RSET
RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY

COURSE HAND-OUT

B.TECH. - SEMESTER IV

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING (EC), RSET

VISION

TO EVOLVE INTO A CENTRE OF EXCELLENCE IN ELECTRONICS AND COMMUNICATION ENGINEERING, MOULDING PROFESSIONALS HAVING INQUISITIVE, INNOVATIVE AND CREATIVE MINDS WITH SOUND PRACTICAL SKILLS WHO CAN STRIVE FOR THE BETTERMENT OF MANKIND

MISSION

TO IMPART STATE-OF-THE-ART KNOWLEDGE TO STUDENTS IN ELECTRONICS AND COMMUNICATION ENGINEERING AND TO INCULCATE IN THEM A HIGH DEGREE OF SOCIAL CONSCIOUSNESS AND A SENSE OF HUMAN VALUES, THEREBY ENABLING THEM TO FACE CHALLENGES WITH COURAGE AND CONVICTION

B.TECH PROGRAMME

Program Outcomes (POs)

Engineering students will be able to

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, Engineering fundamentals, and Electronics and Communication Engineering to the solution of complex Engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and Engineering sciences.
3. **Design/development of solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.
6. **The Engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional Engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable developments.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex Engineering activities with the Engineering Community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life -long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

Program-Specific Outcomes (PSOs)

Engineering students will be able to:

1. Demonstrate their skills in designing, implementing and testing analogue and digital electronic circuits, including microprocessor systems, for signal processing, communication, networking, VLSI and embedded systems applications;

2. Apply their knowledge and skills to conduct experiments and develop applications using electronic design automation (EDA) tools;

3. Demonstrate a sense of professional ethics, recognize the importance of continued learning, and be able to carry out their professional and entrepreneurial responsibilities in electronics engineering field giving due consideration to environment protection and sustainability.

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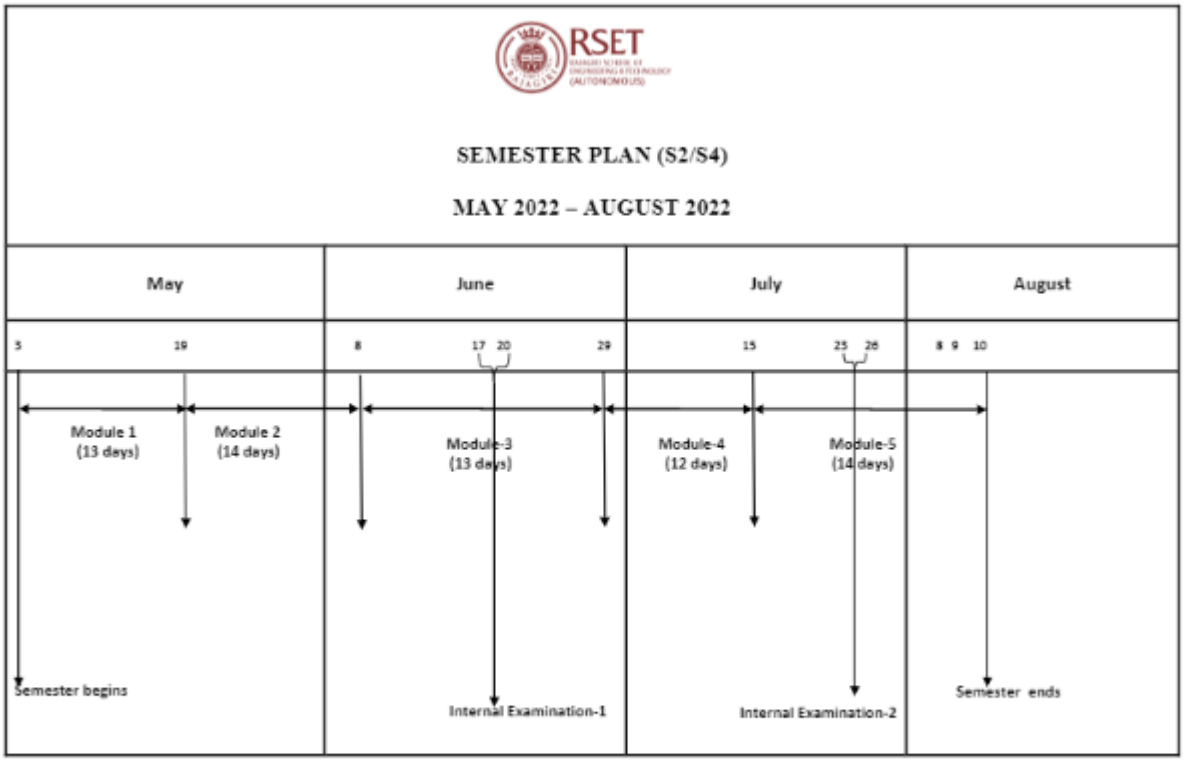
1. SEMESTER PLAN



May: 21 June: 23 July: 21 August: 7

Total no of working days: 72

Total no of instructional days: 66

2. SCHEME

SLOT	Code	Subject	Hours/Week			Credits
			L	T	P	
A	100902/MA400A	PROBABILITY, RANDOM PROCESS AND NUMERICAL METHODS	3	1	0	4
B	100001/EC400B	ANALOG CIRCUITS	3	1	0	4
C	100001/EC400C	SIGNALS AND SYSTEMS	3	1	0	4
D	100001/EC400D	COMPUTER ARCHITECTURE AND MICROCONTROLLERS	3	1	0	4
E	100001/CO900E	DESIGN AND ENGINEERING	2	0	0	2
F	100908/ES400F	CONSTITUTION OF INDIA	2	0	0	-
S	100001/EC422S	ANALOG CIRCUITS AND SIMULATION LAB	0	0	3	2
T	100001/EC422T	MICROCONTROLLER LAB	0	0	3	2

100902/MA400A PROBABILITY, RANDOM PROCESS AND NUMERICAL METHODS

COURSE INFORMATION SHEET

Programme: Electronics & Communication Engineering	**Degree:** B.Tech
Semester: 4	**Course type**: Core
Course area/domain: Mathematics	**Contact hours:** 4 hours/week
Regulation: 2019	

CODE	COURSE NAME	CATEGORY	L-T-P	CREDIT
100903 MA400A	PROBABILITY, RANDOM PROCESSES AND NUMERICAL METHODS	BASIC SCIENCE COURSE	3-1-0	4

COURSE PREREQUISITES:

CODE	COURSE NAME	DESCRIPTION	SEM
101009 MA100B	A basic course in one variable and multivariable calculus.	To develop basic ideas on integration.	I

Course objective:

- To introduce the modern theory of probability and its applications to modelling and analysis and processing of random processes and signals
- To understand some basic numerical methods for interpolation and integration and also for finding roots of equations and solutions of ODEs.

- To learn most of the important models of discrete and continuous probability

distributions and widely used models of random processes such as Poisson processes andMarkov chains.

Textbooks:

1. (Text-1) Jay L. Devore, Probability and Statistics for Engineering and the Sciences, 8thedition, Cengage, 2012 2.
2. (Text-2) Oliver C. Ibe, Fundamentals of Applied Probability and Random Processes,Elsevier, 2005.
3. (Text-3) Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, JohnWiley & Sons, 2016.

Reference Books:

1. Hossein Pishro-Nik, Introduction to Probability, Statistics and Random Processes, KappaResearch, 2014 (Also available online at www.probabilitycourse.com)
2. V. Sundarapandian, Probability, Statistics and Queueing theory, PHI Learning, 2009
3. Gubner, Probability and Random Processes for Electrical and Computer Engineers,Cambridge University Press,2006.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

Syllabus

Module 1 (Discrete probability distributions)

(Text-1: Relevant topics from sections-3.1-3.4, 3.6, 5.1)

Discrete random variables and their probability distributions, Expectation, mean and variance, Binomial distribution, Poisson distribution, Poisson approximation to the binomial distribution, Discrete bivariate distributions, marginal distributions, Independent random variables, Expectation (multiple random variables)

Module 2 (Continuous probability distributions)

(Text-1: Relevant topics from sections-4.1-4.4, 3.6, 5.1)

Continuous random variables and their probability distributions, Expectation, mean and variance,Uniform, exponential and normal distributions, Continuous bivariate distributions, marginal distributions, Independent random variables, Expectation (multiple random variables), i.i.d random variables and Central limit theorem (without proof).

Module 3 (Random Processes)

(Text-2: Relevant topics from sections-8.1-8.5, 8.7, 10.5)

Random processes and classification, mean and autocorrelation, wide sense stationary (WSS) processes, autocorrelation and power spectral density of WSS processes and their properties, Poisson process-distribution of inter-arrival times, combination of independent Poisson processes(merging) and subdivision (splitting) of Poisson processes **(results without proof)**

Module 4 (Numerical methods -I)

(Text 3- Relevant topics from sections 19.1, 19.2, 19.3, 19.5) Errors in numerical computation-round-off, truncation and relative error, Solution of equations – Newton-Raphson method and Regula-Falsi method. Interpolation-finite differences, Newton's forward and backward difference method, Newton's divided difference method and Lagrange's method. Numerical integration- Trapezoidal rule and Simpson's 1/3rd rule **(Proof or derivation of the formulae not required for any of the methods in this module)**

No.	Description	Bloom's Taxonomy Level
CO1	Understand the concept, properties and important modelsof discrete random variables and, using them, analyze suitable random phenomena.	Understand(Level 2)
CO2	Understand the concept, properties and important modelsof continuous random variables and, using them, analyzesuitable random phenomena.	Understand(Level 2)
CO3	Analyze random processes using autocorrelation, powerspectrum and Poisson process model as appropriate.	Analyze (Level 4)
CO4	Compute roots of equations, evaluate definite integrals and perform interpolation on given numerical data usingstandard numerical techniques	Evaluate (Level 5)

Module 5 (Numerical methods -II)

(Text 3- Relevant topics from sections 20.3, 20.5, 21.1)

Solution of linear systems-Gauss-Seidel and Jacobi iteration methods. Curve fitting-method of least squares, fitting straight lines and parabolas. Solution of ordinary differential equations-Eulerand Classical Runge-Kutta method of second and fourth order, Adams-Moulton predictor- correction method (**Proof or derivation of the formulae not required for any of the methods in this module)**

CO-PO Mapping

	PO											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	2	2	2	2					2		1
CO2	3	2	2	2	2					2		1
CO3	3	2	2	2	2					2		1
CO4	3	2	2	2	2					2		1
CO5	3	2	2	2	2					2		1

1- Low correlation (Low), 2- Medium correlation (Medium), 3-High correlation (High)

Mapping		**1/2/3**	**Justification**
CO1	**PO1**	3	Knowledge in discrete random variables will help to analyze the data very easily.
	PO2	2	Discrete random variables can be used to analyze complex Engineerig problems.
	PO3	2	Models of discrete random variables can be used to design solutions of complex engineering problems.
	PO4	2	Concept of discrete random variables help interpretation of data, and synthesis of the information to provide valid conclusions.
	PO5	2	Discrete random variables help in modelling complex engineering activities with an understanding of the limitations.
	PO10	2	Concept of discrete random variables provide best communication for large population.
	PO12	1	Discrete random variables can be used for little time bounds.
CO2	**PO1**	3	Knowledge in continuous random variables will help to analyze the data very easily.
	PO2	2	Continuous random variables can be used to analyze complex Engineerig problems.

	PO3	2	Models of continuous random variables can be used to design solutions of complex engineering problems.
	PO4	2	Concept of continuous random variables help interpretation of data, and synthesis of the information to provide valid conclusions.
	PO5	2	Continuous random variables help in modelling complex engineering activities with an understanding of the limitations.
	PO10	2	Continuous random variables help in modelling complex engineering activities with an understanding of the limitations.
	PO12	1	Continuous random variables can be used for little time bounds.
CO3	**PO1**	3	Random Processes is used in signals and image processing.
	PO2	2	Random Processes can be used to analyze complex Engineerig problems.
	PO3	2	Random Processes can be used to design solutions of complex engineering problems, design system components.
	PO4	2	Concept of Random processes helps in design of experiments, analysis and interpretation of data.
	PO10	2	Random Processes helps in modelling complex engineering activities.
	PO12	1	Random process provides learning in the broadest context of technological change.
CO4	**PO1**	3	Numerical methods for solving system of linear equations can be used in data interpretation.
	PO2	2	Interpolation methods help in analysis of data.
	PO3	2	Numerical methods can be used in the design of appropriate system components..
	PO4	2	Numerical approximation methods provide valid conclusions.
	PO5	2	Apply appropriate numerical techniques for complex engineering activities with an understanding of the limitations.
	PO10	2	With the help of Numerical methods, one will be able to comprehend and writ effective reports and design documentation.

	PO12	1	Numerical methods provide life-long learning in the context of technological change.
CO5	**PO1**	3	Numerical integration and differentiation helps to solve complex integration and differential equations.
	PO2	2	Numerical methods can be used to approximate certain integro differential equations.
	PO3	2	Apply numerical methods to design appropriate components / processes for a specific need.
	PO4	2	Apply numerical techniques to analyze and interpret data.
	PO5	2	Numerical techniques help to simplify certain problems related to integrations and differential equations.
	PO10	2	With the help of Numerical techniques, one will be able to comprehend and writ effective reports and design documentation.
	PO12	1	Numerical techniques provide life-long learning in the context of technological change.

CO-PSO Mapping

	PSO 1	**PSO 2**	**PSO 3**
CO1		1	
CO2		1	
CO3	2		
CO4	2		
CO5		1	

	PSO1	**PSO2**	**PSO3**
CO1		Discrete random variables used in modelling	

		of communication networks.	
CO2		Continuous random variables are used in modelling communication systems.	
CO3	Apply the basic knowledge of random processes for understanding communication and network systems.		
CO4	Special random processes are used in modelling of communication systems.		

CO5		Numerical techniques are used in modelling communication systems.	

