106.2												
AS106.3												
AS106.4												
AS106.5												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
AS106.1							
AS106.2							
AS106.3							
AS106.4							
AS106.5							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
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Department of CSE-DS

Lab Component

Trade No.	Unit No.	Topics	Ref.	Hrs.
1	Unit 1	Electronic Components	5	4
	1.1	Introduction to Electronic Components Exposure to usual electronic equipment/instruments such as Multi-meter, Oscilloscope, Function generator, IC tester and Power supply, Information about their front panels, Demonstrations on their working, Hands-on for measurement of component values and DC voltage using multi-meter, AC mains voltage/1 KHz Square wave/any small signal from function generator on Oscilloscope, Testing of sample digital ICs using IC tester. OR Repairing of gadgets and appliances: Elementary skills of repairing juicer, mixer, grinder, etc.		
2	Unit 2	PCB Laboratory Exercises	6	4
	2.1	Layout drawing, Positive and negative film making, PCB etching and drilling, Tinning and soldering technique.		
3	Unit 3	Hardware and Networking	7, 8	4
	3.1	Dismantling of a Personal Computer (PC), Identification of Components of a PC such as power supply, motherboard, processor, hard disk, memory (RAM, ROM), CMOS battery, CD drive, monitor, keyboard, mouse, printer, scanner, pen drives, disk drives etc.		
	3.2	Assembling of PC, Installation of Operating System and Device drivers, Boot-up sequence. Installation of application software (at least one).		
	3.3	Basic troubleshooting and maintenance.		
4	Unit 4	Traditional Trades*	1, 2	4
		Carpentry Use and setting of hard tools like hacksaws, jack planes, chisels and gauges for construction of various joints, wood turning and modern wood turning methods. One carpentry job involving a joint and report on demonstration of a job involving wood turning required for successful completion of module. OR Electrical board wiring House wiring, staircase wiring, and wiring diagram for fluorescent tube light, Godown wiring and three phase wiring for electrical motors. OR		



Department of CSE-DS

		Sheet Metal Practice Introduction to primary technology processes involving bending, punching and drawing various sheet metal joints, development of joints. Utility job in sheet metal required for successful completion of module.		
5	Unit 5	3D Modeling and Printing	3, 4	4
	5.1	Modeling approaches for ideation and creation. Developing a CAD file (.iges/.step/.dwg) of a 3D model and export it as an .stl file for the purpose of 3D printing. Importing the 3D .stl file to generate a .gcode file for 3D printing through slicing, using open source software.		
	5.2	Introduction to 3D printing: methodologies, best practices, material and model variation. Live printing sessions of generated .gcode files in real time with optimal parameters and troubleshooting.		
			Total	20

* Students can opt for any one of the three trades from Unit 4.

Text Books:

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Workshop Manual	Sixth	Venkat Reddy	BS Publication	2008
2	Wiring Simplified: Based on 2017 National Electrical Code	Forty Fifth	Frederic P Hartwell, Herbert P. Richter, W.C. Schwan	Park Publishing	2017

Reference Books:

Sr. No.	Title	Edition	Authors	Publisher	Year
3	Autocad 2017	First	ShyamTikoo	Dreamtech Press	2016
4	Ultimaker 2+ reference manual	-	-	Ultimaker	2017
5	Encyclopedia of Electronic Components	First	Charles Platt	O Reilly	2012
6	Printed Circuit Boards	First	Khandpur R. S.	Tata McGraw Hill	2005
7	Troubleshooting Your PC For Dummies	Second	Gookin Dan	For Dummies	2005
8	Networking For Dummies	Eighth	Lowe Doug	For Dummies	2007



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Department of CSE-DS

Semester-II



Sardar Patel Institute of Technology

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Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Differential Equations and Complex Analysis	3	1	0	8	12	3	1	0	4
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		400
MA102		Laboratory		--		--		--		--

Pre-requisite Course Codes, if any.		MA101
Course Objective: To develop mathematical skills for solving engineering problems.		
Course Outcomes (CO): At the End of the course students will be able to:-		
MA102.1	Solve differential equations of first order.	
MA102.2	Solve differential equations of higher order using operators.	
MA102.3	Solve differential equations in electrical engineering problems.	
MA102.4	Find powers, roots & logarithm of a complex number and to separate the function of a complex number into real and imaginary.	
MA102.5	Check whether a given function is analytic and construct analytic functions.	
MA102.6	Compute integrals of complex valued functions.	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA102.1	3											
MA102.2	3											
MA102.3	1	1										
MA102.4	3											
MA102.5	2											
MA102.6	2	1										

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MA102.1							
MA102.2							
MA102.3							
MA102.4							
MA102.5							
MA102.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember ✓	Understand ✓	Apply ✓	Analyze	Evaluate	Create
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Department of CSE-DS

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	Title	Linear Differential Equations of first order	1,2,3	11
	1.1	Exact Differential Equations, Integrating Factors and equations reducible to exact form.		3
	1.2	Linear differential equations (Definition), equations reducible to linear form, Bernoulli's equation		2
	1.3	Simple application of differential equation of first and second order to electrical engineering problems.		2
	1.4	Numerical solution of ordinary differential equations of first order and first degree using (a) Taylor's series method (b) Euler's method (c) Modified Euler method (d) Runge-Kutta fourth order formula.		4
2	Title	Linear Differential Equations of higher order	1,2,3	11
	2.1	Linear Differential Equation with constant coefficient-complementary function, particular integrals of differential equation of the type $f(D)y = X$ where X is e^{ax} , $\sin(ax+b)$, $\cos(ax+b)$, x^m , $e^{ax}V$, xV , where V is a function of x .		7
	2.2	Cauchy's homogeneous linear differential equation and Method of variation of parameters for second order.		2
	2.3	System of Differential Equations.		2
3	Title	Complex Numbers	1,2,3	12
	3.1	Revision: Complex Numbers as ordered pairs, Argand's diagram, Cartesian, Polar and Exponential form of Complex Numbers.		1
	3.2	De Moivre's Theorem and its application to determine powers of complex numbers. Roots of complex numbers by De Moivre's Theorem.		3
	3.3	Expansion of $\sin n\theta$ and $\cos n\theta$ in terms of powers of $\sin\theta$ and $\cos\theta$. Expansion of $\sin^n\theta$ and $\cos^n\theta$ in terms of sines and cosines of multiples of θ .		2
	3.4	Hyperbolic Functions: relation between circular and hyperbolic functions, Inverse hyperbolic functions. Separation into real and imaginary parts of complex functions.		4
	3.5	Logarithm of a complex number.		2
4	Title	Analytic functions and Complex Integrals	1,2,3	8
	4.1	Analytic functions, Cauchy Reimann equations in cartesian and polar form, construction of analytic functions using Milne-Thompson's method, Harmonic functions, poles of $f(z)$.		4
	4.2	Line Integral, Cauchy's Integral theorem for simply connected regions, Cauchy's Integral formula (for poles lying inside or outside the curve).		4

**Department of CSE-DS**

5	Self Study	1.3 To form D.E. for given L-C-E-R circuit 1.4 Picard's method 2.1 Method of undetermined coefficients to solve differential equations. 2.2 Legendre's differential equation, Method of variation of parameters for third order differential equations. 3.2 Complex examples using De Moivre's Theorem. 4.1 Construction of analytic function $f(z) = u+iv$ when $u+v$ or $u-v$ is given. Orthogonal trajectories		08
Total				42*

***Total of 42 hours does not include self study hours.**

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1.	Higher Engineering Mathematics	Forty Fourth	Dr. B. S. Grewal	Khanna Publications	2020

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1.	Advanced Engineering Mathematics	Twenty Eighth	H.K Das	S.Chand	2014
2.	Advanced Engineering Mathematics	Tenth	Erwin Kreyszig	John Wiley & Sons	2011
3.	Advanced Engineering Mathematic	Fourth	Jain and Iyengar	Narosa Publications	2014



Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
BS AS102	Engineering Chemistry	2	0	2	3	7	2	0	1	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		50		50		100		200
		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.		HSC level Chemistry
Course Objective: To provide necessary background of Chemistry suited for relevant areas of engineering		
Course Outcomes (CO): <i>At the End of the course students will be able to</i>		
AS102.1	Relate thermodynamic principles and laws to crucial applications like heat engines (Understanding)	
AS102.2	Summarize properties and applications of different materials like polymers, ceramics, alloys, nanomaterials, conductors and insulators (Understanding)	
AS102.3	Identify methods for corrosion control based on knowledge of different types of corrosion and factors affecting rate of corrosion (Application)	
AS102.4	Compare different sources of energy like conventional fossil fuels, alternative fuels, batteries and fuel cells with respect to availability, working principles, constitution, efficiency of performance and environmental impact (Understanding)	
AS102.5	Apply knowledge of electrochemistry and green chemistry in the interest of public health and environment (Application)	
AS102.6	Make use of analytical techniques (complexometric and iodometric titrations) and instruments (pHmeter, conductometer and Orsats's Apparatus) for various purposes like hardness parameters of water, composition of alloys etc.	
AS102.7	Estimate key properties of lubricants like flash point, viscosity and acid value	
AS102.8	Estimate molecular weight of polymer	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS102.1	1											
AS102.2	1											
AS102.3	2											
AS102.4	2						1					
AS102.5	1						2					
AS102.6				1								
AS102.7				1								
AS102.8				1								



Department of CSE-DS

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
AS102.1						
AS102.2						
AS102.3						
AS102.4						
AS102.5						
AS102.6						
AS102.7						
AS102.8						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create
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Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	Thermodynamics		4
	1.1	Introduction, Terminology, Concepts of Internal Energy and Thermodynamic equilibrium, Zeroth and First Law of Thermodynamics, Implications and Limitations of First law	1,3	
	1.2	Concept of Enthalpy, Joule Thomson Effect, Carnot's Cycle, Carnot's theorem and related numerical, Second Law of Thermodynamics	1,3	
	1.3	Applications of thermodynamic principles to the working of refrigerator and air conditioner	1,3	
2	Title	Polymers		3
	2.1	Introduction, Effect of heat on polymers: Glass transition temperature and melting with significance;	1,2,3	
	2.2	Conducting polymers, Liquid crystal polymers, Engineering Polymers	1,2,3	
3	Title	Corrosion		5
	3.1	Introduction, Dry corrosion (i) Due to oxygen (ii) Due to other gases	1,2	
	3.2	Electrochemical corrosion and mechanism, Galvanic, differential aeration corrosion, Significance of galvanic series for corrosion phenomenon	1,2	
	3.3	Factors affecting rate of corrosion (i) Position in galvanic series, (ii) relative areas of anode and cathode, (iii) conductance of medium	1,2	
	3.4	Methods to decrease the rate of corrosion: Material selection, Proper designing, Cathodic protection- i) Sacrificial anodic protection ii) Impressed current method, Metallic coatings, Cathodic and anodic coatings (Galvanization and Tinning: principle	1,2	



