SECOND YEAR ELECTRONICS AND COMPUTER SCIENCE

PROGRAM PROPOSED SCHEME OF INSTRUCTION AND EXAMINATION, REVISED COURSE (2019-2020)

Implemented from 2023-24

Semester III

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs./Week			Scheme of Examination						
		L	T	P#	Duration (Hrs.)	Marks					Credits
						Th	IA	TW**	P	Total	
ECS310	Essential Mathematics for Engineers	3	--	--	3	100	25	--	--	125	3
ECS320	Electrical Circuits and Systems	4	--	--	3	100	25	--	--	125	4
ECOMP330	Electronic Devices and Circuits	3	1	--	3	100	25	25	--	150	4
ECOMP340	Digital Electronics	3	1	--	3	100	25	25	--	150	4
ECOMP350	Data Structures and Algorithms using C++	3	--	--	3	100	25	--	--	125	3
ECS360	Electronic Devices and Circuits Lab	--	--	2	--	--	--	25	25	50	1
ECOMP370	Data Structures and Algorithms using C++ Lab	--	--	2	--	--	--	25	25	50	1
ECS380	Digital Electronics Lab	--	--	2	--	--	--	25	25	50	1
HM012	Technical Writing and Professional Communication	1	1	--	--	--	--	75	--	75	2
AC390	Mathematics- I and II (Bridge Course*)	2	--	--	--	--	--	--	--	--	--
	TOTAL	**19**	**3**	**6**	--	**500**	**125**	**200**	**75**	**900**	**23**

L-Lecture T-Tutorial P-Practical Th-Theory TW-Term Work IA-Internal Assessment

***Applicable to direct second year /lateral entry students.**

****Term Work marks are to be awarded through continuous evaluation**

A candidate is considered to have successfully fulfilled the requirement of a semester, provided he/ she submits to the department a certified journal reporting the experiments conducted during the semester.

SECOND YEAR ELECTRONICS AND COMPUTER SCIENCE
PROGRAM PROPOSED SCHEME OF INSTRUCTION AND EXAMINATION,
REVISED COURSE (2019-2020)

Semester IV

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs./Week			Scheme of Examination						
		L	T	P#	Duration (Hrs.)	Marks					Credits
						Th	IA	TW**	P	Total	
ECS410	Signal Processing Fundamentals	3	1	--	3	100	25	25	--	150	4
ECS420	Computer Organization & Operating Systems	4	0	--	3	100	25	--	--	125	4
ECS430	Analog Electronics & Instruments	3	1	--	3	100	25	25	--	150	4
ECS440	Microprocessors & Microcontrollers	3	--	--	3	100	25	--	--	125	3
ECOMP450	Java Programming	3	--	--	3	100	25	--	--	125	3
ECS460	JAVA Programming Lab	--	--	2	--	--	--	25	25	50	1
ECOMP470	Analog Circuits Design Lab	--	--	2	--	--	--	25	25	50	1
ECS480	Microcontrollers Lab	--	--	2	--	--	--	25	25	50	1
HM013	Business Economics and Management	3	--	--	3	100	25	--	--	125	3
	TOTAL	**19**	**2**	**6**	**--**	**600**	**150**	**125**	**75**	**950**	**24**

L-Lecture T-Tutorial P-Practical Th-Theory TW-Term Work IA-Internal Assessment

****Term Work marks are to be awarded through continuous evaluation**

A candidate is considered to have successfully fulfilled the requirement of a semester, provided he/ she submits to the department a certified journal reporting the experiments conducted during the semester.

THIRD YEAR ELECTRONICS AND COMPUTER SCIENCE PROGRAM
PROPOSED SCHEME OF INSTRUCTION AND EXAMINATION,
REVISED COURSE (2019-2020)
Semester V

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs./Week			Scheme of Examination						
		L	T	P	Duration(Hrs.)	Marks					Credits
						Th	IA	TW**	P	Total	
ECS510	Electronic Communication Systems	4	--	--	3	100	25	--	--	125	4
ECS520	Database Systems Concepts	3	--	--	3	100	25	--	--	125	3
ECS531	Open Source Software Development	3	--	--	3	100	25	--	--	125	3
ECOMP532	Software Engineering										
ECOMP533	Soft Computing										
ECOMP534	Design and Analysis of Algorithms										
ECOMP535	Computer Graphics										
ECOMP541	Control System Engineering	3	--	--	3	100	25	--	--	125	3
ECOMP542	Power Electronics										
ECS543	Digital Signal Processing and Applications										
ECS544	Transmission Lines and Antennas										
ECOMP545	Consumer Electronics										
ECOMP550	Web Technology Lab	--	--	2	--	--	--	25	25	50	1

ECS560	Database Systems Lab	--	--	2	--	--	--	25	25	50	1
ECS570	Professional Elective Lab - I	--	--	2	--	--	--	25	25	50	1
*	Open Elective	3	--	--	3	100	25	--	--	125	3
HM009	Ethics & Entrepreneurship	3	--	--	3	100	25	--	--	125	3
	TOTAL	**19**	**0**	**6**	**--**	**600**	**150**	**75**	**75**	**900**	**22**

L-Lecture T-Tutorial P-Practical Th-Theory TW-Term Work IA-Internal Assessment

****Term Work marks are to be awarded through continuous evaluation**

A candidate is considered to have successfully fulfilled the requirement of a semester, provided he/ she submits to the department a certified journal reporting the experiments conducted during the semester.

* Students may enter the subject code of the open elective selected from the courses of other branch of Engineering.

THIRD YEAR ELECTRONICS AND COMPUTER SCIENCE PROGRAM
PROPOSED SCHEME OF INSTRUCTION AND EXAMINATION,
REVISED COURSE (2019-2020)
Semester VI

Course Code	Nomenclature of the Course	Scheme of instruction Hrs./Week			Scheme of Examination						
		L	T	P#	Duration (Hrs.)	Marks					Credits
						Th	IA	TW**	P	Total	
ECS610	VLSI Design and Technology	4	--	--	3	100	25	--	--	125	4
ECS620	Introduction to Computer Networks	3	--	--	3	100	25	--	--	125	3
ECS631	Neural Networks and Deep Learning	3	--	--	3	100	25	--	--	125	3
ECOMP632	Augmented Reality and Virtual Reality										
ECOMP633	Mobile Phone Programming										
ECOMP634	Software Testing and Quality Assurance										

ECS635	Introduction to Cloud Computing										
ECOMP641	Digital Image Processing	3	--	--	3	100	25	--	--	125	3
ECOMP642	Information Theory and Coding										
ECOMP643	Advanced Microcontroller										
ECS644	Industrial Automation and Control										
ECOMP645	Robotics										
ECOMP650	VLSI Design Lab	--	--	2	--	--	--	25	25	50	1
ECOMP660	Computer Networks Lab	--	--	2	--	--	--	25	25	50	1
ECS670	Professional Elective Lab- II	--	--	2	--	--	--	25	25	50	1
*	Open Elective	3	--	--	3	100	25	--	--	125	3
HM006	Cyber Law & IPR	3	--	--	3	100	25	--	--	125	3
	TOTAL	**19**	**0**	**6**	**--**	**600**	**150**	**75**	**75**	**900**	**22**

L-Lecture T-Tutorial P-Practical Th-Theory TW-Term Work IA-Internal Assessment

****Term Work marks are to be awarded through continuous evaluation**

A candidate is considered to have successfully fulfilled the requirement of a semester, provided he/ she submits to the department a certified journal reporting the experiments conducted during the semester.

* Students may enter the subject code of the open elective selected from the courses of other branch of Engineering.

FOURTH YEAR ELECTRONICS AND COMPUTER SCIENCE PROGRAM
PROPOSED SCHEME OF INSTRUCTION AND EXAMINATION,
REVISED COURSE (2019-2020)
Semester VII

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs./Week			Scheme of Examination						
						Marks					Credits
		L	T	P#	Duration (Hrs.)	Th	IA	TW**	O	Total	

ECS710	Discrete Structures and Automata Theory	3	--	--	3	100	25	--	--	125	3
ECOMP721	Block chain Technology	3	--	--	3	100	25	--	--	125	3
ECOMP722	Machine Learning										
ECOMP723	Hardware Descriptive Languages										
ECOMP724	Wireless Sensor Networks										
ECS725	Microwave and Radar Engineering										
ECS730	Professional Elective Lab- III	--	--	2	--	--	--	25	25	50	1
*	Open Elective	3	--	--	3	100	25	--	--	125	3
ECS740	Internship	--	--	6	--	--	--	50	50	100	3
ECS750	Project Work - Phase I	--	--	6	--	--	--	50	75	125	3
ECS760	Electronic System Design & Manufacturing Lab	--	--	2	--	--	--	25		25	1
	TOTAL	**9**	--	**16**	**--**	**300**	**75**	**150**	**150**	**675**	**17**

L-Lecture T-Tutorial P-Practical Th-Theory TW-Term Work IA-Internal Assessment

****Term Work marks are to be awarded through continuous evaluation**

A candidate is considered to have successfully fulfilled the requirement of a semester, provided he/ she submits to the department a certified project report of the work done during the semester.

* Students may enter the subject code of the open elective selected from the courses of other branch of Engineering.

FOURTH YEAR ELECTRONICS AND COMPUTER SCIENCE PROGRAM
PROPOSED SCHEME OF INSTRUCTION AND EXAMINATION,
REVISED COURSE (2019-2020)
Semester VIII

Course Code	**Nomenclature of the Course**	**Scheme of Instructio**	**Scheme of Examination**

		n Hrs./Week										
		L	T	P	Duration (Hrs.)	Marks						Credits
						Th	IA	TW**	O	OCS	Total	
ECOMP810	Cryptography and Network Security	3	--	--	3	100	25	--	-	-	125	3
ECOMP821	Compiler Design	3	--	--	3	100	25	--	-	-	125	3
ECS822	Advanced Communication Systems											
ECOMP823	Biomedical Electronics & Instrumentation											
ECOMP824	Internet of Things											
ECOMP825	Data Analytics											
ECS830	Elective - NPTEL/ MOOC/ SWAYAM	3	--	--	--	--	--	25#	-	75#	100	3
ECS840	Project Work - Phase II	--	--	18	--	--	--	200	200	-	400	9
	TOTAL	**9**	**--**	**18**	**--**	**200**	**50**	**225**	**200**	**75**	**750**	**18**

****Term Work marks are to be awarded through continuous evaluation**

Students should mandatorily undertake one NPTEL Course of only 3 credits from the list of approved
Online courses of Goa University to be offered during the V/ VI/VII Semester.