GAPS in the syllabu

Sl. No	**Description**	**Proposed Actions**	**Relevance with POs and PSO**
1.	Basic concepts of Probability	Assignment	PO2

Topic beyond Syllabus

	Description	Proposed Actions	Relevance with POs and PSO
	Applications of Numerical methods	Reading, Assignment	PO2, PO4
	Applications of Random Processes in Engineering	Reading	PO1, PO2, PO4

Web source references

- **www.probabilitycourse.com**
- **NPTEL:: Mathematics - NOC: Introduction to probability theory**

Delivery/instructional methodologies:

✓ Chalk & talk	✓ Stud. Assignment	✓ Web resources	☐ Lcd/smartboards

Assessment methodologies-direct

✓Assignments	☐ Stud. Seminars	✓ Internal Tests	✓ Univ. Examination
☐ Stud. Lab practices	☐ Stud. Viva	☐ Mini/major projects	☐ Certifications
☐ Add-on courses	☐ Others		

Assessment methodologies-indirect

✓ Assessment of course outcomes (by feedback, once)	✓ Student feedback on faculty (twice)

Prepared by **Approved by**

Vinmol K jesudas

COURSE PLAN

Module 1 (Discrete probability distributions) (Text-1: Relevant topics from sections- 3.1-3.4, 3.6, 5.1)	Discrete random variables and their probability distributions, Expectation, mean and variance, Binomial distribution, Poisson distribution, Poisson approximation to the binomial distribution, Discrete bivariate distributions, marginal distributions, Independent random variables, Expectation (multiple random variables)
Module 2 (Continuous probability distributions) (Text-1: Relevant topics from sections- 4.1-4.4, 3.6, 5.1)	Continuous random variables and their probability distributions, Expectation, mean and variance, Uniform, exponential and normal distributions, Continuous bivariate distributions, marginal distributions, Independent random variables, Expectation (multiple random variables), i.i.d random variables and Central limit theorem (without proof).
Module 3 (Random Processes) (Text-2: Relevant topics from sections- 8.1-8.5, 8.7, 10.5)	Random processes and classification, mean and autocorrelation, wide sense stationary (WSS) processes, autocorrelation and power spectral density of WSS processes and their properties, Poisson process-distribution of inter-arrival times, combination of independent Poisson processes(merging) and subdivision (splitting) of Poisson processes **(results without proof)**
	Errors in numerical computation-round-off, truncation and relative error, Solution of equations – Newton-Raphson method and Regula-Falsi method. Interpolation-finite differences, Newton's forward and backward differencemethod, Newton's divided difference method and Lagrange's method. Numerical integration- Trapezoidal rule and Simpson's 1/3rd rule **(Proof or derivation of the formulae not required for any of the methods in this module)**

Module 5 (Numerical methods -II) (Text 3- Relevant topics from sections 20.3, 20.5, 21.1)	Solution of linear systems-Gauss-Seidel and Jacobi iteration methods. Curve fitting-method of least squares, fitting straight lines and parabolas. Solution of ordinary differential equations-Euler and Classical Runge-Kutta method of second and fourth order, Adams-Moulton predictor- correction method (**Proof or derivation of the formulae not required for any of the methods in this module)**

SAMPLE QUESTIONS

MODULE 1

1. A random variable X has the following probability mass function

X:	0	1	2	3	4	5	6	7
P(X):	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2+k$

Find (i) the value of k (ii) $P(0 < X < 5)$ (iii) $P(X \geq 6)$

2. A random variable X takes values 0,1, 2 and 3 with probabilities $P(X=0) = \frac{8}{15}$, $P(X=1) = \frac{1}{3}$, $P(X=2) = P(X=3) = \frac{1}{15}$.
Find the mean and variance of X.
If $Y = 1000 + 300X$, find $P(Y \geq 1500)$ and $E[Y]$.

3. An insurance company agent accepts policies of 5 men, all of identical age and good health. Probability that a man of this age will be alive 30 years is $\frac{2}{3}$. Find the probability that in 30 years (i) all 5 men will be alive (ii) at least one man will be alive.

4. The probability that a component is acceptable is 0.93. Ten components are picked at random. What is the probability that:
(i) At least nine are acceptable ii) At most three are acceptable.

5. In a given city 6% of all drivers get at least one parking ticket per year. Use the Poisson approximation to the binomial distribution to determine the probabilities that among 80 drivers (randomly chosen in this city)
   (a) 4 will get at least one parking ticket in any given year
   (b) at least 3 will get at least one parking ticket in any given year
   (c) anywhere from 3 to 6 inclusive, will get at least one parking ticket in any given year.

MODULE 2

1. What can you say about $P(X = a)$ for any real number a when X is a (i) discrete random variable? (ii) continuous random variable?

2. A string, 1 meter long, is cut into two pieces at a random point between its ends. What is the probability that the length of one piece is at least twice the length of the other?

3. A random variable has a normal distribution with standard deviation 10. If the probability that it will take on a value less than 82.5 is 0.82, what is the probability that it will take on a value more than 58.3?

4. X and Y are independent random variables with X following an exponential distribution with parameter μ and Y following and exponential distribution with parameter λ. Find $P(X + Y \leq 1)$.

MODULE 3

1. Find the PSD function of a stationary process whose ACF is $e^{-|\tau|}$.
2. A random process X(t) is defined by $X(t) = Y(t)\cos(\omega t + \theta)$ Where Y(t) is a WSS process, ω is a constant and $\boldsymbol{\theta}$ is a random variable which is uniformly distributed in [0,2π] and is independent of Y(t). Show that X(t) isWSS.
3. Calculate the autocorrelation function of the process X(t) = A sin $(\omega t + Y)$ where Y is uniformly distributed in $(0, 2\pi)$ and A and ω are constants.
4. If X(t) = R sin $(\omega t + Y)$ whereR and Y are independent r.v's and Y is uniformly distributed in $(-\pi, \pi)$, prove that $R(t_1, t_2) = \frac{1}{2} E(R^2)\cos\omega(t_1 - t_2)$.
5. If X(t) and Y(t) are jointly WSS with cross correlation function $R_{XY}(\tau)$, show that $2R_{XY}(\tau) \leq R_{XX}(0)R_{YY}(0)$.
6. For a random process of tossing a fair coin, consider a random process $X(t)$ defined as follows

$$X(t) = \begin{cases} t & \text{if H is the outcome} \\ \sin 2t & \text{if T is the outcome} \end{cases}$$ Find the:

   a. Mean of $X(t)$
   b. Autocorrelation function $R_{XX}(t_1, t_2)$ of $X(t)$
   c. Autocovariance function $C_{XX}(t_1, t_2)$ of $X(t)$
   d. Variance of $X(t)$

7. If $X(t)$ is a random process with mean $\mu(t) = 2$ and autocorrelation $R(t_1, t_2) = 5 + 3e^{-0.2|t_1 - t_2|}$ find the mean, variance and the covariance of the random variable.

MODULE 4

1. Find the real root of $\cos x - x + 2 = 0$, correct to five decimal places using Regula-falsi method.
2. Calculate the Lagrange Polynomial for the values Γ(1.00) = 1.0000, Γ(1.02) = 0.9888, Γ(1.04) = 0.9784 of the Gamma function and from it approximations of Γ(1.01) and Γ(1.03).
3. Apply Newton's method to compute the roots of $2x - \cos x = 0$, $x_0 = 1$
4. Given sin 45° = 0.7071, sin 50° = 0.766$\overline{0}$, sin 55° = 0.8192, sin 60° = 0.8660, find sin 52°, usingNewton's forward interpolation formula.
5. Evaluate the integral $\int_0^1 e^{x^2}$ by rectangular rule with subintervals of length 0.1.

MODULE 5

TUTORIAL

1. Find the real root of $\cos x - x + 2 = 0$, correct to five decimal places using Regula-falsi method.
2. Calculate the Lagrange Polynomial for the values $\Gamma(1.00) = 1.0000$, $\Gamma(1.02) = 0.9888$, $\Gamma(1.04) = 0.9784$ of the Gamma function and from it approximations of $\Gamma(1.01)$ and $\Gamma(1.03)$.
3. Apply Newton's method to compute the roots of $2x - \cos x = 0$, $x_0 = 1$
4. Given $\sin 45^\circ = 0.7071$, $\sin 50^\circ = 0.766\overline{0}$, $\sin 55^\circ = 0.8192$, $\sin 60^\circ = 0.8660$, find $\sin 52^\circ$, usingNewton's forward interpolation formula.
5. Evaluate the integral $\int_0^1 e^{x^2}$ by rectangular rule with subintervals of length 0.1.

ASSIGNMENT

1. Use Newton-Raphson's Formula to solve $e^{-x} - \tan x = 0$, $x_0 = 1$.
2. Using Lagrange's interpolation formula, find the values of y when $x = 5$, from the following table

x	0	1	3	8
y	1	3	13	123

3. Using Newtons formula, interpolate the data $f(1.0) = 0.94608$, $f(1.5) = 1.32468$, $f(2.0) =$ 1.60541, $f(2.5) = 1.77852$. Find the value of $f(1.25)$.
4. Using Newton's Formula compute $\sqrt[3]{7}$.

100001/EC400B

ANALOG CIRCUITS

COURSE INFORMATION SHEET

PROGRAMME: Electronics & Communication Engineering	DEGREE: BTECH
COURSE: ANALOG CIRCUITS	SEMESTER: S4 CREDITS: 4
COURSE CODE: 100902/EC400B REGULATION: 2021	COURSE TYPE: **CORE** /ELECTIVE / BREADTH/ S&H
COURSE AREA/DOMAIN: ELECTRONICS	CONTACT HOURS: 3+1 (Tutorial) hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY): 100902/EC422S	LAB COURSE NAME: Analog Circuits and simulation Lab

SYLLABUS:

UNIT	DETAILS	HOURS
I	**Wave shaping circuits:** First order RC differentiating and integrating circuits, First order RC low pass and high pass filters. Diode Clipping circuits - Positive, negative and biased clipper. Diode Clamping circuits - Positive, negative and biased clamper. **Transistor biasing:** Need, operating point, concept of DC load line, fixed bias, self bias, voltage divider bias, bias stabilization.	10
II	**BJT Amplifiers:** RC coupled amplifier (CE configuration) – need of various components and design, Concept of AC load lines, voltage gain and frequency response. Small signal analysis of CE configuration using small signal hybrid-pi model for mid frequency and low frequency. (gain, input and output impedance). High frequency equivalent circuits of BJT, Miller effect, Analysis of high frequency response of CE amplifier.	9
III	**MOSFET amplifiers:** MOSFET circuits at DC, MOSFET as an amplifier, Biasing of discrete MOSFET amplifier, small signal equivalent circuit. Small signal voltage and current gain, input and output impedance of CS configuration. CS stage with current source load, CS stage with diode-connected load.	9

	Multistage amplifiers - effect of cascading on gain and bandwidth. Cascode amplifier.	
IV	**Feedback amplifiers:** Effect of positive and negative feedback on gain, frequency response and distortion. The four basic feedback topologies, Analysis of discrete BJT circuits in voltage-series and voltage-shunt feedback topologies - voltage gain, input and output impedance. **Oscillators:** Classification, criterion for oscillation, Wien bridge oscillator, Hartley and Crystal oscillator. (working principle and design equations of the circuits; analysis of Wien bridge oscillator only required).	10
V	**Power amplifiers:** Classification, Transformer coupled class A power amplifier, push pull class B and class AB power amplifiers, complementary-symmetry class B and Class AB power amplifiers, efficiency and distortion (no analysis required) **Regulated power supplies:** Shunt voltage regulator, series voltage regulator, Short circuit protection and fold back protection, Output current boosting.	7
	TOTAL HOURS	45 hrs.

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
1	Sedra and Smith: *Microelectronic Circuits*, 4/e, Oxford University Press 1998.
2	B. Razavi , "*Fundamentals of Microelectronics*", Wiley
3	Donald A Neamen. : *Electronic Circuit Analysis and Design*, 3/e, TMH.
4	Millman and Halkias: *Integrated Electronics*, TMH, 2004.
5	Spencer &Ghausi: *Introduction to Electronic Circuit Design,* Pearson Education, 2003.
6	Roger T. Howe, Charles G. Sodini**:** *Microelectronics: An Integrated Approach*, Pearson Education, 1997.
7	R E Boylstead and L Nashelsky: *Electronic Devices and Circuit Theory*, 9/e, Pearson Education

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
100908/CO900F	Basics of Electrical and Electronics Engineering	Students should know about basic electronics components like BJT, diode, Resistor etc&its working	S2

COURSE OBJECTIVES:

1	To understand the concept of first order RC circuits & diodes
2	To provide insight into the working , analysis and design of basic analog circuits using BJT
3	To provide insight into the working , analysis and design of basic analog circuits using MOSFET
4	To understand different types of feedback amplifiers & Oscillators
5	To provide insight into the working of different types power amplifiers and regulated power supply circuits.