Department of CSE-DS

		and application only)		
4	Title	Energy Sciences		5
	4.1	Definition and classification of fuels, Calorific value: Definition, Gross or Higher calorific value & Net or lower calorific value, Dulong's formula & numerical for calculations of Gross and Net calorific values.	1,2	
	4.2	Knocking, Octane number, Cetane number, Antiknock agents, unleaded petrol	1,2	
	4.3	Combustion- Calculations for requirement of only oxygen and air (by weight and by volume only) for given solid & gaseous fuels.	1,2	
	4.4	Disadvantages of fossil fuels, Alternative (Green) Fuels : Power alcohol , Biomass, Biogas, Biodiesel, Natural Gas and CNG (Description, Utility, advantages and disadvantages)	1,2	
5	Title	Batteries and Battery Technology		4
	5.1	Introduction, Important terms, Nickel-Hydrogen (metal hydride), Rechargeable Lithium-ion batteries	1,2	
	5.2	Reserve Batteries, Fuel cells, characteristics, description, construction and working of Hydrogen-oxygen fuel cells, Types of fuel cells (in brief)	1,2	
	5.3	Electrochemical sensors: Working principle, construction and applications	1,2	
6	Title	Green Chemistry		3
	6.1	12 principles of green chemistry with examples, numerical on Atom Economy, Green Solvents (Water, Supercritical Fluids),	1,2	
7	Title	Engineering Materials		4
	7.1	Eutectic mixtures and soft solders, Advanced Ceramic materials and cermet's: magnetic, electronic and electrical applications Carbon nanomaterials : Fullerenes and Carbon nanotubes, Structure, Properties and applications	1,2,3	
	7.2	Insulators, Semiconductors and Superconductors: Thermal and electrical insulating materials and important engineering applications, Stoichiometric, defect and controlled valency semiconductors.	1,2,3	
	7.3	Superconductors, perovskite structure and 1:2:3 compound YBa ₂ Cu ₃ O _{7-y} , properties and applications	1,2,3	
8	Self Study	<ol style="list-style-type: none"> Supramolecular polymers and their applications Anodic Protection as a corrosion control strategy Current research and advances in fuel cells Commercial applications of superconducting materials Tops down vs bottoms up approach to nanotechnology and applications of nanoparticles other than carbon 		4*
Total (* Not Included)				28

Laboratory Component

**Department of CSE-DS**

Sr. No.	Title of the Experiment
1	Determination of total, temporary and permanent hardness of water sample
2	Removal of hardness using ion exchange column
3	Molecular weight determination of polymers by Oswald's Viscometer
4	To determine flash point of a lubricating oil
5	Determination of Viscosity of oil by Redwood Viscometer
6	Estimation of acid value of lubricant
7	Determination of amount of strong acid present in a solution using a conductometer
8	Determination of strength of acid using a pH meter
9	Estimation of Copper in brass by Iodometric Titration
10	Analysis of Flue gas for its composition (by Orsat's Apparatus)
11	Estimation of Iron in plain Carbon steel
12	Determination of COD of wastewater sample

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Engineering Chemistry	Eleventh	P.C.Jain&M.Jain	Dhanpat Rai & Co. (Pvt) Ltd.	2014
2	A Textbook of Engineering Chemistry	Twelfth	S.S.Dara&S.S.Umare	S. Chand & Co.	2014
3	A Textbook of Engineering Chemistry	Third	S Chawla	Dhanpat Rai & Co. (Pvt) Ltd.	2015

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Physical Chemistry	Eleventh	Peter Atkins	Oxford University Press	2017



Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Biology for Engineers	2	0	0	3	5	2	0	0	2
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		50		50		100		200
AS103		Laboratory		-		--		-		-

Pre-requisite Course Codes, if any.		HSC level Biology
Course Objective: To provide engineering perspective towards the biological principles and systems		
Course Outcomes (CO): <i>At the End of the course students will be able to</i>		
AS103.1	Understand basic biological principles and organizational structure of living systems at molecular level.	
AS103.2	Comprehend basic biological principles and organizational structure of living systems at cellular level	
AS103.3	Know Energy transformation and information processing in biological systems	
AS103.4	Appreciate biological process with engineering perspective	
AS103.5	Identify significance of Gene, Blood and Skin in human health system.	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS103.1	3											
AS103.2	3											
AS103.3	2											
AS103.4	2	1										
AS103.5	2	1										

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
AS103.1						
AS103.2						
AS103.3						
AS103.4						
AS103.5						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember ✓	Understand ✓	Apply ✓	Analyze	Evaluate	Create
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Department of CSE-DS

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	Bio-molecules and bio-polymers: Structure and Function	1,3	4
	1.1	Organic and inorganic molecules, Unique Properties of water		
	1.2	Carbohydrates, Lipids, Amino Acids and proteins, Nucleic Acids (DNA and RNA)		
2	Title	Levels of organization of life	1,3	4
	2.1	Cell as a basic unit of life, prokaryotic and eukaryotic cells, microbes, plant and animal cells; Cell organelles – structure and function; Cell membrane.		
	2.2	Levels of organization: cells, tissues, organs, systems & organism		
3	Title	Energy transformations	1,3	5
	3.1	Energy transformations in Chloroplast: Photosynthesis (photochemical & biochemical phase) and ATP generation, Aerobic and anaerobic systems		
	3.2	Energy transformations in Mitochondria: Cellular respiration (glycolysis and Krebs cycle) and ATP generation		
4	Title	Transport and Defense mechanisms	1,3	5
	4.1	Transport Phenomena in Biological Systems: Membrane channels and ion channels; Fluid flow and mass transfer (nutrients & ions); In plants: Xylem and Phloem; In animals: Blood and Lymph Transport of gases: Oxygen and Carbon dioxide Heat Transport - Body temperature regulation.		
	4.2	Defense mechanisms: In plants: Herbivory, secondary metabolites In animals: Innate and Adaptive immune systems		
5	Title	Engineering perspectives of biological sciences:	1,3	6
	5.1	Biology and engineering crosstalk – At cell level: Hybridoma technology At tissue level: Plant Tissue Culture, Animal Tissue Culture;		
	5.2	Tissue Engineering: Principles, methods and applications Introduction to Biomimetics and Bio-mimicry, nano-biotechnology		
6	Title	Role of Gene, Blood and Skin in human health system.	2,4	4
	6.1	Introduction to Genetic Engineering. Blood Type, Complete Blood Count Test and Abnormalities.		
	6.2	Structure of Skin, Functions of Skin. Engineering methods for identification of Skin diseases.		
7	Self Study	Introduction to Biosensors, transducers, amplifiers; Introduction to medical imaging and different medical Imaging modalities; Review of Signals and system; Electro Physiological Signal Analysis.		4*
Total (* Not included)				28



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Department of CSE-DS

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Molecular Cell Biology	Fourth	Lodish H, Berk A, Zipursky SL	W. H. Freeman	2000
2	Textbook of Anatomy and Physiology for Nurses and allied Health Sciences	First	Indu Khurana & Arushi	CBS Publsihers & Distributors Pvt Ltd	2019

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
3	Lehninger Principles of Biochemistry	Fourth	Nelson, D. L., & Cox, M. M.	Freeman	2004
4	Introduction to Biomedical Engineering.	Third	Joseph D. Bronzino, John Enderle	Academic Press	2012



Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(ESC)	Engineering Mechanics	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		50		50		100		200
AS105		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.

Course Objective: To provide knowledge of force analysis methods required in engineering applications and solutions. Also, to develop analytical and computational ability.

Course Outcomes (CO): *At the End of the course students will be able to*

AS105.1	Draw free body diagram and determine reactive forces using conditions of equilibrium and Lami's theorem
AS105.2	Determine coefficient of friction for various contact surfaces
AS105.3	Analyze the three-dimensional system of space forces.
AS105.4	Analyze the kinematics of particle and obtain the various parameters of motion.
AS105.5	Determine Instantaneous centre of rotation (ICR).
AS105.6	Design and conduct an experiment to demonstrate principles of statics and dynamics

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS105.1	3	3										
AS105.2	3	3										
AS105.3	3	3										
AS105.4	3	3										
AS105.5	3	3										
AS105.6	3	3										

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
AS105.1	3					
AS105.2	3					
AS105.3	3					
AS105.4	3					
AS105.5	3					
AS105.6	3					

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	A Apply ✓	Analyze	Evaluate	Create
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Department of CSE-DS

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Unit1	Equilibrium of forces		8
	1.1	Equilibrant force, conditions of equilibrium for concurrent forces, parallel forces and general force system, equilibrium of connected bodies, Lami's theorem.	1,3	
	1.2	Types of supports, types of loads, Beams, Determination of reactions at supports for various types of loads on beams	3	
2	Unit2	Friction		4
	2.1	Introduction to Laws of friction, Cone of friction, Equilibrium of bodies on inclined plane, Application to problems involving wedges, ladders.	1,2	
3	Unit3	Forces in space		5
	3.1	Rectangular Components of Forces in Space, Resultant of Space forces, Moment of a Force about a point, axis and line. Equilibrium of a particle in space.	1	
4	Unit4	Kinematics of Particle		8
	4.1	Motion along straight and curved path, Rectangular component of velocity and acceleration, Tangential & Normal component of acceleration, Motion curves(a-t, v-t, s-t curves), Projectile motion,	2,3	
5	Unit5	Kinematics of Rigid Bodies		3
	5.1	Instantaneous center of rotation for the velocity of bodies in plane motion, (up to 2 linkage mechanism)	3	
6	Self Study	1. Applications of resultant of forces, concept of couple and moments, 2. Centroid and center of gravity, analysis of trusses. 3. Kinetics of rigid body, work energy principle. 4. Principle of Law of Conservation of momentum, Impact and collision.	1,2,3	6*
Total (*Not included)				28

Laboratory Component

Sr. No.	Title of the Experiment
1	Draw the force polygon and determine the equilibrant force for concurrent coplanar force system.
2	Use the conditions of equilibrium for parallel force system and determine the support reactions.
3	Apply the principle of moment for equilibrium of levers.
4	Determine the coefficient of friction for glass slab and a metal plate on an inclined plane.