Online Assignments Score obtained will be considered/scaled accordingly for Term Work (TW)and Proctored Exam Score will be considered/scaled accordingly for Online Course Score(OCS) of NPTEL / MOOC / SWAYAM certification course. The score obtained shall be rounded to near higher integer.

LEGEND

Abbreviation	Description
L	**Lecture**
T	**Tutorial**
P	**Practical**
O	**Oral**
Th	**Theory**
TW	**Term Work**
IA	**Internal assessment**
OCS	**Online Course Score**

Name of the Programme: Electronics and Computer Science
Course Code: ECS310 **Title of the Course:** Essential Mathematics for Engineers
Number of Credits: 03
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="2">Mathematics- I and Mathematics-II</td></tr>
<tr><td>Course Objectives:</td><td colspan="2">The subject aims to equip the student with:
1. Mathematical tools necessary to formulate, solve and analyze engineering problems
2. An understanding of matrix theory and graph theory in order to apply them to problems arising in the field of engineering.
3. A familiarization of sets, functions, relations, combinatorics and mathematical induction.
4. An overview of Probability theory and random processes.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="2">Upon completion of the course, students will be able to
<table>
<tr><td>ECS 310.1</td><td>Perform operations and linear transformations on matrices; compute the inverse, transpose, determinant, rank, Eigen values and Eigen vectors of a given matrix and Solve system of linear equations using matrices.</td></tr>
<tr><td>ECS 310.2</td><td>Discuss and apply the fundamental concepts and structures of discrete mathematics such as set theory, relations and functions and develop problem-solving skills using Combinatorics and Mathematical Logic.</td></tr>
<tr><td>ECS 310.3</td><td>Demonstrate various graph algorithms and apply the concepts of graph theory & trees.</td></tr>
<tr><td>ECS 310.4</td><td>Apply the basic concepts of probability, random variables, mean, variance, standard deviation, probability distributions and random processes.</td></tr>
</table></td></tr>
<tr><td>Content:</td><td>UNIT- I</td><td>No. of Hrs.</td></tr>
<tr><td></td><td>Matrix Algebra: Matrices, Types, Determinants, Transpose and Inverse of Matrix. Elementary transformations: Rank and Normal Form, Linearly Dependent and Linearly independence of vectors, Solving systems of Linear homogeneous and non-homogeneous equations.
Eigen value and Eigen vectors, Eigen Value Decomposition, Diagonalization using Similarity transformations, Cayley-Hamilton theorem and its applications, Minimal Polynomial</td><td>11 Hrs.</td></tr>
<tr><td></td><td>UNIT-2</td><td></td></tr>
<tr><td></td><td>Sets, Relations and Functions: Sets, Set Operations, Relations and their properties, Representing Relations, Equivalence Relations, partial orderings. Functions: One-to-One and Onto Functions, Inverse Function, Composition of functions, some important functions in</td><td>11 Hrs.</td></tr>
</table>

	computer science. **Mathematical Logic:** Propositional logic, tautologies and contradictions, Mathematical Induction, predicates and quantifiers (1 variable only), rules of inference, PCNF and PDNF	
	UNIT-3	
	Combinatorics: The basics of counting, pigeonhole principle, permutations and combinations, binomial coefficients. **Graphs:** Graphs and graph models, graph terminology and special types of graphs, representing graphs and graph isomorphism, connectivity, Euler and Hamilton paths. **Trees:** Introduction to Trees, applications of trees, tree traversal, Spanning Trees	11 Hrs.
	UNIT-4	
	Probability theory: Definition, properties, Axioms, Conditional probability, Bayes' theorem, Random variables: Discrete and continuous, probability distribution functions, Expectation and Variance, Moment generating function **Standard Distributions:** Binomial, Poisson, Uniform, Normal, and Exponential **Random Processes:** Definition, ensemble mean, auto-correlation function, cross-correlation function, Types of Random Processes: Stationary Processes, Markov Processes	12 Hrs.
Pedagogy:	Learner centric teaching	
References/ Readings:	**TEXTBOOKS:** 1. B. S. Grewal; Higher Engineering Mathematics; Khanna Publications, New Delhi, 44th Edition 2. Kenneth H. Rosen; Discrete Mathematics and Its Applications; Tata McGraw Hill,6th edition 3. Swapan Kumar Sarkar; Discrete Mathematics; S. Chand Publication 4. Sheldon Ross, A first course in Probability, Pearson; 6th Edition **REFERENCES:** 1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015 2. Montgomery, D. C., Probability and Statistics for Engineers; Prentice Hall of India 3. G.V.Kumbhojkar; Discrete Structures and Graph Theory; Pradeep Prakashan. 4. T. Veerajan; Probability, Statistics and Random Processes; Second Edition; Tata Mc Graw- Hill. 5. J. P. Tremblay and R. Manohar, McGraw Hill; Discrete Mathematical Structures withApplications to Computer Science; New York McGraw Hill	

Name of the Programme: Electronics and Computer Science
Course Code: ECS320 **Title of the Course:** Electrical Circuits and Systems
Number of Credits: 04
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="3">Basics of Electrical and Electronics Engineering</td></tr>
<tr><td>Course Objectives:</td><td colspan="3">The subject aims to equip the student with:
1. Ability to analyse linear electrical networks and perform Time domain analysis of electrical networks
2. An understanding of graph theory and its application for network analysis
3. Ability to synthesize an electrical network and model it into any equivalent Two port network
4. An understanding of the Construction and working of various types of attenuators, motors and bridges.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="3">Upon completion of the course, students will be able to
<table><tr><td>ECS 320.1</td><td>Explain the concepts related to electrical networks and graph theory</td></tr><tr><td>ECS 320.2</td><td>Explain the construction and working of the different types of motors</td></tr><tr><td>ECS 320.3</td><td>Apply network theorems, differential equations, to compute steady state and transient response of circuits</td></tr><tr><td>ECS 320.4</td><td>Analyse electrical networks to compute two port parameters, design resonant circuits and attenuators</td></tr></table></td></tr>
<tr><td>Content</td><td>UNIT-1</td><td>No. of Hrs.</td></tr>
<tr><td></td><td>Network Classification: Distributed and lumped, passive and active, time variable and time invariant, symmetrical and asymmetrical networks.
Network Analysis: Mesh and nodal analysis (ac and dc sources), super-node and super-mesh analysis.
Network Theorems (AC and DC analysis): Thevenin’s, Maximum power transfer, Norton’s, Superposition, Millman’s, Substitution, Compensation, Reciprocity and Tellegen’s theorem.</td><td>15 hrs</td></tr>
<tr><td></td><td>UNIT-2</td><td></td></tr>
<tr><td></td><td>Graph Theory: Basic definitions, Duality, Matrices associated with network graphs: Incidence, Tieset, Cutset matrices.
Time- domain analysis: Steady State and Transient Response, DC response of RL, RC and RLC circuits, Sinusoidal response of RL, RC and RLC circuits
Resonance: Series resonance-Voltages, Currents, Impedance, Phase angle, Bandwidth, selectivity and Q-factor; Parallel resonance- resonant frequency, Band Width, selectivity and Q-factor</td><td>15 hrs</td></tr>
</table>

	UNIT-3	
	Two Port Networks: Characterization in terms of Z, Y, H and ABCD parameters, Equivalent circuits; input, output, characteristic impedance and image impedances of two ports. **Filters and Attenuators –** Classification of filters, equations of filter network, characteristic impedance in Pass and Stop bands, Constant K-Low pass and high pass filter; Analysis and design of T, pi, Lattice and Bridged-T attenuator.	15 hrs
	UNIT-4	
	DC Motors: Construction, working and types of DC Motors, significance of back emf, voltage equation of a motor, Speed and Torque expressions, Characteristics of DC motors (series and shunt). **Stepper motors:** Principle, construction and operation of Variable reluctance and permanent magnet stepper motors **Induction Motor:** Classification, General principle, construction, working and types of three phase Induction Motor, Speed torque characteristics	15 hrs
Pedagogy:	Learner centric teaching	
References/ Readings:	**Textbooks:** 1. A. Sudhakar& P. Shyamohan, Circuits & Networks- Analysis and Synthesis. 4th edition,Tata McGraw-Hill,2011. 2. D. Roy Choudhary, Networks and Systems.2nd edition, New Age International Publishers, 2011. 3. B. L. Theraja,A. K. Theraja, A Textbook of Electrical Technology.1st edition,Volume II, S. Chand Publication, 2019. 4. V. K. Mehta, Rohit Mehta, Principles of Electrical Machines.2nd edition, 5. S. Chand Publication, 2020. 6. Ashfaq Hussain,Harroon Ashfaq,Electric Machines-2nd edition, Dhanpat Rai Publishing Company,2005 . **REFERENCES:** 1. F. F. Kuo, Network Analysis and Synthesis. 2nd edition, Wiley Eastern, 2011. 2. Chakrabarti, Circuit theory Analysis and Synthesis. 7th edition, Dhanpat Rai Publishing Company, 2017. 3. M.E. Van Valkenburg, Network Analysis.3rd edition, Pearson Education,2012.	