COURSE OUTCOMES:

Sl. No.	DESCRIPTION	BLOOM'S TAXONOMY LEVEL
1	Students will be able to **understand** the working and **design** of first order RC circuits & diodes	Understand & Create (2 & 6)
2	Students will be able to **analyze** basic amplifier configuration using BJT.	Analyze (4)
3	Students will be able to **analyze** basic amplifier configuration using MOSFET.	Analyze (4)
4	Students can **apply** the principle of different feedback amplifiers & Oscillators.	Apply (3)
5	Students can **apply** the principle of power amplifiers & regulated power supply circuits.	Apply (3)

CO-PO-PSO MAPPING:

CO No.	Programme Outcomes (POs)												Programme-Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3										2	3	2	1
2	3	3										2	3	2	1
3	3	3										2	3	2	1
4	3	3										2	3	2	1
5	3	3										2	3	2	1
ECT 202	**3**	**3**										**2**	**3**	**3**	**1**

JUSTIFATIONS FOR CO-PO-PSO MAPPING

MAPPING	**LOW/MEDIUM /HIGH**	**JUSTIFICATION**
CO.1- PO1	H	Working of diodes and RC circuits require mathematical background, to solve engineering problems
CO.1 – PO2	H	Understanding the basic diode circuits helps students to reach better conclusions when faced similar cases
CO.1 – PO12	M	Understanding the design of basic circuits with diodes helps students in learning new circuits in future
CO.1 - PSO1	H	Good understanding of concepts in electronics
CO.1 – PSO2	M	To develop new circuits with the knowledge of basic diode circuits
CO.1 – PSO3	L	Ability to use the basic knowledge of working of RC circuits & diodes to build new skills
CO.2 - PO1	H	Fundamental knowledge of basic BJT amplifier helps in applying this knowledge for solving new problems

CO.2 – PO2	H	Analyzing the working of BJT amplifier gives good understanding of the concept
CO.2 – PO12	M	Analyzing basic circuits like BJT configurations facilitates lifelong learning
CO.2 - PSO1	H	Sound knowledge of the core concept of working of BJT as an amplifier
CO.2 – PSO2	M	Analyzing basic BJT amplifier working helps in developing new systems
CO.2 – PSO3	L	Doing simulations with BJT helps in team building and leadership
CO.3- PO1	H	Fundamental knowledge of basic MOSFET amplifier helps in applying this knowledge for solving new problems
CO.3 – PO2	H	Analyzing the working of MOSFET amplifier gives good understanding of the concept
CO.3 – PO12	M	Analyzing basic circuits like MOSFET amplifier facilitates lifelong learning
CO.3 – PSO1	H	Sound knowledge of the core concept of working of BJT as an amplifier
CO.3 – PSO2	M	Analyzing basic MOSFET amplifier working helps in developing new systems
CO.3 – PSO3	L	Doing simulations with MOSFET helps in team building and leadership

CO.4- PO1	H	Applying the basic knowledge of feedback amplifiers helps in controlling the gain in practical amplifiers
CO.4 – PO2	H	Applying the basic knowledge of feedback amplifiers & oscillators helps in analyzing research problems
CO.4 – PO12	M	Learning to apply knowledge of feedback amplifiers & oscillators provides better understanding of new concepts in future
CO.4 – PSO1	H	Knowledge of feedback amplifiers & oscillators is important for better understanding of instrumentation systems
CO.4 – PSO2	M	Proper selection of feedback amplifiers/oscillators equips the student to develop new instruments
CO.4 – PSO3	L	Learns to adapt to new industrial scenarios
CO.5- PO1	H	Applying these concepts builds the foundation for building new circuits for solving engineering problems
CO.5 – PO2	H	Ability to review new research literature on power amplifiers & regulators
CO.5 – PO12	M	Ability to implement circuit for daily life applications
CO.5 - PSO1	H	Knowledge of power amplifiers & regulators is important for better understanding of instrumentation systems
CO.5 – PSO2	M	Selection of power amplifiers & regulators for the correct application equips the student to develop new instruments systems

CO.5 – PSO3	L	Learns to adapt to new industrial scenarios

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SNO	DESCRIPTION	PROPOSED ACTIONS	
1	Introduction to switching circuits	Lecture/Simulation assignments	

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

S No:	DESCRIPTION	PO MAPPING
1	Simulation of circuits using EDA tools	1,2,3,4,5,6,9,10

DESIGN AND ANALYSIS TOPICS:

Sl. No.	DESCRIPTION	PO MAPPING
1	Design & analysis of different switching circuits	1,2,3,4,5,6,9,10

WEB SOURCE REFERENCES:

1	cc.ee.ntu.edu.tw/~lhlu/eecourses/Electronics1/Electronics_Ch4.pdf
2	www.techpowerup.com/articles/overclocking/voltmods/21
3	www.electronics-tutorials.ws › RC Networks
4	www.pa.msu.edu/courses/2014spring/PHY252/Lab4.pd
5	www.iet.ntnu.no/courses/ttt4100/oppg1_eng.pdf

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑ CHALK & TALK	☑ STUD. ASSIGNMENT	☑ WEB RESOURCES	
☐ LCD/SMART BOARDS	STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

☑ ASSIGNMENTS	STUD. SEMINARS		☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA		☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS			

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by **Approved by**

Dr. Sabna N **(HOD)**
Dr. Jobin K Antony
Ms. Maleeha Abdul Azeez

COURSE PLAN

UNIT	DETAILS	HOURS
I	**Wave shaping circuits:** First order RC differentiating and integrating circuits, First order RC low pass and high pass filters. Diode Clipping circuits - Positive, negative and biased clipper. Diode Clamping circuits - Positive, negative and biased clamper. **Transistor biasing:** Need, operating point, concept of DC load line, fixed bias, self bias, voltage divider bias, bias stabilization.	10
II	**BJT Amplifiers:** RC coupled amplifier (CE configuration) – need of various components and design, Concept of AC load lines, voltage gain and frequency response. Small signal analysis of CE configuration using small signal hybrid-pi model for mid frequency and low frequency. (gain, input and output impedance). High frequency equivalent circuits of BJT, Miller effect, Analysis of high frequency response of CE amplifier.	9
III	**MOSFET amplifiers:** MOSFET circuits at DC, MOSFET as an amplifier, Biasing of discrete MOSFET amplifier, small signal equivalent circuit. Small signal voltage and current gain, input and output impedance of CS configuration. CS stage with current source load, CS stage with diode-connected load. **Multistage amplifiers** - effect of cascading on gain and bandwidth. Cascode amplifier.	9
IV	**Feedback amplifiers:** Effect of positive and negative feedback on gain, frequency response and distortion. The four basic feedback topologies, Analysis of discrete BJT circuits in voltage-series and voltage-shunt feedback topologies - voltage gain, input and output impedance. **Oscillators:** Classification, criterion for oscillation, Wien bridge oscillator, Hartley and Crystal oscillator. (working principle and design equations of the circuits; analysis of Wien bridge oscillator only required).	10
V	**Power amplifiers:** Classification, Transformer coupled class A power amplifier, push pull class B and class AB power amplifiers, complementary-symmetry class B and Class AB power amplifiers, efficiency and distortion (no analysis required) **Regulated power supplies:** Shunt voltage regulator, series voltage regulator, Short circuit protection and fold back protection, Output current boosting.	7

SAMPLE QUESTIONS

MODULE I

- Explain the working of (a) RC integrator (b) RC differentiator. Provide the condition to be satisfied by the time constant in each
- case.
- With the help of the circuit, explain the frequency response of (a) RC low-pass filter (b) RC high-pass filter.
- What is a clipper? Diffrentiate between positive and negative clippers using sample circuits.
- Provide the circuit diagram of a biased clipper and explain its working.
- What is a clamper circuit? Draw a sample circuit and explain its working.
- Identify the different types of clamper circuits with suitable examples.
- What is transistor biasing? Explain the need for biasing.
- What are the considerations when fixing an operating point in a BJT to be operated as an amplifier?
- Define DC load line.
- With the aid of circuit diagrams, distinguish between the given biasing circuits: (a) fixed bias (b) self bias (c) voltage divider bias.

MODULE II

- Draw the circuit of an RC-Coupled CE amplifier. Explain the function of each component in the circuit.
- Give a detailed description of design considerations while designing an RC-coupled CE amplifier.
- What is an AC load line? Explain.
- Write the expression for voltage gain of RC-Coupled CE amplifier. Explain the terms.
- Draw the frequency response of an RC-coupled CE amplifier. Explain the important characteristics of the graph.
- Draw and explain the small-signal hybrid-pi model of BJT.
- Derive the voltage gain of RC-Coupled CE amplifier using smallsignal hybrid-pi model of BJT.
- Derive the input impedance of RC-Coupled CE amplifier using small-signal hybrid-pi model of BJT.
- Derive the output impedance of RC-Coupled CE amplifier using small-signal hybrid-pi model of BJT.
- Draw and explain the HF small-signal hybrid-pi model of BJT.
- Explain Miller effect. Why is it significant in frequency response analysis?
- Perform HF analysis of RC-Coupled CE amplifier using small-signal hybrid-pi model of BJT.

MODULE III

- Explain how a MOSFET functions as an amplifier.
- Explain the biasing techniques of a MOSFET amplifier.
- Draw and explain the small-signal equivalent of a MOSFET.
- Derive the voltage gain of CS amplifier using small-signal model of MOSFET.
- Derive the input impedance of CS amplifier using small-signal model of MOSFET.

- Derive the output impedance of CS amplifier using small-signal model of MOSFET.
- What is the advantage of using current source loads? Explain.
- Explain the advantages of using diode-connected MOSFETs as load.
- What is meant by cascading of amplifiers? What are its effects on circuit performance?
- What is a cascode amplifier? Why is it used?

MODULE IV

- What is feedback? What are the types of feedback.
- Explain the impact of feedback on circuit performance.
- Explain the 4 basic feedback topologies with sample circuits.
- Derive the voltage gain of a voltage-series circuit.
- Derive the input impedance of a voltage-series circuit.
- Derive the output impedance of a voltage-series circuit.
- Derive the voltage gain of a voltage-shunt circuit.
- Derive the input impedance of a voltage-shunt circuit.
- Derive the output impedance of a voltage-shunt circuit.
- What is an oscillator? How are oscillators classified?
- What is the criterion for oscillation?
- Provide the working principle and design equations of Wein bridge oscillator.
- Derive the frequency of oscillation of a Wein Bridge Oscillator.
- Provide the working principle and design equations of Hartley oscillator.
- Provide the working principle and design equations of crystal oscillator.

MODULE V

- What are power amplifiers? How are they classified?
- With suitable diagrams, explain the operation of a transformercoupled Class-A power amplifier.
- With suitable diagrams, explain the operation of a push-pull Class-B power amplifier.
- With suitable diagrams, explain the operation of a Class-AB power amplifier.
- With suitable diagrams, explain the operation of a complementary symmetry class B power amplifier.
- With suitable diagrams, explain the operation of a complementary symmetry class AB power amplifier.
- Compare the efficiency and distortion of different power amplifiers.
- What are voltage regulators? Explain the types.
- With an appropriate circuit, explain the working of a series voltage regulator.
- With an appropriate circuit, explain the working of a series voltage regulator.
- Explain short-circuit protection with the support of figures.
- Explain foldback protection with the support of figures.
- Explain current boosting with the support of figures.

100001/EC400C

SIGNALS AND SYSTEMS

COURSE INFORMATION SHEET

PROGRAMME: **ELECTRONICS AND COMMUNICATION ENGINEERING**	DEGREE: **B. TECH** UNIVERSITY: **APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**
COURSE: **SIGNALS & SYSTEMS**	SEMESTER: **S4** CREDITS: **4**
COURSE CODE: **100001/EC400C** REGULATION: **2019**	COURSE TYPE: **CORE**
COURSE AREA/DOMAIN: **SIGNALS & SYSTEMS**	CONTACT HOURS: **3 (L)+1(T) hours/week**
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	LAB COURSE NAME:

SYLLABUS:

UNIT	DETAILS	HOURS
I.1	Elementary Signals, Classification and representation of continuous time and discrete time signals, Signal operations	4
I.2	Continuous time and discrete time systems – Classification, Properties.	3
I.3	Representation of systems: Differential equation representation of continuous time systems. Difference equation representation of discrete systems.	2
I.4	Continuous time LTI systems and convolution integral.	2
I.5	Discrete time LTI systems and linear convolution.	2
I.6	Stability and causality of LTI systems.	2
I.7	Correlation between signals, Orthogonality of signals.	1
II.1	Frequency domain representation of continuous time signals - continuous time Fourier series and its properties.	4
II.2	Continuous time Fourier transform and its properties. Convergence and Gibbs phenomenon	3
II.3	Review of Laplace Transform, ROC of Transfer function, Properties of ROC, Stability and causality conditions.	3

II.4	Relation between Fourier and Laplace transforms.	1
III.1	Analysis of LTI systems using Laplace and Fourier transforms. Concept of transfer function, Frequency response, Magnitude and phase response.	4
III.2	Sampling of continuous time signals, Sampling theorem for lowpass signals, aliasing.	3
IV.1	Frequency domain representation of discrete time signals, Discrete time fourier series for discrete periodic signals. Properties of DTFS.	4
IV.2	Discrete time fourier transform (DTFT) and its properties. Analysis of discrete time LTI systems using DTFT. Magnitude and phase response.	5
V.1	Z transform, ROC , Inverse transform, properties, Unilateral Z transform.	3
V.2	Relation between DTFT and Z-Transform, Analysis of discrete time LTI systems using Z transforms, Transfer function.Stability and causality using Z transform.	4
TOTAL HOURS		**50**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Alan V. Oppenheim and Alan Willsky, Signals and Systems, PHI, 2/e, 2009
T2	Simon Haykin, Signals & Systems, John Wiley, 2/e, 2003
R1	Anand Kumar, Signals and Systems, PHI, 3/e, 2013.
R2	B P. Lathi, Priciples of Signal Processing & Linear systems, Oxford University Press.
R3	Gurung, Signals and System, PHI.
R4	Mahmood Nahvi, Signals and System, Mc Graw Hill (India), 2015.
R5	P Ramakrishna Rao, Shankar Prakriya, Signals and System, MC Graw Hill Edn 2013.
R6	Rodger E. Ziemer, Signals & Systems - Continuous and Discrete, Pearson, 4/e, 2013

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
-	NIL		

COURSE OBJECTIVES:

1	This course aims to lay the foundational aspects of signals and systems in both continuous time and discrete time, in preparation for more advanced subjects in digital signal processing, image processing, communication theory and control systems.

