VASIREDDY VENKATADRI
INSTITUTE OF TECHNOLOGY

(AUTONOMOUS)

Approved by AICTE and Permanetly Affiliated to JNTU Kakinada, Accredited by NAAC with 'A' Grade & NBA Accreditation

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Minutes of Board of Studies meeting

Date: 12th Aug-2020

The second Board of Studies Meeting of the Department of Electronics and Communication engineering was held online on 11.08.2020 at 03:00PM via gotomeeting platform to finalize curriculum for the semesters III, IV, V, VI, VII and VIII of R19(Autonomous) regulation as well as finalizing the syllabus for III and IV semesters.

The following members were present:

S.No.	Name of the BoS Member	Designation	Signature
1	Prof.M.Y.Bhanu Murthy	Chairman, Prof & HoD ECE	
2	Dr.N.Balaji	University Nominee and External BoS Member	
3	Dr.B.Anuradha	Subject Expert and External BoS Member	
4	Dr.P.V.Subbaiah	Subject Expert and External BoS Member	
5	Dr.K.Giri Babu	Dean of Academics, Member	
6	Dr.P.Ammi Reddy	Professor, Member	
7	Dr.M.R.N.Tagore	Professor, Member	
8	Dr.Sk.Enaul Haq	Assoc.Professor, Member	
9	Mr.G.V.Satya Kumar	Assoc.Professor, Member	
10	Mr.Sk.Riyazuddien	Assoc.Professor, Member	

At the onset of the meeting, the Chairman of BOS, Dr M.Y.Bhanu Murthy, welcomed all the members and introduced internal BOS members to external BOS members. The meeting began with presentation of curriculum by chair for semesters III, IV, V, VI, VII and VIII. He then presented the syllabus of all subjects of III and IV semesters prepared by internal BOS members.

General Comments

1. The python programming subject is included in semester III as per the recommendation of Training and Placement cell.
2. The BOS members unanimously agreed to change title of the subject 'Linear and Digital Integrated Circuits' to Linear IC applications' in semester VI.
3. Dr. P.V.Subbaiah enquired about internal and external evaluation procedures. Dr. P.Ammi Reddy explained the norms being followed at VVIT.
4. Dr. P.V. Subbaiah has asked to include edition and year of publication for the recommended text books for each subject.
5. The external BOS members expressed their satisfaction towards the contents for each subject prepared by internal BOS members.
6. Dr. K. Giri Babu informed the BOS members that the syllabus of core subjects is framed for the sake of GATE and competitive exams mostly.
7. The external BOS members gave their consent to the department to offer Minor Degree Program for II B.Tech ECE students upon receiving permission from JNTUK.

Curriculum related Comments

1. External BOS expert Dr. N.Balaji has proposed to include P-N-P-N devices in Electronic devices and Circuits.
2. External BOS expert Dr. B.Anuradha opined to include PLA,PAL and PROM design in Digital Circuits and Logic Design
3. Based on the advise of External BOS expert Dr. B.Anuradha, the internal BOScommittee has agreed to limit Boolean Expression simplification using K-Mapup to 4 variables.

4. The committee decided to use MATLAB or equivalent software to conduct the Signals and Systems laboratory. Also it is resolved to avoid built-in functions as much as possible while conducting laboratory.
5. External BOS expert Dr. N.Balaji has suggested to include Engineering Electronic Workshop along with Electronic Devices Laboratory.
6. Dr.K.Giri Babu has proposed to opt for online virtual labs during the I semester of 2020-21 until college reopens.
7. External BOS expert Dr.B.Anuradha advised to replace the word 'study' with 'design' in the names of laboratory experiments.
8. External BoS expert Dr. N. Balaji suggested the committee to include applications of sequential circuits in the "Digital System Design with VHDL" and recommended a textbook "Digital System Design with FPGA: Implementation using Verilog and VHDL " authored by CemUnsalan, Bora Tar McGraw Hill Education, 2017" to be placed in the curriculum.
9. In reply to the suggestion of Dr.N.Balaji about the introduction of Digital ICs in the subject Digital System design (DSD), the chairman has given the clarification about its inclusion in the respective units of syllabus along with coding.
10. As far as DSD with VHDL laboratory is concerned, it has been mentioned that the VHDL code of some simple ICs like decoder are to be included.
11. External BoS expert Dr. N. Balaji also recommended the committee to include two or three application oriented hardware experiments in the laboratory.
12. Based on the suggestions of external BOS member Dr. P.V.Subbaiah, the committee has resolved to rearrange the order of Professional Electives.
13. To provide better assistance to students appearing for placements, GATE and other competitive exams, the committee unanimously approved following changes in R-19 curriculum.

    (i) Control Systems will be dealt in semester IV instead of semester V.

    (ii) Antennas and Wave Propagation is moved to semester V from semester VI.

    (iii) Managerial Economics & Financial Analysis, Management Science subject are placed in semester VI & VII instead of IV and V.

(iv) Computer Networks will be dealt in semester V instead of semester VI.

(v) The professional electives 1, 2 and 3 are accommodated in semester VI and professional electives 4 and 5 are accommodated in semester VII.

14. After due deliberations, the external BOS committee accepted the syllabus of Network Analysis and Transmission Lines, Signals and Systems, Random Variables and Stochastic Processes, Analog Circuits, Electromagnetic fields and Waves, Control Systems and Analog and Digital Communications without any changes.

Resolutions in Meeting

Agenda 1: To discuss and finalize the course structures of III,IV,V, VI, VII and VIII B.Tech of R-19 (Autonomous) Regulations.

Resolutions: Course Structure of B.Techprogramme of R-19 (Autonomous) Regulations is approved by BoS.

Encl: **Annexure –I**

Agenda 2: To discuss and finalize the course Contents of proposed III and IV semesters of R-19(Autonomous) Regulations

Resolutions: After due Consultations and the suggestions of BoS experts, the proposed course contents of III and IV semesters are finalized.

Encl: **Annexure-II**

(BoS Chairman)

Dept. of ECE

ANNEXURE-I: Course Structure of B.Tech R-19(autonomous) regulations.

Structure of B.Tech (ECE) program

S.No.	Category	Suggested Breakup of Credits by AICTE (Total 160)	Breakup of Credits
1	Humanities and Social Sciences including Management courses	12	12
2	Basic Science courses	25	24
3	Engineering Science courses including workshop, drawing, basics of electrical/ mechanical/ computer etc	24	24
4	Professional core courses	48	55
5	Professional Elective courses relevant to chosen specialization/ branch	18	18
6	Open subjects – Electives from other technical and /or emerging subjects	18	12
7	Project work, seminar and internship in industry or elsewhere	15	15
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	Non-Credit	Non-Credit
Total		160	160

FIRST YEAR

SEMESTER - I

S.No	Course Code	Name of the Course	L	T	P	C
1	**BS01**	Mathematics – 1	2	1	0	3
2	**BS02**	Applied Physics	3	0	0	3
3	**HSM01**	Communicative English-1	3	0	0	3
4	**ES01**	Programming for Problem Solving using C	3	0	0	3
5	**ES02L**	Comp. aided Engg Graphics	0	0	3	1.5
6	**BS02L**	Physics Lab	0	0	3	1.5
7	**HSM01L**	Communicative English-1Lab	0	0	3	1.5
8	**ES01L**	Programming for Problem Solving using C Lab	0	0	3	1.5
9	**MC01**	**Indian Constitution**	3	0	0	0
Total Credits						18.0