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5	Determine the axial forces using Lami's theorem for Jib crane apparatus.
6	Use the conditions of equilibrium for non-concurrent non-parallel force system and draw the force polygon.
7	Measure the acceleration due to gravity with the help of simple pendulum apparatus.
8	Determine the range of projectile and the time of flight for the projectile motion.
9	Verify the law of conservation of momentum and determine the coefficient of restitution for collision
10	(Plot the motion of projectile using air-cushion table apparatus.) A small project based on Engineering Mechanics concept.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Vector Mechanics for Engineers statics and dynamics	Nineth	Beer and Johnston	McGraw Hill	2010
2	Engineering Mechanics	Fifth	Bhavikatti S and Rajsekharappa	New Age International	2009
3	Engineering Mechanics Statics and Dynamics	Fourteenth	A K Tayal	Umesh Publication, Delhi	2012

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Engineering Mechanic: Statics and Dynamics,	Fifth	E.W. Nelson, C.L. Best, W.G. McLean,	McGraw Hill	1998
2	Singer's Engineering Mechanics Statics and Dynamics	Third	Vijaya Kumar Reddy. K. and Suresh Kumar. J	BS Publication	2012



Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(ESC)	Problem Solving using OOP	2	0	2	3	7	2	0	1	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
CS102		Theory		--		--		--		--
		Laboratory		200		--		100		300

Pre-requisite Course Codes, if any.	Problem Solving using Imperative Programming
Course Objective:	To learn problem solving using Object-Oriented programming paradigm
Course Outcomes (CO):	<i>At the End of the course students will be able to</i>
CS102.1	Apply concepts of object-oriented programming using classes and objects
CS102.2	Apply Inheritance for a given scenario
CS102.3	Apply polymorphism for solving a given problem
CS102.4	Apply abstraction and exception handling to create efficient program.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS102.1	2	2	2									
CS102.2	2	2	2									
CS102.3	2	2	2									
CS102.4	2	2	2									

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
CS102.1	2						
CS102.2	2						
CS102.3	2						
CS102.4	2						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create
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**Department of CSE-DS**

Theory (This course content delivery will be in C++/Java. Course Contents to be taken care accordingly)

Module No.	Unit No.	Topics	Ref.	Hrs.
1		Introduction and Encapsulation		8
	1.1	Introduction to Object Oriented Programming, Procedural verses Object Oriented Programming, Principles, Benefits and applications of Object-Oriented Programming.	1,2	
	1.2	Encapsulation: Problem solving with Objects and Classes		
	1.3	static data member and methods, constructors and their types. Types of functions and keywords, Strings, Arrays		
2		Inheritance		6
	2.1	Concept of Inheritance, parent class, derived class, base class and derived class constructor	1,2	
	2.2	Types of inheritance: single, multiple, multilevel, hierarchical, hybrid		
	2.3	Aggregation and Composition		
3		Polymorphism		6
	3.1	Static Polymorphism: Method overloading and Constructor overloading	1,2	
	3.2	Dynamic Polymorphism: Method overriding		
	3.3	Data conversion		
4		Abstraction		2
	4.1	Abstraction: abstract class	1,2	
5		Exception Handling		6
	5.1	try, throw, and catch exceptions	1,2	
	5.2	Function exception declaration		
6	Self Study	File Handling, \$ STL, \$pointers, \$virtual functions @Multithreading, @Packages, @interface	1,2	5*
Total				28+ 5*

\$ only for C++

@ only for Java

**** Language used: C++ for Etrx and Extc Branch**

**** Language used: C++/Java for CSE and CE Branch**



Department of CSE-DS

Laboratory Component

Sr. No.	Title of the Experiment
1	Program on Encapsulation: Write a program to demonstrate classes and objects
2	Program on Encapsulation: Write a program to demonstrate constructor
3	Program on Polymorphism: Implement a Program to demonstrate method overloading,
4	Program on Polymorphism: Implement a Program to demonstrate constructor overloading
5	Program on Polymorphism: Implement a Program to demonstrate method overriding
6	Program on Inheritance: Implement a Program to demonstrate single, multilevel Inheritance
7	Program on Inheritance: Implement a Program to demonstrate multiple Inheritance
8	Program on Abstraction: Implement a Program to demonstrate Abstraction using abstract class
9	Program on Abstraction: Implement a Program to demonstrate multithreading/ STL
10	Program to demonstrate File Handling

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Object Oriented Programming with C++	Sixth	E Balagurusamy	Tata McGraw Hill	2017
2	Oriented Programming in Turbo C++	Fourth	Robert Lafore	Galgotia	2001
3	Java -The Complete Reference	Tenth	Herbert Schildt	Tata McGraw-Hill	2017
4	Java Programming From the Ground Up	First	Ralph Bravaco, Shai Simoson	Tata McGraw-Hill	2009

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	The Complete Reference C++	Fourth	Herbert Schlitz	Tata McGraw Hill	2017
2	An introduction to Programming and Object Oriented Design using Java	Third	Jaime Nino, Frederick A. Hosch	Wiley Student Edition	2010



Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(ESC)	Digital Systems and Microprocessor	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		300
EC101		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.		
Course Objective: To prepare students to perform the analysis and design of various digital electronic circuits and introduce them to the concept of microprocessors		
Course Outcomes (CO): <i>At the End of the course students will be able to</i>		
EC101.1	Explain various logic gates, SOP, POS forms and their minimization with k-map for given combinational circuits.	
EC101.2	Construct combinational circuits using given MSI devices.	
EC101.3	Apply the knowledge of flip-flops and MSI to design sequential circuits	
EC101.4	Compare the logic families based on their characteristics	
EC101.5	Comprehend the architectural features of 8085 with basic assembly language programming	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC101.1												
EC101.2												
EC101.3												
EC101.4												
EC101.5												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
EC101.1							
EC101.2							
EC101.3							
EC101.4							
EC101.5							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
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Department of CSE-DS

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	Combinational Circuits		11
	1.1	Logic Gates: Basic gates, Universal gates, Sum of products and products of sum, minimization with Karnaugh Map (up to four variables), Quine Mc'Clusky method and realization.	1,4	
	1.2	Combinational Circuits using basic gates as well as MSI devices: Half adder, Full adder, Half Subtractor, Full Subtractor, Multiplexer, Demultiplexer, Decoder, Comparator	1,4	
2	Title	Sequential Circuits		11
	2.1	Sequential Logic: Latches and Flip-Flops. Conversions of Flip-Flops.	1,4	
	2.2	Counters: Asynchronous Counters, Synchronous Counters, Up Down Counters, Mod Counters, Ring and Twisted Ring Counters, Shift Registers, Universal Shift Register	1,4	
	2.3	MSI counters (IC 7490, IC 74160, IC 74163, IC 74169), MSI Shift registers (IC 74194) and their applications	2,5	
3	Title	Clocked Synchronous Machines		05
	3.1	Mealy and Moore Machines, Clocked synchronous state machine analysis, State reduction techniques.	2,5	
4	Title	Logic Families		05
	4.1	Types of logic families (TTL and CMOS), characteristic parameters (propagation delays, power dissipation, Noise Margin, Fan-out and Fan-in), transfer characteristics of TTL NAND.	1,4	
5	Title	Introduction to Microprocessors		10
	5.1	Evolution of computers and Microprocessors	3	
	5.2	Essential components of a conventional Central Processing Unit (CPU)	3	
	5.3	Architecture of 8-bit microprocessor 8085	3	
	5.4	Basic instruction set with its addressing modes and concepts of Instruction cycle, Machine cycle and T states. Elementary programming in assembly language.	3	
	5.5	Elements of I/O data transfer with the concept of interrupts	3	
6	Self Study	Concepts of PROM, PAL and PLA. Timing Considerations and Meta-stability in Flip-Flops. Clocked synchronous state machine design. Interfacing CMOS to TTL and TTL to CMOS. Concepts of peripherals and memory with its interfacing with 8085 microprocessors		5*
Total (*Not included)				42

**Sardar Patel Institute of Technology**

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Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

Department of CSE-DS**Laboratory Component (Minimum 10 Laboratory experiments are expected)**

Sr. No.	Title of the Experiment
1	To implement the combinational logic for given function using basic gates/MSI ICs. a. To study and verify the truth table of logic gates b. To study the universal NAND and NOR gate c. To study the working of half adder, full adder, half subtractor, Full subtractor along with truth table
2	To implement TTL and CMOS logic family a. To study TTL NAND gate (BJT implementation). b. To study CMOS NAND gate c. To study interfacing of the TTL /CMOS
3	To implement 4-bit, 5-bit and 8-bit comparator using given MSI
4	To design implement gate level multiplexers and MSI multiplexers
5	To design and implement gate level and MSI circuits of flip-flops
6	To design counters a. To design a MOD4 synchronous up/down counter b. To study IC 7490 – Asynchronous Decade Counter
7	To synchronous counters, synchronous counters and shift register using given MSI. a. To study IC 74160 as Synchronous Decade Counter and Mod 6 counter b. To study IC 74163 as Synchronous MOD 16 Counter and Mod 10 counter c. To verify the truth table of IC 74194 as Universal Shift Register and implement Ring and Twisted Ring Counter.
8	To perform basic arithmetic operations through assembly language program in 8085
9	To simulate COPY and PASTE operation through 8085 assembly programs
10	To write a program to add N elements stored in an array of 8-bit numbers (8085)

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1.	Modern Digital Electronics	Fourth	R. P. Jain	Tata McGraw Hill	2009
2	Digital Design Principles And Practices	Third	John F. Wakerly	Pearson Education	2001
3	Microprocessor Architecture, Programming, and Applications with the 8085	Sixth	Ramesh S. Gaonkar	Penram International	2013

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Digital Design	Forth	Morris Mano	Pearson Education	2008
2	Fundamentals of digital logic design with VHDL	Second	Stephen Brown and Zvonko Vranesic	McGraw Hill	2006



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Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(SBC)	Communication Skills	1	0	2	2	5	1	0	1	2
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		--		50**		--		50
AS107		Laboratory		150*		--		--		150

** MSE will be evaluated on the basis of written test based on module 1 and 2.

** ISE will be evaluated on the basis of marks scored in practicals, out of 150.

Pre-requisite Course Codes, if any.	
Course Objective: To apply the principles of communication in personal and professional environment.	
Course Outcomes (CO): <i>At the end of the course students will be able to</i>	
AS107.1	Apply the principles of business writing for professional documents.
AS107.2	Develop advance vocabulary and grammar for spoken and written communication.
AS107.3	Design the draft a formal speech.
AS107.4	Analyze received information by using active listening and reading skills.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS107.1										2		
AS107.2										2		
AS107.3										2		
AS107.4										2		

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
AS107.1							
AS107.2							
AS107.3							
AS107.4							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze ✓	Evaluate	Create
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Department of CSE-DS

Theory Component

Module No.	Unit No.	Topics	Ref.	L Hrs.	P Hrs
1	Title	Vocabulary Building & Grammar		2	4
	1.1	Concept of word formation, the root words from foreign languages and their use in English	7,1		
	1.2	Common errors in writing, confused pair of words, redundancies, clichés	6, 2		
2	Title	Writing Skills		7	14
	2.1	Principles of Business Writing: 7Cs of communication, sentence structures, Organizing paragraph in direct and indirect style; Summarization	4		
	2.2	Practices in Writing: E-mail Etiquettes, e-mail for business purposes	3		
	2.3	Critical Reading: understanding the concept of critical reading and applying to analyze a given text.	5		
3	Title	Oral Skills		5	10
	3.1	Listening Comprehension(audio): Pronunciation, intonation, Stress and Rhythm	5		
	3.2	Speaking Practices: 1. Common everyday situation: Conversation and dialogues (group activity, ice-breaking session) 2. Public Speaking: Extempore, formal speech	3		
4	Self Study	1. Basic Rules Of Grammar 2. GRE Vocabulary 3. Reading a book(fiction/non-fiction) and preparing a review on it		6*	
Total (*Not included)				42 hrs	