Name of the Programme: Electronics and Computer Science
Course Code: ECOMP330 **Title of the Course:** Electronics Devices and Circuits
Number of Credits: 3 (L)+1(T)
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="2">Basics of Electrical and Electronics Engineering</td></tr>
<tr><td>Course Objectives:</td><td colspan="2">The subject aims to provide the student with:
1. An ability to analyze and design circuits using diodes.
2. Ability to perform DC analysis and AC small signal analysis for BJT biasing circuits and to perform DC analysis of JFET and MOSFET biasing circuits.
3. An understanding of multistage and large signal amplifier, feedback mechanism and its application in amplifier and oscillator circuits.
4. Ability to analyze and design integrator, differentiator, and multivibrator circuits.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="2">Upon completion of the course, students will be able to<table><tr><td>ECOMP330.1</td><td>Analyze and design diode circuits such as rectifiers, filters, clippers & clampers and RC Integrators & Differentiators.</td></tr><tr><td>ECOMP330.2</td><td>Examine DC biasing circuits for BJT, JFET and MOSFET and perform small signal analysis using BJT hybrid and re models</td></tr><tr><td>ECOMP330.3</td><td>Analyze the multi-stage amplifiers, large signals BJT amplifiers and feedback on amplifiers and oscillators</td></tr><tr><td>ECOMP330.4</td><td>Analyze and design different types of oscillators, and Multivibrator circuits.</td></tr></table></td></tr>
<tr><td>Content:</td><td>UNIT- 1</td><td>No. of Hrs.</td></tr>
<tr><td></td><td>Diode and Circuits: Load Line Analysis; Diode Approximations; Series, Parallel and Series- Parallel Diode Configurations; Clippers and clampers.
Rectifiers and Filters: C, LC analysis and design
Linear Wave-shaping: RC Low pass and high pass circuits, Steady state response of RC differentiator & integrating circuits to square wave.</td><td>10 L+4TH rs.</td></tr>
<tr><td></td><td>UNIT-2</td><td></td></tr>
<tr><td></td><td>DC Biasing of BJT: Voltage- Divider Bias
BJT AC Analysis (for voltage divider bias): BJT transistor modelling, re transistor model, BJT small signal analysis using re transistor model, hybrid equivalent model, approximate hybrid equivalent circuit, complete hybrid equivalent model.
FET Biasing: (JFETs and Depletion –type FET) Fixed-Bias, Self-Bias and Voltage-Divider Bias Configurations (both n- and p-channel), common gate configuration; Enhancement-Type MOSFETs-Feedback Biasing Arrangement, Voltage –Divider Biasing Arrangement</td><td>12L+4T Hrs.</td></tr>
</table>

	UNIT -3	
	Multistage Amplifiers: Cascading, Coupling techniques: RC, transformer and direct, Cascode,Darlington pair. **Power amplifiers:** Classification, Class A (Direct coupled with resistive load, transformer coupled with resistive load), Class B, Push-pull amplifier, crossover distortion, Class AB Push- pull amplifier and complementary Symmetry, Class C **Negative feedback in amplifiers:** Block diagram of Voltage series, voltage shunt, current series, and current shunt types of feedback. Effect of negative feedback on input and output impedance, voltage and current gains, bandwidth, noise and istortion.	11L+4 T Hrs.
	UNIT -4	
	Positive feedback: Concept of feedback and stability, Barkhausen criterion, Types of oscillators – Tuned LC, Hartley's, Colpitts, RC phase shift, crystal oscillator. **BJT Switch:** BJT as a switch, Junction & Diffusion Capacitance of a BJT, Improvingswitching times. **Multivibrators:** Analysis & Design of Basic BJT Monostable Multivibrator, BJT Bistable Multivibrator, BJT Astable Multivibrator	12L+3 T Hrs
Pedagogy:	Learner centric teaching	
References / Readings:	**TEXTBOOKS:** 1. R. Boylestad & L. Nashelsky; Electronic Devices and Circuits; PHI, 7th Edition, 1998 2. J.B Gupta; Electronic Devices and Circuits; S. K. Kataria & Sons, 1st Edition, 2012. 3. J. Millman, C. Halkias & Satyabrata Jit; Electronic Devices and Circuits; McGraw Hill, 3rd Edition, 2010. 4. David Bell, Solid state Pulse circuits, Oxford University Press, 2nd, 1981. **REFERENCE BOOKS** 1. A. Mottershead; Electronic Devices and Circuits; PHI, 1st Edition, 1979. 2. A. Anandkumar, Pulse digital circuits, PHI, 2nd Edition, 2008. 3. Anil K. Maini/ Varsha Agarwal, Electronic Devices and Circuits, Wiley, 1st Edition, 2009. 4. David Bell, Electronic Devices and Circuits, Oxford University Press, 5th Edition, 2008.	
Term work Rubrics	Students can be evaluated based on assignments / class tests / mini-project / seminars / quiz / viva / presentations / circuit simulations, etc.	

Name of the Programme: Electronics and Computer Science
Course Code: ECOMP340 **Title of the Course:** Digital Electronics
Number of Credits: 03(L)+1(T)
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="2">Basics of Electrical and Electronics Engineering</td></tr>
<tr><td>Course Objectives:</td><td colspan="2">The subject aims to provide the student with:
1. An understanding of various Number Systems & Codes along with Boolean algebra.
2. An ability to solve problems using Boolean algebra, K-maps and VEM
3. An ability to design combinational and sequential circuits.
4. An understanding of digital Logic families</td></tr>
<tr><td>Course Outcomes:</td><td colspan="2">Upon completion of the course, students will be able to
<table>
<tr><td>ECOMP340.1</td><td>Perform interconversion of different number systems and perform arithmetic operations using 1’s and 2’s compliments</td></tr>
<tr><td>ECOMP340.2</td><td>Solve Boolean expressions using Boolean algebra, K-maps and VEM and implement them using logic gates</td></tr>
<tr><td>ECOMP340.3</td><td>Design and implement Combinational and Sequential circuits and compare characteristics of Digital Logic families</td></tr>
<tr><td>ECOMP340.4</td><td>Explain different flip flops, registers and their application</td></tr>
</table></td></tr>
<tr><td>Content:</td><td>UNIT- 1</td><td>No. of Hrs.</td></tr>
<tr><td></td><td>Number Systems & Codes: Decimal, Binary, Hexadecimal, Octal systems; Interconversions, Signed & Unsigned Binary numbers, Complements
Binary Arithmetic: Addition & Subtraction using 1’s & 2’s complements. Binary Codes-Decimal codes (BCD, Excess-3, 8421, 2421), Error Detection codes (Parity generation & Detection), Reflected code, Alphanumeric codes (EBCDIC, ASCII), Study of Binary logic with logic gates.
Boolean Algebra: Postulates & Theorems, Boolean functions and their Algebraic manipulation, Canonical & Standard forms, Minterms & Maxterms.
Simplification of Boolean functions: K-maps, POS & SOP simplification and their inter conversions, NAND & NOR implementation, Plotting & Reading of K-map using VEM.</td><td>10L+4 T Hrs.</td></tr>
<tr><td></td><td>UNIT-2</td><td></td></tr>
<tr><td></td><td>Combinational Logic: Design Procedure for Combinational logic circuits, Design & Analysis of Half Adder, Full Adder, Half Subtractor, Full Subtractor, Code Conversion, binary Parallel Adder, Look-ahead Carry generator, Decimal Adder (BCD Adder), Magnitude Comparator, Decoders, Combinational logic implementation, Demultiplexers,</td><td>12L+4 T Hrs.</td></tr>
</table>

	Encoders, Multiplexers, Boolean function implementation with multiplexers, Design of seven segment display, Parity generator, checker. **Flip-flops**: Basic flip-flop circuit, Clocked RS flip-flop, D flip-flop, JK flip-flop, T flip-flop, Triggering of flip-flops, Master Slave flip-flop, Edge triggered flipflops: their schematic symbols, truth table & Excitation table, conversion between different types of flip flops	
	UNIT -3	
	Shift Registers: SISO, SIPO, PISO, PIPO, Bidirectional shift register, Universal shift register, Applications of shift registers. **Asynchronous Counters**: Ripple up counters, ripple down counters, ripple up-down counters (using positive edge and negative edge triggering), Mod n Asynchronous counters. **Synchronous counters**: Design of synchronous counters, Synchronous up counter, synchronous down counter, synchronous up-down counter, Synchronous Mod n Counters, Ring counter, Johnson counter, Applications of counters.	12L+3 THrs.
	UNIT -4	
	Sequential Circuits: Design procedure for sequential circuits using state diagrams, state table, state equations, state reduction and assignment, Circuit implementation, Moore & Mealy Machine. Finite state machine. **Digital Logic Families**: Characteristics of Digital ICs, TTL-Operation of TTL NAND gate, Active pull-up, Open Collector output, Wired AND, Schottky TTL, ECL	11L+ 4T Hrs.
Pedagogy:	Learner centric teaching	
References/ Readings:	**TEXTBOOKS:** 1. M. Morris Mano; Digital Logic and Computer Design; PHI. 2016 2. Anand Kumar; Fundamentals of Digital Circuits; 4e PHI. 2016 3. R P JAIN ;Modern Digital Electronics ; 4e,Tata Mc Graw Hill 4. Thomas Floyd; Digital Fundamentals - A Systems Approach; 11e Pearson Education. 2015. **REFERENCES:** 1. D. Leach, A. P. Malvino, G. Saha; Digital Principles & Applications; 8e Tata McGraw-Hill.2014 2. William Fletcher; An Engineering Approach to Digital Design; PHI. 2009 3. Vincent P. Heuring, Harry F. Jordan, T.G. Venkatesh; Computer Systems Design and Architecture, 2e PHI 2012	
Termwork Rubrics	Students can be evaluated based on assignments / class tests / mini-project / seminars / quiz / viva / presentations / circuit simulations, etc.	