COURSE OUTCOMES:

SL. NO.	DESCRIPTION	Blooms' Taxonomy Level
C0.1	Apply properties of signals and systems to classify them	Understand and Apply (level 2, 3)
C0.2	Represent signals with the help of series and transforms	Understand and Apply (level 2, 3)
C0.3	Describe orthogonality of signals and convolution integral.	Understand and Apply (level 2, 3)
C0.4	Apply transfer function to compute the LTI response to input signals.	Understand and Apply (level 2, 3)
C0.5	Apply sampling theorem to discretize continuous time signals	Understand and Apply (level 2, 3)

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	-	-	-	-	-	-	-	-	-	-			
CO2	3	3	3	-	-	-	-	-	-	-	-	-			
CO3	3	3	3	-	-	-	-	-	-	-	-	-			
CO4	3	3	-	-	-	-	-	-	-	-	-	-			
CO5	3	3	3	-	-	-	-	-	-	-	-	-			

JUSTIFATIONS FOR CO-PO MAPPING

MAPPING	LOW/MEDIUM/ HIGH	JUSTIFICATION

CO1-PO1	H	Apply the knowledge of mathematics, science and engineering fundamentals to understand the concepts of signals & systems.
CO1-PO2	H	Differential and difference equation representation of systems using the first principles of mathematics and engineering sciences.
CO1-PSO1		
CO1-PSO2		
CO2-PO1	H	Apply the knowledge of mathematics, science and engineering fundamentals to represent signals with the help of series and transforms.
CO2-PO2	H	Analyze signals with the help of Fourier series, Laplace, Fourier & Z transforms and study the properties of different transforms using the first principles of mathematics.
CO2-PO3	H	Analyzing signals with the help of series and transforms helps in design solutions for complex engineering problems
CO2-PSO1		
CO2-PSO2		
CO2-PSO3		
CO3-PO1	H	Apply the knowledge of mathematics, science and engineering fundamentals to describe orthogonality of signals and convolution integral.
CO3-PO2	H	Concept of orthogonality and convolution integral requires the first principles of mathematics.
CO3-PO3	H	Analyzing orthogonality of signals & convolution integral helps in design solutions for complex engineering problems.
CO3-PSO1		
CO3-PSO3		
CO4-PO1	H	Apply the knowledge of mathematics and engineering fundamentals to compute the LTI response of a system to input signals
CO4-PO2	H	Analysis and characterization of LTI systems using Laplace and Z-Transform
CO4-PSO1		
CO4-PSO3		

CO5-PO1	H	Apply the knowledge of mathematics and engineering fundamentals to understand the importance of sampling theorem to discretize continuous time signals.
CO5-PO2	H	Understand the Nyquist criteria and evaluate different sampling criteria using the first principles of mathematics and engineering sciences.
CO5-PO3	H	The analysis of sampling theorem provides design solutions for different signal processing algorithms.
CO5-PSO1		

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SL NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Matlab Simulations	Assignments, projects	1,5	1

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SL NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Discrete Fourier Transform (DFT)	Video lectures	1,2	1
2	Fast Fourier Transform (FFT)	Video lectures	1,2	1

WEB SOURCE REFERENCES:

1	Signals and Systems NPTEL online IIT Mumbai
2	*www.nptel.iitm.ac.in/courses/117104074/*
3	www.ece.gatech.edu/users/bonnie/book/worked_problems.html
4	*www.ece.jhu.edu/~cooper/courses/214/**signalsandsystems**notes.pdf*
5	*link.springer.com/journal/498*

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☐ CHALK & TALK	☑ STUD. ASSIGNMENTS	☑ WEB RESOURCES	☑ ONLINE CLASSES
☑ LCD/SMART BOARDS	☑ STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

☑ASSIGNMENTS	☑ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by **Approved by**

Mr. Naveen N
Ms. Neethu Radha Gopan
Ms. Ramitha Rajesh Dr. Rithu James

COURSE PLAN

UNIT	DETAILS	HOURS
I.1	Elementary Signals, Classification and representation of continuous time and discrete time signals, Signal operations	4
I.2	Continuous time and discrete time systems – Classification, Properties.	3
I.3	Representation of systems: Differential equation representation of continuous time systems. Difference equation representation of discrete systems.	2
I.4	Continuous time LTI systems and convolution integral.	2
I.5	Discrete time LTI systems and linear convolution.	2
I.6	Stability and causality of LTI systems.	2
I.7	Correlation between signals, Orthogonality of signals.	1
II.1	Frequency domain representation of continuous time signals - continuous time Fourier series and its properties.	4
II.2	Continuous time Fourier transform and its properties. Convergence and Gibbs phenomenon	3
II.3	Review of Laplace Transform, ROC of Transfer function, Properties of ROC, Stability and causality conditions.	3
II.4	Relation between Fourier and Laplace transforms.	1
III.1	Analysis of LTI systems using Laplace and Fourier transforms. Concept of transfer function, Frequency response, Magnitude and phase response.	4
III.2	Sampling of continuous time signals, Sampling theorem for lowpass signals, aliasing.	3
IV.1	Frequency domain representation of discrete time signals, Discrete time fourier series for discrete periodic signals. Properties of DTFS.	4
IV.2	Discrete time fourier transform (DTFT) and its properties. Analysis of discrete time LTI systems using DTFT. Magnitude and phase response.	5
V.1	Z transform, ROC , Inverse transform, properties, Unilateral Z transform.	3
V.2	Relation between DTFT and Z-Transform, Analysis of discrete time LTI systems using Z transforms, Transfer function.Stability and causality using Z transform.	4
TOTAL HOURS		**50**

SAMPLE QUESTIONS

MODULE 1

- Define Signal.
- What are the major classifications of the signal?
- Define discrete time signals and classify them.
- Define continuous time signals and classify them.
- Define discrete time unit step &unit impulse.
- Define continuous time unit step and unit impulse.
- Define unit ramp signal.
- Define periodic signal and non0periodic signal.
- Define even and odd signal ?
- Define Energy and power signal.
- Define unit pulse function.
- Define continuous time complex exponential signal.
- What is continuous time real exponential signal.
- What is continuous time growing exponential signal?
- State the BIBO criterion for stability.
- Find whether the signal given by x (n) = 5cos (6 _n) is periodic

MODULE 2

- Write down the exponential form of the Fourier series representation of a Periodic signal?
- Write down the trigonometric form of the fourier series representation of a periodic signal?
- Write short notes on dirichlets conditions for fourier series.
- State Time Shifting property in relation to fourier series.
- State parseval‟s theorem for continuous time periodic signals.
- Explain about the properties of continuous time fourier series.
- Find the fourier coefficients of the given signal. x(t) = 1+ sin 2_ot + 2 cos 2_ot + cos (3_ot + _/3)
- Find the exponential series of the following signal.
- Explain the properties of Discrete time fourier serier
- Find the cosine fourier series of an half wave rectified sine function.
- Explain the classification of signals with examples
- Define continuous time system.

MODULE 3

- Define Fourier transform pair.
- Write short notes on dirichlets conditions for fourier transform.
- Explain how aperiodic signals can be represented by fourier transform.
- State convolution property in relation to fourier transform.
- State parseval‟s relation for continuous time fourier transform.
- What is the use of Laplace transform?
- What are the types of laplace transform?
- Define Bilateral and unilateral laplace transform.
- Define inverse laplace transform.
- State the linearity property for laplace transform.
- State the time shifting property for laplace transform.
- Region of convergence of the laplace transform.
- What is pole zero plot.
- State initial value theorem and final value theorem for laplace transform.
- State Convolution property.

MODULE 4

- Define a causal system.
- What is meant by linear system?
- Define time invariant system.
- Define stable system?
- Define memory and memoryless system.
- Define invertible system.
- What is superposition property?
- Find the fourier transform of x(t)=cos(_0t)
- Determine the inverse laplace of the following functions. 1/s(s+1) 2) 3s2 +8s+6 (s+2)(s2+2s+1)
- Explain about the classifications of continuous time system.
- Bring the equivalence between Laplace transform and Fourier transform
- Explain the properties of laplace transform
- Find the impulse and step response of the following systems H(s) = 10/s2+6s+10
- Why CT signals are represented by samples.
- What is meant by sampling.
- State Sampling theorem.
- What is meant by aliasing.
- What are the effects aliasing.
- How the aliasing process is eliminated.
- Define Nyquist rate.and Nyquist interval.
- Define sampling of band pass signals.

MODULE 5

- Define Z transform.
- What are the two types of Z transform?
- Define unilateral Z transform.
- What is region of Convergence.
- What are the Properties of ROC.
- What is the time shifting property of Z transform.
- What is the differentiation property in Z domain.
- State convolution property of Z transform.
- State the methods to find inverse Z transform.
- State multiplication property in relation to Z transform.
- State parseval‟s relation for Z transform.
- What is the relationship between Z transform and fourier transform.
- What is meant by step response of the DT system.
- State and prove the sampling theorem. Also explain how reconstruction of original signal is done from sampled signal
- Define Transfer function of the DT system.
- Define impulse response of a DT system.
- State the significance of difference equations.
- Write the differece equation for Discrete time system.
- Define frequency response of the DT system.
- What is the condition for stable system.
- What are the blocks used for block diagram representation.
- State the significance of block diagram representation.
- What are the properties of convolution?
- State theCommutative properties of convolution?
- State the Associative properties of convolution
- State Distributive properties of convolution
- Define causal system.
- Check whether the system is causal or not ,the H(z) is given by (z3 + z)/(z+1).
- Check whether the system is stable or not ,the H(z) is given by (z/z0a).,|a|<1.
- How the discrete time system is represented.
- Give the properties of convolution

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100001/EC400D

COMPUTER ARCHITECTURE AND MICROCONTROLLERS

COURSE INFORMATION SHEET

PROGRAMME: **ELECTRONICS AND COMMUNICATION ENGINEERING**	DEGREE: **B.TECH** UNIVERSITY: **APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**
COURSE: **COMPUTER ARCHITECTURE AND MICROCONTROLLERS**	SEMESTER: **IV** CREDITS: **4**
COURSE CODE: **100001/EC400D** REGULATION: **2020**	COURSE TYPE: **CORE**
COURSE AREA/DOMAIN: **ELECTRONICS ENGINEERING**	CONTACT HOURS: **3(L) + 1(T)hours/week**
CORRESPONDING LAB COURSE CODE (IF ANY): **100001-EC422T**	LAB COURSE NAME: **MICROCONTROLLER LAB**

SYLLABUS:

UNIT	DETAILS	HOURS
I.1	Algorithms for binary multiplication and division	2
I.2	Fixed- and floating-point number representation in computers.	1
I.3	Functional units of a computer, Von Neumann and Harvard computer architectures, CISC and RISC architectures.	1
I.4	Processor Architecture – General internal architecture, Address bus, Data bus, control bus. Register set – status register, accumulator, program counter, stack pointer, general purpose registers.	2
I.5	Processor operation – instruction cycle, instruction fetch, instruction decode, instruction execute, timing response, instruction sequencing and execution (basic concepts), data path	3
II.1	Microcontrollers and Embedded Processors and Applications	1
II.2	Architecture – Block diagram of 8051, Pin configuration, Registers, Internal Memory, Timers, Port Structures, Interrupts.	3
II.3	Addressing Modes of 8051	1
II.4	Instruction sets (Detailed study of 8051 instructions)	4
III.1	Simple programming examples in assembly language.	2
III.2	Interfacing programming in Assembly language	2

III.3	Programming in C - Declaring variables, Simple examples – delay generation, port programming, code conversion.	3
III.4	Interfacing of 7 segment LCD display	1
III.5	Interfacing of Keyboard and stepper motor	2
III.6	Interfacing of DAC and ADC	2
IV.1	8051 Timers/Counters - Modes and Applications	2
IV.2	Serial Data Transfer – SFRs of serial port, working, Programming the 8051 to transfer data serially	2
IV.3	Introduction to ARM - ARM family, ARM 7 register architecture. ARM programmer's model	2
IV.4	System software - Assembler, Interpreter, Compiler, Linker, Loader, Debugger.	2
V.1	Types of memory - RAM, ROM. Memory Characteristics and Hierarchy	2
V.2	Cache memory – The basics of Caches, Mapping techniques, Improving Cache performance	2
V.3	Virtual memory – Overlay, Memory management, Address translation	2
V.4	Input/Output Organization – Introduction, Synchronous vs. asynchronous I/O, Programmed I/O, Interrupt driven I/O, Direct Memory Access.	3
TOTAL HOURS		**47**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Muhammed Ali Mazidi & Janice Gilli Mazidi, R.D. Kinley, The 8051 microcontroller and Embedded System, Pearson Education, 2nd edition,2007.
T2	Subrata Ghoshal, Computer Architecture and Organization: From 8085 to Core2Duo and beyond, Pearson, 2011.
T3	Steve Furber, ARM System - on-chip Architecture, Pearson Education, 2015.
R1	Mano M M, Computer System Architecture, 3rd Ed, Prentice Hall of India.
R2	Computer organization and design: The Hardware/Software interface/David A. Patterson, John L. Hennessy. — 5th ed.
R3	Computer Organisation V. Carl Hamacher, Zvonko G. Vranesic, Safwat G.Zaky.
R4	John P Hayes, Computer Architecture and Organization, McGraw Hill.
R5	Ramesh S Goankar, 8085 Microprocessor Architecture, Applications and Programming, Penram International, 5/e.
R6	The 8051 Microcontrollers: Architecture Programming and Applications, K Uma Rao & Andhe Pallavi, Pearson, 2011.
R7	Stallings W., Computer Organisation and Architecture, 5/e, Pearson Education.

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
100001/EC300C	Logic Circuit Design	Imparts the basic knowledge of logic circuits and enable students to apply it to design a digital system.	S3

COURSE OBJECTIVES:

1	To impart knowledge of basic computer architecture and modern microcontrollers.

COURSE OUTCOMES:

SL. NO.	DESCRIPTION	Blooms' Taxonomy Level
C0.1	Explain the functional units, I/O and memory management w.r.t a typical computer architecture.	Remember and Understand (Level 1 and 2)
C0.2	Distinguish between microprocessor and microcontroller.	Understand (Level 2)
C0.3	Develop simple programs using assembly language programming.	Apply (Level 3)
C0.4	Interface 8051 microcontroller with peripheral devices using ALP/Embedded C	Apply (Level 3)
C0.5	Familiarize system software and Advanced RISC Machine Architecture.	Understand (Level 2)

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	2	-	1

CO2	3	-	-	-	-	1	-	-	-	-	-	3	2	-	1
CO3	3	-	3	-	3	-	-	-	-	-	-	3	2	3	1
CO4	3	3	3	-	3	-	-	-	-	-	-	3	3	1	1
CO5	3	-	-	-	3	-	-	-	-	-	-	3	2	-	-

JUSTIFATIONS FOR CO-PO MAPPING

MAPPING	**LOW/MEDIUM/ HIGH**	**JUSTIFICATION**
CO1-PO1	H	A deep knowledge of computer architecture enables the students to design and develop application in a microprocessor/microcontroller to solve complex engineering problems.
CO1-PO12	H	Acquiring a deep knowledge in basic microprocessor/microcontroller architecture helps the students to understand and develop applications in advanced microprocessors/microcontrollers.
CO2-PO1	H	A clear understanding of the difference between microprocessors and microcontrollers enable the students to choose the right hardware for the development of an application in future.
CO2-PO12	H	A clear understanding of the difference between microprocessors and microcontrollers enable the students to develop applications in advanced microprocessors/microcontrollers.
CO3-PO1	H	With sufficient programming skills, students develop the logic to write programs to solve complex problems.
CO3-PO3	H	With sufficient programming practice, students develop the logic to write programs to solve complex problems.
CO3-PO5	H	Hardware knowledge gained through assembly language programming helps the students to write optimized high level programs for advanced microprocessors/microcontrollers.