BS: 3+3+1.5 =7.5; HS: 3 +1.5 = 4.5; ES: 3 + 1.5 + 1.5=6.0

SEMESTER - II

S.No	Course Code	Name of the Course	L	T	P	C
1	**BS03**	Mathematics – 2	2	1	0	3
2	**BS04**	Mathematics -3	2	1	0	3
3	**BS05**	Engineering Chemistry	3	0	0	3
4	**ES03**	Basic Electrical Engineering	3	0	0	3
5	**ES04**	Data Structures	2	0	0	2
6	**ES05L**	Engineering Workshop	0	0	3	1.5
7	**BS05L**	Engineering Chemistry Lab	0	0	3	1.5
8	**ES03L**	Basic Electrical Engineering Lab	0	0	3	1.5
9	**ES04L**	Data Structures Lab	0	0	3	1.5
10	**HSM02L**	Communicative English-2Lab	0	0	3	1.5
11	**MC**	**Environmental Science**	0	0	0	0
Total Credits						21.5

BS: 3 + 3 + 3 + 1.5 = 10.5; HS = 1.5 , ES: 3 + 2 + 1.5 + 1.5 + 1.5 = 9.5

SECOND YEAR

SEMESTER - III

S.No	Course Code	Name of the Course	L	T	P	C
1	**BS06**	Complex Variables and Statistical Methods	2	1	0	3
2	**EC01**	Electronic Devices & Circuits	3	0	2	3
3	**EC02**	Signals and Systems	2	1	0	3
4	**EC03**	Digital Circuits and Logic Design	3	0	2	3
5	**ES06**	Network Analysis & Transmission Lines	3	0	0	3
6	**ES07**	Python Programming	2	0	0	2
7	**MC03**	Essence of Indian Traditional Knowledge	2	0	0	0
8	**EC01L**	Electronic Devices & Circuits Lab	0	0	3	1.5
9	**EC02L**	Signals and Systems Lab	0	0	3	1.5
10	**ES07L**	Python Programming Lab	0	0	3	1.5
Total Credits						21.5

EC: 3+3+3+1.5+1.5 = 12 , BS = 3 , ES:3+2+1.5 = 6.5

SEMESTER - IV

S.No	Course Code	Name of the Course	L	T	P	C
1	**BS07**	Random Variables & Stochastic Processes	3	0	0	3
2	**EC04**	Analog Circuits	3	0	0	3
3	**EC05**	Electromagnetic Fields & Waves	3	0	0	3
4	**EC06**	Digital System Design with VHDL	2	0	0	2
5	**EC07**	Analog & Digital Communications	3	0	0	3
6	**ES08**	Control Systems	2	0	0	2
7	**EC05L**	Analog Circuits Lab	0	0	3	1.5
8	**EC06L**	Analog & Digital Communications Lab	0	0	3	1.5
9	**EC07L**	Digital System Design with VHDL Lab	0	0	3	1.5
Total Credits						20.5

BS = 3 , ES = 2 , EC: 3+3+2+3+1.5+1.5+1.5 = 15.5

THIRDYEAR

SEMESTER -V

S.No	Course Code	Name of the Course	L	T	P	C
1	**EC08**	Linear IC Applications	3	0	0	3
2	**EC09**	Micro Processors & Micro Controllers	3	0	0	3
3	**EC10**	Antennas & Wave Propagation	3	0	0	3
4	**EC11**	VLSI Design	3	0	0	3
5	**OE01**	Open Elective – 1	3	0	0	3
6	**EC12**	Computer Networks	3	0	0	3
7	**EC08L**	Linear IC Applications Lab	0	0	3	1.5
8	**EC09L**	Micro Processors &Micro Controllers Lab	0	0	3	1.5
9	**EC11L**	VLSI Design Lab	0	0	3	1.5
Total Credits						22.5

OE = 3, EC = 3 + 3 + 3 + 3 + 3 + 1.5 + 1.5 + 1.5 = 19.5

SEMESTER - VI

S.No	Course Code	Name of the Course	L	T	P	C
1	**EC13**	Digital Signal Processing	3	0	0	3
2	**HSM03**	Managerial Economics & Financial Analysis	3	0	0	3
3	**PE01**	Elective -1	3	0	0	3
4	**PE02**	Elective – 2	3	0	0	3
5	**PE03**	Elective –3	3	0	0	3
6	**EC13L**	Digital Signal Processing Lab	0	0	3	1.5
7		*Mini Project*	0	0	6	3
Total Credits						19.5

EC: 3 + 1.5 = 4.5, HSM = 3, PE: 3 + 3 + 3 = 9 , Mini Project = 3

FOURTH YEAR

SEMESTER - VII

S.No	Course Code	Name of the Course	L	T	P	C
1	**EC14**	Microwave Engineering	2	0	0	2
2	**HSM04**	Management Science	3	0	0	3
3	**PE04**	Elective-4	3	0	0	3
4	**PE05**	Elective – 5	3	0	0	3
5	**OE02**	Open Elective-2	3	0	0	3
6	**EC14L**	Microwave Engineering Lab	0	0	3	1.5
7		*Project Stage – 1*			8	4
Total Credits						19.5

HSM = 3, EC: 2 + 1.5 = 3.5, PE: 3 + 3 =6, OE = 3, Project Stage-1 = 4.

SEMESTER - VIII

S.No	Course Code	Name of the Course	L	T	P	C
1	**PE06**	Elective - 6	3	0	0	3
2	**OE03**	Open Elective - 3	3	0	0	3
3	**OE04**	Open Elective - 4	3	0	0	3
4		*Project Stage - 2*	0	0	16	8
Total Credits						17

PE = 3, OE = 3 + 3 = 6, Project Stage-2 = 8

Professional Electives

Elective - 1	Elective - 2	Elective - 3	Elective - 4	Elective - 5	Elective - 6
Cellular & Mobile Communication	Optical Communications	Satellite Communications	Information Theory & Coding	Cognitive Radio	Radar Engineering
ASIC Design	Low Power VLSI	Analog IC Design	CPLD & FPGA	MEMS	Scripting Languages
Machine Learning	Embedded System Design & Robotics	Embedded & Real Time Operating Systems	Internet of Things	DSP Processors & Architectures	Deep Learning
Digital TV Engineering	Bio-Medical Electronics	Speech Signal Processing	Image & Video Processing	DSP Processors & Architectures	Multimedia Processing

Open Electives

Open Elective- I	Open Elective- II	Open Elective- III	Open Elective- IV
OOPS Through Java	Neural Networks and Fuzzy Logic	Operating Systems	Database Management Systems
MATLAB for Engineering Applications	Energy Auditing	Advanced Control Systems	Programming Logic Controllers
Total Quality Management	Supply Chain Management	Product Design & Development	Entrepreneurship
Disaster Management	Environmental Pollution and Control	Green Buildings	Remote Sensing & GIS Applications

ANNEXURE-II: Syllabus of III and IV semester of R-19 regulations.

VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY

NAMBUR-522508 ANDHRA PRADESH, INDIA

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

R-19 Syllabus for ECE – w. e. f. 2019 – 20

SECOND YEAR COURSE STRUCTURE
(AUTONOMOUS)

SEMESTER – III

S.No	Course Code	Name of the Course	L	T	P	C
1	19SHT301	Complex Variables and Statistical Methods	2	1	0	3
2	19ECT301	Electronic Devices and Circuits	3	0	0	3
3	19ECT302	Signals and Systems	2	1	0	3
4	19ECT303	Digital Circuits and Logic Design	3	0	0	3
5	19ECT304	Networks and Transmission Lines	3	0	0	3
6	19CST304	Python Programming	2	0	0	2
7	19ECL301	Electronic Devices and Circuits Lab	0	0	3	1.5
8	19ECL302	Signals and Systems Lab	0	0	3	1.5
9	19CSL304	Python Programming Lab	0	0	3	1.5
10	19SHN301	Essence of Indian Traditional Knowledge	2	0	0	0
Total Credits						21.5

Detailed Syllabus of the Courses

S.No.	Course Code	Name of the Course	L	T	P	C
1	19SHT301	Complex Variables and Statistical Methods (Common to ECE, EEE, CE and ME)	2	1	0	3

Pre-Requisites:

1. Calculus
2. Partial Differentiation
3. Multiple Integration
4. Set Theory

Course objectives: The student should be able to

1. Familiarize the complex variables.
2. Familiarize the students with the foundations of probability and statistical methods.
3. Equip the students to solve application problems in their disciplines.