Name of the Programme: Electronics and Computer Science
Course Code: ECOMP350 **Title of the Course:** Data Structures and Algorithms using C++
Number of Credits: 03
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="2">Basics of Computer Programming</td></tr>
<tr><td>Course Objectives:</td><td colspan="2">The subject aims to provide the student with:
1. Ability to understand the generic principles of object oriented programming using C++
2. An ability to plan, design, execute and document sophisticated object oriented programs to handle different computing problems
3. An ability to use data structures as the foundational base for computer solutions to engineering problems
4. An ability to plan, design, execute and document sophisticated technical programs to handle various sorts of data structures using object oriented principles</td></tr>
<tr><td>Course Outcomes:</td><td colspan="2">Upon completion of the course, students will be able to<table><tr><td>ECOMP350.1</td><td>Illustrate the concept of object oriented programming</td></tr><tr><td>ECOMP350.2</td><td>Demonstrate the concepts of function overloading, operator overloading, Inheritance, Pointers, Templates and Exception Handling</td></tr><tr><td>ECOMP350.3</td><td>Demonstrate the use of data structures like linked lists, stacks and queues. and complex data structures like trees and graphs</td></tr><tr><td>ECOMP350.4</td><td>Illustrate searching and sorting techniques</td></tr></table></td></tr>
<tr><td>Content:</td><td>UNIT- 1</td><td>No. of Hrs.</td></tr>
<tr><td></td><td>Object Oriented Programming: Basic concepts and benefits of OOP, Basic user-defined and derived data types. Reference variables, Arithmetic and logical operators, scope resolution and memory management operators. Expressions and control structures. Functions in C++, Classes & Objects, Constructors & Destructors</td><td>10 Hrs.</td></tr>
<tr><td></td><td colspan="2">UNIT-2</td></tr>
<tr><td></td><td>Operator Overloading: Definition, Overloading unary and binary operators, manipulation of strings
Inheritance: derived classes, Types of inheritance, constructors in derived classes, nesting of classes
Pointers: pointers to objects, this pointer, pointers to derived classes. Virtual functions
Templates: Class templates & Function templates. Exception handling</td><td>10 Hrs.</td></tr>
<tr><td></td><td colspan="2">UNIT -3</td></tr>
</table>

	Linked list: Single, Doubly, Circular linked lists **Stacks:** as an array and linked list, applications of stacks **Queues**: as an array and linked list, Circular **Trees:** Traversal of binary tree, BST, operations on BST, Reconstruction of Binary tree	12 Hrs.
	UNIT -4	
	Graphs: Definitions and Terminology, DFS & BFS, Spanning Tree **Searching:** Linear search, Binary search **Sorting:** Bubble sort, selection sort, Quick sort, Insertion sort, Merge sort, Heap sort	13 Hrs.
Pedagogy:	Learner centric teaching	
References/ Readings:	**TEXTBOOKS:** 1. Object Oriented Programming with C++ by E. Balagurusamy.edition 5,2011 2. Data Structures using C++ by Yeshwant Kanetkar, BPB Publications,edition 1,2011 3. Data Structures using C++ by Tenenbaum,edition 2, 2011 **REFERENCES:** 1. Object Oriented Programming in Turbo C++ by Robert Lafore,edition 4,2013 2. Mastering C++ by Venugopal, Rajkumar, Ravishankar,edition 1,2011 3. Let Us C++ by Yeshwant Kanetkar	

Name of the Programme: Electronics and Computer Science
Course Code: ECS360 **Title of the Course:** Electronic Devices and Circuits Lab
Number of Credits: 01
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="2">Basics of Electrical and Electronics Engineering</td></tr>
<tr><td>Course Objectives:</td><td colspan="2">The subject aims to provide the student with:
The EDC concepts, working, design, characteristics of Diodes, BJT and FET Transistors, amplifiers, and biasing techniques of transistors</td></tr>
<tr><td>Course Outcomes:</td><td colspan="2">Upon completion of the course, students will be able to
<table>
<tr><td>ECS 360.1</td><td>Analyze & design diode circuits like series and parallel diode circuits, clippers, clampers.</td></tr>
<tr><td>ECS 360.2</td><td>Analyze and design the RC differentiator & integrator and multivibrator circuits</td></tr>
<tr><td>ECS 360.3</td><td>Analyze & design transistor biasing circuits for various configurations.</td></tr>
<tr><td>ECS 360.4</td><td>Analyze & design multi stage, large signals BJT amplifiers and observe the effect of negative and positive feedback on amplifiers and oscillators.</td></tr>
</table></td></tr>
<tr><td>Content:</td><td>List of Experiments:

Note: At least 10 experiments should be conducted from the list below:
1. Series & parallel diode configuration
2. Analysis and Design of Filters
3. Clippers and Clampers
4. BJT DC Biasing techniques
5. Analysis and Design Amplifiers using BJT
6. Small Signal Analysis of BJT Amplifiers
7. Analysis and Design of Power Amplifiers
8. Analysis and Design of Oscillators
9. Analysis of BJT as a Switch
10. Analysis of Integrators and Differentiators
11. Analysis and Design of Multivibrators using BJT
12. Design Schmitt trigger using BJT
13. Design RC-coupled Amplifier
14. Feedback Amplifiers
15. FET biasing circuits</td><td>30HRS</td></tr>
<tr><td>Pedagogy:</td><td colspan="2">Learner centric teaching</td></tr>
<tr><td>References/ Readings:</td><td colspan="2">TEXTBOOKS:
1. R. Boylestad & L. Nashelsky; Electronic Devices and Circuits; PHI, 7th Edition, 1998
2. J.B Gupta; Electronic Devices and Circuits; S. K. Kataria & Sons, 1st Edition, 2012.</td></tr>
</table>

	3. J. Millman, C. Halkias & Satyabrata Jit; Electronic Devices and Circuits; McGraw Hill, 3rd Edition, 2010. 4. David Bell, Solid state Pulse circuits, Oxford University Press, 2nd, 1981. **REFERENCE BOOKS** 1. A. Mottershead; Electronic Devices and Circuits; PHI, 1st Edition, 1979. 2. A. Anandkumar, Pulse digital circuits, PHI, 2nd Edition, 2008. 3. Anil K. Maini/ Varsha Agarwal, Electronic Devices and Circuits, Wiley, 1st Edition, 2009. 4. David Bell, Electronic Devices and Circuits, Oxford University Press, 5th Edition, 2008.
Termwork Rubrics	Students can be evaluated based on assignments / class tests / mini-project / seminars / quiz / viva / presentations / circuit simulations, etc.

Name of the Programme: Electronics and Computer Science
Course Code: ECOMP370
Title of the Course: Data Structures and Algorithms using C++ Lab
Number of Credits: 01
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td>Programming Languages</td></tr>
<tr><td>Course Objectives:</td><td>The course aims to provide the student with:
1. Ability to understand the generic principles of object oriented programming using C++.
2. An ability to plan, design, execute and document sophisticated object oriented programs to handle different computing problems
3. An ability to use data structures as the foundational base for computer solutions to engineering problems.
4. An ability to plan, design, execute and document sophisticated technical programs to handle various sorts of data structures using object oriented principles</td></tr>
<tr><td>Course Outcomes:</td><td>Upon completion of the course, students will be able to<table><tr><td>ECOMP370.1</td><td>Implement the concepts of classes, objects, friend function, Constructor and Destructor</td></tr><tr><td>ECOMP370.2</td><td>Implement the concepts of polymorphism, Inheritance, Templates and Exception Handling</td></tr><tr><td>ECOMP370.3</td><td>Implement linked lists, stacks and queues</td></tr><tr><td>ECOMP370.4</td><td>Implement searching and sorting techniques.</td></tr></table></td></tr>
<tr><td>Content:</td><td colspan="2">List of Experiments:
Note: At least 10 experiments should be conducted from the list of experiments.</td></tr>
<tr><td></td><td>1. Classes and objects
2. Function overloading
3. Operator Overloading
4. Constructor and Destructors
5. Friend function and friend classes
6. Inheritance
7. Templates
8. Implementation of singly/doubly/circular linked list
9. Implementation of stack using array/ linked list
10. Implementation of queue using array/linked list
11. Implementation of sorting technique
12. Implementation of searching technique</td><td>30HRS</td></tr>
<tr><td>Pedagogy:</td><td colspan="2">Learner centric teaching</td></tr>
<tr><td>References/ Readings:</td><td colspan="2">TEXTBOOKS:
1. Object Oriented Programming with C++ by E. Balagurusamy.edition</td></tr>
</table>

	5,2011 2. Data Structures using C++ by Yeshwant Kanetkar, BPB Publications,edition 1,2011 3. Data Structures using C++ by Tenenbaum,edition 2, 2011 **REFERENCES:** 1. Object Oriented Programming in Turbo C++ by Robert Lafore,edition 4,2013 2. Mastering C++ by Venugopal, Rajkumar, Ravishankar,edition 1,2011 3. Let Us C++ by Yeshwant Kanetkar
Termwork Rubrics	Students can be evaluated based on assignments / class tests / mini-project / seminars / quiz / viva / presentations / circuit simulations, etc.

Name of the Programme: Electronics and Computer Science
Course Code: ECS380 **Title of the Course:** Digital Electronics Lab
Number of Credits: 01
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="2">Knowledge of digital electronics</td></tr>
<tr><td>Course Objectives:</td><td colspan="2">The subject aims to provide the student with:
1. An understanding of the basics of digital electronics
2. An ability to design basic logic circuits, combinational and sequential circuits</td></tr>
<tr><td>Course Outcomes:</td><td colspan="2">Upon completion of the course, students will be able to :
<table>
<tr><td>ECS380.1</td><td>Verify the working of basic gates and Universal gates.</td></tr>
<tr><td>ECS380.2</td><td>Apply Boolean laws to simplify and implement digital circuits.</td></tr>
<tr><td>ECS380.3</td><td>Design and implement combinational circuits and Sequential circuits</td></tr>
<tr><td>ECS380.4</td><td>Verify the operation of counters, shift registers</td></tr>
</table></td></tr>
<tr><td>Content:</td><td>List of Experiments
Note: At least 10 experiments should be conducted from the list below:
1. Study of Logic Gates and Performance of Universal Gates
2. Realization of Boolean expressions in SOP & POS forms
3. Half Adder, Full Adder
4. Half Subtractor, Full Subtractor
5. BCD Adder
6. Multiplexer & Demultiplexer
7. Encoder &Decoder
8. Design of Combinational Logic Circuits
9. Magnitude Comparator
10. Parity generators and checkers
11. Code converters
12. Study of SR & JK Flip-Flop and conversion of one FF to another
13. Ring & Twisted Ring Counter
14. Binary Asynchronous Counter
15. Synchronous UP/DOWN Counter Design SISO, SIPO Shift register</td><td>30HRS</td></tr>
<tr><td>Pedagogy:</td><td colspan="2">Learner centric teaching</td></tr>
<tr><td>References/ Readings:</td><td colspan="2">TEXTBOOKS:
1. M. Morris Mano; Digital Logic and Computer Design; PHI. 2016
2. Anand Kumar; Fundamentals of Digital Circuits; 4e PHI. 2016
3. R P JAIN ;Modern Digital Electronics ; 4e,Tata Mc Graw Hill
4. Thomas Floyd; Digital Fundamentals - A Systems Approach; 11e Pearson Education. 2015.</td></tr>
</table>

	REFERENCES: 1. D. Leach, A. P. Malvino, G. Saha; Digital Principles & Applications; 8e Tata McGraw-Hill.2014 2. William Fletcher; An Engineering Approach to Digital Design; PHI. 2009 3. Vincent P. Heuring, Harry F. Jordan, T.G. Venkatesh; Computer Systems Design and Architecture, 2e PHI 2012
Termwork Rubrics	Students can be evaluated based on assignments / class tests / mini-project / seminars / quiz / viva / presentations / circuit simulations, etc.