List of activities (Graded, Non-graded)

Sr. No.	Title of the assignments	Marks
1	Skit based on a given situation	-
2	ISE 1 – Summary Writing	10
3	ISE 2 – Extempore	10
4	ISE 3 – Grammar	20
5	ISE 4 – Vocabulary	20
6	Reviewing a book (fiction/ non-fiction)	10
7	ISE 5 – Email Writing (Inquiry)	20
8	ISE 6 – Email Writing (Complaint)	20
9	ISE 6 – Speech	20
10	ISE 7 – Critical Reading	20
	Total	150



Bharatiya Vidya Bhavan's

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Department of CSE-DS

Text Books:

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Communication Skills	2013	Shirley Mathews	Technical Publication, Pune	2013
2	English Vocabulary in Use	1999	Michael McCarthy, Felicity O'Dell	Cambridge University Press, India	1999

Reference Books:

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Oxford Practice Grammar	1999	John Eastwood	Oxford, India	1999
2	Communication Skills	2011	Meenakshi Raman, Sangeeta Sharma	Oxford, India	2011
3	Communication Skills	2010	Dr. Meera Bharwani	Synergy Knowledge ware, India	2010
4	English Grammar for Today	2005	Geoffrey Leech	Palgrave, UK	2005
5	Word Power Made Easy	1978	Norman Lewis	Anchor Books, New York	1978



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Department of CSE-DS

Sem III									
No	Type	Code	Course	L	T	P	O	E	C
1	BSC	MA203	Probability and Statistics	3	0	0	5	08	3
1	BSC*	MA202	Foundation of Mathematics-I*	2	1	0	6	09	3
2	PC	DS201	Discrete Structures and Graph Theory	3	0	0	4	07	3
3	PC	DS202	Data Structures	3	0	2	5	10	4
4	PC	DS203	Computer Architecture and Organization	3	0	2	4	09	4
5	PC	DS204	Database Management Systems	3	0	2	5	10	4
6	ABL	SVXX/STXX	SEVA II or III /SATVA II or III	0	0	0	3	03	1
7	HSSE	HSEX1	HSS-I	2	0	0	3	05	2
			TOTAL	19	1	6	35	52	24

**Only for Lateral Entry Students*

Sem IV									
No	Type	Code	Course	L	T	P	O	E	C
1	BSC	MA201	Linear Algebra	2	0	2	5	09	3
1	BSC*	MA204	Foundation of Mathematics-II	3	0	0	6	09	3
2	PC	DS205	Design and Analysis of Algorithms	3	0	2	5	10	4
3	PC	DS206	Operating Systems	3	0	2	5	10	4
4	PC	DS207	Computer Communications and Networks	3	0	2	5	10	4
5	SBC	DS208	Mini Project-I	0	0	0	4	04	2
6	ABL	SVXX/STXX	SEVA II or III /SATVA II or III	0	0	0	3	01	1
7	HSSE	HSEX2	HSS-II	2	0	0	3	05	2
8	SBC	AS201	Professional Communication Skills	1	0	2	2	05	2
9	S/M	SCX1/MNX1	SCOPE-I/Minor-I						3
			TOTAL	17	0	10	38	63	28

**Only for Lateral Entry Students*

Second Summer for HSC students									
No	Type	Code	Course	L	T	P	O	E	C
1	MLC	AS202	Constitution of India				06	06	NC

Second Summer (For Lateral Entry Students)									
No	Type	Code	Course	L	T	P	O	E	C
1	BSC	MA201	Linear Algebra	2	0	2	5	09	3
1	BSC	MA203	Probability and Statistics	3	0	0	5	08	3
2	MLC	AS202	Constitution of India				06	06	NC



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Semester-III



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Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Probability and Statistics	3	0	0	5	8	3	0	0	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		300
MA203		Laboratory		--		--		--		--

Pre-requisite Course Codes, if any.		-
Course Objective: To give an exposure to the students the basic concepts of Probability and Statistical methods and their application.		
Course Outcomes (CO): <i>At the End of the course students will be able to</i>		
MA203.1	Familiarize with basic probability axioms, rules and their applicability.	
MA203.2	Identify the characteristics of various discrete and continuous distributions.	
MA203.3	Find unbiased and efficient estimates using estimation theory.	
MA203.4	Test the hypothesis for means and variances using 't' & F; chi-square distribution tests.	
MA203.5	Find Correlation and Regression and fit different types of curves.	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA203.1	2											
MA203.2		2										
MA203.3		2										
MA203.4		2										
MA203.5		2										

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MA203.1	2						
MA203.2	2						
MA203.3	2						
MA203.4	2						
MA203.5	2						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create
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Department of CSE-DS

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	Probability and Random Variables	1, 2	12
	1.1	Classical, relative frequency and axiomatic definitions of probability, addition rule and multiplication rule. Conditional Probability, Bayes’ theorem and independence.		04
	1.2	Discrete, continuous and mixed random variables, probability mass function (PMF), Probability Density Function (PDF) and cumulative distribution function (CDF). Joint Distributions: Joint, marginal and conditional distribution.		04
	1.3	Mathematical expectation, moments, moments generating function, Chebyshev’s inequality.		04
2	Title	Probability Distributions	1, 2	12
	2.1	Standard discrete distributions: Bernoulli, Binomial, Poisson and Geometric distributions, Probability density function, Cumulative distribution function, Expectation and Variance,		06
	2.2	Standard continuous distributions – Uniform, Normal, Exponential, Joint distribution and Joint density functions		06
3	Title	Test of Hypothesis and Significance	1, 2	12
	3.1	Statistical hypothesis, Null and Alternate hypothesis, test of hypothesis and significance, Type I and Type II errors, Level of Significance, Tests involving the Normal distribution, One-Tailed and Two-Tailed tests, P value.		03
	3.2	Special tests of significance for large samples and small samples (F, chi- square, z, t- test), ANOVA.		09
4	Title	Correlation and Regression	1, 2	06
	4.1	Correlation, Rank correlation, Regression Analysis, Linear and Non-linear Regression, Multiple regressions, Curve fitting by method of least squares, fitting of straight lines, Polynomials, Exponential curves.		
5	Self Study	1. Applicability of Bayes theorem 2. Proofs for mean & variance for all distribution: included in module 2 3. Examples to test goodness of fit using Chi-square		01* 02* 02*
Total				42

* Not included in Total 42 hrs.



Bharatiya Vidya Bhavan's

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Department of CSE-DS

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Introduction to Probability and Statistics for Engineers and Scientists	Fourth	Sheldon M. Ross	Academic Foundation	2011
2	Probability and Statistics for Engineers and Scientists	Eighth	E. Walpole, R. H. Meyers, S. L. Meyers and K. Ye	Pearson Education	2007

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Probability and Statistics in Engineering	Fifth	Douglas C. Montgomery	Wiley India	2012
2	Probability & Statistics	Third	Spiegel, M. R., Schiller, J. and Srinivasan, R. A.	Tata McGraw Hill	2010



Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Foundations of Mathematics-I	2	1	0	0	3	2	1	0	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		300
MA202		Laboratory		--		--		--		--

Pre-requisite Course Codes, if any.		-
Course Objective: To develop basic foundation of mathematical skills.		
Course Outcomes (CO): At the End of the course students will be able to:-		
MA202.1	Differentiate a function of one variable and partially differentiate a function of more than one variable.	
MA202.2	Apply the concept of partial differentiation to find extreme values of a given function.	
MA202.3	Find nth order derivative of a given function.	
MA202.4	Expand a given function as a power series.	
MA202.5	Perform operations on matrices and find inverses and determinants of them.	
MA202.6	Perform vector operations and compute dot products and cross products between them.	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA202.1	2											
MA202.2	2											
MA202.3	2											
MA202.4	1											
MA202.5	1											
MA202.6	1											

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
MA202.1						
MA202.2						
MA202.3						
MA202.4						
MA202.5						
MA202.6						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember ✓	Understand ✓	Apply ✓	Analyze	Evaluate	Create
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Department of CSE-DS

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	Title	Differential Calculus	1,2	18
	1.1	Partial fractions. Derivatives of standard functions, product and quotient rule for differentiation.		04
	1.2	Partial derivatives of first and higher order, composite differentiation		03
	1.3	Application of partial derivatives: Local Maxima and Minima of functions of two variables.		02
	1.4	Successive Differentiation: Proofs of nth derivatives of standard functions. Use of partial fractions to calculate nth derivatives of given functions. Leibnitz theorem for nth derivative of product of two functions.		05
	1.5	Infinite series: expansion of functions in powers of x using maclaurin series. Taylor's series.		04
2	Title	Matrices	1,2	07
	2.1	Addition and scalar multiplication of matrices. Matrix multiplication, types of matrices.		03
	2.2	Elementary row transformations, finding inverses using matrices, determinants and its properties		04
3	Title	Vectors	1,2	03
	3.1	Vector definition, addition, scalar multiplication, dot product of two vectors, angle between two vectors, cross product.		03
Total				28

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Higher Engineering Mathematics	Forty Forth	Dr. B. S. Grewal	Khanna Publications	2020

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Advanced Engineering Mathematics	Tenth	Erwin Kreyszig	John Wiley & Sons	2011
2	Advanced Engineering Mathematics	Twenty Eighth	H. K. Dass	S. Chand Publications	2014



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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Discrete Structures and Graph Theory	3	0	0	4	7	3	0	0	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		300
DS201		Laboratory		--		--		--		--

Pre-requisite Course Codes, if any.	
Course Objective: To teach students how to think logically and mathematically. It provides the mathematical foundation that is used in most areas of computer science.	
Course Outcomes (CO): <i>At the End of the course students will be able to</i>	
DS201.1	Solve problems using set theory, logic and its various proof techniques.
DS201.2	Apply the concepts of relations, functions, lattices and recurrence relations to solve problems
DS201.3	Apply the concepts of graph, trees and their various types with their traversing techniques to solve problems.
DS201.4	Apply the basics of coding theory and cryptography to solve real world problems.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
DS201.1	3											
DS201.2	3	2										
DS201.3	3											
DS201.4	3	2	2									2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
DS201.1			2				
DS201.2			2				
DS201.3			2				
DS201.4			2				

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create
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Department of CSE-DS