Unit No	Contents	Mapped CO
I	**Functions of complex variable and complex integration: (05 hrs)** Introduction – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne- Thompson method. **Complex integration: (05 hrs)** Line integral – Cauchy"s integral theorem – Cauchy"s integral formula. (all without proofs).	CO1
II	**Series expansions and Residue Theorem: (05 hrs)** Radius of convergence – Expansion in Taylor"s series, Maclaurin"s series - Laurent"s series. **Types of singularities: (05hrs)** Isolated – pole of order m – Essential – Residues – Residue theorem (without proof)	CO2

III	**Probability, Distributions and Sampling Theory: (07 hrs)** Probability-Baye‟s theorem-Random variables-Discrete and Continuous random variables-Distribution function-Mathematical Expectation and Variance **Application approach: (07 hrs)** Binomial, Poisson and Normal distributions, Population and samples-Sampling distribution of Means -Point and Interval estimations, **Applications: Maximum error of estimate – Bayesian estimate**	**CO3**
IV	**Test of Hypothesis: (14 hrs)** Introduction–Hypothesis-Null and Alternative Hypothesis-Type I and Type II errors-Level of significance-One tail and two-tail tests- Tests concerning one mean and two means (Large and Small samples)-Tests on proportions. **Applications: Chi-square test and F-test on small samples.**	**CO4**
V	**Curve fitting and Correlation: (12 hrs)** Method of least squares-Straight line-Parabola-Exponential-Power curves-Correlation-Correlation coefficient-Rank correlation-Regression coefficient and properties-Regression lines. **Multiple regressions**	**CO5**
Advanced topics in this course: Unit-3: Maximum error of estimate – Bayesian estimate. Unit-4: Chi-square test and F-test on small samples. Unit-5: Multiple regressions.		

Course Outcomes: Upon successful completion of the course, the student will be able to

CO1: Cauchy-Riemann equations to complex function in order to determine whether a given continuous function is analytic (**Apply**)

CO2: The differentiation, integration of complex functions used in engineering problems and make use of Cauchy residue theorem to evaluate certain integrals (**Apply**)

CO3: Discrete and continuous probability distributions and design the components of a classical hypothesis test **(Apply & Create)**

CO4: The statistical inferential methods based on small and large sampling tests. **(Analyze)**

CO5: Interpret the association of characteristics and through correlation and regression tools. **(Analyze)**

Text books:

1. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, 11/e (Reprint) 2019, Sultan Chand & Sons Publications.

Reference books:

1. Miller and Freund‟s, Probability and Statistics for Engineers, 7/e, Pearson, 2008.

2. T. K. V. Iyenger, Probability and Statistics, S. Chand & Company Ltd, 2015.
3. Jay I. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.

e- Resources & other digital material:

1. https://www.youtube.com/watch?v=Mwpz1zjPlzI&list=PLbMVogVj5nJS_i8v fVWJG16mPcoEKMuWT (For Complex Variables)
2. https://www.youtube.com/playlist?list=PLiUVvsKxTUr66oLF6Pzirc1EgSst MbRZR (For Complex Variables from 1-13)
3. https://www.youtube.com/watch?v=COI0BUmNHT8&list=PLyqSpQzTE6M_ JcleDbrVyPnE0PixKs2JE (For Probability and Statistics)
4. https://www.youtube.com/watch?v=VVYLpmKRfQ8&list=PL6C92B335BD4 238AB (For Probability and Statistics)
5. https://www.mathsisfun.com/data/standard-normal-distribution- table.html (Information about Normal distribution)
6. https://www.statisticshowto.com/tables/t-distribution-table/(Information about T-distribution)

CO-PO mapping Table with Justification

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations **(High: 3, Medium: 2, Low: 1)**

Mapping	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PSO2
C01		2												
C02		2												
C03	2	1												
C04	1	1												
C05	2	3												

Mapping	Score	Justification
CO1 – PO2	2	Able to analyze and apply Cauchy-Riemann equations to various complex functions in order to determine whether a given continuous function is analytic. This is moderately related.
CO2 – PO2	2	The integration of various complex functions are used in engineering problems. The students able to make use of Cauchy residue theorem to evaluate certain integrals.

CO3 – PO1	2	The knowledge of discrete and continuous probability distributions and finding statistical measurements are useful in solving engineering problems.
CO3 – PO2	1	The discrete and continuous probability distribution helps in solving statistical engineering problems. This is weakly related.
CO4 – PO1	1	The Knowledge of infer the statistical inferential methods based on small and large sampling tests are useful.
CO4 – PO2	1	To analyze engineering problems infer the statistical inferential methods are useful.
CO5 – PO1	2	The knowledge of correlation and regression tools are moderately useful.
CO5 – PO2	3	For quality controlling conclusions by studying correlation and regression tools are strongly useful.

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S.No	Course Code	Name of the Course	L	T	P	C
2	19ECT301	Electronic Devices and Circuits	3	0	0	3

Pre-Requisites: Engineering Physics

Course objectives:

1. To instill the fundamentals of diode operation
2. To understand the implementation of various diode applications
3. To familiarize with the physics and working of transistors
4. To learn how to bias various transistor devices
5. To learn small-signal models of Transistors

Unit No	Contents	Mapped CO
I	**Junction Diode Characteristics (11 Hrs)** Review of semiconductor Physics formation of PN-Junction, Electrical representation, Energy Band Model and Barrier potential (quantitative treatment), Forward and Reverse bias characteristics of PN-junction Diode (Qualitative), Diode current equation, Junction resistance, Diode circuit models, Transition and Diffusion Capacitance. **Special Semiconductor Devices (04 Hrs)** Breakdown mechanisms in diodes, V-I Characteristics of Zener diode, Varactor Diode, Tunnel Diode, LED, photo diode, SCR and UJT.	CO1
II	**Diode Applications (11 Hrs)** Diode as switch, Components of Power Supply, working and Characteristics of Half-wave, Full-Wave and Bridge rectifiers, Working of Full Wave Rectifier with series Inductor , shunt capacitor filters and L , Pi section filters(qualitative), Zener Diode as shunt voltage regulator and design of voltage regulator. Applications of rectifiers and voltage regulators.	CO2
III	**Bi-polar Junction Transistors(BJT) (07 Hrs)** N-P-N and P-N-P transistors structure, Operation of BJT, Early effect, Current equations, Input and Output characteristics of CB, CE and CC, BJT as an Amplifier **Junction Field Effect Transistors(JFET) (04 Hrs)** Junction Field Effect Transistor (JFET) structure, Drain and Transfer Characteristics, Significance of Pinch-Off Voltage, JFET as an amplifier and switch, Comparison of BJT and JFET.	CO3