Name of the Programme: Electronics and Computer Science
Course Code: HM012
Title of the Course: Technical Writing and Professional Communication
Number of Credits: 02
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="2">Basic Knowledge of English Language, Communication Skills</td></tr>
<tr><td>Course Objectives:</td><td colspan="2">1. Acquaint the students with basic concepts, process of technical communication
2. Enhance communication skills by giving adequate exposure in Listening, Speaking, Reading, and Writing skills
3. Improve effective communication and interpersonal skills in life and at workplace
4. Build multidisciplinary approach towards all life tasks and life learning</td></tr>
<tr><td>Course Outcomes:</td><td colspan="2">Upon completion of the course, students will be able to
<table>
<tr><td>HM012.1</td><td>Demonstrate precise language skills with suitable vocabulary and apt style</td></tr>
<tr><td>HM012.2</td><td>Develop life skills/interpersonal skills to progress professionally</td></tr>
<tr><td>HM012.3</td><td>Apply traits of suitable candidature for a job/higher education</td></tr>
<tr><td>HM012.4</td><td>Deliver formal presentations and effectively implementing the verbal and non-verbal communication. skills</td></tr>
</table></td></tr>
<tr><td>Content:</td><td>UNIT-1 Communication Foundations And Analysis</td><td>No of Hrs</td></tr>
<tr><td></td><td>Process of Communication, Importance of Listening, Speaking, Reading, Writing, Principles of Communication, Overcome Barriers to Communication, Conversational Skills, Organizational Communication, Culture and Communication, Communicating Electronically – Webpage Communication, Voice and Wireless Communication, Email Communication, Group Communication – Characteristics of Effective Groups, From Groups to Teams, Group Discussion, Meeting Management, Technical Writing - Elements of Effective Writing, Grammar – Framework of English, Architecture of Sentence, Common Problems with English, Technical Reports, Technical Proposals, Formal Letters, Research Papers, and Technical Descriptions</td><td>10Hrs</td></tr>
<tr><td></td><td>UNIT-2 Personality Development</td><td></td></tr>
<tr><td></td><td>SWOC Analysis, Emotional Intelligence, Leadership, Time Management, Motivation. Goal Setting, Teamwork and Collaboration, Critical Thinking and Problem Solving, Professional Attitude, Persuasion, Anxiety and Stress Management, Social Responsibility</td><td>10Hrs.</td></tr>
<tr><td></td><td>UNIT-3 Career Development</td><td></td></tr>
<tr><td></td><td>Career Plan, Job Application Letter, Resume Building, Interviewing Skills,</td><td>5Hrs.</td></tr>
</table>

	Personal Networking and Branding, Build Professional Portfolio	
	UNIT-4 Public Speaking	
	Build Confidence and Overcome Nervousness, Use of Visual Aids, Craft and Impactful Speech, Design and Deliver Impactful Presentations	5Hrs
Pedagogy:	Learner centric teaching	
References/ Readings:	**TEXTBOOKS:** 1. Technical Writing and Professional Communication for non-native speakers of English. Thomas N. Huckin and Leslie A. Olsen. McGraw Hill 2. Technical Communication – Principles and Practice. Meenakshi Raman and Sangeeta Sharma. Oxford University Press. 2016. 3rd Edition 3. BCOM. Lehman, Dufrene, Sinha. Cengage Learning. 2016. 2nd Edition 4. Personal Development for Life and Work. Masters and Wallace. Cengage Learning. 2012. 10th Edition **REFERENCES:** 1. Mastering Communication. Nicky Stanton. Palgrave Master Series. 2009. 5th Edition 2. Communication Skills. Meenakshi Raman and Sangeeta Sharma. Oxford University Press. 2017. 2nd Edition 3. Effective Technical Communication. Ashraf Rizvi. Tata McGraw Hill. 2014	

Term Work		
Type of Activity	**Number**	**Marks allotted**
Assignments	08	75
Total		**75**

Tutorials		
Unit and Topic	**Hours**	**Marks allotted as Term Work**
01: Group Discussion	05	10
03: Interview Skills (Mock Interviews)	05	10
04: Presentations	03	10

Assignments			
Unit Number and Topic	**Sub-Topic**	**Number of Assignments**	**Marks allotted**
01: Communication Foundations and Analysis	Email Writing	1	05
	Group Discussion	1	**10**
	Proposal Writing	1	10
	Report Writing	1	10
02: Personality evelopment	SWOC Analysis	1	10
03: Career Development	Resume Building	1	10
	Interviews Skills	1	**10**
04: Public Speaking	**Presentations**	1	**10**
	Total	**08**	**75**

*Note: The topics marked in bold are assignments to be done during Tutorials.

Semester IV

Name of the Programme: Electronics and Computer Science
Course Code: ECS410 **Title of the Course:** Signals Processing Fundamentals
Number of Credits: 3(L)+1 (T)
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="2">Basic electrical and electronics engineering, Mathematics-I and Mathematics-II</td></tr>
<tr><td>Course Objectives:</td><td colspan="2">The course aims to provide the student with:
1. Understanding of time-domain representation and analysis of signals and systems
2. An ability to perform frequency-domain analysis using Fourier tools, Laplace and Z Transforms
3. An understanding of sampling, aliasing and Signal reconstruction</td></tr>
<tr><td>Course Outcomes:</td><td colspan="2">Upon completion of the course, students will be able to<table><tr><td>ECS410.1</td><td>Classify & interpret different types of signals and systems</td></tr><tr><td>ECS410.2</td><td>Illustrate the properties of continuous-time and discrete-time systems</td></tr><tr><td>ECS410.3</td><td>Analyze CT and DT signals in Frequency domain using CTFT and DTFT, Laplace Transform and Z Transform</td></tr><tr><td>ECS410.4</td><td>Appreciate the process of sampling, aliasing, and signal reconstruction</td></tr></table></td></tr>
<tr><td>Content:</td><td>UNIT 1</td><td>No. of Hrs.</td></tr>
<tr><td></td><td>Introduction: Definitions and concept of different types of signals; classification of signals: continuous time and discrete time signals; Causal and Non-Causal, Periodic and Non-periodic signals, Signal Energy and Power, Even and Odd Signals.
Basic signal types: Exponential and Sinusoidal signal; Unit impulse and Unit step, Unit Ramp functions, Sinc function. Transformations of independent and dependent variable;
Systems: Continuous time and Discrete time system and basic system properties. Linear time invariant (LTI) systems: Introduction, Discrete time LTI system, the convolution sum, Impulse Response of LTI system</td><td>10L+4THrs</td></tr>
<tr><td></td><td colspan="2">UNIT 2</td></tr>
<tr><td></td><td>Continuous Time Fourier Series (CTFS): Introduction; response of LTI system to complex exponential; Exponential Fourier series representation of continuous-time periodic signals; convergence of the Fourier series; Properties of CTFS (with derivations).
Discrete Time Fourier Series (DTFS): Representation of discrete time periodic signals; Exponential Fourier series representation of discrete-time periodic signals, properties of discrete-time Fourier Series, Properties of DTFS (with derivations).</td><td>12L+3THrs.</td></tr>
</table>

	UNIT 3	
	Continuous-Time Fourier Transform: Representation of aperiodic signals: Fourier transform of aperiodic signals and their properties; linearity, time shifting, differentiation, integration, conjugation and conjugate symmetry, time, frequency scaling, duality, Parseval's relation, convolution. (No derivations expected) **Discrete-Time Fourier Transform**: Representation of aperiodic signals; Fourier transform of aperiodic signals. Properties (No derivations expected) **Sampling of continuous time signals:** Periodic sampling, Frequency domain representation of sampling, Sampling Theorem, Reconstruction of a Band limited Signal from its samples, Aliasing. Numerical problems on sampling in time domain.	12L+4THrs.
	UNIT 4	
	The Laplace transform: Introduction; Laplace transforms; the region of convergence (ROC); Properties of Laplace Transform (No derivations expected), Inverse Laplace transform; Analysis and characterization of LTI system using the Laplace transform. Application of Laplace Transform to RLC circuits. Unilateral Laplace transforms. **The Z-transform**: Introduction; Z-transform; the region of convergence; the inverse Z-transform; properties of Z-transform (No derivations expected), Analysis and characterization of LTI system using Z-transforms.	11L+4THrs.
Pedagogy:	Learner centric teaching	
References/ Readings:	**TEXTBOOKS** 1. A. V. Oppenheim, A.V.Willsky, S. Hamid; Signals and systems; 2nd Edition PHI. 2. S. Haykins, B. V. Veen; Signals and Systems; 2ed Wiley India. 2007 3. V. Krishnaveni, A. Rajeshwari: Signals and Systems; Wiley-India 2012 4. A Sudhakar, S P Shyammohan: Circuits and Networks-Analysis and Synthesis; Tata Mc Graw Hill **REFERENCES** 1. D. G. Rao, S. Tunga; Signals and systems; Pearson Education. 2010 2. R. E. Ziemer, W.H Tranter, D.R.Fannin; Signal and Systems; 4ed Pearson Education, Asia. 2013	
Term work Rubrics	Students can be evaluated based on assignments / class tests / mini-project / seminars / quiz / viva / presentations / circuit simulations, etc.	