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	Set Theory, Logic and Proofs	1, 2	
	1.1	Finite and infinite set, Union, Intersection, Disjoint, and Difference of two sets. Power Set, Partition of Sets, Ordered Sets, De Morgan's Laws, Principle of Inclusion Exclusion		2
	1.2	Predicates, Propositions, Conditional Propositions, Logical Connectivity, Proposition calculus, Universal and Existential Quantifiers, First order logic, Equivalence, Normal Forms, Introduction to proofs, Mathematical Induction, Strong Induction, Well-ordering principle, Logical inference		6
2	Title	Relations, Functions and Lattices	1, 2	
	2.1	Product Sets and Partitions, Paths in relations and Diagraphs, Properties of Relations, Closure of Relation, Equivalence Relations, Operations on Relations, Warshall's Algorithm, Partially Ordered Sets, External Elements of Partially Ordered Sets, Hasse Diagram		8
	2.2	Composition of Functions, Invertible Functions, Recursive Functions, Hashing, Pigeon hole Principle, Extended PHP		3
	2.3	Lattice, Sub lattice, Isomorphic Lattices, Properties of Lattice, Special Types of Lattices		4
	2.4	Recurrence Relations – Introduction, Linear Recurrence Relations with constant coefficients, Homogeneous solutions, Particular Solutions, Total Solutions, Solution by the method of Generating functions, solving Recurrence Relations		5
3	Title	Graph Theory	1, 2	4
	3.1	Concepts and terminologies, Graphs as Model (Konigsberg Bridge Problem)		
	3.2	Matrices, Isomorphism, Bipartite Graphs, Directed Graphs		
	3.3	Minimal Spanning Trees-Prim's Algorithm and Kruskal's Algorithm		
4	Title	Graph connectivity	1, 2	6
	4.1	Cycles – Transport Networks, Max Flows, Matching Problems, Maximum Bipartite Matching, Perfect Matching		
	4.2	Euler Paths- Circuits, Hamiltonian Paths- Circuits		
	4.3	Coloring Graphs, Chromatic Polynomial, Planer Graphs		
5	Title	Coding Theory	1, 2	4
	5.1	Hamming Code, Minimum Distance		
	5.2	Number Theory, Modular Arithmetic and applications to cryptography; Diffie-Hellman Algorithm		



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6	Self-Study	Algebraic Structures - Semi group, Monoids, Groups, Cyclic groups, Abelian groups, Normal Subgroups	1, 2	5*
Total (*Not included)				42

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Discrete Mathematics and its applications	Seventh	Kenneth H. Rosen	Tata McGraw-Hill	2013
2	Discrete Mathematical Structures	Sixth	BernadKolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur-Rehman	Pearson Education	2015

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Elements of Discrete Mathematics	Fourth	C. L. Liu	Tata McGraw-Hill	2012
2	Introduction to graph Theory	Second	Douglas B. West	Pearson Education	2015
3	Discrete Mathematical Structures with Applications to Computer Science	First	Jean-Paul, Tremblay R. Manohar	Tata McGraw-Hill	1987



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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Data Structures	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		300
DS202		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.	1. Problem solving using imperative programming
Course Objective: To introduce the fundamentals and abstract concepts of Data Structures for Problem Solving.	
Course Outcomes (CO): <i>At the End of the course students will be able to</i>	
DS202.1	Apply various operations of linear and non-linear data structures to given problems.
DS202.2	Apply the concepts of Trees and Graphs to a given problem.
DS202.3	Apply various operations of heap data structures.
DS202.4	Apply the concepts of hashing on a given problem

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
DS202.1	3		3						3	3	3	
DS202.2	3		3						3	3	3	
DS202.3	3		3						3	3	3	
DS202.4	3		3						3	3	3	

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
DS202.1			1			1	
DS202.2			1			1	
DS202.3			1			1	
DS202.4			1			1	

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create
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Department of CSE-DS

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	Introduction to Data Structures		
	1.1	Concept of Linear and Nonlinear Data Structures	1,2	1
	1.2	Stack: Stack as ADT, operations on stack, Applications of Stacks	1,2	4
	1.3	Queue: Queue as ADT, Operations on Queue, Applications of Queue, Types of Queue-Circular and Priority Queue	1,2	4
	1.4	Linked List: Linked List as ADT, Operations on Singly Linked List. Types of linked list- Linear and circular linked lists, Doubly Linked List, Circular Linked List and its operations, Generalized Linked List (GLL) concept, Applications of linked List and Generalized Linked List (GLL).	1,2	6
2	Title	Trees		
	2.1	Trees as ADT, General tree v/s Binary Tree Terminology, Traversal of Binary Tree, Operations on Binary tree, Binary Search Tree and its operations, Expression Tree	1,2	5
	2.2	AVL Trees- Properties of AVL trees, Rotations, Insertion, and Deletion	1,2	4
	2.3	Introduction to B tree- Insertion, Deletion.	1,2	3
3	Title	Graphs		
	3.1	Graph as ADT, Introduction To Graph, Representation of Graph-Adjacency Matrix, Adjacency List, Graph Traversal Technique	1,2	3
4	Title	Heap Structure		
	4.1	Heap as ADT, Introduction to Heap Structures, Min Heap, Max Heap, Construction of Heap	1,2	3
	4.2	Fibonacci heaps- Structure of Fibonacci heaps, Mergeable-heap, operations, decreasing a key and deleting a node	1,2	5
5	Title	Hashing		
	5.1	Introduction to Hash Table, Hash functions, Collision Resolution Technique.	1,2	4
6	Self Study	Optimal Binary Search Tree and Red-Black Trees	1,2	5*
Total				42

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Implement a given problem statement using Stack.
2	Implement a given problem statement using Queue
3	Implement a given problem statement using Linked List.
4	Implement a given problem statement using Doubly Linked List.
5	Implement a given problem statement using Binary Trees.
6	Implement insertion of node in AVL tree.



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7	Implementation of expression tree
8	Implement Operations of Heap Structures.
9	Implement hash functions with different collision resolution techniques.
10	Apply Graph Traversal Technique on a given problem statement to solve the problem

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Introduction to Algorithms	Third	Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein	MIT Press	2009
2	Fundamentals of Computer Algorithms	Second	Horowitz E, Sahni S and S. Rajasekaran	Galgotia Publications	2010

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Classic Data Structures	Second	Samanta Debasis	PHI	2009
2	Data Structures With C	First	Seymour Lipschutz	Schaum's Outline Series	2010



Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Computer Architecture and Organization	3	0	2	4	9	3	0	1	4
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		300
DS203		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.		Digital Circuits & Systems, Any Programming Language
Course Objective: Imparting concepts of each component of computer architecture thoroughly with practical aspects including memory systems and I/O communications with interfacing		
Course Outcomes (CO): <i>At the End of the course students will be able to</i>		
DS203.1	Explain basic computer structure and compare computer architecture models	
DS203.2	Design algorithms to solve ALU operations and memory mapping techniques	
DS203.3	Comprehend processor architecture with various design methods of CPU with comparative analysis	
DS203.4	Illustrate memory systems with design and analysis of mapping techniques for cache and virtual memory	
DS203.5	Analyze different parallel processing and pipelining concepts with pipelining hazards	
DS203.6	Comprehend different types of I/O buses, compare and contrast different types of data transfer methods and arbitration techniques	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
DS203.1	3											
DS203.2		3			3			3		3		
DS203.3	3	2										
DS203.4		2	1									
DS203.5		2	1									
DS203.6	3											

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
DS203.1							
DS203.2							
DS203.3							
DS203.4							
DS203.5							
DS203.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze ✓	Evaluate	Create
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Department of CSE-DS

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	Overview of Computer Architecture and Organization		5
	1.1	Introduction of Computer Organization and Architecture, Basic organization of computer and block level description of the functional units, Evolution of x86 Computers, Von Neumann model, Harvard Model, Embedded system	1	
	1.2	Performance Issues: Designing for performance, Amdahl's Law, Multi-core, GPGPU	1	
2	Title	Data Representation and Arithmetic Algorithms		6
	2.1	Number representation: Floating-point representation, Floating point arithmetic, IEEE 754 floating point number representation	2,3	
	2.2	Integer Data computation: Addition, Subtraction. Multiplication: Signed multiplication, Booth's algorithm.	2,3	
	2.3	Division of integers: Restoring and non-restoring division	2,3	
3	Title	Processor Organization and Control Unit		9
	3.1	CPU Architecture, Register Organization Instruction formats, basic instruction cycle. Instruction interpretation and sequencing, Case Study of 8086 architecture and Register Organization	1,2,4	
	3.2	Control Unit: Soft wired (Micro-programmed) and hardwired control unit design methods. Microinstruction sequencing and execution. Micro operations	2,4	
	3.3	RISC and CISC: Introduction to RISC and CISC architectures and design issues.	2,4	
4	Title	Memory Organization		11
	4.1	Introduction to Memory and Memory parameters. Classifications of primary and secondary memories. Types of RAMS and ROM, Allocation policies, Memory hierarchy and characteristics.	1,2	
	4.2	Cache memory: Concept, architecture (L1, L2, L3), mapping techniques. Cache Coherency, Interleaved and Associative memory.	1,2	
	4.3	Virtual Memory: Concept, Segmentation and Paging, Page replacement policies	1,2,4	
5	Title	I/O Organization and Introduction to Parallel Processing		11
	5.1	Buses: Types of Buses, Bus Arbitration, BUS standards	2	
	5.2	I/O Interface, I/O channels, I/O modules and IO processor, Types of data transfer techniques: Programmed I/O, Interrupt driven I/O and DMA.	1,2	
	5.3	Introduction to parallel processing concepts, Flynn's classifications, pipeline processing, Pipeline stages, Pipeline Hazards	1,2,4	

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6	Self Study	Comparative Study of microprocessors and micro architectures with respect to their important features. 8086 instructions and assembler directives with addressing modes with memory interfacing techniques. Cache memory protocol and virtual memory concepts in Pentium processors. Vector and Array Processors with VLIW architecture.	Ref. 2,5,6	6*
Total (* Not included)				42

Laboratory Component (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Implement various Arithmetic Operations through Assembly Language Programming for microprocessor 8086 (MASM)
2	Simulate the operation of COPY and PASTE in 8086 (MASM)
3	Implement various String Operations in 8086 through the utilities provided by DOS interrupts (MASM)
4	Generation of alphabetic arrangement of a given string in 8086 (MASM)
5	Design password application (generation and detection) in 8086 (MASM/C)
6	Design of Carry Look Ahead Adder
7	Implement Booth's Multiplication Algorithm
8	Implement Division Algorithm (Non-Restoring and Restoring)
9	Implement Mapping techniques of Cache memory
10	Implement Page Replacement Policies

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Computer Organization	Fifth	Carl Hamacher, Zvonko Vranesic, Safwat Zaky	Tata McGraw-Hill	2002
2	Computer Organization and Architecture: Designing for Performance	Eighth	William Stallings	Pearson	2010
3	Computer System Architecture	Third	M, Morris Mano	Pearson	2007
4	Computer Architecture & Organization	Third	John P. Hayes	McGraw-Hill	1998