	Metal-Oxide-Semiconductor Field Effect Transistors (MOSFET) (04 Hrs) Structure of Depletion-MOSFET and Enhancement-MOSFETs, V-I Characteristics of MOSFET, Significance of threshold voltage. **Uni-Junction Transistor(UJT) (01 Hr)** Construction and working of UJT	
IV	**Transistor Biasing (12 Hrs)** Need for Proper Biasing, Q-point stability, Fixed, Collector to Base bias and Voltage Divider biasing for BJT, Emitter Degeneration, Design of Self Biasing circuit, Thermal Stability considerations. Fixed, Voltage Divider biasing for JFET and MOSFETs.	**CO4**
V	**Small Signal Low frequency analysis of BJT and FET amplifiers (12 Hrs)** Small signal low frequency analysis of BJT using h parameter model and r_{π} model. Determination of h-parameters from transistor characteristics, Analysis of CE, CC, CB Amplifiers. Simplified h- parameter model, analysis of CE Amplifier with emitter resistance. Small Signal Model, Analysis of JFET Amplifiers, Analysis of CS, CD JFET Amplifiers.	**CO5**
Advanced topics in this course: Analysis of simple non-linear circuits using BJT and FET, Linearization of non-linear circuits using BJT and FET, Metal-oxide semiconductor capacitor (MOSCAP) and its I-V Characteristics.		

Course Outcomes: Upon successful completion of the course, the student will be able to

CO1: Describe the working of junction diodes and interpret V-I relations **(Understand)**

CO2: Demonstrate the usage of diodes in various applications **(Apply) CO3:**

Explain the working principles of BJTs and FETs **(Understand) CO4: Learn** the art

of biasing of BJTs and FETs **(Apply)**

CO5: Apply the equivalent small signal low frequency models of BJTs and FETS in amplifier analysis **(Analyze)**

Text books:

1. Jacob Millman and Halkias, "Electronic Devices and Circuits", Tata-Mcgraw Hill Second Edition, 2007.

2. Robert L. Boylestead and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education Inc. Eleventh Edition 2013

Reference books:

1. Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits", Oxford University Press, 2004 Edition.
2. D. A. Neaman, "Semiconductor Physics and Devices", Times Mirror High Education Group, Chicago, 1997.
3. Jacob Millman and Halkias, "Integrated Electronics",Tata Mc-Graw Hill, SecondEdition,2009

e- Resources & other digital material:

1. https://nptel.ac.in/courses/117/102/117102061/
2. https://nptel.ac.in/courses/117/102/117102061/
3. https://nptel.ac.in/courses/117/106/117106091/
4. https://nptel.ac.in/courses/108/107/108107142/

CO-PO mapping Table with Justification:

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations **(High: 3, Medium: 2, Low: 1)**

Mapping	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PSO2
C01		3												2
C02	2	2												2
C03		3												3
C04		3												2
C05	2		2											2

Mapping	Score	Justification
CO1-PO2	3	Students have a scope to apply the knowledge natural and engineering sciences to understand the diode operation.
CO2-PO1,PO2	2,2	Students will able to design power supplies and diode based appliances utilizing engineering mathematics and engineering physics.
CO3-PO2	3	Students will be able to understand transport phenomenon in BJT"s and FET using substantiated knowledge gained from engineering sciences.
CO4-PO2	3	Students must rely on high degree of conclusions drawn from engineering sciences to formulate various biasing techniques needed in different transistor amplifier applications using BJT and FET"s.
CO5-PO1,PO3	2,2	Students will be able to design amplifiers based on the knowledge gained from mathematical models and electrical laws.

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S.No	Course Code	Name of the Course	L	T	P	C
3	19ECT302	Signals and Systems	2	1	0	3

Pre-Requisites: Engineering Mathematics-1 and 3 Course

objectives: The student should be able to

1. Describe signals mathematically and understand how to perform mathematical operations on signals and Compute the Fourier series of a set of well-defined signals from first principles.
2. Compute the Fourier transform of a set of well-defined signals and Understand the Nyquist sampling theorem and the process of reconstructing a continuous- time signal from its samples.
3. Perform the process of convolution and correlation between signals and Compute the output of an LTI system given the input and the impulse response through convolution sum and convolution integral.
4. Understand Laplace transforms and their properties for analysis of signals and systems.
5. Understand Z-transforms and their properties for analysis of signals and systems.

Unit No	Contents	Mapped CO
I	**Signals Analysis and Fourier Series** **Signal Analysis (09hr)** Signal definition (continuous and discrete), Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function. Classification of signals. Time operations on signals. Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Closed or complete set of orthogonal functions. **Fourier Series (06hr)** Representation of Fourier series, Dirichlet"s conditions, Properties of Fourier Series, Trigonometric Fourier Series and Exponential/ Complex Fourier Series, Complex Fourier spectrum.	CO1
II	**Fourier Transform and Sampling Theorem** **Fourier Transform (08hr)** Deriving Fourier Transform from Fourier series, Fourier Transform convergence condition, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier	CO2

	Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform. **Sampling Theorem (05hrs)** Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling –Aliasing, Introduction to Band Pass sampling.	
III	**Signal transmission through Linear Time Invariant (LTI) Systems (07hrs)** System definition (continuous and discrete), Classification of Systems, impulse response, transfer function, LTI system response, Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time. **Convolution and Correlation (09hrs)** Concept of convolution, convolution in time and frequency domain properties of Fourier Transform, graphical and analytical convolution, Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Relation between auto correlation function and energy/power spectral density spectrum. Relation between convolution and correlation	**CO3**
IV	**Laplace Transforms (08hrs)** Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence(ROC) for Laplace Transforms, Properties of ROC of Laplace Transform, Properties of Laplace Transform, Relation between LT and Fourier Transform of a signal, Response of LTI system using Laplace Transform, Laplace transform of causal periodic signals, Laplace transform of certain signals using waveform synthesis.	**CO4**
V	**Z-Transforms (08hrs)** Concept of Z- Transform and Inverse Z-Transform, Distinction between Laplace, Fourier and Z -transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Properties of ROC of Z-Transform, Properties of Z-transforms, Inverse Z-transform, Response of LTI system using Z-Transform, Introduction to DTFT, Relationship between Z-Transform and DTFT, Conversion from Laplace transform to Z-transform and vice- versa,	**CO5**

Advanced topics in this course: Fourier Series and LTI systems, Eigen function property of LTI systems, DTFS Introduction, Relationship Discrete Time Fourier Series and Discrete Time Fourier Transform, Solution of LCCDE with initial conditions, Cascade and parallel realization of transfer function.

Course Outcomes: Upon successful completion of the course, the student will be able to

CO1: The student will be able to understand various types of signals mathematically and able to calculate complex Fourier spectrum. **(Understand, Calculate).**

CO2: Analyse the continuous-time signals and continuous-time systems using Fourier transform and **Apply** sampling theorem to convert continuous-time signals to discrete-time signal and reconstruct the original signal from samples. **(Analyse, Apply)**

CO3: Define systems based on their properties and determine the response of LTI system. Understand the concept convolution, correlation, energy spectral density and power spectral density. **(Remember, Understand)**

CO4: Compute Laplace transforms to analyze continuous time signals and systems and understand the concept of region of convergence. **(Compute)**

CO5: Compute Z-transform to analyze discrete-time signals and systems, and understand the concept of region of convergence. **(Compute).**

Text books:

1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H.Nawab, 2nd Edn, PHI, 1997.
3. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2ndEdition,2007

Reference books:

1. Principles of Linear Systems and Signals by B. P. Lathi, 2nd Edition, Oxford publications, 2015.
2. Fundamentals of Signals and Systems- Michel J. Robert, 2nd Edition, MGH International Edition, 2008.
3. Signals and Stochastic Processes by Y Mallikarjuna Reddy and Giri Babu Kande, 1st edition, University Press, 2017.