Name of the Programme: Electronics and Computer Science
Course Code: ECS420
Title of the Course: Computer Organization and Operating Systems
Number of Credits: 04
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="3">Basic of C, C++ Programming, Digital Electronics</td></tr>
<tr><td>Course Objectives:</td><td colspan="3">The subject aims to provide the student with:
1. An understanding of the structure, function and characteristics of computer systems
2. The knowledge of the basics of memory system, its types, and input-output functionalities
3. A comprehensive understanding of the underlying principles, techniques and approaches in operating systems
4. The knowledge of process synchronization, algorithms of process scheduling and deadlocks to ensure the orderly execution of processes
5. An ability to describe ways to manage memory and concepts of virtual memory.
6. A general understanding of file management aspects of an operating system and various disk scheduling policies</td></tr>
<tr><td>Course Outcomes:</td><td colspan="3">Upon completion of the course, students will be able to
<table>
<tr><td>ECS430.1</td><td>Understand and analyze computer organization, memory, it’s hierarchy, and input-output functionalities</td></tr>
<tr><td>ECS430.2</td><td>Summarize the objectives of an operating system, concepts of process management and concurrency control</td></tr>
<tr><td>ECS430.3</td><td>Understand process scheduling algorithms and the classic problems of process synchronization and approaches to deal with deadlocks</td></tr>
<tr><td>ECS430.4</td><td>Describe and identify suitable ways to manage memory, virtual memory and understand file management & its organization in OS and identify disk scheduling algorithms</td></tr>
</table></td></tr>
<tr><td>Content:</td><td colspan="3">UNIT- 1</td></tr>
<tr><td></td><td>Introduction to Computer Organization: Computer components, Functions, interconnection Structure, Bus Interconnection, Register organization, Instruction Cycle, Instruction Pipelining: Strategy, Performance and Hazards
Memory System: Basic concepts, Characteristics, Hierarchy, Semiconductor RAM Memories, Internal Organization of Memory Chip, Read-Only Memories, Cache Memory Principles, Elements of Cache Design
Input/Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access
Control Unit Operations: Micro Operations, Control of CPU,</td><td>15 Hrs.</td></tr>
</table>

	Hardwired Implementation, Micro programmed Control: Basic Concepts, Microinstruction sequencing and microinstruction execution.	
	UNIT-2	
	Operating System: OS objectives and functions, Services provided, Kernel, Booting, Multiprocessor system, Multiprogramming System, time sharing system **Process management:** Process concepts, process states, creation & termination of processes, two & five model process model, suspended process, inter-process communication, Thread overview, Multithreading models **Concurrency Control:** Principles of concurrency, operating system concerns, Process interaction, Competition amongst processes for resources, Cooperation amongst processes by sharing & communication, Semaphores	15 Hrs.
	UNIT-3	
	Process Scheduling: Basic concepts: CPU – I/O Burst Cycle, CPU Scheduler, Pre-emptive Scheduling, Dispatcher, Scheduling criteria, Scheduling Algorithms: FCFS, SJF, Priority, RR **Process Synchronization:** Background, The Critical – Section Problem, Synchronization Hardware, Semaphores, classic problems of Synchronization: The Bounded Buffer Problem, the Readers-Writers Problem, The Dining-Philosophers Problem **Deadlocks:** System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.	15 Hrs.
	UNIT-4	
	Memory Management: Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Memory Allocation Strategies: Best-Fit, First Fit, Worst Fit, Paging and Segmentation **Virtual Memory:** Background, Demand Paging, Page Replacement: Basic Scheme, FIFO, Optimal, LRU, Allocation of frames, Thrashing: cause of Thrashing. **File Management:** Files, File Management Systems, File Organization and access, File Directories, File Sharing, Record Blocking **Secondary Storage Structure:** Introduction, Disk Scheduling Algorithms	15 Hrs.
Pedagogy:	Learner centric teaching	
References/ Readings:	**TEXTBOOKS:** 1. William Stalling, A textbook of Computer Organization and Architecture, 2. Edition VI 3. William Stallings; Operating Systems: Internal & design principles, 6th Edition; PHI 4. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi. 5. M. Morris Mano ; A textbook of Computer Organization and Architecture	

	REFERENCES: 1. Achyut S. Godbole, Atul Kahate, "Operating Systems, McGraw Hill Education, 2016 2. Operating System Concepts - Abreham Silberchatz, Peter B. Galvin, Greg Gagne, 8th Edition, John Wiley.

Name of the Programme: Electronics and Computer Science
Course Code: ECS430 **Title of the Course:** Analog Electronics & Instruments
Number of Credits: 3(l)+1(T)
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="2">Mathematics, Basic Electrical and Electronic Engineering, Electronic Devices and Circuits</td></tr>
<tr><td>Course Objectives:</td><td colspan="2">The subject aims to provide the student with:
1. An understanding of the basic principles, configurations and practical limitations of op-amps.
2. Ability to design op-amp circuits, Voltage regulators, A/D and D/A converters. 3. An understanding of the basic principles of VCO and PLL.
3. Ability to design circuits using 555 timer IC.
4. An understanding of the working of measuring instruments.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="2">Upon completion of the course, students will be able :
<table><tr><td>ECS430.1</td><td>Explain the DC and AC characteristics of operational amplifiers and its effect onoutput</td></tr><tr><td>ECS430.2</td><td>Explain and design the linear and non-linear applications of an op-amp</td></tr><tr><td>ECS430.3</td><td>Design the function of application specific ICs such as Data Converters,Voltage Regulators, IC 555 timer, PLL</td></tr><tr><td>ECS430.4</td><td>Explain with block schematic the principle working of measuring instruments.</td></tr></table></td></tr>
<tr><td>Content:</td><td>UNIT- I</td><td>No. of hrs.</td></tr>
<tr><td></td><td>Differential Amplifiers: Differential amplifiers, ac and dc analysis, constant current bias, current mirror circuit.
Basics of Op-Amp: Functional block diagram and pin diagram of Op-amp, op-amp parameters, definitions, equivalent circuit of Op-amp and voltage transfer curve, Open loop Configurations: Inverting, non- inverting & differential amplifier, Disadvantages of open loop op-amp
Closed loop Configurations: Inverting and non-inverting amplifiers, Frequency response of op-amp
Applications of Op-amp: Voltage follower, V-I & I-V converter, Differentiator, integrator, summing scaling and averaging amplifier, Instrumentation amplifier</td><td>11L+4T Hrs.</td></tr>
<tr><td></td><td>UNIT-2</td><td></td></tr>
<tr><td></td><td>Applications of Op-amp: Op-Amps as comparators, zero crossing detectors, Schmitt trigger, comparator characteristics, limitations of comparator, sample and hold circuit.
Filters using Op-Amp: Advantages of active filter, Butterworth low pass, high pass, band pass, band reject filter (Analysis & design).</td><td>11L+3T Hrs.</td></tr>
</table>

	Oscillators using Op-Amp: Wien bridge and Phase shift oscillators(Analysis & design). **Voltage Regulators:** Specifications & working of three terminal voltage regulators - IC78XX, 79XX, LM317 voltage regulator. Specifications & functional block diagrams of IC 723. Design of IC 723 as high and low voltage regulators.	
	UNIT-3	
	Special ICs: Timer IC 555 - Functional block diagram, working, specification and modes: IC 555 as monostable and astable multivibrator (Analysis & design), applications of IC555 as monostable (missing pulse detector, frequency divider, PWM) and astable multivibrator (Square wave oscillator, free running ramp generator). **VCO IC566:** Block diagram of Voltage Controlled Oscillator, Pin Diagram **PLL:** Functional block diagram, working, transfer characteristics of PLL, lock range and capture range (no derivations). Applications of PLL as frequency multiplier, PLL IC 565 **Data converters:** Resolution, accuracy, quantization error in convertors, DAC: Binary weighted resistors and R-2R resistor ladder (Analysis & Design), ADC: Successive approximation	12L+4T Hrs
	UNIT-4	
	Instrumentation: Characteristics of Instruments: Static and Dynamic characteristics, Errors in measurement. **Digital Voltmeter:** Dual Slope Integrating Type, Successive Approximation Type DVMs. **Digital Multimeter:** Block Diagram, Sensitivity & Resolution. **DSO:** Block diagram of DSO, applications, advantages **Signal Generators:** Block diagram of Function generator, Spectrum Analyzer	11L+4T Hrs
Pedagogy:	Learner centric teaching	
References/ Readings:	**TEXTBOOKS** 1. Ramakant A. Gayakwad, Op-Amps and linear integrated circuits, Pearson 2015 2. K. R. Botkar, Integrated Circuits, Khanna Publishers.2004 3. H. S. Kalsi, Electronic Instrumentation, Tata McGraw Hill 4. N.V.S. Raju, Instrumentation: Operation, Measurement, Scope and Application of Instruments, BS Publications 5. Er. R.K.Rajput, Electrical Measurements and Measuring Instruments, 2ed, S. Chand. 2013. **REFERENCE BOOKS** 1. J. Millman, C. Halkias, C. Parikh; Integrated Electronics: Analog and 2. Digital Circuits and Systems; 2ed, McGraw Hill. 2017 3. S. Salivahanan, V.S.K. Bhaskara, Linear Integrated Circuits, Mc Graw Hill	

	4. A.K.Sawhney , Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co.
Term work Rubrics	Students can be evaluated based on assignments/ class tests/ seminars/ quizzes/ viva etc.