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Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Structured Computer Organization	Sixth	Andrew S. Tanenbaum	Pearson	2013
2	Microprocessor and Interfacing: Programming & Hardware	Third	Douglas V Hall	Tata-McGraw Hill	2012
3	Computer Architecture and Organization: Design Principles and Applications	Second	B. Govindarajulu	McGraw Hill	2017
4	Programmer's reference Manual for IBM Personal Computers	First	Steven Armburst	McGraw Hill	1986
5	Pentium Processor System Architecture	Second	Don Anderson, Tom Shanley, MindShare Inc, MindShare, Inc	Addison-Wesley Professional	1995
6	Modern Processor Design: Fundamentals of Superscalar Processors	Second	John Paul Shen , Mikko H. Lipasti	Waveland Press Inc.	2013



Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Database Management Systems	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		300
DS204		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.		-
Course Objective: To efficiently and effectively Design, develop, maintain and retrieve the Information from DBMS.		
Course Outcomes (CO): <i>At the End of the course students will be able to</i>		
DS204.1	Demonstrate understanding of given system to construct a database model.	
DS204.2	Apply various Relational and SQL commands on the populated database.	
DS204.3	Examine the functional dependencies to make a normalized database system.	
DS204.4	Examine transaction processing techniques on a database.	
DS204.5	Illustrate query processing and optimization method on a database.	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
DS204.1	1	2	2	2	2	1		1	2			2
DS204.2	2	2	2		2							
DS204.3	1	2	2		2							
DS204.4	1	2			2							
DS204.5	2	2										

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
DS204.1						3	
DS204.2							
DS204.3							
DS204.4							
DS204.5							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze✓	Evaluate	Create
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Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	Introduction: Database Concepts and ER Modeling	1,2	09
	1.1	Introduction to basic concept of Database, Characteristics of databases, File system V/s Database system, Users of Database system, Database Administrator, Data Independence, Codd's Rule, DBMS system architecture.		
	1.2	Introduction to ER model, Benefits of Data Modeling, Types of data Models, Phases of Database Modeling, The Entity-Relationship (ER) Model, Extended Entity-Relationship (EER) Model		
2	Title	Relational Algebra and SQL	1,2	16
	2.1	Introduction, Mapping the ER and EER Model to the Relational Model, Relational Algebra: Overview, Basic Operators, Extended Operators		
	2.2	Overview of SQL, Data Definition Commands, Data Manipulation commands, Data Control commands, Set operations, aggregate function, null values, Views in SQL, Subquery, Trigger, stored procedure		
3	Title	Normalization	1,2	06
	3.1	Design guidelines for relational schema, Functional dependencies		
	3.2	Normal Forms- 1NF, 2 NF, 3NF, BCNF and 4NF,5NF		
4	Title	Transaction Processing and Recovery	1,2	07
	4.1	Transaction concept, Transaction states, ACID properties, Implementation of atomicity and durability, Concurrent Executions, Serializability, Recoverability, Lock-based, Timestamp-based, Validation-based protocols.		
	4.2	Shadow paging, Deadlock handling.		
5	Title	Introduction to Query Processing and Query Optimization	1,2	04
	5.1	Basics of Query Processing, Measures of Query Cost		
	5.2	Query Optimization: Equivalence Rules, Pictorial representations		
6	Self Study	1. Relational Calculus-Information retrieval 2. NO SQL-Data type, Database creation, Basic command for creation, updating and querying the database, Mongo dB	1,2	5*
Total (*Not included)				42

**Department of CSE-DS****Laboratory Component:**

Assign a case study for group of 2/3 students and each group will perform following experiments on the case study.

Exp No.	Title of the Experiment
1	Formulate a case study and create an E-R Diagram. Mapping of E-R model to Relational Model.
2	To create a database and populate using SQL commands (With constraints) <ul style="list-style-type: none">• Data Definition Language- Create, Alter, Drop, Rename, Truncate• Data Manipulation Language- Insert, Update, Delete, Select• Constraints-Not Null, Unique Key, Primary Key, Foreign Key, Check, Dropping a Constraint.
3	To perform DCL, TCL commands <ul style="list-style-type: none">• Data Control Language: Grant, Revoke, Roles• Transaction Control Language: Commit, Rollback, Save point
4	To perform Date, Time, Arithmetic and Set operation on database.
5	To perform Aggregate function and Group by- Having clause on database
6	To perform Join operations on database. <ul style="list-style-type: none">• Equijoins, Non-Equijoins, Self Joins, Outer Join, cross Join
7	To retrieve a data using Subquery.
8	To Create a different view of database.
9	To examine integrity of database using Triggers.
10	To improve performance of system using stored procedure.

Textbooks

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Database System Concepts	Seventh	Korth, Silberchatz, Sudarshan	McGraw – Hill	2019
2	Fundamentals of Database Systems	Sixth	Elmasri and Navathe	PEARSON Education	2011

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Database Management Systems	Third	Raghu Ramkrishnan and Johannes Gehrke	TMH	2003
2	Database Management Systems	First	G. K. Gupta	McGraw – Hill.	2018
3	SQL, PL/SQL programming language of ORACLE	Forth	Ivan Bayross	BPB	2010



Bharatiya Vidya Bhavan's

Sardar Patel Institute of Technology

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Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

Department of CSE-DS

Semester-IV



Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Linear Algebra	2	0	2	5	9	2	0	1	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		50		50		100		200
MA201		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.		Engineering Calculus/Foundation of Mathematics-I and Differential Equations and Complex Analysis/Foundation of Mathematics-II
Course Objective: To develop mathematical skills for solving engineering problems.		
Course Outcomes (CO): <i>At the End of the course students will be able to:</i>		
MA201.1	Solve a homogeneous and non-homogeneous system of linear equations using rank of a matrix.	
MA201.2	Solve system of linear equations by Numerical Methods.	
MA201.3	Solve equations in real life problems and to encode and decode messages using the concept of matrices.	
MA201.4	Identify whether given structures are vector spaces and subspaces and construct a basis for them.	
MA201.5	Show if a given matrix is diagonalisable or not.	
MA201.6	Apply concepts of eigenvalues and eigenvectors to calculate functions of a square matrix, google page rank vector and solve systems of differential equations using diagonalisation of matrices.	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA201.1	3											
MA201.2	3											
MA201.3	3	1										
MA201.4	3											
MA201.5	3											
MA201.6	3	1										

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MA201.1							
MA201.2							
MA201.3							
MA201.4							
MA201.5							
MA201.6							



Department of CSE-DS

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember ✓	Understand ✓	Apply ✓	Analyze	Evaluate	Create
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Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	Title	Basics of matrices	3,5	03
	1.1	Revision of basic matrices and types of matrices.		01
	1.2	Row echelon form, Reduced Row Echelon form, Rank of a matrix.		02
2	Title	Linear equations & its solutions	1,2,3,5	07
	2.1	Consistency and solution of simultaneous linear homogeneous and non-homogeneous equations.		02
	2.2	Application of solving systems of equations in traffic control.		01
	2.3	Solution of system of linear algebraic equations, by (1) Gauss Elimination Method (2) Gauss Jordan method (3) Gauss Jacobi Iteration method (4) Gauss Seidel Method. (5) LU Decomposition -Crout's method		04
3	Title	Vector spaces (over field of real numbers)	1,2,5	08
	3.1	Vector space, subspace, span, linear dependence and independence of vectors, basis, dimension, orthogonal projection & gram-Schmidt process. Null space, row space, column space, Rank-Nullity theorem (only statement). Least square method.		08
4	Title	Encoding & decoding using Matrices.	4	02
	4.1	Application of matrices to Coding and Decoding		02
5	Title	Eigenvalues and Eigenvectors	1,2,3,5	08
	5.1	Eigenvalues, Eigenvectors and its properties. Cayley Hamilton theorem and its applications. Diagonalization of matrices. Derogatory and Non-derogatory matrices.		04
	5.2	Application to find google page rank. Functions of a square matrix. Solving system of differential equations using diagonalization.		04
6	Self Study	1.2 Normal form. 2.2 Forming equations using KVL for circuits and solving them using matrices. 3.1 Singular Value Decomposition. 5.1 Additional properties with proofs of eigenvalues and eigenvectors.	1,2,3,5	05
Total				28*

***Total of 28 hours does not include the self-study hours.**



Department of CSE-DS

Laboratory Component (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Introduction to Scilab (getting started) and its benefits to use as a mathematics tool.
2	Basic commands of Scilab and vectors & matrix operations.
3	Conditional branching and iterations using Scilab.
4	Solution of linear equations using row-echelon and inverse of a matrix.
5	Solutions of linear equations using Gauss Elimination method.
6	Solutions of linear equations using Gauss Jordan method.
7	Solutions of linear equations using Gauss-Jacobi method.
8	Solutions of linear equations using Gauss-Seidel method.
9	Solutions of linear equations using Crout's method.
10	To find Eigen values and Eigenvectors using Scilab

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Linear Algebra and its applications	Fourth	Gilbert Strang	Cengage	2014
2	Higher Engineering Mathematics	Forty Fourth	Dr. B. S. Grewal	Khanna Publications	2020

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Linear Algebra and its applications	Third	David. C. Lay	Pearson Education	2006
2	Elementary Linear Algebra Application Version	Sixth	H Anton and Corres	John Wiley and Sons	2010
3	Advanced Engineering Mathematics	Twenty Eighth	H.K Das	S. Chand	2014
4	Hill Ciphers	First	Jonaki B Ghosh	At Right Angles	2015
5	Advanced Engineering Mathematics	Tenth	Erwin Kreyszig	John Wiley & Sons	2011



Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Foundations of Mathematics-II	2	1	0	0	3	2	1	0	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		300
MA204		Laboratory		--		--		--		--

Pre-requisite Course Codes, if any.		Foundations of Mathematics-I
Course Objective: To develop basic foundation of mathematical skills.		
Course Outcomes (CO): At the End of the course students will be able to: -		
MA204.1	Integrate a function of one variable using various techniques	
MA204.2	Sketch basic curves and solve double and triple integrals.	
MA204.3	Solve basic problems using properties of complex numbers.	
MA204.4	Solve differential equations of first order.	
MA204.5	Apply the techniques of solving first order differential equations to electrical engineering problems.	
MA204.6	Solve differential equations of higher order	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA204.1	1											
MA204.2	1											
MA204.3	1											
MA204.4	2											
MA204.5	1	1										
MA204.6	2											

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2
MA204.1						
MA204.2						
MA204.3						
MA204.4						
MA204.5						
MA204.6						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember ✓	Understand ✓	Apply ✓	Analyze	Evaluate	Create
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Department of CSE-DS

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	Title	Integral Calculus	1,2	13
	1.1	Formulae for integral of standard functions, integration by parts, integration by method of substitution.		04
	1.2	Gamma functions, Beta functions. Differentiation under Integral sign with constant limits and one parameter.		04
	1.3	Standard curves (lines, circles, parabolas, ellipses). Concept of double integration. Evaluation of double and triple integrals.		05
2	Title	Complex Numbers	1,2	03
	2.1	Operations on complex numbers, polar form of a complex number, properties of a complex number.		03
3	Title	Differential Equations	1,2	12
	3.1	Exact differential equations. Linear differential equations of the first order and equations reducible to linear.		04
	3.2	Solving differential equations of first order in electrical networks.		01
	3.3	Linear differential equations with constant coefficients: complementary function and particular integral.		07
Total				28