e- Resources & other digital material:

1. https://nptel.ac.in/courses/108/106/108106163/
2. https://nptel.ac.in/courses/108/104/108104100/
3. https://nptel.ac.in/courses/108/105/108105065/
4. https://nptel.ac.in/courses/117/104/117104074/
5. https://nptel.ac.in/courses/117/101/117101055/
6. https://nptel.ac.in/courses/108/106/108106075/

CO-PO mapping Table with Justification:

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations **(High: 3, Medium: 2, Low: 1)**

	PO1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	2											3
CO2	3	3	2											3
CO3	3	2	3											3
CO4	3	2	2											3
CO5	3	2	2											3

Justification:

Mapping	Score	Justification
CO1-PO1	3	Students can be able to strongly apply concept of orthogonality in signals and Fourier Series to solve complex engineering problems.
CO1-PO2	3	Students can be able to analyze complex engineering problems by using Fourier series.
CO1-PO3	2	Students can be able to design simulation projects using Fourier series.
CO1-PSO2	3	Students can be able to score marks in competitive exams.
CO2-PO1	3	Students can be able to strongly apply Fourier Transform and Sampling process to solve complex engineering problems.
CO2-PO2	3	Students can be able to analyze complex engineering problems by using signal Fourier transform and sampling process.
CO2-PO3	2	Students can be able to design simulation projects using Fourier transform.
CO2-PSO2	3	Students can be able to score marks in competitive exams.
CO3-PO1	3	Students can be able to strongly apply concept of Convolution and Correlation to solve complex engineering problems.
CO3-PO2	2	Students can be able to analyze complex engineering problems by using Convolution and Correlation process to some extent.
CO3-PO3	3	Students can be able to extract signal from noise using correlation.
CO3-PSO2	3	Students can be able to score marks in competitive exams.

CO4-PO1	3	Students can be able to strongly apply concept of Laplace Transform to solve complex engineering problems.
CO4-PO2	2	Students can be able to analyze complex engineering problems by using Laplace Transform up to some extent.
CO4-PO3	1	Students can be able to analyze continuous time systems in terms of stability.
CO4-PSO2	3	Students can be able to score marks in competitive exams.
CO5-PO1	3	Students can be able to strongly apply concept of Z-Transform to solve complex engineering problems.
CO5-PO2	2	Students can be able to analyze complex engineering problems by using Z-Transform up to some extent.
CO5-PO3	2	Students can be able to analyze discrete time systems in terms of stability.
CO5-PSO2	3	Students can be able to score marks in competitive exams.

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S.No	Course Code	Name of the Course	L	T	P	C
4	19ECT303	Digital Circuits and Logic Design (Common to ECE, CSE and IT)	3	0	0	3

Pre-Requisites: Nil

Course objectives: The student should be able to

1. To understand common forms of number representation in digital circuits and Boolean algebra.
2. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems and simplify logic expressions using basic theorems, K-map and Tabular methods.
3. To understand the concept of Combinational logic design and realize logic expressions using MUX and Decoder
4. Illustrate the concept of sequential logic design; analyze the operation of flip- flop and conversion from one flip-flop to another, and application of flip-flop.
5. To impart to student the concepts of sequential machines of digital system.

Unit No	Contents	Mapped CO
I	**Number Systems and Boolean Algebra** **11 Hours** **Number systems:** Introduction to different number system and their conversions, Complement of number system and subtraction using complement method, Floating-Point Representation, Weighted and Non-weighted codes and its Properties, Error detection and correction codes, **Boolean Algebra:** Boolean algebra and logic gates, Basic theorems and properties of Boolean Algebra, Boolean functions, canonical and standard forms, Universal Gates.	CO1
II	**Minimization Methods of Boolean functions** **10 Hours** Minimization of logic expressions by algebraic method, Sum of Products (SOP), Product of Sums (POS), K-Map Method, Don"t Care Combinations, Multilevel NAND/NOR realizations, Prime and essential Prime Implicants, Tabular Method, Prime Implicants Chart, Simplification Rules.	CO2
III	**Combinational Circuits** **13 Hours** Design procedure, Half/full adders, Half / full substractors, Carry look ahead adder, BCD adder, Multiplexer/De- Multiplexer, Encoder / Decoder, Priority encoders, Implementation of Higher - Order Device Using Lower Order devices, Implementation of combinational logic using MUX/Decoder, Magnitude Comparator, Programmable logic devices.	CO3

IV	**Sequential Circuits** **10 Hours** Sequential Circuits Fundamentals: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another. Registers and Counters: Shift Registers Left, Right and Bidirectional Shift Registers, Applications of Shift Registers, Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.	**CO4**
V	**Sequential Machines** **8 Hours** Finite State Machines, Synthesis of Synchronous Sequential Circuits, Mealy and Moore models, Serial Binary Adder, Sequence Detector, Parity bit Generator Synchronous Modulo N – Counters, Finite state machine capabilities and limitations.	**CO5**
Advanced Topics in this Subject: Two Level Logic Minimization Algorithms (branch and bound approach), Arithmetic Circuits Design, Digital System Design, Power Analysis and Technology Integration		

Course Outcomes: Upon successful completion of the course, the student will be able to

CO1: Distinguish the analog and digital systems, apply positional notations, number systems, computer codes in digital systems. **(Remember, Understand, and Apply)**

CO2: Understand the Boolean Algebra theorems, simplify and design logic circuits. **(Understand, Apply, Analyze and valuate)**

CO3: Implement combinational logic circuit design and modular combinational circuits using encoders, decoders, multiplexers and demultiplexers. (**Apply, Analyze, valuate, and create)**

CO4: Understand the basic elements of sequential logic circuits. **(Understand, Apply, Analyze)**

CO5: Design and analyze sequential circuits. **(Apply, Analyze and create) Text books**:

1. Digital Design by M. Morris Mano, Michael D Ciletti, 4th edition, PHI publication, 2008
2. Switching and finite automata theory Zvi. KOHAVI, Niraj. K. Jha, 3rdEdition, Cambridge University Press,2009
3. Switching theory and logic design by Hill and Peterson**,** Mc-Graw Hill TMH edition, 2012.

Reference books:

1. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers, 2016
2. Modern Digital Electronics by RP Jain, 4th edition TMH, 2009
3. Switching Theory and Logic Design by A. Anand Kumar, PHI Learning Pvtltd, 2016.

e- Resources & other digital material:

1. https://nptel.ac.in/courses/117/106/117106086/
2. https://nptel.ac.in/courses/108/105/108105113/
3. https://www.coursera.org/learn/digital-systems
4. https://swayam.gov.in/nd1_noc20_ee70/preview

CO-PO mapping Table with Justification

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations **(High: 3, Medium: 2, Low: 1)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	2							1				3
CO2	3	2	2							1				3
CO3	3	2	2							1				3
CO4	3	2	2							1				3
CO5	3	2	2							1				3

Justification:

Mapping	Score	Justification
CO1-5: PO1	3	Students can be able to strongly apply concept of number theory, Boolean algebra, Logic circuits fundamentals and design combinational and sequential circuits.
CO1-5: PO2	2	Students can be able to problem analyze by using digital logic principles and design digital system.
CO1-5: PO3	2	Students can be able to design digital circuit"s using logic gates.
CO1-5: PO10	1	Its successful completion will provide the necessary foundation for more specialists are learning in digital microelectronics and computer engineering.
CO1-5: PSO2	3	Students can be able to score marks in competitive exams.