CO3-PO12	H	A deep knowledge in assembly language programming helps the students to write optimized high level programs for advanced microprocessors/microcontrollers.
CO4-PO1	H	Students can apply the knowledge of peripheral interfacing of 8051 microcontroller to develop systems to solve complex engineering problems.
CO4-PO2	H	Students develop the capability to analyze a new engineering problem through the experience gained by understanding peripheral interfacing of 8051 microcontroller.
CO4-PO3	H	Knowledge in peripheral interfacing of 8051 microcontrollers will enable students to design and develop solutions to complex engineering problems.
CO4-PO5	H	Knowledge gained through peripheral interfacing of 8051 microcontrollers helps the students to write optimized high level programs for advanced microprocessors/microcontrollers.
CO4-PO12	H	A deep knowledge in peripheral interfacing of 8051 microcontrollers helps the students to develop applications in advanced microprocessors/microcontrollers.
CO5-PO1	H	Familiarity of system software and RISC machine architecture enables the students to select appropriate hardware to design solutions for engineering problems.
CO5-PO5	H	Knowledge of system software and different architectures qualifies the students to use microprocessors and microcontrollers with advanced architecture.
CO5-PO12	H	Knowledge of system software and ARM architectures helps the students to understand latest computer architectures
CO1-PSO1	M	Understanding Computer Architecture will enable the students to design, implement and test complex digital circuits.
CO1-PSO3	L	Deep knowledge in basic computer architecture will help the students to understand latest processor and micro-controller designs
CO2-PSO1	M	A clear understanding of the difference between microprocessors and microcontrollers enable the students to design, implement and test complex digital circuits.

CO2-PSO3	L	A clear understanding of the difference between microprocessors and microcontrollers enable the students to understand latest processor and micro-controller designs
CO3-PSO1	M	A deep knowledge in assembly language programming helps the students to design, implement and test complex digital circuits.
CO3-PSO2	H	EDA Softwares like Keil uvision can be used to simulate microcontroller behavior in a system
CO3-PSO3	L	A deep knowledge in assembly language programming helps the students to write optimized high level programs for advanced microprocessors/microcontrollers.
CO4-PSO1	H	Students can apply the knowledge of peripheral interfacing of 8051 microcontroller to design, implement and test complex digital circuits.
CO4-PSO2	L	EDA Softwares like Keil uvision can be used to simulate microcontroller behavior in a system
CO4-PSO3	L	A deep knowledge in peripheral interfacing of 8051 microcontrollers helps the students to develop applications in advanced microprocessors/microcontrollers.
CO5-PSO1	M	Familiarity of system software and RISC machine architecture enables the students to design, implement and test complex digital circuits.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SL NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	History of Microprocessors	Lecture Delivered Material Provided	12	3
2	Basic 8085 architecture		1,2,3,4,5,12	1
3	Brief introduction about ISA and micro architecture		1,2,3,4,5,12	1,2

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SL NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs

1	ARM cortex programming basics	Suggested NPTEL lecture https://nptel.ac.in/courses/117106111		

WEB SOURCE REFERENCES:

1	Computer architecture and organization, Prof. Indranil Sengupta, Prof. Kamalika Datta | IIT Kharagpur – NPTEL Swayam
2	Computer Organization and Architecture: A Pedagogical Aspect, Prof. Santhosh biswas, Prof. Jatindra kumar deka , Prof. Arnab sarkar | IIT Bhillai, IIT Guwahati, IIT Kharagpur - – NPTEL Swayam
3	Computer Architecture, Prof. Smruti Ranjan Sarangi | IIT Delhi -–- NPTEL Swayam
4	Microprocessors And Microcontrollers, Prof. Santanu Chattopadhyay | IIT Kharagpur - -–- NPTEL Swayam
5	Microprocessors And Microcontrollers, Prof. Santanu Chattopadhyay | IIT Kharagpur - -–- NPTEL Swayam
6	Assembly Language & Computer Architecture MIT open courseware https://ocw.mit.edu/
7	Digital Design and Computer Architecture by Onur Mutlu https://safari.ethz.ch/digitaltechnik/spring2021/doku.php?id=start
8	Fundamentals of Computer Organization https://ece.engineering.arizona.edu/undergrad-programs/courses/fundamentals-computer-organization
9	Computer Architecture, Coursera https://www.coursera.org/learn/comparch

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑ CHALK & TALK	☑ STUD. ASSIGNMENT	☑ WEB RESOURCES	
☐ LCD/SMART BOARDS	STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

☑ ASSIGNMENTS	STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by
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(Faculty)

Approved by

Dr. Rithu James

(HOD)

COURSE PLAN

UNIT	DETAILS	HOURS
I.1	Algorithms for binary multiplication and division	2
I.2	Fixed- and floating-point number representation in computers.	1
I.3	Functional units of a computer, Von Neumann and Harvard computer architectures, CISC and RISC architectures.	1
I.4	Processor Architecture – General internal architecture, Address bus, Data bus, control bus. Register set – status register, accumulator, program counter, stack pointer, general purpose registers.	2
I.5	Processor operation – instruction cycle, instruction fetch, instruction decode, instruction execute, timing response, instruction sequencing and execution (basic concepts), data path	3
II.1	Microcontrollers and Embedded Processors and Applications	1
II.2	Architecture – Block diagram of 8051, Pin configuration, Registers, Internal Memory, Timers, Port Structures, Interrupts.	3
II.3	Addressing Modes of 8051	1
II.4	Instruction sets (Detailed study of 8051 instructions)	4
III.1	Simple programming examples in assembly language.	2
III.2	Interfacing programming in Assembly language	2
III.3	Programming in C - Declaring variables, Simple examples – delay generation, port programming, code conversion.	3
III.4	Interfacing of 7 segment LCD display	1
III.5	Interfacing of Keyboard and stepper motor	2
III.6	Interfacing of DAC and ADC	2
IV.1	8051 Timers/Counters - Modes and Applications	2
IV.2	Serial Data Transfer – SFRs of serial port, working, Programming the 8051 to transfer data serially	2
IV.3	Introduction to ARM - ARM family, ARM 7 register architecture. ARM programmer's model	2
IV.4	System software - Assembler, Interpreter, Compiler, Linker, Loader, Debugger.	2
V.1	Types of memory - RAM, ROM. Memory Characteristics and Hierarchy	2
V.2	Cache memory – The basics of Caches, Mapping techniques, Improving Cache performance	2
V.3	Virtual memory – Overlay, Memory management, Address translation	2
V.4	Input/Output Organization – Introduction, Synchronous vs. asynchronous I/O, Programmed I/O, Interrupt driven I/O, Direct Memory Access.	3
TOTAL HOURS		**47**

SAMPLE QUESTIONS

MODULE:1

- Explain the Booth's algorithm for multiplication with an example.
- Explain the Booth's algorithm for multiplication with the appropriate flow chart.
- Explain the Division algorithm with an example.
- Represent the number (85.125)10 as a 32 bit number in IEEE 754 format.
- Explain the general internal architecture of a processor with suitable block diagram.
- Explain the function of address bus, data bus and control bus in a processor.
- Explain the different steps in an instruction cycle with suitable flow chart.
- Differentiate between instruction cycle, machine cycle and T-state.
- Differentiate between Von Neumann and Harvard architecture with block diagrams.
- Differentiate between RISC and CISC processor architectures.
- With an example explain the "shift and add" algorithm for multiplying two binary numbers.

MODULE: 2

- Differentiate between a microprocessor and a microcontroller.
- Explain the different criteria for choosing a microcontroller.
- With a block diagram explain the architecture of an 8051 microcontroller.
- Explain in short about the special function registers of 8051 microcontroller.
- Explain the memory organization of 8051 microcontroller.
- Explain the addressing modes of 8051 microcontroller with suitable examples.
- Explain the instruction set of 8051 microcontroller with suitable examples.
- Explain in short about the registers associated with interrupts in an 8051 microcontroller.
- Explain the circuitry for different ports of an 8051 microcontroller.
- Explain about the two timers of an 8051 microcontroller.

MODULE: 3

- Write a program to add the first ten natural numbers.
- Write a program to a) load the accumulator with the value 55H, and (b) complement the accumulator 700 times.
- Write a program to determine if the contents of R0 is FFH. If so, move FFH to R5.
- Write a program to toggle the bits of port1 with a delay which depends on the value of a number in R0..Write a program to copy the value 55H into RAM memory locations 40H to 45H using a) Direct addressing mode b)Register indirect addressing mode c)with a loop.
- Write a program to clear the 16 RAM locations starting at RAM address 60H.

- Write a program to take 10 bytes of data from data RAM locations 45H to 54H, add 02 to each of them, and save the result in data RAM locations 79H to 70H.
- Write a program to save the accumulator in R7 of bank 2.
- Write a program to see if the RAM location 37H contains an even value.If so,send it to P2.If not,make it even and then send it to P2.
- Write a program to verify the stored result of a signed arithmetic operation in RAM location 27H is positive or negative. If it is negative,send a high value to P1.7. otherwise send a low value.
- Write a program to save the status of bit P1.7 on RAM address bit 05.
- Write a program to move the content of the 7th bit of the A register to pin P0.7, and also save it in RAM location 08H.
- Write a program to toggle the LED connected to the pin P1.7 forever using the bit directive.
- Write a program to get the status of the switch connected to pin P1.7 and send it to the LED connected to pin P2.0.
- Write a program to see whether the accumulator is divisible by 8.
- Write a program to find the number of zeros in register R2.
- Write an 8051 program to send letters 'M','D', and 'E' to the LCD using delays.
- Write a C program to read the keypad and send the result to the first serial port.
- P1.0-P1.3 connected to rows
- P2.0-P2.3 connected to columns
- Configure the serial port for 9600 baud,8-bit, and 1 stop bit.
- Write a program to rotate the stepper motor connected to 8051 continuously.
- Write a program to rotate the stepper motor connected to 8051, 64 degrees in the clockwise direction.

MODULE: 4

- What is the difference between the operation of a timer and a counter ?
- What is the function of the TMOD register ?
- Program Timer 0 to be an event counter.Use mode 2 and display the binary count on P2 continuously Set the initial count to 20.
- Which bits of the TCON register function as start bits of the timer ?
- Which bits of the TCON register are the timer rollover flags ?
- How can an external frequency be counted using the 8051?
- Write an 8051 program to transfer the numbers 1 to 9 serially.
- What is indicated by the REN bit of the SCON register?

MODULE: 5

- Explain in detail about different types of memories.
- What are the different cache mapping techniques? Explain them briefly.
- Explain the need for Address Translation in virtual Memory.
- Draw the internal structure of a SRAM cell and explain the read and write operation.

- Draw the internal organization of a 32M x 8 dynamic memory chip using a 16K x 16K cell array.
- Briefly explain the following standard I/O interfaces:
- Serial port (ii) Parallel port
- Explain about Memory Characteristics and Hierarchy.
- Explain in detail about Direct Memory Access (DMA).
- What are the different mapping techniques in cache?, explain in detail.
- What is meant by cache block conflict?
- Explain about different cache replacement algorithms.
- Explain in details about the virtual memory, and the use of virtual memories in computer organisation.
- Discuss about the address translation.
- Compare between paging and segmentation.
- Compare between interrupt driven IO and programmed IO.

100001/CO900E

DESIGN AND ENGINEERING

COURSE INFORMATION SHEET

PROGRAMME: **ELECTRONICS AND COMMUNICATION ENGINEERING**	DEGREE: **B. TECH**
COURSE: **DESIGN AND ENGINEERING**	SEMESTER: **S4** CREDITS: **2**
COURSE CODE: **101908/CO900E** REGULATION: **2021**	COURSE TYPE: CORE
COURSE AREA/DOMAIN: **ENGINEERING DESIGN**	CONTACT HOURS: **2 (L) hours/week**
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	LAB COURSE NAME: NIL

SYLLABUS:

UNIT	DETAILS	HOURS
1.1	Introduction to Design and Engineering Design. What does it mean to design something? How is engineering design different from other kinds of design? Where and when do engineers design? What are the basic Vocabulary in engineering design? How to learn and do engineering design.	1
1.2	Defining a Design Process-: Detailing Customer Requirements. How to do engineering design? Illustrate the process with an example. How to identify the customer requirements of design?	1
1.3	Defining a Design Process-: Setting Design Objectives, Identifying Constraints, Establishing Functions. How to finalize the design objectives? How to identify the design constraints? How to express the functions a design in engineering terms?	1
1.4	Defining a Design Process-: Generating Design Alternatives and Choosing a Design. How to generate or create feasible design alternatives? How to identify the "best possible design"?	1
1.5	Case Studies:- Stages of Design Process. Conduct exercises for designing simple products going through the different stages of design process.	1
2.1	Introduction to Design Thinking How does the design thinking approach help engineers in creating innovative and efficient designs?	1
2.2	Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. How can the engineers arrive at better designs utilizing the iterative design thinking process (in which knowledge acquired in the later stages can be applied back to the earlier stages)?	1
2.3	Design Thinking as Divergent-Convergent Questioning. Describe how to create a number of possible designs and then how to refine and narrow down to the 'best design'	1

2.4	Design Thinking in a Team Environment. How to perform design thinking as a team managing the conflicts ?	1
2.5	Case Studies: Design Thinking Approach. Conduct exercises using the design thinking approach for designing any simple products within a limited time and budget	1
3.1	Communicating Designs Graphically. How do engineering sketches and drawings convey designs?	1
3.2	Communicating Designs Orally and in Writing. How can a design be communicated through oral presentation or technical reports efficiently?	1
3.3	Mathematical Modeling in Design. How do mathematics and physics become a part of the design process?	1
3.4	Prototyping and Proofing the Design. How to predict whether the design will function well or not?	1
3.5	Case Studies: Communicating Designs Graphically. Conduct exercises for design communication through detailed 2D or 3D drawings of simple products with design detailing, material selection, scale drawings, dimensions, tolerances, etc.	1
4.1	Project-based Learning and Problem-based Learning in Design. How engineering students can learn design engineering through projects? How students can take up problems to learn design engineering?	1
4.2	Modular Design and Life Cycle Design Approaches. What is modular approach in design engineering? How it helps? How the life cycle design approach influences design decisions?	1
4.3	Application of Bio-mimicry, Aesthetics and Ergonomics in Design. How do aesthetics and ergonomics change engineering designs? How do the intelligence in nature inspire engineering designs? What are the common examples of bio-mimicry in engineering?	1
4.4	Value Engineering, Concurrent Engineering, and Reverse Engineering in Design. How do concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?	1
4.5	Case Studies: Bio-mimicry based Designs. Conduct exercises to develop new designs for simple products using bio-mimicry and train students to bring out new nature inspired designs.	1
5.1	Design for Production, Use, and Sustainability. How designs are finalized based on the aspects of production methods, life span, reliability and environment?	1
5.2	Engineering Economics in Design. How to estimate the cost of a particular design and how will economics influence the engineering designs?	1
5.3	Design Rights. What are design rights and how can an engineer put it into practice?	1
5.4	Ethics in Design.	1

	How do ethics play a decisive role in engineering design?	
5.5	Case Studies: Design for Production, Use, and Sustainability. Conduct exercises using simple products to show how designs change with constraints of production methods, life span requirement, reliability issues and environmental factors	1
TOTAL HOURS		**25**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	YousefHaik, SangarappillaiSivaloganathan, Tamer M. Shahin, Engineering Design Process, Cengage Learning 2003, Third Edition, ISBN-10: 9781305253285,
T2	Voland, G., Engineering by Design, Pearson India 2014, Second Edition, ISBN 9332535051
R1	Philip Kosky, Robert Balmer, William Keat, George Wise, Exploring Engineering, Fourth Edition: An Introduction to Engineering and Design, Academic Press 2015, 4th Edition, ISBN: 9780128012420.
R2	Clive L. Dym, Engineering Design: A Project-Based Introduction, John Wiley & Sons, New York 2009, Fourth Edition, ISBN: 978-1-118-32458-5
R3	Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Berg Publishers 2011, First Edition, ISBN: 978-1847886361
R4	Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H., Engineering Design: A Systematic Approach, Springer 2007, Third Edition, ISBN 978-1-84628-319-2

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
Nil. The course will be generic to all engineering disciplines and will not require specialized preparation or prerequisites in any of the individual engineering disciplines.			