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Higher Engineering Mathematics	Forty Fourth	Dr. B. S. Grewal	Khanna Publications	2020

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Advanced Engineering Mathematics	Tenth	Erwin Kreyszig	John Wiley & Sons	2011
2	Advanced Engineering Mathematics	Twenty Eighth	H. K. Dass	S. Chand	2014



Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Design and Analysis of Algorithms	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		300
DS205		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.	Advanced Data Structures
Course Objective: 1. To teach paradigms and approaches used to analyze and design algorithms and to appreciate the impact of algorithm design in practice. 2. To make students understand how the worst-case time complexity of an algorithm is defined, how asymptotic notation is used to provide a classification of algorithms.	
Course Outcomes (CO): At the End of the course students will be able to	
DS205.1	Analyze time and space complexity of an algorithm.
DS205.2	Apply divide and conquer strategy to solve problems.
DS205.3	Apply the concept of dynamic programming and greedy approach to solve problems.
DS205.4	Apply the idea of backtracking, branch and bound strategy to solve problems.
DS205.5	Apply various string matching algorithms.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
DS205.1	3	2						1		1		1
DS205.2	3	2	2	1				1	1	1		1
DS205.3	3	2	2	1				1	1	1		1
DS205.4	3	2	2	1				1	1	1		1
DS205.5	3	2	2					1	1	1		1

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
DS205.1							
DS205.2	1		1			1	
DS205.3	1		1			1	
DS205.4	1		1			1	
DS205.5	1		1			1	



Department of CSE-DS

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze ✓	Evaluate	Create
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Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	Introduction to Analysis of algorithm		12
	1.1	Role of Algorithms in Computing, Performance analysis-space and time complexity, Growth of Functions: Asymptotic Notation, Standard Notation and Common Functions, Analysis of sorting algorithms Such as Selection sort and insertion sort.	1,2	
	1.2	Divide and Conquer Approach – General Method, Analysis of Merge Sort, Analysis of Quick sort, Analysis of Binary search, Finding the maximum and minimum, Strassen's matrix multiplication.	1,2	
	1.3	Recurrences: The substitution method, Recursion tree method, Master method and Proof.	1	
2	Title	Dynamic Programming and Amortized Analysis		12
	2.1	Dynamic Programming: Assembly-line scheduling, Matrix Chain Multiplication, Longest common subsequence.	1	
	2.2	Amortized analysis- Aggregate analysis, accounting and Potential Method, Dynamic Table.	1	
3	Title	Greedy Approach		5
	3.1	Greedy Approach: Basic strategy, application to job sequencing with deadlines problem, single source shortest path-Dijkstra's algorithm.	1,2	
	3.2	Knapsack problem, Minimum cost spanning trees-Kruskal and prim's algorithm.	1,2	
4	Title	Backtracking and Branch-and-bound		5
	4.1	Backtracking: General method, 8 queen problem (N-queen problem), Sum of subsets, Graph coloring.	2	
	4.2	Branch and Bound: 0/1 knapsack problem, Travelling salesman problem, 15 puzzle problem.	2	
5	Title	Approximation and String Matching algorithms		8
	5.1	Approximation algorithms: The vertex-cover problem, The traveling-salesman problem, The set covering problem	1	
	5.2	String Matching algorithms: The naïve string-matching Algorithms, The Rabin Karp algorithm, String matching with finite automata, The Knuth-Morris-Pratt algorithm	1	
6	Self Study	NP-complete problems: Basic concepts, non-deterministic Algorithms, NP-hard and NP-complete, Cook's Theorem, NP-Hard graph and scheduling Problems. NP-completeness and reducibility, decision and optimization problems, polynomial reduction	1,2	5*
Total				42



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Laboratory Component (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Experiment on finding the running time of an algorithm.
2	Experiment based on divide and conquers approach.
3	Experiment on Recurrence relation.
4	Experiment using dynamic programming approach
5	Experiment based on greedy approach
6	Experiment based on graph Algorithms
7	Experiment using Backtracking strategy
8	Experiment using branch and bound strategy
9	Experiment based on Approximation Algorithms
10	Experiment on string matching algorithms.

Text Book(s):

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Introduction to Algorithms	Third	Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein	MIT Press	2009
2	Fundamentals of Computer Algorithms	Second	Horowitz E, Sahni S and S. Rajasekaran	Galgotia Publications	2010

Reference Books:

Sr. No.	Title	Edition	Authors	Publisher	Year
1	The Design and analysis of algorithms	First	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman	Pearson Education India	2006



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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Operating Systems	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		300
DS206		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.		Computer Architecture and Organization
Course Objective: To understand structure of OS, process synchronization, memory management and file system.		
Course Outcomes (CO): At the End of the course students will be able to		
DS206.1	Comprehend the primitive concepts of Operating System services and System Programming functionality.	
DS206.2	Articulate process scheduling algorithms in effective execution of processes.	
DS206.3	Acquaint with efficient process synchronization techniques in effective execution of programs.	
DS206.4	Analyze virtual memory management algorithms in effective allocation of main memory usage.	
DS206.5	Evaluates various algorithms of File Storage & I/O management for performance and quality criterion.	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
DS206.1	1											1
DS206.2	2	2	2	2					2			2
DS206.3	2	2	2	2					2			2
DS206.4	2	2	2	2					2			2
DS206.5	2	2	2	2					2			2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
DS206.1							
DS206.2							
DS206.3						2	
DS206.4							
DS206.5							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create
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Department of CSE-DS

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	Introduction to System Software and Operating Systems		8
	1.1	System Software – Introduction, Goal, Systems Programs and Systems Programming, Views of Systems Software. Linkers and Loader – Relocation and Linking Concepts, Design of Linker, Self-Relocating Programs, Linking of Overlay Structured Programs, Dynamic Linking, Loaders.	1	
	1.2	Operating Systems – Introduction, Structure and Principles of Operations of Operating Systems, Classes of Operating Systems, Batch Processing Systems, Multiprogramming Systems, Time Sharing Systems, Real Time Operating Systems.	1	
2	Title	Process Management		8
	2.1	Processes and Threads – Process Concept, Process Scheduling, Operations on Processes, Multicore Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues, Operating-System Examples	2	
	2.2	UNIX Process and Threads – Process Abstraction, Process Creation using fork and exec, invoking new process, process termination, awaiting process termination, User and Kernel Threads.	3	
3	Title	Process Coordination		12
	3.1	Process Synchronization - Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization Examples	2	
	3.2	CPU Scheduling - Scheduling Criteria, Scheduling Algorithms, Real-Time CPU Scheduling, Operating-System Examples. Deadlock - Characterization, Methods for Handling Deadlocks, Detection, Prevention, Avoidance, Recovery methods for Deadlock.	2	
	3.3	UNIX IPC – Universal IPC Facilities, System V IPC, Message, Ports, Message Passing, Port Operations.	3	
4	Title	Memory management		6
	4.1	Memory Management Strategies - Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.	2	
	4.2	Virtual Memory Management - Demand Paging, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory, Operating-System Examples.	2	
5	Title	File Management		8
	5.1	Storage Management - Disk Structure, Disk Scheduling, Disk Management	2	



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	5.2	File-System Implementation - File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management	2	
	5.3	UNIX Internal File Representation - Inodes, Structure of Regular File, Directories, Path Name to Inode Conversion, Super Block, Inode Assignment, Allocation of Disk blocks, Other File Types.	4	
6	Self Study	1) Explore Features, characteristics and CPU scheduling of Real-Time Operating System along an example 2) Explore the requirements of Kernel, CPU Scheduling, Disk Scheduling for Multimedia Systems 3) Explore all UNIX System Calls for File System.	2,4	5*
Total (*Not included)				42

List of Experiments for Operating System Laboratory

Sr. No.	Title of the Experiment
1	Installation of Linux OS on Virtual Machine.
2	Write a program for creating a static/dynamic link library for complex number operations and then test this library through linuxld linker.
3	Write a program which creates exactly 16 copies of itself by calling fork() only twice within a loop. The program should also print a tree of the pids.
4	Write a program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin d) Priority
5	The program r.c initializes n number of semaphores. It first assign count equal -1, which is then used by process p and q. This count is protected by semaphore. It also allocates shared memory of size 40 ints. It waits for process p and q to enter all n1 and n2 elements through different terminals. This program r.csorts shared data in ascending order. It waits to finish p and q. At end, The program r.c detaches and deletes n semaphores and print the sorted list.
6	Write a multithreaded program for preventing race conditions and deadlock avoidance for the banker's algorithm as follows. Several customers' request and release resources from the bank. The banker will grant a request only if it leaves the system in a safe state. A request that leaves the system in an unsafe state will be denied.
7	Write a program which acts as a chat application between two users on the same computer using shared memory.
8	Assume that a system has a 32-bit virtual address with a 4-KB page size. Write a C program that is passed a virtual address (in decimal) on the command line and have it output the page number and offset for the given address. As an example, your program would run as follows: ./a.out 19986 Your program would output: The address 19986 contains: page number = 4 offset = 3602 Writing this program will require using the appropriate data type to store 32 bits. We encourage you to use unsigned data types as well.



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9	Write a program to simulate disk scheduling algorithms a) FCFS b) SCAN c) C-SCAN
10	Write a program to prevent destructive update of files by locking as follows: Suppose the inode contains a new permission setting such that it allows only one process at a time to open the file for writing, but many processes can open the file for reading.