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S.No	Course Code	Name of the Course	L	T	P	C
5	19ECT304	Networks and Transmission Lines	3	0	0	3

Pre-Requisites: Basic Electrical Engineering

Course objectives: The student should be able to

1. To make the students capable of analyzing any given electrical network.
2. To solve the given ac circuit with various theorems and methods.
3. To understand the basic concepts on RLC circuits under steady and transient states using time domain and Laplace domain techniques.
4. To understand the two port network parameters and transform two port networks.
5. To analyze the properties of Transmission lines and to understand smith chart usage.

Unit No	Contents	Mapped CO
I	**DC and Sinusoidal Steady State Analysis of Electrical Circuits: DC Analysis (06hr)** Basic mesh and node analysis, solving problems with dependant sources. **Sinusoidal Steady State Analysis (09hr)** Review AC fundamentals, Mesh and Node analysis for AC circuits, Super Position, Thevenin"s, Norton"s and Maximum Power transfer theorem for AC circuits.	
II	**Two Port networks and Magnetically Coupled circuits:** **Two Port Networks (10hr)** Two port parameters, short circuit admittance parameter, open circuit impedance parameters, Transmission parameters, Image parameters and Hybrid parameters. Ideal two port devices, ideal transformer. Tee and Pie circuit representation, Cascade and Parallel Connections. **Coupled Circuits (05hr)** Coupled circuits and dot convention, coefficient of coupling, Analysis of coupled circuits.	CO2
III	**Network Transients** **Transients (15hr)** Source free response in RL, RC, and RLC networks using Time Domain methods, Evaluating initial conditions procedure, DC response in RL, RC and RLC circuits. Laplace transforms method to analyse RL, RC and RLC circuits with step and sinusoidal excitations.	CO3

IV	**Transmission Lines- General Characteristics (10hr)** Transmission Lines, their types and applications, Distributed constants, Transmission line equation, expression for voltage, current and impedance at a point on the line. Secondary Constants, Concept of infinite line, Low-loss transmission lines, impedance on line and related problems.	**CO4**
V	**Transmission Lines- Wave Phenomenon (10hr)** Waves Phenomenon on Transmission lines, concept of reflection and standing waves, definition of reflection coefficient, VSWR and power relations, Transmission lines at high frequencies and applications, properties and applications of smith chart, Single stub Matching and related Problems.	**CO5**
Advanced topics in this course: Network transmission criteria, State Variable representation of electrical circuits and formulating solutions, Transients on transmission lines.		

Course Outcomes: Upon successful completion of the course, the student will be able to

CO1: Apply the mesh and node methods to analyze the behavior of electrical circuits (RLC circuits) under steady state conditions.**(Apply)**

CO2: Learns and gain the knowledge on characteristics of two port network parameters (Z, Y, ABCD, h & g) and solves for parameter for any sort of two port network.**(Understand)**

CO3: Analyze the transient behavior of RLC circuits in detail using time domain and s-domain methods.**(Analyze)**

CO4: Familiarize with the general characteristics of transmission lines by applying the basic circuit laws and concepts. **(Understand)**

CO5: Articulate how the standing wave phenomenon is formed on transmission lines and be able solve the problems of transmission line using Schmidt chart **(Understand)**

Text books:

1. Hayt, Kemmerly and Durbin "Engineering Circuit Analysis", 4th edition, Tata McGraw-Hill, 2013.
2. Charles K Alexander and Mathew N O Sadiku, "Fundamentals of Electric Circuits", 6th edition Tata McGraw-Hill, 2016.
3. Y. Mallikarjuna Reddy "Electromagnetic Waves and Transmission Lines", 1st edition, University Press, 2015.
4. Matthew N.O. Sadiku, "Elements of Electromagnetics", 7th edition, Oxford Univ. Press, 2018.

Reference books:

1. John D. Ryder "Networks, Lines and Fields", 2nd edition, PHI, 1978.
2. Edminister "Electric Circuits – Schaum"s Outline Series", 5th edition McGraw-Hill, 2017
3. Umesh Sinha, Satya Prakashan "Transmission Lines and Networks", Tech. India publications, 2010.
4. Ravish R., Network Analysis and Synthesis, 2nd edition, McGraw-Hill, 2019.

e- Resources & other digital material:

1. https://nptel.ac.in/courses/108/104/108104139/
2. https://nptel.ac.in/courses/108/105/108105159/

CO-PO mapping Table with Justification:

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations **(High: 3, Medium: 2, Low: 1)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3													2
CO2	3	2												2
CO3	3	2												3
CO4	3	3												2
CO5	3	2												2

Justification:

Mapping	Score	Justification
CO1-PO1	3	Students have a scope to apply the knowledge natural and engineering sciences, vectors and trigonometry to solve both the dc and ac electrical circuit problems using network theorems.
CO2-PO1, PO2	3,2	Students will gain the understanding of two port parameters and transformation between two-port parameters for which basic engineering laws like KCL, KVL, mesh and Node Analysis.
CO3-PO1, PO2	3,3	Students will be able to solve the transient networks with the aid of basic working of resistor, inductor and capacitor working as well as mathematical models such as calculus i.e. finding natural and forced solution of first and second order differential equation. The study of transient analysis for various types of forces will also be better understood for students with the help of usage of Laplace Transform.
CO4-PO1	3,3	Students must rely on solutions and conclusions obtained from lumped parameter analysis to analyze distributed networks like transmission lines. Students also strongly recommended to be familiar with all laws of circuit theory to find impedance of transmission lines with different types of loads
CO5-PO1, PO2	3,2	Students will be able to design stubs and various high frequency transmission lines based on the knowledge gained from electrical laws and physical behavior of inductors and capacitors at high frequencies.

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S.No	Course Code	Name of the Course	L	T	P	C
6	19CST304	Python Programming (Common to EEE and ECE)	2	0	0	2

Pre-Requisites: Nil

Course objectives: The student should be able to

1. To introduce the concepts of Python programming and build scripts using python language constructs, and control structures.
2. To impart knowledge of data structures in python and their application in real- time scenarios.
3. To introduce the concept of reusability using functions.
4. To introduce the concepts of OOPs in python programming.
5. To develop the concepts of interfacing hardware modules and building real-time systems using python and Raspberry Pi.

Unit No	Contents	Mapped CO
I	**Introduction to Python (16hrs)** **Introduction**: History of Python, Need of Python Programming, Introduction to Object-oriented Programming, Comparison with Modular Programming, Python Programming Basics, Sample programs, Data types and operators, Strings and Characters, Control statements, Expressions and order of evaluation, Arrays	
II	**OOPS &Data Structures (12hrs)** **OOPS:** Introduction, OOPs principles, Classes, Objects, Functions, Arguments & their types. Self variables and static keyword, Constructor Overloading, Lambda functions. **Data Structures**: Lists - Operations, Slicing, Methods; Tuples. Sets, Dictionaries, Sequences, Comprehensions	CO2
III	**Inheritance, Exceptions& Modules (14hrs)** **Inheritance:** Introduction, Types of Inheritance, Overriding, Access modifiers, Abstract Classes, Interfaces. **Exception Handling:** Error Vs Exception, Exception handling in python, Exception Hierarchy, usage of try, catch, throw. User Defined Exceptions. **Modules:** Creating modules, import statement, from. Import statement, name spacing, Using Python Packages like OS, Math, Date time, Regular Expressions.	CO3