COURSE OBJECTIVES:

1	Introduce the undergraduate engineering students the fundamental principles of design engineering.
2	Make them understand the steps involved in the design process.
3	Familiarize them with the basic tools used and approaches in design.

COURSE OUTCOMES:

SL. NO.	DESCRIPTION	Blooms' Taxonomy Level
CO.1	Explain the different concepts and principles involved in design engineering.	Remember and

		understand (Level 1,2)
CO.2	Apply design thinking while learning and practicing engineering.	Understand and apply (Level 2,3)
CO.3	Develop innovative, reliable, sustainable and economically viable designs incorporating knowledge in engineering.	Understand and apply (Level 2,3)

CO-PO AND CO-PSO MAPPING

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	1	-	-	-	-	1	-	-	1	-	-	-	-	2
CO2	-	2	-	-	-	1	-	1	-	-	-	2	-	-	2
CO3	-	-	2	-	-	1	1	-	2	2	-	1	-	-	2

JUSTIFATIONS FOR CO-PO-PSO MAPPING

MAPPING	**LOW/MEDIUM/ HIGH**	**JUSTIFICATION**
CO1-PO1	M	Prototyping and proofing in engineering design,
CO1-PO2	L	Different stages in a design process, design thinking
CO1-PO7	L	Design rights
CO1-PO10	L	Communicate design thinking
CO1-PSO3	M	Engineering design for various societal needs
CO2-PO2	M	Problem-based learning in creating better design engineering solutions
CO2-PO6	L	iterative process for design thinking in developing products needed for society
CO2-PO8	L	Ethics play a decisive role in designs
CO2-PO12	M	Divergent-convergent thinking helps in generating alternative designs
CO2-PSO3	M	Problem-based learning helps in creating better design engineering solutions
CO3-PO3	M	Development of any simple product
CO3-PO6	L	To develop new designs for simple products

CO3-PO7	L	New designs through bio-mimicry.
CO3-PO9	M	To develop new designs in a team
CO3-PO10	M	Design communication with the help of detailed 2D or 3D drawings for any simple product.
CO3-PO12	L	Development of any simple product by passing through the different stages of design process
CO3-PSO3	M	Develop new designs for simple products

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SL NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Numerical and mathematical modeling	Solving problems in class	1, 6	2
2	Market survey, house of quality theory	Activity to prepare questionnaire on market survey, HOQ	1, 6	2

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SL NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Product centered and user centered designs	Assignment	2,3,4	2

WEB SOURCE REFERENCES:

1	Design thinking for Innovation by COURSERA www.coursera.org/learn/uva-darden-design-thinking-innovation
2	Design thinking for the greater good : Innovation in the social sector by COURSERA
3	Engineering design-NOC Understanding design by NPTEL

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑ CHALK & TALK	☑ STUD. ASSIGNMENTS	☑ WEB RESOURCES	☑ ONLINE CLASSES
☑ LCD/SMART BOARDS	☐ STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

☑ASSIGNMENTS	☑ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION

☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☑ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

Prepared by

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Mr. Naveen N
(Faculty in Charges)

Approved by

Dr. Rithu James
(HOD, ECE)

COURSE PLAN

UNIT	DETAILS	HOURS
1.1	Introduction to Design and Engineering Design. What does it mean to design something? How is engineering design different from other kinds of design? Where and when do engineers design? What are the basic Vocabulary in engineering design? How to learn and do engineering design.	1
1.2	Defining a Design Process-: Detailing Customer Requirements. How to do engineering design? Illustrate the process with an example. How to identify the customer requirements of design?	1
1.3	Defining a Design Process-: Setting Design Objectives, Identifying Constraints, Establishing Functions. How to finalize the design objectives? How to identify the design constraints? How to express the functions a design in engineering terms?	1
1.4	Defining a Design Process-: Generating Design Alternatives and Choosing a Design. How to generate or create feasible design alternatives? How to identify the "best possible design"?	1
1.5	Case Studies:- Stages of Design Process. Conduct exercises for designing simple products going through the different stages of design process.	1
2.1	Introduction to Design Thinking How does the design thinking approach help engineers in creating innovative and efficient designs?	1
2.2	Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test. How can the engineers arrive at better designs utilizing the iterative design thinking process (in which knowledge acquired in the later stages can be applied back to the earlier stages)?	1
2.3	Design Thinking as Divergent-Convergent Questioning. Describe how to create a number of possible designs and then how to refine and narrow down to the 'best design'	1
2.4	Design Thinking in a Team Environment. How to perform design thinking as a team managing the conflicts ?	1
2.5	Case Studies: Design Thinking Approach. Conduct exercises using the design thinking approach for designing any simple products within a limited time and budget	1
3.1	Communicating Designs Graphically. How do engineering sketches and drawings convey designs?	1
3.2	Communicating Designs Orally and in Writing. How can a design be communicated through oral presentation or technical reports efficiently?	1

3.3	Mathematical Modeling in Design. How do mathematics and physics become a part of the design process?	1
3.4	Prototyping and Proofing the Design. How to predict whether the design will function well or not?	1
3.5	Case Studies: Communicating Designs Graphically. Conduct exercises for design communication through detailed 2D or 3D drawings of simple products with design detailing, material selection, scale drawings, dimensions, tolerances, etc.	1
4.1	Project-based Learning and Problem-based Learning in Design. How engineering students can learn design engineering through projects? How students can take up problems to learn design engineering?	1
4.2	Modular Design and Life Cycle Design Approaches. What is modular approach in design engineering? How it helps? How the life cycle design approach influences design decisions?	1
4.3	Application of Bio-mimicry, Aesthetics and Ergonomics in Design. How do aesthetics and ergonomics change engineering designs? How do the intelligence in nature inspire engineering designs? What are the common examples of bio-mimicry in engineering?	1
4.4	Value Engineering, Concurrent Engineering, and Reverse Engineering in Design. How do concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?	1
4.5	Case Studies: Bio-mimicry based Designs. Conduct exercises to develop new designs for simple products using bio-mimicry and train students to bring out new nature inspired designs.	1
5.1	Design for Production, Use, and Sustainability. How designs are finalized based on the aspects of production methods, life span, reliability and environment?	1
5.2	Engineering Economics in Design. How to estimate the cost of a particular design and how will economics influence the engineering designs?	1
5.3	Design Rights. What are design rights and how can an engineer put it into practice?	1
5.4	Ethics in Design. How do ethics play a decisive role in engineering design?	1
5.5	Case Studies: Design for Production, Use, and Sustainability. Conduct exercises using simple products to show how designs change with constraints of production methods, life span requirement, reliability issues and environmental factors	1
TOTAL HOURS		**25**

SAMPLE QUESTIONS

- Write about the basic design process.
- Describe how to finalize the design objectives.
- State the role of divergent-convergent questioning in design thinking.
- Discuss how to perform design thinking in a team managing the conflicts.
- Show how engineering sketches and drawings convey designs.
- Explain the role of mathematics and physics in design engineering process.
- Distinguish between project-based learning and problem-based learning in design engineering.
- Describe how concepts like value engineering , concurrent engineering and reverse engineering influence engineering designs?
- Show how designs are varied based on the aspects of production methods, life span, reliability and environment?
- Explain how economics influence the engineering designs?

Module 1

- Show the designing of a wrist watch going through the various stages of the design process. Use hand sketches to illustrate the processes.

  OR

- Find the customer requirements for designing a new car showroom. Show how the design objectives were finalized considering the design constraints?

Module 2

- Illustrate the design thinking approach for designing a bag for college students within a limited budget. Describe each stage of the process and the iterative procedure involved. Use hand sketches to support your arguments.

  OR

- Construct a number of possible designs and then refine them to narrow down to the

best design for a drug trolley used in hospitals. Show how the divergent-convergent thinking helps in the process. Provide your rationale for each step by using hand sketches only.

Module 3

- Graphically communicate the design of a thermo flask used to keep hot coffee. Draw the detailed 2D drawings of the same with design detailing, material selection, scale drawings, dimensions, tolerances, etc. Use only hand sketches.

OR

- Describe the role of mathematical modelling in design engineering. Show how mathematics and physics play a role in designing a lifting mechanism to raise 100 kg of weight to a floor at a height of 10 meters in a construction site.

Module 4

- Show the development of a nature inspired design for a solar powered bus waiting shed beside a highway. Relate between natural and man-made designs. Use hand sketches to support your arguments.

OR

- Show the design of a simple sofa and then depict how the design changes when considering 1) aesthetics and 2) ergonomics into consideration. Give hand sketches and explanations to justify the changes in designs.

Module 5

- Examine the changes in the design of a foot wear with constraints of 1) production methods, 2) life span requirement, 3) reliability issues and 4) environmental factors. Use hand sketches and give proper rationalization for the changes in design.

OR

- Describe how to estimate the cost of a particular design using ANY of the following:
- a website, ii) the layout of a plant, iii) the elevation of a building, iv) an electrical or electronic system or device and v) a car.
- Show how economics will influence the engineering designs. Use hand sketches to support your arguments.

100908/ES400F

CONSTITUTION OF INDIA

COURSE INFORMATION SHEET

PROGRAMME: B. TECH ALL BRANCHES	**DEGREE:** B.TECH
COURSE: CONSTITUTION OF INDIA	**SEMESTER:** 4
COURSE CODE: 100908/ES400F **REGULATION:** 2020	**COURSE TYPE:** CORE
COURSE AREA/DOMAIN: SOCIAL SCIENCE	**CONTACT HOURS:** 2-0-0
CORRESPONDING LAB COURSE CODE(IF ANY): NIL	**LAB COURSE NAME:** NA

SYLLABUS:

No	Topic	No. of Lectures
1	**Module 1**	
1.1	Definition of constitution, historical back ground, salient features of the constitution.	1
1.2	Preamble of the constitution, union and its territory.	1
1.3	Meaning of citizenship, types, termination of citizenship.	2
2	**Module 2**	
2.1	Definition of state, fundamental rights, general nature, classification, right to equality, right to freedom, right against exploitation	2
2.2	Right to freedom of religion, cultural and educational rights, right to constitutional remedies. Protection in respect of conviction for offences.	2
2.3	Directive principles of state policy, classification of directives, fundamental duties.	2
FIRST INTERNAL EXAM		
3	**Module 3**	
3.1	The Union executive, the President, the vice President, the council of ministers, the Prime minister, Attorney-General, functions.	2
3.2	The parliament, composition, Rajya sabha, Lok sabha, qualification and disqualification of membership, functions of parliament.	2
3.3	Union judiciary, the supreme court, jurisdiction, appeal by special leave.	1
4	**Module 4**	

4.1	The State executive, the Governor, the council of ministers, the Chief minister, advocate general, union Territories.	2
4.2	The State Legislature, composition, qualification and disqualification of membership, functions.	2
4.3	The state judiciary, the high court, jurisdiction, writs jurisdiction.	1
SECOND INTERNAL EXAM		
5	**Module 5**	
5.1	Relations between the Union and the States, legislative relation, administrative relation, financial Relations, Inter State council, finance commission.	1
5.2	Emergency provision, freedom of trade commerce and inter course, comptroller and auditor general of India, public Services, public service commission, administrative Tribunals.	2
5.3	Official language, elections, special provisions relating to certain classes, amendment of the Constitution.	2
TOTAL HOURS		**25**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHOR/PUBLICATION
T	Das Basu Durga, *Introduction to The Constitution of India*, Lexix Nexis Publication, RELX India Pvt. Ltd. 24th Edition, 2020
T	PM Bhakshi, The constitution of India, Universal Law, 14e, 2017
R	Ministry of law and justice, The constitution of India, Govt of India, New Delhi, 2019
R	JN Pandey, The constitutional law of India, Central Law agency, Allahabad, 51e,2019
R	MV Pylee, India's Constitution, S Chand and company, New Delhi, 16e, 2016

COURSE OBJECTIVES:

SL./NO.	COURSE OBJECTIVES
1.	To enable the students to understand the importance of the Indian Constitution
2.	To create awareness among the students about the Indian Judiciary and its functions.
3.	To make the students aware about their fundamental rights and duties

COURSE OUTCOME:

CO 1:	Explain the background of the present constitution of India and features
CO 2:	Utilize the fundamental rights and duties
CO 3:	Understand the working of the union executive, parliament and judiciary
CO 4:	Understand the working of the state executive, legislature and judiciary

CO 5	Utilize the special provisions and statutory institutions
CO: 6	Show national and patriotic spirit as responsible citizens of the country

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES:

CO / PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1						**2**	**2**	**2**		**2**		
CO 2						**3**	**3**	**3**		**2**		
CO 3						**3**	**2**	**3**		**2**		
CO 4						**3**	**2**	**3**		**2**		
CO 5						**3**	**2**	**3**		**2**		
CO 6						**2**	**2**	**2**		**2**		