Note – Implement all programs in C language under Linux OS environment

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	System Programming	First	D M Dhamdhare	Tata McGraw-Hill Education	2011
2	Operating System Concepts	Ninth	Abraham Silberschatz, Peter B Galvin, Greg Gagne	Wiley	2012
3	UNIX Internals: The New Frontiers	First	Uresh Vahalia	Prentice Hall	1995
4	Design of the UNIX Operating Systems	First	Maurice J. Bach	Prentice-Hall	1990

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Operating Systems: Internals and Design Principles	Eighth	William Stallings	Pearson	2014
2	Modern Operating Systems	Fourth	Andrew S. Tanenbaum, Herbert Bos	Pearson	2014



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Department of CSE-DS

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Computer Communications and Networks	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
DS207		Theory		50		50		100		200
		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.		
Course Objective: Understand the state-of-the-art in network protocols, architectures and applications.		
Course Outcomes (CO): At the End of the course students will be able to		
DS207.1	Describe the fundamental concepts of Data Communication.	
DS207.2	Distinguish the different layers of the OSI model and TCP/IP.	
DS207.3	Identify the different types of protocols and their functions within a network.	
DS207.4	Apply the knowledge of subnetting, routing mechanisms and Software Defined Networking.	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
DS207.1	2	1						1	1			2
DS207.2	2	2						1	1			2
DS207.3	2	2						1	1			2
DS207.4	2	2						1	1			2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
DS207.1	3						
DS207.2	3						
DS207.3	3						
DS207.4	3						

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create
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Department of CSE-DS

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	Computer Communication and The Internet	1,2	10
	1.1	Internet: A Nut and Bolts Description, A Services Description, Protocol. The Network Edge: Access Network, The Network Core: Packet Switching, Circuit Switching, A Network of Networks	1,2	
	1.2	Delay, Loss, Throughput in Packet Switched Networks: Overview of Delay in Packet Switched Networks, Queuing Delay and Packet Loss, End to End Delay, Throughput in Computer Networks.	1,2	
	1.3	Protocol Layers and their Service Models: Layered Architecture and their Encapsulation.	1,2	
	1.4	Data and Signals: Analog and Digital, Periodic analog signals, Digital signals, Transmission impairment.	2	
	1.5	Digital Transmission: Digital-to-Digital conversion, Analog-to-Digital conversion. Transmission modes, Analog Transmission: Digital-to-Analog conversion, Analog-to-Analog conversion.	2	
2	Title	Application Layer	1,2	6
	2.1	Principles of Network Applications: Network Applications Architecture, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application Layer Protocols.	1,2	
	2.2	The Web and HTTP: Overview of HTTP, Non-Persistent and Persistent Connections, HTTP Message Format, User Server Interaction: Cookies, Web Catching, The Conditional Get.	1,2	
	2.3	File Transfer Ftp: Ftp Commands and Replies. FTP, SMTP, Mail Access Protocol (IMAP, POP), DNS	1,2	
3	Title	Transport Layer	1,2	8
	3.1	Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet	1,2	
	3.2	Multiplexing and Demultiplexing	1,2	
	3.3	Connectionless Transport - UDP: UDP Segment Structure, UDP Checksum	1,2	
	3.4	Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N (GBN), Selective Repeat (SR),	1,2	
	3.5	Connection-Oriented Transport - TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management	1,2	
	3.6	Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control.	1,2	
4	Title	The Network Layer	1,2	10



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	4.1	Introduction: Forwarding and Routing, Network Service Models.	1,2	
	4.2	Virtual Circuit and Datagram Networks: Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks.	1,2	
	4.3	Router: Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane.	1,2	
	4.4	The Internet Protocol (IP): Forwarding and Addressing in the Internet, Datagram Format, IPv4 Addressing, Internet Control Message Protocol (ICMP), IPv6	1,2	
	4.5	Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing	1,2	
	4.6	Software Defined Networking: Introduction and Overview	R3	
5	Title	The Link Layer: Links, Access Networks, and LANs	1,2	8
	5.1	Introduction to the Link Layer: The Services Provided by the Link Layer, Implementation of the Link Layer	1,2	
	5.2	Error-Detection and Correction Techniques: Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC)	1,2	
	5.3	Multiple Access Links and Protocols: Channel Partitioning Protocols, Random Access Protocols, Taking-Turns Protocols.	1,2	
6*	Title	Self-Study Topic	1,2	5*
	6.1	Transmission Media: Guided media, Unguided media: Wireless	1,2	
	6.2	ARP and RARP usage	1,2	
	6.3	Multicast routing and Broadcast routing	1,2	
	6.4	Routing in the Internet: Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP	1,2	
	6.5	Network Function Virtualization	R3	
Total				42

*This module hrs. not included in Total 42 hrs

Laboratory Component (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Use and interpret basic Networking Utilities
2	Describe various Network Topology and Networking Hardware
3	Experiment with Packet Tracers/Analyzers
4	Implement Web server and DHCP server for given scenario
5	Implement TELNET and FTP server for given scenario
6	Implement SMTP server for given scenario
7	Implement DNS server for given scenario
8	Develop client-server model using Socket Programming for given scenario
9	Illustrate basic Mininet operations for Software Defined Networking
10	Implement in Mininet to control switch manually



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Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Computer Networking: Top-Down Approach	Sixth	James Kurose and Kieth Ross	Pearson	2013
2	Data Communication and Networking	Second	Behrouz Forouzan	McGraw Hill	2000

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Computer Networks	Fifth	Andrew Tanenbaum	Pearson	2013
2	Computer Networks	Third	Larry L. Peterson and Bruce Davie	Morgan Huffman	2003
3	SDN and NFV Simplified	First	Jim Doherty	Addison Wesley	2016



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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned				
		L	T	P	O	E	L	T	P	O	Total
(SBC)	Mini Project-I	0	0	0	4	4	0	0	0	2	2
		Examination Scheme									
Component			ISE		MSE		ESE		Total		
Theory			--		--		--		--		
Laboratory			100		--		100		200		
DS208											

Pre-requisite Course Codes, if any.		
Course Objective: To develop the skills of Planning and Designing the working model for solving the real-world Problem.		
Course Outcomes (CO): <i>At the End of the course students will be able to</i>		
DS208.1	Discover potential research areas for addressing societal issues	
DS208.2	Conduct a survey of basic and contemporary literature in the preferred field of study.	
DS208.3	Formulate and propose a plan for creating a solution for the research plan identified.	
DS208.4	Exercise the team building, communication and management for design and implementation of projects.	
DS208.5	Compare and contrast the several existing solutions for research challenge	
DS208.6	Report and present the findings of the study conducted in the preferred domain.	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
DS208.1	2	2				2		3	3	3		2
DS208.2	2	2				2		3	3	3		2
DS208.3	2	3					2	3	3	3		2
DS208.4	2		3	1	2			3	3	3	3	2
DS208.5	2	2		2				3	3	3		2
DS208.6	2	2						3	3	3		2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
DS208.1	2	2	2			2	
DS208.2	2	2	2			2	
DS208.3	2	2	2			2	
DS208.4	2	2	2			2	
DS208.5	2	2	2			2	
DS208.6	2	2	2			2	

BLOOM'S Levels Targeted (Pl. appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create ✓
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Mini-project is an opportunity to make a difference in the experience of education in its own way. It is an attempt of scientific study of the problem in surrounding in order to guide, correct and evaluate the actions and decisions about it. It is based on a small project correlating scientific knowledge and day to day experience which encourages development of scientific attitude to solve real life problems among students.

The Objectives of Action Research are:

- ✓ To make students sensitive towards societal issues
- ✓ To learn scientific principles from day-to-day experiences
- ✓ To develop psycho-technological skills through observation, classification, statement of hypothesis etc.
- ✓ Development of communication, organizational skills and maturity through discussion, presentation etc.
- ✓ To develop ability to correlate science, technology and society
- ✓ To apply engineering knowledge and propose innovative, sustainable solutions to the real-life challenges

Steps for Implementation (ISE: 2 Phases) and ESE

- ✓ Keen observation of the surrounding/society
- ✓ Identification of the problem
- ✓ Analysis of the problem
- ✓ Collection of relevant information by formulating research questions
- ✓ Suggesting plan of action
- ✓ Conducting experiments
- ✓ To draw conclusion
- ✓ To find the possible solution to rectify the problem
- ✓ To execute experiments and remedial measures wherever possible

Students can seek guidance from teachers, other experts and make effective use of other sources of information available around them. Students must ensure that problem to be solved is manageable in one semester.

Criteria of a good project:

- ✓ Appropriate idea, clear understanding, and proper presentation of the concept
- ✓ Quality of work
- ✓ Project plan and its execution
- ✓ Credibility of the work
- ✓ Probable impact of the work on the attitude of students and society
- ✓ Scientific attitude, creativity and novelty reflected in project work and analysis of the situation
- ✓ Utility and innovation of the remedial measures
- ✓ Desirability, Feasibility and Viability in real life

The H/W and S/W resources required to complete the Mini-Project-I may be beyond the scope of curriculum of courses taken or may be based on the courses but thrust should be on



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- Learning additional skills
- Development of ability to define and design the problem and lead to its accomplishment with proper planning
- Learn the behavioral discipline by working in a team. The team may be maximum three (03) students.

Evaluation:

Project report should contain project title, student details, certificate and acknowledgements. Other sections of the report shall be decided by the department based on projects. But it must have introduction, necessity of project, objectives, hypothesis, plan, observations, analysis of results, conclusion and references along with other sections related to technology. The ISE and ESE evaluation will be carried out based on the rubrics framed by the Department. The ESE marks will be based on final demonstration of the project and viva based on it and report/poster/technical paper of the project in the standard format provided by the Department.



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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(SBC)	Professional Communication Skills	1	0	2	2	5	1	0	1	2
AS201		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		--		--		--		--
		Laboratory		200		--		--		200

Pre-requisite Course Codes, if any.		
Course Objective: To demonstrate the desired spoken and written communication skills required in early professional life, with focus on job placements.		
Course Outcomes (CO): <i>At the End of the course students will be able to</i>		
AS201.1	Demonstrate the spoken and written skills for job placements.	
AS201.2	Draft professional documents.	
AS201.3	Design written communication for social media.	

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS201.1										2		
AS201.2										2		
AS201.3										2		

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
AS201.1							
AS201.2							
AS201.3							

BLOOM'S Levels Targeted (Pl. appropriate)

Remember	Understand	Apply ✓	Analyze ✓	Evaluate	Create
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Theory Component

Module No.	Unit No.	Topics	L Hrs.	P Hrs
1.	Title	Placement Skills	6	12
	1.1	Resume Writing & Cover Letter		
	1.2	Group Discussion		
	1.3	Case Studies/Pitching a startup		
	1.4	Team Building Skills/Work		
	1.5	Interview Skills		
2	Title	Corporate Communication	6	12
	2.1	Presentation Skills		
	2.2	Meeting: Notice, Agenda, Minutes		
	2.3	Proposal Writing		
	2.4	Report Writing: Informative, Analytical report		
3	Title	Research Writing	2	4
	3.1	Sourcing information through digital media		
	3.2	Written communication using social media: Blog		
4	Self Study	Research Paper, News Analysis	6*	
Total			42 hrs	

*Not included in the total

List of ISEs

Sr. No.	Title of the Experiment
1	Resume
2	Cover Letter
3	GD
4	Mock Interview
5	Presentation
6	Blog Writing
7	Team Building Activity
8	Minutes of the Meeting/Notice & Agenda
9	Proposal Writing
10	Report Writing

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Interpersonal Skills at Work	2002	John Hayes	McGraw Hill Education	2002
2	Campus Placement: A Comprehensive Guide	2016	Ankur Malhotra	McGraw Hill Education	2016



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Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	If I Understood You, Would I Have This Look on My Face? My Adventures in the Art and Science of Relating and Communicating	FIRST	Alan Alda	Random House	2017
2	Handbook for Writing Proposals	SECOND	Robert J. Hamper, Sue Baugh	McGraw Hill Education	2010
3	Effective Communication Skills for Scientific and Technical Professionals	2000	Harry Chambers	Paperback Basic Books	2000
4	The Art Of Writing Together	2008	William Issac	Crown Business	2008
5	Communication Skills	2011	Meenakshi Raman, Sangeeta Sharma	Oxford, India	2011