IV	**Data & File Handling (10hrs)** **Data Handling:** Math, Numpy Library, scipy and Matplotlib - Loading the library and importing the data, How Mat plot lib works, modifying the appearance of a plot, Plotting multiple plots, Modifying the tick marks, Scatter plots, Bar plots. **File Input Output:** Introduction to files, File I/O handling – File Operations, Random Access file**.**	**CO4**
V	**Interfacing with Raspberry Pi (14hrs) Python programming on Raspberry Pi ::** Basic features, Raspberry Pi2B, Raspberry Pi3B, Raspberry Pi3B+ and Raspberry Pi4B, System setup and booting – Steps involved in making the raspberry pi board ready for use. Introduction to Raspbian Operating system, basic commands – Creating, deleting files, directories, listing files and directories, Python IDE on Raspberry Pi, Accessing the board, Basic I/O – Reading analog, digital inputs. **Interfacing with Raspberry Pi:** Purpose of datasheets, Interfacing – LED, 7-segment display, Ultrasonic sensor, Passive Infrared (PIR) sensor, interfacing a camera module with Raspberry Pi. (Programming using Python)	**CO5**

Course Outcomes: Upon successful completion of the course, the student will be able to

CO1: Identify the basic python constructs with a view of using them in problem solving.**(Remember, Understand, and Apply)**

CO2: Apply control structures and use python lists in examples of problem solving.**(Understand, Apply, Analyze and Evaluate)**

CO3: Explore the utility of functions in modular programming using python. (**Apply, Analyze, valuate, and create)**

CO4: Apply the concepts of Object Oriented Programming to solve the real-time problems. **(Understand, Apply, Analyze)**

CO5: Interface hardware components with Raspberry Pi using Python APIs. **(Understand, Apply, Analyze and create) Text**

books:

1. R. Nageswara Rao, "Core python programming", 2nd Edition, Dreamtech, 2017.
2. Python Programming using problem solving Approach by Reema Thareja, 1st Edition, Oxford University Higher Education, 2017
3. Povel Solin, Martin Novak, "Introduction to Python Programming", NC Lab Public Computing, 2013.
4. Programming the Raspberry Pi: Getting Started with Python, 2nd Edition, Simon Monk, 2015.

Reference books:

1. Jacob Fredslund, "Introduction to Python Programming" 2007.
2. Y. Daniel Liang, "Introduction to programming using python", 1st Edition Pearson, 2017.
3. Bill Lubanovic, "Introducing Python - "Modern Computing in Simple Packages", 1st Edition, O„ReillyPublication, 2015.
4. Mark Summerfield, "Programming in Python 3" 2nd Edition, Pearson Education, 2010.
5. Magnus Lie Hetland, "Beginning Python –From Novice to Professional", APress Publication, 2017.

e- Resources & other digital material:

The official Raspberry Pi Beginner‟s Guide How to use your new computer, Gareth Halfacree. Available Online: https://www.raspberrypi.org/magpi-issues/Beginners_Guide_v1.pdf.

CO-PO mapping Table with Justification:

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations **(High: 3, Medium: 2, Low: 1)**

	PO1	PO 2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	1	-	3	-	-	-	-	-	-	2	3	1
CO2	3	2	1	-	3	-	-	-	-	-	-	2	3	1
CO3	3	2	1	-	3	-	-	-	-	-	-	2	3	1
CO4	3	2	3	-	3	-	2	-	-	-	-	2	3	1
CO5	3	2	3	3	3	-	2	-	-	-	-	2	3	1

Justification:

Mapping	Score	Justification
CO1,2,3: PO"s 1,2,3,5, and 12, PSO1,2	1-3	The Identification of basic python constructs with a view of using them in problem solving includes the knowledge of engineering fundamentals, specialization which analyzes complex engineering problems reaching substantiated conclusions for system components or processes that meet the specified needs by applying appropriate techniques, resources, modern engineering and IT tools for life-long learning in the broadest context of technological change for building the inter disciplinary skills to meet current and future needs of industry and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools.
CO4,5: PO"s 1,2,3,4,5,7 and 12, PSO1,2	1-3	This objective requires conceptual understanding about design and analysis of specific problem which may address an industry or society. Python programming is a modern tool which helps in conceptualizing, modeling, and developing a solution. A complete design requires proper documentation for its sustainable growth over a long run.

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S.No	Course Code	Name of the Course	L	T	P	C
7	19ECL301	Electronic Devices and Circuits Lab	0	0	3	1.5

Course objectives: The student should be able to

1. To study basic electronic components.
2. To observe characteristics of electronic devices

Outcomes: At the end of the course the students can able to

CO1: Measure voltage, frequency and phase of any waveform using CRO. **(Understand)**

CO2. Generate sine, square and triangular waveforms with required frequency and amplitude using function generator. **(Apply)**

CO3. Analyze the characteristics of different electronic devices such as diodes, transistors etc. **(Apply)**

CO4. Apply the diode working principles to design simple circuits like rectifiers, power supplies and amplifiers etc. **(Apply)**

CO5. Design the BJT amplifier circuit for the given operating conditions and specifications. (**Apply)**

Electronic Workshop Practice:

1. Identification, Specifications, Testing of R, L, C Components (Color Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO.

List of Experiments: (Minimum of Ten Experiments has to be performed)

1. V-I characteristics of Junction diode (Both Silicon and Germanium Diodes).
2. V-I characteristics of Zener diode.
3. Half Wave Rectifier with and without Capacitor filter
4. Centre-tap Full Wave Rectifier with and without capacitor filter
5. Bridge Rectifier with and without capacitor filter
6. Zener diode as voltage regulator (design).
7. BJT characteristics (CB-input, output characteristics and measurement of device parameters).

8. BJT characteristics (CE-input, output characteristics and measurement of device parameters).
9. JFET Characteristics (Drain, transfer characteristics and measurement of parameters).
10. MOSFET characteristics (drain, transfer characteristics and measurement of device parameters).
11. JFET/MOSFET voltage-divider bias circuit
12. Design of CE amplifier with self-bias.
13. Design of variable DC power supply (application).

CO-PO mapping Table with Justification:

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations **(High: 3, Medium: 2, Low: 1)**

	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2												2
CO2	3	2												2
CO3	3	2												2
CO4	3	3												3
CO5	3	3												2

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S.No	Course Code	Name of the Course	L	T	P	C
8	19ECL302	Signals and Systems Lab	0	0	3	1.5

Course objectives: Using MATLAB or equivalent software, the student should be able to

1. To observe different signals and operations on signals.
2. To study Fourier Transform/Series and sampling theorem.
3. To study continuous time and discrete time systems.
4. To observe convolution.

Course Outcomes: At the end of the course using MATLAB or equivalent software, the students can able to

CO1: Generate different signals.

CO2: Understand Fourier Transform/Series and process of sampling. CO3: Generate continuous time and discrete time systems.

CO4: Perform convolution.

List of Experiments: (Minimum of Ten Experiments has to be performed)

1. Introduction to Relational Operators, Loops & Functions, Matrix Operations.
2. Exercises on understanding complex numbers, Tylor‟s and Euler‟s series, finding the roots of linear system of equations.
3. Loading and printing/playing/displaying multimedia files.
4. Construction of elementary signals, operations on those signals, synthesis of some deterministic musical notes and the generation of their echo, delay & reverberation.
5. Periodic signals, synthesis of signals using Fourier series and Gibbs phenomenon
6. Fourier transforms and verification of its properties.
7. Sampling, reconstruction, rate conversion and investigation of aliasing effect.
8. Determining the transfer functions of analog filters using Laplace transforms and their analysis using pole-zero plots.
9. Determination of the transfer function of a system constructed by the interconnection of several sub systems
10. Understanding z-transforms and Frequency Responses of a causal discrete- time LTI system implemented using the difference equation.
11. Convolution on Continuous Time Signals with application of smoothing some noisy speech or any one dimensional real signal (data files are to be provided).
12. Filtering Periodic Signals.