JUSTIFICATION FOR COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING				
CO / PO	**PO 6**	**PO 7**	**PO 8**	**PO 10**
CO 1	To conceptualize the cause effect relationship between professional practices upon society within the constitutional framework.	Engineering practices are subject to the environmental protection laws and regulations of the respective nations. The Constitution lays down Articles which specify the rules and regulations to preserve national resources.	Engineering projects have a direct impact on the society and hence engineers should follow honesty, impartiality, fairness, and equity in engineering practices twined with the protection of the public health, safety, and welfare. The Constitution lays down the fundamental duties of a citizen along with ethical code of conduct to be followed.	The constitutional framework helps a citizen undertaking any profession, to consider the interest of stake holders while engaging in any activity.
CO 2	To design and plan any activity that so that it does not result in breaching the rights and privileges enjoyed by the society and it abide by the constitutional provisions.	Constitution lays down the provisions for environmental protection while undertaking engineering projects in future. E.g. Article 48 (A) and Article 51 (A) g	To regulate any arbitrary action by the individual against any entity and helps to work in an ethical manner.	Fundamental rights and duties create a sense of responsibility and accountability among the students towards the society
CO 3	An awareness of the judiciary, parliament makes the students realize the pros and cons of negligence of respective laws related to their business as well as social environment.	The Articles laid down by the Constitution create awareness among citizens, to give priority to the natural resources while undertaking any activity in the country.	The Indian constitution lays down certain ethical codes of conduct and moral principles for its citizens. Every individual must follow integrity, honesty, transparency, impartiality etc. in his profession.	Understands the procedure and law abiding by the Centre, State and the Judiciary conduct the engineering practices in accordance with the same.
CO 4	An awareness of the State Executive, Legislature and Judicial system makes a student realize the consequences of negligence of the laws applicable to their profession. This helps them to think about the legal consequences while undertaking projects.	Art.47 and Art.48(A) emphasize the duty of citizens to protect the country's environment. Awareness of the environmental laws under the constitutional framework regulates actions of the citizen by prioritizing environmental sustainability.	The engineers are to use their expertise for the benefit of society. Ethics laid down by the Constitution regulates the performance of their own selves and their fellow engineers. The constitutional ethical values discussed under Liberty (eg. Art. 19 to 21), Justice (Art. 20,21, 39A, 39) Equity (Art. 15, 16 17), Impartiality (art. 17, 21, 21A,25, 26), Transparency and accountability, Public Welfare and Fraternity gives an idea of ethical values to be followed within a country.	Understands the procedure and law abiding by the Centre, State and the Judiciary conduct the engineering practices in accordance with the same
CO 5	Special Provisions are framed in order to protect the interest of Women, Children and Backward classes. This helps a student to develop an empathy towards these groups as and when required. The statutory institutions are formed to protect the rights of people, environment etc. An idea of the same creates an alertness among the students while engaging in engineering activities.	To be aware that not all places in a country are treated alike and some places have its own uniqueness w.r.t language, tribes, environmentally fragility, historical importance etc. and to plan actions by considering the special provisions granted to these places by the constitution.	Certain States are having special provisions to safeguard the minorities, backward areas and their development. An awareness of the special provisions helps a student to realize that certain moral principles have to be followed while undertaking engineering practices with respect to different States.	Special Provisions are framed in order to protect the interest of Women, Children and Backward classes. This helps the engineer to plan and execute projects in such a way that the interest of these groups are also incorporated. The statutory institutions are formed to protect the rights of people, environment etc. An idea of the same reminds the engineer to communicate effectively the purpose and motive of every engineering practice undertaken within the State.
CO 6	Reminds every student about his/her duties as citizen of India as an ordinary citizen as well as an professional engineer.	Understanding the constitution creates a sense of conscious effort from the part of the students to utilize the natural resources efficiently.	Understanding the ethical code of conduct laid down by the constitution creates a sense of responsibility within the students towards the society while engaging in engineering practices	The Indian constitution enables the citizen to understand the toil and struggle undertaken by the freedom fighters and the emotion behind framing such a constitution. This will

				enlighten them to the fact that they have a great deal of responsibility for the welfare of

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS

Sl.No.	Description	Proposed Actions
1.	Environmental Protection Act	NPTEL
2.	Pollution Control Laws: Administrative process	NPTEL
3.	Cyber Laws: Administrative Process	Assignment
4.	Intellectual Property Law & Rights	NPTEL
5.	Human Rights	Webinar
6.	Contract Laws and Tort Laws	Webinar

Proposed Actions: Topics beyond Syllabus/Assignment/Industry Visit/Guest Lecture/NPTEL Etc

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

Sl.No.	Topic
1.	Challenges to Indian Political System
2.	India's External Relations
3.	Working of Election Commission
4.	Environmental Impact Assessment and Administrative Process

WEB SOURCE REFERENCES:

Sl. No.	Web Sources
1.	E – PG pathshaala – Law
2.	https://indiankanoon.org/
3.	https://www.sci.gov.in/
4.	https://cag.gov.in/en
5.	www.india.gov.in
6.	https://www.epw.in/

7.	https://www.barandbench.com/
8.	https://www.lawweb.in/

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓ Chalk & Talk	✓ Student Assignment	✓ Web Resources	LCD/Smart Boards
✓ Student Seminars	Add-On Courses	✓ ICT Enabled Classes	

ASSESSMENT METHODOLOGIES-DIRECT

✓ Assignments	✓ Student Seminars	✓ Tests/Model Exams	✓ Univ. Examination
Stud. Lab Practices	Stud. Viva	Mini/Major Projects	Certifications
Add-On Courses	Others	✓ Group Discussion	

ASSESSMENT METHODOLOGIES-INDIRECT

✓ Assessment of Course Outcomes (By Feedback, Once)	✓ Student Feedback On Faculty (Twice)
Assessment Of Mini/Major Projects By External Experts	✓ Others

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Department of Basic Sciences and Humanities

Rajagiri School of Engineering and Technology

COURSE PLAN

No	Topic
1	**Module 1**
1.1	Definition of constitution, historical back ground, salient features of the constitution.
1.2	Preamble of the constitution, union and its territory.
1.3	Meaning of citizenship, types, termination of citizenship.
2	**Module 2**
2.1	Definition of state, fundamental rights, general nature, classification, right to equality, right to freedom, right against exploitation
2.2	Right to freedom of religion, cultural and educational rights, right to constitutional remedies. Protection in respect of conviction for offences.
2.3	Directive principles of state policy, classification of directives, fundamental duties.
FIRST INTERNAL EXAM	
3	**Module 3**
3.1	The Union executive, the President, the vice President, the council of ministers, the Prime minister, Attorney-General, functions.
3.2	The parliament, composition, Rajya sabha, Lok sabha, qualification and disqualification of membership, functions of parliament.
3.3	Union judiciary, the supreme court, jurisdiction, appeal by special leave.
4	**Module 4**
4.1	The State executive, the Governor, the council of ministers, the Chief minister, advocate general, union Territories.
4.2	The State Legislature, composition, qualification and disqualification of membership, functions.
4.3	The state judiciary, the high court, jurisdiction, writs jurisdiction.
SECOND INTERNAL EXAM	
5	**Module 5**
5.1	Relations between the Union and the States, legislative relation, administrative relation, financial Relations, Inter State council, finance commission.
5.2	Emergency provision, freedom of trade commerce and inter course, comptroller and auditor general of India, public Services, public service commission, administrative Tribunals.
5.3	Official language, elections, special provisions relating to certain classes, amendment of the Constitution.
TOTAL HOURS	

SAMPLE QUESTIONS

MODULE: I

- What were the salient features of Government of India Act 1935?
- Which were the changes introduced by Indian Independence Act 1947?
- Charter of 1833 was a turning point in the history of British rule in India. Discuss
- Discuss the historical background of the Indian constitution.
- Explain the salient features of the Indian constitution.
- Discuss the importance of Article 32 of the Indian Constitution.
- Which are the modes of losing Indian Citizenship? Explain.
- Which are the modes of acquiring Indian Citizenship? Explain.
- Explain the federal features of constitution.
- Define and explain the term Constitution.
- What the major commitments of the Constitution of India are as incorporated in its preamble?
- What is the significance of a Preamble to a Constitution? Bring out the philosophy of the Indian polity as enshrined in the Preamble of Indian Constitution.
- Describe the emergence of Basic Structure concept in the Indian Constitution.
- Explain the procedure to amend the constitution. Also explain importance basic structure doctrine in the amending the constitution.
- Discuss the development of constitutional model in India.
- Explain the need and importance of the Preamble
- Discuss the Rights of citizenship of certain migrants to Pakistan (Article 7)
- Can Parliament to regulate the right of citizenship by law? Discuss
- How are the new States formed in India? Why have the demands of separate States like those of Vidarbha, Telangana etc, not been considered by the Government recently.
- What are the essentials of a true federation? Analyze the nature of the Indian federation.
- "Indian constitution is primarily federal in nature, however, it has strong centralizing tendency." Comment. Point out the unitary features of the Indian Constitutionalso.
- "Power of Parliament to amend the constitution is very wide but not unlimited." Comment. Refer to important cases.
- Why constitution makers of India preferred Parliamentary form of Government rather than Presidential form of Government? What are the salient features of both

Module II

- State and Explain the Constitutional Remedies.
- Define a Writ. How can a citizen file a writ petition?

- State the following: (i) Writ of Habeas Corpus, (ii) Writ of Mandamus, (iii) Writ of Certiorari,
- (iv) Writ of Prohibition, (v) Writ of Quo-Warranto
- Write short note on "Right against exploitation".
- "No person shall be deprived of his property save by authority of law". Comment.
- What were the recommendations of the 'Swarna Singh Committee'?
- State the difference between the fundamental rights and DPSP.
- What is meant by DPSP? What are the features of DPSP? List the directives.
- What are the new DPSPs added by the 42nd Amendment Act, 1976?
- What are the socialist principles stated in the DPSP?
- Discuss: Right to Equality under the Constitution.
- What is "discrimination"? State the provisions in the Constitution with regard to "prohibition of discrimination on certain grounds."
- How is the "Right to Freedom" guaranteed under the Indian Constitution?
- Discuss right to education guaranteed under the Constitution.
- Discuss right to freedom of religion guaranteed under the Constitution.
- Explain fundamental duties establishing their relationship between the fundamental rights.
- Explain the background under which the fundamental duties were inserted to the constitution of India.
- Are all fundamental duties enforceable? Substantiate your answer.
- What do you mean by cultural and educational rights? Explain with example.

Module III

- How is the vice president elected?
- What is the tenure of Prime minister?
- How can the President be removed from the office?
- Write a short note on the judicial powers of the President.
- Write a short note on financial powers of the President.
- What are the special powers of rajyasabha?
- What are the powers and functions of the Prime Minister?
- Write a short note on Council of Ministers.
- What is the maximum strength of Rajya Sabha as well as Lok Sabha?
- What do you mean by judiciary?
- Write down the composition of the Supreme Court of India.
- What is a Money Bill?
- What is ordinary bill?
- How can we categorize the council of ministers?
- Apart from being as an Indian citizen what are the qualification needed for being as a Prime Minister.
- What are the qualification required to be the Vice President of India?

MODULE IV

- What are the minimum qualifications to be a Governor of a State?
- Explain the Ordinance making power of the Governor.
- Which Articles of the Constitution deals with State Executive?
- Examine the organization, powers, and functions of the State Legislature
- State the duties of the Chief Minister.
- How is a Chief Minister appointed?
- What is the term of the Chief Minister's office?
- What is the term of the Governor's office?
- How is the Council of Ministers appointed?
- What are the functions of the Chief Minister in relation to the Governor?
- What are the functions of the Chief Minister in relation to the Council of Ministers?
- Elaborate on the composition of the State Legislative Assembly.

MODULE V

- List three types of emergency under Indian constitution.
- What is federalism?
- How have the powers been distributed in the federation of India?
- What is the electoral process in India?
- What is the administrative relationship between the central and state government in India? Explain.
- Mention some features of federal government.
- What do you know the article 351 of our Constitution?
- What do you understand by Article 343 of our constitution?
- Explain the provisions in Constitution related to official language.
- Explain the functions of finance commission
- Explain the procedure for the amendment of the Constitution
- What is the need of the administrative tribunals? Explain the functions of State administrative tribunals.
- Discuss the functions of Comptroller and Auditor General of India.
- Explain the distribution of tax revenue with respect to center-state financial relation.
- Explain the powers of public service commission.
- How have the powers been distributed in the federation of India?
- What is the composition of Election Commission of India?

100001/EC422S

ANALOG CIRCUITS AND SIMULATION LAB

COURSE INFORMATION SHEET

PROGRAMME: **ELECTRONICS AND COMMUNICATION ENGINEERING**	DEGREE: **B. TECH** UNIVERSITY: **APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**
COURSE: **Analog Circuits and Simulation Lab**	SEMESTER: **S4** CREDITS: **2**
COURSE CODE: 100001/EC422S REGULATION: **2019**	COURSE TYPE: **CORE**
COURSE AREA/DOMAIN: BASIC ELECTRONIC CIRCUITS	CONTACT HOURS: **3 (P) hours/week**
CORRESPONDING LAB COURSE CODE (IF ANY): NA	LAB COURSE NAME: NA

SYLLABUS:

UNIT	DETAILS	HOURS
List of experiments using discrete components: PART A (6 experiments mandatory)		
1	RC integrating and differentiating circuits (Transient analysis with different inputs and frequency repsonse)	3
2	Clipping and clamping circuits (Transients and transfer charatcteristics)	3
3	RC Coupled CE amplifier - frequency response characteristics.	3
4	MOSFET amplifier (CS) - frequency response characteristics.	3
5	Cascade amplifier – gain and frequency response	3
6	Cascode amplifier – frequency response	3
7	Feedback amplifiers (current series, voltage series) - gain and frequency response	3
8	Low frequency oscillators – RC phase shift, Wien bridge	3
9	Power amplifiers (transformer less), Class B and Class AB.	3

10	Transistor series voltage regulator (load and line regulation)	3
PART B: Simulation Experiments (6 experiments mandatory)		
1	RC integrating and differentiating circuits (Transient analysis with different inputs and frequency repsonse)	3
2	Clipping and clamping circuits (Transients and transfer charatcteristics)	3
3	RC Coupled CE amplifier - frequency response characteristics.	3
4	MOSFET amplifier (CS) - frequency response characteristics.	3
5	Cascade amplifier – gain and frequency response	3
6	Cascode amplifier – frequency response	3
7	Feedback amplifiers (current series, voltage series) - gain and frequency response	3
8	Low frequency oscillators – RC phase shift, Wien bridge	3
9	Power amplifiers (transformer less), Class B and Class AB.	3
10	Transistor series voltage regulator (load and line regulation)	3

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
R	Microelectronic Circuits / Sedra and Smith /OUP
R	Pulse, Digital and Switching Waveforms / Millman and Taub / McGraw Hill
R	Electronic Circuits – Analysis and Design / Neamen D. / TMH
R	Microelectronic Circuits – Analysis and Design / Rashid M. H. / Cengage Learning
R	Introduction to Electronic Circuit Design / Spencer R.R. and M. S. Ghausi / Pearson
R	Fundamentals of Microelectronics / Razavi B. / Wiley
R	Electronics Lab Manual Vol. 1 / K. A. Navas /

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
EST 130	Basics of Electrical and Electronics Engineering	Students should know about basic electronics components like BJT, diode, Resistor etc & its working	S2
ESL 130	Electrical and Electronics Workshop	Students should familiar with breadboard and electronic components	S2

COURSE OBJECTIVES:

1	To familiarize students with the Analog Circuits Design through the implementation Of basic Analog Circuits using discrete components.
2	To familiarize students with simulation of basic Analog Circuits.