Name of the Programme: Electronics and Computer Science
Course Code: ECS440 **Title of the Course:** Microprocessors & Microcontrollers
Number of Credits: 03
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="2">Digital Electronics</td></tr>
<tr><td>Course Objectives:</td><td colspan="2">The subject aims to provide the student with:
1. An understanding of the Intel 8085 architecture.
2. An in-depth understanding of the 8051 Microcontroller architecture.
3. An ability to write Assembly language programs for a given task.
4. An ability to interface various I/O devices with the 8051 microcontroller.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="2">Upon completion of the course, students will be able to<table><tr><td>ECS440.1</td><td>Explain the microcomputer system concepts and architecture and working of 8085..</td></tr><tr><td>ECS440.2</td><td>Understand the architecture of 8051 and analyze its instruction Set</td></tr><tr><td>ECS440.3</td><td>Analyze Timers and Counters, Serial Communication and Interrupts and code the various applications based on these concepts</td></tr><tr><td>ECS440.4</td><td>Create Assembly language programs for 8051 & interface it with the hardware for a given application.</td></tr></table></td></tr>
<tr><td>Contents</td><td>Unit 1</td><td>No of hours</td></tr>
<tr><td></td><td>Core of the Embedded System: General Purpose and Domain Specific Processors, Microprocessors v/s Microcontrollers, Big-Endian vs. Little-Endian, RISC v/s CISC Architectures, Von Neumann v/s Harvard Architecture.
8085 Microprocessors: 8085 MPU: Pin description, signals, Communication and Bus Timings, Generating control signals, Detailed architecture of 8085A microprocessor.
8085 Machine Cycles and Bus Timings: Opcode Fetch machine cycle, Memory Read/Write machine cycle and I/O Read/Write machine cycle.</td><td>10 Hrs</td></tr>
<tr><td></td><td>Unit 2</td><td></td></tr>
<tr><td></td><td>8051 Architecture: Introduction, 8051 Microcontroller Hardware: 8051 Oscillator and clock, Program counter and data pointer, A and B CPU register, Flags and PSW, Internal Memory, Internal RAM, Stack and Stack Pointer, SFRs, Internal ROM, Input/output Pins, ports and circuits, External Memory.
8051 Instruction Set & Programming: Addressing Modes, Data movement instruction: External Data moves, Code memory Read-Only Data moves, PUSH and POP opcodes, Data exchanges. Example programs. Logic operation: Bit and Byte level, Rotate and Swap. Example Programs. Arithmetic operations: Flags, incrementing, decrementing, addition, subtraction, multiplication and division,</td><td>11 Hrs</td></tr>
</table>

	decimal arithmetic. Bit manipulation instructions, example Programs.	
	Unit 3	
	8051 Timers and Counters: Timer/Counter SFRs and modes of operation, Calculating delay Problem using Timers. Programming on Timers and Counters. **8051 Serial Data input/output:** Serial Communication SFRs and modes of operations, Basic Programming. **8051 Interrupts:** Interrupts SFRs, Interrupt Priority, Basic programming on Interrupts. **8051 Instruction Set & Programming:** Jump and Call instruction: Range, Jumps, Calls and subroutines, Interrupts and Return. I/O port programming, example programs. 8051 connection to RS232, Pipelining.	12 Hrs
	Unit 4	
	Interfacing with 8051 based Microcontroller system: Interfacing LEDs, matrix keyboard, LCD, ADCs, DACs: Generating Triangular, Staircase and Sine wave using DACs, Temperature sensors, Relay, Opto-isolators & Stepper Motors. Interfacing of external Memory.	12 Hrs
Pedagogy:	Learner centric teaching	
References / Readings:	**TEXTBOOKS:** 1. Gaonkar R. S.; "Microprocessor Architecture, Programming and Applications"; 5th Ed.; Penram International; 2007. 2. Muhammad Ali Mazidi, Janice Gillispie Mazidi; The 8051 Microcontroller and Embedded systems; Pearson Education 3. Kenneth J. Ayala; The 8051 Microcontroller, Architecture, Programming & applications, second edition; Penram International 4. Shibu K V; Introduction to Embedded Systems; McGraw Hill, 2nd Edition **REFERENCES:** 1. Hall D. V.; "Microprocessor and Interfacing-Programming and Hardware"; 2nd Ed.; Tata McGraw-Hill Publishing Company Limited; 2008. 2. 8051 Microcontroller-Internals,Instructions,Programming & Interfacing by Subrata Ghoshal; Pearson Education India, 2010. 3. Embedded Systems and Robots – Projects using the 8051 Microcontroller by Subrata Ghoshal; Cengage Learning, 2009.	

Name of the Programme: Electronics and Computer Science
Course Code: ECOMP450 **Title of the Course:** Java Programming
Number of Credits: 03
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="2">Data structure concepts, Discrete structures</td></tr>
<tr><td>Course Objectives:</td><td colspan="2">The subject aims to provide the student with:
1. To learn designing and development of JAVA applications using OOP concepts
2. To learn back end connection and utilization of schema based as well as schema less databases</td></tr>
<tr><td>Course Outcomes:</td><td colspan="2">Upon completion of the course, students will be able to :
<table>
<tr><td>ECOMP450.1</td><td>Write programs using basic features of Java and demonstrate the use of classes, object, packages and collection framework using Java</td></tr>
<tr><td>ECOMP450.2</td><td>Illustrate and implement exception handling, multithreading and event handling</td></tr>
<tr><td>ECOMP450.3</td><td>Utilize JAVA collection Framework and filesystem object</td></tr>
<tr><td>ECOMP450.4</td><td>Design interface with Java Database Connectivity and create enterprise applications using components of J2EE</td></tr>
</table></td></tr>
<tr><td>Content:</td><td>UNIT- 1</td><td>No of Hrs</td></tr>
<tr><td></td><td>Introduction to JAVA: Java and Java applications; Java Development Kit (JDK) Byte Code, JVM; Object-oriented programming
Simple Java programs: Data types and other tokens: Boolean variables, int, long, char, operators, arrays, white spaces, literals, assigning values; Creating and destroying objects; Access specifiers. Operators and Expressions: Arithmetic Operators, Bitwise operators, Relational operators, The Assignment Operator, Ternary Conditional Operator; Operator Precedence; Logical expression; Typecasting; Strings.
Control Statements: Selection statements, iteration statements, Jump Statements.
Classes, Inheritance, Exceptions: Classes: Classes in Java; Declaring a class; Class name; Super classes; Constructors; Creating instances of class; Inner classes. Inheritance: Simple, multiple, and multilevel inheritance; Overriding, overloading, Exception handling in Java.
Java Packages: Creating a Package, The import Keyword, The Directory Structure of Packages, Set CLASSPATH System Variable.</td><td>11 Hrs.</td></tr>
<tr><td></td><td>UNIT-2</td><td></td></tr>
</table>

	Multi-Threaded Programming: Multi-Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, readwrite problem, producer-consumer problems. **Event Handling:** Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes. **Swings:** The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; Jlabel and ImageIcon; JTextField;The Swing Buttons; JTabbedpane; JScrollPane; JList; JComboBox; JTable; Jframes	12 Hrs.
	UNIT -3	
	Java Collection Framework: Interfaces (Set, List, Queue, Deque), ArrayList, Vector, LinkedList, PriorityQueue, HashSet, LinkedHashSet, TreeSet; Lambda Expressions **Files and Streams:**Stream, Standard Streams, Reading and Writing Files, ByteArrayInputStream, DataInputStream, FileOutputStream, ByteArrayOutputStream, DataOutputStream, Navigation and I/O, Working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects	11 Hrs.
	UNIT -4	
	JAVA 2 Enterprise Edition Overview, Database Access: Overview of J2EE and J2SE. The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions. **Servlets:** Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. **JSP:** Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects	11 Hrs.
Pedagogy:	Learner centric teaching	
References/ Readings:	**TEXTBOOKS:** 1. "Java The Complete Reference", Herbert Schildt, McGraw Hill; Eleventh edition, 2020 2. "Programming with Java", E. Balagurusami, McGraw-Hill; Sixth edition, 2019. **REFERENCES:**	

	1. “J2EE - The Complete Reference”, Jim Keogh, Tata McGraw Hill. 2. “Core Java Volume 1: Fundamentals”, Cay S. Horstmann, Oracle Press, 12th edition 3. “Introduction to JAVA Programming”, Y. Daniel Liang, Pearson Education, 6th Edition

Name of the Programme: Electronics and Computer Science
Course Code: ECS460 **Title of the Course:** Java programming Lab
Number of Credits: 1
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="2">Basic Programming Skills</td></tr>
<tr><td>Course Objectives:</td><td colspan="2">The course aims to provide the student with:
1. To learn designing and development of JAVA applications using object oriented programming concepts.
2. To design web application using java server pages, servlets and java collection framework.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="2">Upon completion of the course, students will be able to<table><tr><td>ECS 460.1</td><td>Learn and implement basic Java programs adhering to Object Oriented Programming Concepts</td></tr><tr><td>ECS 460.2</td><td>-Apply concepts of Inheritance, Exception handling, Multithreading & Event handling to solve problems</td></tr><tr><td>ECS 460.3</td><td>Utilization of Java collection Framework & files and streams using Java.</td></tr><tr><td>ECS 460.4</td><td>Design and implement Swing classes with database connectivity along with servlets.</td></tr></table></td></tr>
<tr><td>Content:</td><td>List of Experiments:
Note: At least 10 experiments should be conducted from below mentioned list
1. Basic Programs in Java (2-3 sub programs)
2. Constructors in Java
3. Inheritance in Java
4. Exception handling in Java
5. Multi-threading in Java
6. Event Handling in Java
7. Swings in Java
8. A program with utilization of Java Collection Framework
9. A program to demonstrate importance of Files and Streams
10. A program to demonstrate JDBC/ODBC connectivity
11. A program to demonstrate Servlets
12. Web Application using JSP</td><td>30 HRS</td></tr>
<tr><td>Pedagogy:</td><td colspan="2">Learner centric teaching</td></tr>
<tr><td>References/ Readings:</td><td colspan="2">TEXTBOOKS:
1. Herbert Schildt, Java The Complete Reference, McGraw Hill, Eleventh edition, 2020.
2. E. Balagurusami, Programming with Java, McGraw-Hill, Sixth edition, 2019.
3. Jim Keogh, J2EE - The Complete Reference, Tata McGraw Hill.
REFERENCES:
1. Cay S. Horstmann, Core Java Volume 1: Fundamentals, Oracle Press, 12th edition.
2. Daniel Liang, Introduction to JAVA Programming, Pearson Education, 6th</td></tr>
</table>

	Edition.
Term Work Rubrics	Marks for students can be granted based on the Practical file submission along with mini-project/ viva/ circuit simulations, etc.