CO-PO mapping Table with Justification:

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations **(High: 3, Medium: 2, Low: 1)**

	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1				2	3									
CO2				2	3									
CO3				2	3									
CO4				2	3									
CO5				2	3									

Justification:

Mapping	Score	Justification
CO1-PO4	3	Students can be able analyze different signals and operations on different signals.
CO1-PO5	3	Students can be able to simulate different signals and operations on different signals.
CO2-PO4	2	Students can be able to analyze Fourier Transform/Series and Sampling of signals.
CO2-PO5	3	Students can be able to simulate Fourier Transform/Series and Sampling of signals.
CO3-PO4	3	Students can be able to analyze different systems
CO3-PO5	3	Students can be able to simulate different systems
CO4-PO4	2	Students can be able to analyze convolution of signals
CO4-PO5	3	Students can be able to simulate convolution of signals

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S.No	Course Code	Name of the Course	L	T	P	C
9	19CSL304	Python Programming Lab	0	0	3	1.5

Course objectives: The student should be able to

1. Experiment with scripting language
2. Evaluate expression evaluation, control statements
3. Use Data structures
4. Model Functions, Modules and packages
5. Outline OOP through Python and Exception Handling

Course Outcomes: At the end of the course the students can able to

1. **Comprehend** how software easily to be built right out of the box.
2. **Demonstrates** the use of an interpreted language for problem solving through control statements including loops and conditionals.
3. **Practice** with data structures for quick programming solutions.
4. **Demonstrates** software building for real needs by breaking out code into reusable functions and modules.
5. **Comprehend** the software reliability through exception handling.

Experiments:

Section - A

Exercise 1 - Basics

a) Running instructions in Interactive interpreter and a Python Script

b) Write a program to purposefully raise Indentation Error and Correct it

Exercise - 2 Control Flow

a) Write a Program for checking whether the given number is a even number or not.

b) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . . , 1/10

c) Write a program using for loop that loops over a sequence. What is sequence?

d) Find the sum of all the primes below two million.

e) Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89.

Exercise - 3 - DS

a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure

b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.

Exercise - 4 Files

a) Write a program to print each line of a file in reverse order.

b) Write a program to compute the number of characters, words and lines in a file.

Exercise - 5 Functions

a) Find mean, median, mode for the given set of numbers in a list.

b) Write a function nearly_equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b.

c) Write a function dups to find all duplicates in the list.

d) Write a function unique to find all the unique elements of a list.

Exercise 6 - Multi-D Lists

a) Write a program to perform addition of two square matrices

b) Demonstrate operations on a bank account of a customer. The operations are deposit(), withdraw(), checkbalance(), displayDetails(). Use classes and objects to implement the operations.

c) Demonstrate Single Inheritance in Python with relevant class structure.

Section-B

Problem#1: Pangrams

Roy wanted to increase his typing speed for programming contests. So, his friend advised him to type the sentence "The quick brown fox jumps over the lazy dog" repeatedly, because it is a pangram. (Pangrams are sentences constructed by using every letter of the alphabet at least once.)

After typing the sentence several times, Roy became bored with it. So he started to look for other pangrams.

Given a sentence, tell Roy if it is a pangram or not.

Input Format

Input consists of a string.

Constraints

Length of can be at most and it may contain spaces, lower case and upper case letters. Lower-case and upper-case instances of a letter are considered the same.

Output Format

Output a line containing pangram if is a pangram, otherwise output not pangram.

Sample Input

Input #1

We promptly judged antique ivory buckles for the next prize

Input #2

We promptly judged antique ivory buckles for the prize

Sample Output
Output #1
pangram

Output #2
not pangram

Explanation
In the first test case, the answer is pangram because the sentence contains all the letters of the English alphabet.

Problem# 2: Left Rotation

A left rotation operation on an array of size shifts each of the array's elements unit to the left. For Example, if 2 left rotations are performed on array [1,2,3,4,5], then the array would become [3,4,5,1,2].

Given an array of n integers and a number, d, perform d left rotations on the array. Then print the updated array as a single line of space-separated integers.

Input Format

The first line contains two space-separated integers denoting the respective values of n (the number of integers) and d (the number of left rotations you must perform).

The second line contains n space-separated integers describing the respective elements of the array's initial state.

Constraints

$1<=n<<10^5$

$1<<d<<n$

$1<<a_i<<10^6$

Output Format

Print a single line of space-separated integers denoting the final state of the array after performing d left rotations.

Sample Input

5 4

1 2 3 4 5

Sample Output

5 1 2 3 4

Explanation

When we perform d=4 left rotations, the array undergoes the following sequence of changes:

[1,2,3,4,5]→ [2,3,4,5,1]→ [3,4,5,1,2] →[4,5,1,2,3] →[5,1,2,3,4]

Thus, we print the array's final state as a single line of space-separated values, which is 5 1 2 3 4.

Problem#3: Time Conversion

Given a time in 12-hour AM/PM format, convert it to military (24 -hour) time.

Note: Midnight is12:00:00AM on a 12-hour clock, and 00:00:00 on a 24-hour clock. Noon is 12:00:00 PM on a 12-hour clock, and 12:00:00 on a 24-hour clock.

Input Format

A single string containing a time in 12-hour clock format (i.e.: hh:mm:ss AM or hh:mm:ss PM), where 01<=hh<12 and 00<=mm, ss<=59.

Output Format

Convert and print the given time in 24-hour format, where 00<=hh<=23

Sample Input

07:05:45PM

Sample Output

19:05:45

Section – C

(Students must perform any 5 experiments from the following list)

1. Design and implement a system that measures the distance between an object and current position using Raspberry Pi 4B.
2. Design and implement a system that can detect and alert movement of an object/person using Raspberry Pi 4B.
3. Design and implement a system that measures the temperature of the room using Raspberry Pi 4B.
4. Interface an LED and a 7-Segment display to a Raspberry Pi 4B board.
5. Interface a relay switch to Raspberry Pi board and demonstrate its operation.
6. Interface a camera module and store an image/video in a specific location on Raspberry Pi 4B board.

CO-PO mapping Table with Justification:

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations **(High: 3, Medium: 2, Low: 1)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1			3	2	2				2				2	
CO2	2	3	2	2	2				2				2	
CO3	3	3	3	3	2				2				2	
CO4	3	3	3	3	2				3				1	1
CO5			3	2	2				2				2	

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S.No	Course Code	Name of the Course	L	T	P	C
10	19SHN301	Essence of Indian Traditional Knowledge	2	0	0	0

Pre-Requisites: Nil

Course objectives: To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system**.**

1. The course aim of the importing basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledge system
2. To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act 2003.
3. The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge and protection.
4. To know the student traditional knowledge in different sector.

Unit No	Contents	Mapped CO
I	Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge	CO1
II	Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.	CO2
III	Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act); B:The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.	CO3
IV	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional	CO4

	knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.	
V	Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.	**CO5**

Course Outcomes: Upon successful completion of the course, the student will be able to

CO1: understand the concept of Traditional knowledge and its importance

CO2: Know the need and importance of protecting traditional knowledge.

CO3: Understand legal framework of TK, Contrast and compare the ST and other traditional forest dwellers

CO4: Know the various enactments related to the protection of traditional knowledge.

CO5: Understand the concepts of Intellectual property to protect the traditional knowledge

Text books:

1. Traditional Knowledge System in India, by Amit Jha, 2009
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.
3. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002
4. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino

e- Resources & other digital material:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

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