COURSE OUTCOMES:

SL. NO.	DESCRIPTION	Blooms' Taxonomy Level
C0.1	Students will be able to ***design*** and ***demonstrate*** the functioning of basic analog circuits using discrete components.	Understand and analyze (level 2 ,4))
C0.2	Students will be able to ***design*** and ***simulate*** the functioning of basic analog circuits using simulation tools.	Understand and apply (level 2 ,3)
C0.3	Students will be able to Function effectively as an individual and in a team to accomplish the given task.	Understand (level 2)

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	-	-	-	-	-	2	-	-	2	1	-	-

CO2	3	3	3	-	3	-	-	-	2	-	-	2	1	3	-
CO3	3	3	3	-		-	-	-	3	-	-	3	1	-	-
	3	**3**	**3**		**1**				**2.3 3**			**2.3 3**	**1**	**1**	

JUSTIFATIONS FOR CO-PO MAPPING

MAPPING	**LOW/MEDIUM/ HIGH**	**JUSTIFICATION**
CO1-PO1	H	Apply the knowledge of mathematics, science and engineering fundamentals to understand the concepts of basic analog circuits using discrete components.
CO1-PO2	H	Problem analysis of basic analog circuits
CO1-PO3	H	Design of basic analog circuits using discrete components.
CO1-PO9	M	Function effectively as an individual and in a team to accomplish the given task.
CO1-PO12	M	The students will be able to design advanced analog circuits in the broadest context of technological change
CO2-PO1	H	Apply the knowledge of mathematics, science and engineering fundamentals to understand the concepts of basic analog circuits using simulation tools.
CO2-PO2	H	Basic analog circuit design and simulation using simulation tools helps in analyzing circuits for complex Engineering problems
CO2-PO3	H	Basic analog circuit design and simulation using simulation tools helps in designing solutions for complex Engineering problems

CO2-PO5	H	The usage of simulation tools for basic analog circuit design and simulation helps in using latest advanced tools for complex Engineering activities
CO2-PO9	M	Conduct of experiments using simulation tools in teams helps to function effectively as an individual and as a member or leader in diverse teams
CO2-PO12	M	The students will be able to understand and use the latest tools developed in the broadest context of technological change
CO3-PO1	H	Basic knowledge and understanding of the analog circuit design and simulation helps in functioning effectively as an individual and a team member.
CO3-PO2	H	Contributions as an individual and a team member helps in the analyzes of complex Engineering problems
CO3-PO3	H	Contributions as an individual and a team member helps in designing solutions for complex Engineering problems
CO3-PO9	H	Conduct of experiments in teams helps to function effectively as an individual and as a member or leader in diverse teams
CO3-PO12	H	Individual and team member skills helps in the life long learning of project management.
CO1-PSO1	L	Demonstrate their skills in designing ,implementing and testing analogue electronic circuits
CO2-PSO1	L	Demonstrate their skills in designing ,implementing and testing analogue electronic circuits using simulation tools
CO2-PSO2	H	Students could simulate,design and implement analog circuits in this laboratory and helps to understand the usage of EDA tools
CO3-PSO1	L	Demonstrate their skills as an individual and in a team to design, implement and test analogue electronic circuits effectively.

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SL NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs

1	Rectifiers with L, LC, π filters – waveforms, ripple factors.	Included as an additional experiment	PO1,PO2,PO3	PSO1

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SL NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Experiments related to switching circuits	Simulation Assignment	PO1,PO2,PO3	PSO1

WEB SOURCE REFERENCES:

1	www.nptel.iit.a.c.in
2	https://kicad.org/
3	http://qucs.github.io/
4	https://www.ti.com/tool/TINA-TI
5	

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑CHALK & TALK	☑ STUD. ASSIGNMENTS	☑ WEB RESOURCES	☑ ONLINE CLASSES
☑ LCD/SMART BOARDS	☐ STUD. SEMINARS	☐ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

☑ASSIGNMENTS	☐ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS

□ ADD-ON COURSES	□ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (TWICE)
□ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	□ OTHERS

Prepared by

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(Faculties in Charge)

Approved by

Dr. RITHU JAMES
(HOD, ECE)

COURSE PLAN

UNIT	DETAILS	HOURS
List of experiments using discrete components: PART A (6 experiments mandatory)		
1	RC integrating and differentiating circuits (Transient analysis with different inputs and frequency repsonse)	3
2	Clipping and clamping circuits (Transients and transfer charatcteristics)	3
3	RC Coupled CE amplifier - frequency response characteristics.	3
4	MOSFET amplifier (CS) - frequency response characteristics.	3
5	Cascade amplifier – gain and frequency response	3
6	Cascode amplifier – frequency response	3
7	Feedback amplifiers (current series, voltage series) - gain and frequency response	3
8	Low frequency oscillators – RC phase shift, Wien bridge	3
9	Power amplifiers (transformer less), Class B and Class AB.	3
10	Transistor series voltage regulator (load and line regulation)	3
PART B: Simulation Experiments (6 experiments mandatory)		
1	RC integrating and differentiating circuits (Transient analysis with different inputs and frequency repsonse)	3
2	Clipping and clamping circuits (Transients and transfer charatcteristics)	3
3	RC Coupled CE amplifier - frequency response characteristics.	3
4	MOSFET amplifier (CS) - frequency response characteristics.	3
5	Cascade amplifier – gain and frequency response	3

6	Cascode amplifier – frequency response	3
7	Feedback amplifiers (current series, voltage series) - gain and frequency response	3
8	Low frequency oscillators – RC phase shift, Wien bridge	3
9	Power amplifiers (transformer less), Class B and Class AB.	3
10	Transistor series voltage regulator (load and line regulation)	3

100001/EC422T

MICROCONTROLLER LAB

COURSE INFORMATION SHEET

PROGRAMME: ELECTRONICS & COMMUNICATION	DEGREE: BTECH
COURSE: MICROCONTROLLER LAB	SEMESTER: 4 CREDITS: 2
COURSE CODE: 100001/EC422T REGULATION: Autonomous	COURSE TYPE: CORE
COURSE AREA/DOMAIN: ELECTRONICS	CONTACT HOURS: 0+0+3 (LAB) hours/Week.
CORRESPONDING THEORY COURSE CODE (IF ANY): 100001/EC400D	THEORY COURSE NAME:NIL

SYLLABUS:

PART	DETAILS	HOURS
A	**Assembly Language Programming experiments using 8051 Trainer kit.** 1. Data transfer/exchange between specified memory locations. 2. Largest/smallest from a series. 3. Sorting (Ascending/Descending) of data. 4. Addition / subtraction / multiplication / division of 8/16 bit data. 5. Sum of a series of 8 bit data. 6. Multiplication by shift and add method. 7. Square / cube / square root of 8 bit data. 8. Matrix addition. 9. LCM and HCF of two 8 bit numbers.	18

	10. Code conversion – Hex to Decimal/ASCII to Decimal and vice versa (The above experiments are conducted with different addressing modes and data is accessed from registers or memory locations)	
B	**Interfacing experiments using 8051 Trainer kit and interfacing modules.** 1. Time delay generation and relay interface. 2. Display (LED/Seven segments/LCD) and keyboard interface. 3. ADC interface. 4. DAC interface with wave form generation. 5. Stepper motor and DC motor interface. 6. Realization of Boolean expression through port.	12
TOTAL HOURS		**30**

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
R1	Kenneth J. Ayala, The 8051 Microcontroller, Cengage learning, 3/e
R2	Lyla B.Das : Microprocessors and Microcontrollers, Pearson Education, India, 2011
R3	Soumitra Kumar Mandal. Microprocessors and Microcontrollers Architecture, Programming & Interfacing Using 8085, 8086 and 8051, McGraw Hill Education (2011).
R4	Nagoorkani, Microprocessors and Microcontrollers 2e, McGraw Hill Education India, 2012.

R5	Muhammed Ali Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education, 2nd edition

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

1	This course aims at familiarizing the students with Assembly Language Programming of modern microcontrollers.
2	This course aims at imparting the skills for interfacing the microcontroller with the help of Embedded C/Assembly Language Programming.

COURSE OUTCOMES:

SNO	DESCRIPTION	Bloom Taxonomy Level
1	Write an Assembly language program/Embedded C program for performing data manipulation.	Understand(level 2)
2	Develop ALP/Embedded C Programs to interface microcontroller with peripherals	Understand and Apply (level 2, 3)
3	Perform programming/interfacing experiments with IDE for modern microcontrollers.	Understand and Apply (level 2, 3)

CO – PO mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**

CO1	3	-	3	-	3	-	-	-	3	-	-	3	1	-	-
CO2	3	-	3	2	3	-	-	-	3	-	-	3	1	1	-
CO3	3	-	3	3	3	3	-	-	3	-	3	3	1	1	-

Justification

MAPPING	**JUSTIFICATION**
CO1-PO1	Based on the application requirement, embedded systems using these operations/functions can be used.
CO1-PO3	The experience gained through Assembly language/Embedded C programming can be used to design and develop solutions for engineering problems.
CO1-PO5	Using an IDE for simulations, basic knowledge of IDEs is obtained, which can be extended to more complex simulation environments.
CO1-PO9	Project execution being a team work, students get to work as team players and leaders.
CO1-PO12	The exposure to Assembly language/Embedded C programming equips the students to adapt quickly to advanced programming in future.
CO2-PO1	Knowledge of basic hardware requirements for embedded systems is acquired.
CO2-PO3	Students gain experience in interfacing microcontroller with different peripherals which enable them to design and develop system components as solutions to problems.
CO2-PO4	Knowledge of interfacing microcontroller with peripherals equips the students to reach at valid conclusions for complex problems.
CO2-PO5	Knowledge of the 8051 programmer module and basics for microcontroller programming that can be applied to other microcontroller hardware is attained.
CO2-PO9	Project execution being a team work, students get to work as team players and leaders.

CO2-PO12	Students realize the need for technology upgradation so as to come up with newer and better products, for which continuous learning is a necessity.
CO3-PO1	Software interfacing of peripheral modules to 8051 so as to build a complete embedded system is learnt.
CO3-PO3	Ability to choose appropriate interfacing modules for an application is developed.
CO3-PO4	Knowledge of programming/interfacing microcontroller with peripherals in an IDE equips the students to reach at valid conclusions for complex problems.
CO3-PO5	Experience gained through programming/ interfacing with IDE for microcontrollers help the students to extend the same for advanced microcontrollers.
CO3-PO6	Develop the capability to assess problems regarding programming/interfacing with microcontrollers with IDE.
CO3-PO9	Project execution being a team work, students get to work as team players and leaders.
CO3-PO11	A fundamental understanding of some factors to be managed and coordinated in a project is acquired.
CO3-PO12	Students realize the need for technology upgradation so as to come up with newer and better products, for which continuous learning is a necessity

MAPPING	**JUSTIFICATION**
CO1-PSO1	Students develop the capability to design and implement complex digital circuits using microcontrollers.
CO2-PSO1	Students can apply the knowledge of peripheral interfacing of 8051 microcontroller to design, implement and test complex digital circuits.
CO2-PSO2	EDA Softwares like Keil uvision can be used to simulate microcontroller behavior in a system
CO3-PSO1	Students can apply the knowledge of peripheral interfacing of modern microcontroller to design, implement and test complex digital circuits.

CO3-PSO2	EDA Softwares like Keil uvision can be used to simulate microcontroller behavior in a system

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SL NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Introduction to microcontroller-based boards	Micro projects using microcontroller based boards	1,2,3,4,5,12	1,2

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SL NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Embedded system design	Video Lecture	1,2,3,4,5,12	1,2

WEB SOURCE REFERENCES:

1	https://www.coursera.org/learn/comparch
2	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-823-computer-system-architecture-fall-2005/
3	http://www.nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors%20and%20Microcontrollers/New_index1.html
4	**http://nptel.ac.in/courses/108107029/**
5	**http://freevideolectures.com/Course/3018/Microprocessors-and-Microcontrollers**

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

□ CHALK & TALK	☑ STUD. ASSIGNMENTS	☑ WEB RESOURCES	☑ ONLINE CLASSES
☑ LCD/SMART BOARDS	□STUD. SEMINARS	☑ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

□ASSIGNMENTS	□STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑UNIV. EXAMINATION
☑ STUD. LAB PRACTICES	☑STUD. VIVA	☑ MINI/MAJOR PROJECTS	□ CERTIFICATIONS
□ ADD-ON COURSES	□ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (TWICE)
□ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	□ OTHERS

Prepared by **Approved by**

Mr. Nitheesh Kurian

Dr. Simi Zerine Sleeba

Ms. Tressa Michael

COURSE PLAN

PART	DETAILS	HOURS
A	**Assembly Language Programming experiments using 8051 Trainer kit.** 1. Data transfer/exchange between specified memory locations. 2. Largest/smallest from a series. 3. Sorting (Ascending/Descending) of data. 4. Addition / subtraction / multiplication / division of 8/16 bit data. 5. Sum of a series of 8 bit data. 6. Multiplication by shift and add method. 7. Square / cube / square root of 8 bit data. 8. Matrix addition. 9. LCM and HCF of two 8 bit numbers. 10. Code conversion – Hex to Decimal/ASCII to Decimal and vice versa (The above experiments are conducted with different addressing modes and data is accessed from registers or memory locations)	18
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TOTAL HOURS		**30**