Name of the Programme: Electronics and Computer Science
Course Code: ECOMP470 **Title of the Course:** Analog Circuits Design Lab
Number of Credits: 01
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td>Basic Electrical and Electronics Engineering</td></tr>
<tr><td>Course Objectives:</td><td>The subject aims to provide the student with:
1. To apply operational amplifiers in linear and nonlinear applications.
2. To acquire the basic knowledge of special function ICs</td></tr>
<tr><td>Course Outcomes:</td><td>Upon completion of the course, students will be able to :
<table>
<tr><td>ECOMP 470.1</td><td>Understand the working of op-amp and its applications</td></tr>
<tr><td>ECOMP 470.2</td><td>Design and analyze various linear and non-linear application circuits of op-amp</td></tr>
<tr><td>ECOMP 470.3</td><td>Construct and trouble shoot op amp circuits in the laboratory with proper useof test equipment.</td></tr>
<tr><td>ECOMP 470.4</td><td>Develop IC based project kits in above areas according to specifications</td></tr>
</table></td></tr>
<tr><td>Content:</td><td>List of Experiments
Note: At least 10 experiments should be conducted from the following list of experiments:
<table>
<tr><td>1. Current mirror circuit.
2. Op-amp open loop inverting and non-inverting circuit.
3. Op-amp closed loop Inverting and Non-Inverting amplifier.
4. Op-amp: Differentiator, Integrator.
5. Op-amp: Summing, Scaling and Averaging amplifier.
6. Op-amp: Instrumentation amplifier.
7. Op-amp Schmitt Trigger and Monostable Multivibrator.
8. Binary Weighted &R-2R Ladder type D- A Converter using op-amp.
9. Op-amp: Square wave generator, triangular wave generator.
10. Active HP, LP and BP filter using op-amp.
11. RC Phase Shift and Wein Bridge oscillator using op-amp.
12. Astable and Monostable Multivibrator using IC 555.
13. PLL Characteristics</td><td>30 HRS</td></tr>
</table></td></tr>
<tr><td>Pedagogy:</td><td>Learner centric teaching</td></tr>
<tr><td>References/ Readings:</td><td>TEXTBOOKS
1. Ramakant A. Gayakwad, Op-Amps and linear integrated circuits, Pearson 2015
2. K. R. Botkar, Integrated Circuits, Khanna Publishers.2004
REFERENCE BOOKS
1. J. Millman, C. Halkias, C. Parikh; Integrated Electronics: Analog and Digital Circuits and Systems; 2ed, McGraw Hill. 2017</td></tr>
</table>

	2. S. Salivahanan, V.S.K. Bhaskara, Linear Integrated Circuits, Mc Graw Hill
Term work Rubrics	Marks for students can be granted based on the Practical file submission along with mini-project/ viva/ circuit simulations, etc.

Name of the Programme: Electronics and Computer Science
Course Code: ECS480 **Title of the Course:** Microcontrollers Lab
Number of Credits: 1
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td>Digital Electronics, Digital Electronics Lab</td></tr>
<tr><td>Course Objectives:</td><td>The subject aims to provide the student with:
1. To develop in students assembly language programming skills and understanding of programming a microcontroller (8051).
2. To interface peripherals with 8051</td></tr>
<tr><td>Course Outcomes:</td><td>Upon completion of the course, students will be able to
<table>
<tr><td>ECS480.1</td><td>Explain assembly language programming and use of simulation tool for 8051</td></tr>
<tr><td>ECS480.2</td><td>Write assembly language programs using data movement, arithmetic and logical instructions, using 8051</td></tr>
<tr><td>ECS480.3</td><td>Understand programming of 8051 using a development board.</td></tr>
<tr><td>ECS480.4</td><td>Interface different peripherals with 8051</td></tr>
</table></td></tr>
<tr><td></td><td>Experiment List (Contents)
Note: At least 10 experiments should be conducted from the list below:
<table>
<tr><td>1. ALP for block transfer of data in memory using 8051.
2. ALP to search numbers from a set of numbers in memory using 8051
a) to find largest/smallest number
b) to find even and odd numbers
c) to count positive and negative numbers
d) to count the number of ones in a given data byte.
3. ALP for sorting the numbers in ascending and descending order using 8051
4. ALP for arithmetic and logic operations using 8051
5. ALP for timing and counting using 8051
6. Interfacing of LEDs and Switches to 8051
7. Interfacing of seven segment display to 8051
8. Interfacing of LCD to 8051
9. Interfacing of DC, Stepper and Servo Motor to 8051
10. Measurement of pulse width using timers of 8051
11. Interfacing of ADC and DAC with 8051
12. Implementation of hardware interrupt using simple Switch & LED using 8051
13. Serial port programming using 8051</td><td>30HRS</td></tr>
</table></td></tr>
<tr><td>Pedagogy:</td><td>Learner centric teaching</td></tr>
<tr><td>References/ Readings:</td><td>TEXTBOOKS
1. Muhammad Ali Mazidi, Janice Gillispie Mazidi; The 8051 Microcontroller and Embedded systems; Pearson Education.
2. Kenneth J. Ayala; The 8051 Microcontroller, Architecture, Programming & applications, second edition; Penram International.</td></tr>
</table>

	3. Shibu K V; Introduction to Embedded Systems; McGraw Hill, 2nd Edition. **REFERENCES** 1. 8051 Microcontroller-Internals,Instructions,Programming & Interfacing by Subrata Ghoshal; Pearson Education India, 2010. 2. Embedded Systems and Robots – Projects using the 8051 Microcontroller by Subrata Ghoshal; Cengage Learning, 2009.
Term work Rubrics	Marks for students can be granted based on the Practical file submission along with mini-project/ viva/ circuit simulations, etc.

Name of the Programme: Electronics and Computer Science
Course Code: HM013 **Title of the Course:** Business Economics and Management
Number of Credits: 03
Effective from AY: 2023-24

<table>
<tr><td>Pre-requisites for the Course:</td><td colspan="2">Nil</td></tr>
<tr><td>Course Objectives:</td><td colspan="2">The subject aims to provide the student with:
1. To expose students to basic Economic concepts and inculcate an analytical approach to the subject matter
2. To apply economic reasoning to problems of business
3. To be able to recognize, formulate and analyze cash flow models in practical situations
4. To familiarize the students with the basic principles of management
5. To acquaint the students with standard concepts that they are likely to find useful in their profession when employed
6. To be able to understand the various concepts in Ethics</td></tr>
<tr><td>Course Outcomes:</td><td colspan="2">Upon completion of the course, students will be able to :<table><tr><td>HM013.1</td><td>Understand and apply the basic principles of economics and national income terms</td></tr><tr><td>HM013.2</td><td>Apply the basic financial concepts and analyse different financial statements to make sound business decisions</td></tr><tr><td>HM013.3</td><td>Evaluate different management concepts</td></tr><tr><td>HM013.4</td><td>Apply managerial concepts to solve complex problems related to global issues</td></tr></table></td></tr>
<tr><td>Content:</td><td>UNIT- 1</td><td>No of Hrs</td></tr>
<tr><td></td><td>Introduction and General Concepts: Demand and Supply- Demand curve, Supply curve, Market Equilibrium
Estimation/Forecasting of Demand: Meaning, importance, methods–trend, exponential smoothing, regression analysis
National Income Terms: GDP, Real v/s Nominal GDP, Net Domestic Product, GNP, National Income, Per capita income, Disposable Income, Price Index, Inflation.</td><td>10 Hrs.</td></tr>
<tr><td></td><td>UNIT-2</td><td></td></tr>
<tr><td></td><td>Preparation of Income statement, Balance sheet.
Understanding and analyzing them using financial ratios – liquidity, leverage and profitability ratios.
Capital Budgeting: Different Methods of Evaluation of Projects- Payback Period, Discounted Cash Flow methods- Net Present Value.
Working Capital Management: Determinants of working capital, financing of working capital, dangers of excessive and shortage of working capital.Break even Analysis</td><td>10 Hrs.</td></tr>
</table>

	UNIT -3	
	General Principles of Management: Introduction to Management, Functions of a manager. **Planning:** Importance of planning, types of plans. **Controlling:** Basic control process, Critical control points and standards Human Resource Management and Selection, Definition of Staffing, Overview of the staffing function, Selection process. **Appraising and Rewarding Performance**: Money as a means of Rewarding Employees, performance appraisal, the Reward Pyramid MBO Process, How to set objectives, benefits and weaknesses, Span of management , Factors determining an effective span, Organization, Structure of organization, Formal and informal organization, Depart mentation, Matrix Organization, Strategic Business Unit Decentralization and Delegation. **Leadership:** Ingredients of leadership, Managerial grid.	12Hrs.
	UNIT -4	
	Communication: Nature and Importance of Communication, The Two-Way Communication Process, Communication Barriers , Downward and Upward Communication/ Formal Informal Communication, Forms of communication. **Motivation:** Model of Motivation, Motivational Drives, Human Needs, Types of Needs, Maslow's Hierarchy of Needs, Hezberg's Two-Factor Theory. **Managing Change:** Nature of Work Change, three Stage in Change **Engineering Ethics:** Engineering Ethics, Self-interest, Customs and Religion. Interpersonal Behavior: Nature and Levels of Conflict, Sources of Conflict, Effects of Conflict, Model of Conflict: Participant Intentions, Resolution Strategies. Whistle – Blowing **Safety Responsibility and Rights:** Responsibility of Engineers, Risk-Benefit Analysis, Ethical issues in Cost-benefit Analysis, Ethics and Risk Management, Reducing Risk	13 Hrs.
Pedagogy:	Learner centric teaching	
References/ Readings:	**TEXTBOOKS:** 1. P.A. Samuelson & W.D. Nordhaus, Economics, 19th Edition McGraw Hill, New York, 1995 2. P. C. Tripathi, P. N. Reddy; Principles of Management; 2nd edition, Tata McGraw Hill; 1991. 3. R. L. Varshney, K L Maheswari; Managerial Economics; Nineteenth, Revised and Enlarged Edition; Sultan Chand and Sons Publications 4. Prasanna Chandra; Fundamentals of Financial Management; Third Edition, Tata McGraw-Hill, NewDelhi **REFERENCES:**	

	5. John W. Newstrom, Keith Davis; Organizational Behavior (Human Behavior at Work); Tenth Edition, Tata McGraw Hill 6. A. Alavudeen, R. Kalil Rahman and M. Jayakumaran; Professional Ethics and Human Values; Laxmi Publications 7. Richard M. Lynch, Robert W. Williamson; Accounting for Management, Planning and Control; Third Edition, Tata McGraw-Hill, New Delhi 8. C. B Gupta; Management: Theory and Practice; Seventeenth Revised and Enlarged edition; Sultan Chand &Sons 9. H. Craig Petersen, W. Cris Lewis, Sudhir K. Jain; Managerial Economics; Prentice Hall India