Department of Electronics Engineering

Minutes of Online Board of Studies Meeting of Electronics Engineering held on 24.05.2024

The Board of Studies (BoS) meeting of the Electronics Engineering department was held on 24th May 2024 at 11:00 AM onwards. Following external and internal members have attended online meeting through google link : https://meet.google.com/ojh-rdsd-gqj .

1. Dr. R.B Pachori, Professor, IIT-Indore, External Member
2. Dr. Ashutosh Datar, Professor, SATI-Vidisha, RGPV-Nominee
3. Dr. Jyoti Singhai, Professor, MANIT-Bhopal, External Member
4. Mr. Saurabh Kumar, MD, Hitsavi Ent, Noida, Industry Representative
5. Mr. Yasho Vijay Singh Yadav, Scientist, CSIR, Alumni Member
6. Dr. P.K Singhal, Professor
7. Dr. Vandana Vikas Thakare, Professor & Head
8. Dr. Laxmi Shrivastava, Professor
9. Dr. R. P. Narwaria, Assistant Professor
10. Dr. Karuna Markam, Assistant Professor
11. Prof Madhav Singh, Assistant Professor
12. Prof Pooja Sahoo, Assistant Professor
13. Prof D K Parsedia, Assistant Professor
14. Dr. Vikas Mahor, Assistant Professor
15. Dr. Rahul Dubey, Assistant Professor
16. Dr. Deepak Batham, Assistant Professor
17. Dr. Hemant Choubey, Assistant Professor
18. Dr. Varun Sharma, Assistant Professor
19. Dr. Shubhi Kansal, Assistant Professor
20. Prof. Prateek Bhadauria, Assistant Professor
21. Prof. Rachit Jain, Assistant Professor
22. Dr. R. Jenkin Suji, Assistant Professor
23. Dr. Pawan Dubey, Assistant Professor
24. Dr. Tej Singh, Assistant Professor
25. Dr. Vikram, Assistant Professor
26. Dr. Vibha Tiwari, Assistant Professor
27. Dr. Priyanka Garg, Assistant Professor
28. Dr. Nookala Venu, Assistant Professor
29. Mr. Manoj Kumar, Assistant Professor

Agenda of the BoS Meeting

Courses where revision was carried out*

(Course/subject name)	Course Code	Year/Date of introduction	Year/Date of revision	Percentage of content added or replaced	Agenda Item No.	Page No.	Link of relevant documents/minutes
Digital Signal Processing	2140520	2023	24-05-2024	15%	Item 9	59	**Annexure XVI**

Courses focusing on employability/entrepreneurship/ skill development*

(Course/subject name)	Course Code	Activities/contents which have a bearing on increasing skill and employability	Agenda Item No.	Page No.	Link of relevant documents/minutes
Digital Image Processing	140751	Exploring generative adversarial networks (GANs) for image synthesis and enhancement.	Item3	17	**Annexure II**
Microwave Engineering	140754	Gain proficiency in simulation tools like ADS (Advanced Design System), HFSS, CST Microwave Studio, and MATLAB.	Item3	17	**Annexure II**
Fundamental of Wireless Communication	140761	Gain knowledge of wireless communication standards like GSM, CDMA, LTE, 5G, Wi-Fi, Bluetooth, and Zigbee.	Item3	17	**Annexure II**
Fiber Optic Communication Technology	140762	Gain expertise in testing and measuring optical fiber networks using tools such as Optical time-domain reflectometers(OTDRs),Optical power meters and Optical spectrum analyzers.	Item3	17	**Annexure II**

		libraries like TensorFlow,PyTorch and Scikit learn.			
Analysis and Design Principles of Microwave Antennas	140755	Hands-on experience with industry-standard simulation and design software (e.g., HFSS, CST Microwave Studio, MATLAB).	Item3	17	**Annexure II**
Real Time Digital Signal Processing	140764	Testing and validating DSP systems, including performance measurement, debugging, and compliance with industry standards.	Item3	17	**Annexure II**

New Courses added*

(Course/subject name)	Course Code	Activities/contents which have a bearing on increasing skill and employability	Agenda Item No.	Page No.	Link of relevant documents/minutes
Stochastic Processes	140716	Data Analysis,Probability modelling and hypothesis testing using tools like R,SAS or SPSS.	Item-4	23	AnnexureIII

Feedback on curriculum received from stakeholders: Analysis& ATR*

Stakeholder	Student	Faculty	Alumni	Employer
No. of responses	23	18	32	12
Link of Analysis	https://rb.gy/o6e7ln https://rb.gy/gpkb8a	https://rb.gy/dctnvb	https://shorturl.at/91x9j	https://bit.ly/3yPQDNl

ATR Link	https://shorturl.at/yPy6U	https://rb.gy/10scx2	https://shorturl.at/rXYku	https://bit.ly/4dXr6lv
Link showing Excel sheet of Google Form details of stakeholders	https://shorturl.at/IOD2F	https://rb.gy/xo7c4i	https://shorturl.at/f6Rlq	https://bit.ly/4c0cobA

BoS Agenda Items

Item 1

To confirm the minutes of previous BoS meeting held in the month of December 2023.
The minutes of previous BOS held on 29 Nov 2023 has been finalized.

Item 2

To review and finalize the **scheme structure of B.Tech. VII Semester** with the provision of *Three (03) Departmental Electives (DEs) and Open Category (OC) Course*. **(Out of which One (01) Elective and o1 Open category course is to be offered in traditional mode** and **remaining Two (02) Departmental Electives are to be offered in online mode** with credit transfer **for the batch admitted in 2021-22**.

Scheme Structure of B.Tech VII Semester with provision of Three Departmental Electives and One Open Category courses has been discussed and finalized. AnnexureI

Item 3

To propose the list of courses which the students can opt from SWAYAM/NPTEL/MOOC based Platforms, to be offered in **online mode for Two (02) Departmental Electives** (DE) Course, with credit transfer in the B.Tech. VII Semester under the flexible curriculum (Batch admitted in 2021-22).

The list of course which the students can opt from SWAYAM/NPTEL/MOOC based platforms, to be offered in online mode under department elective (DE) course, with credit transfer in the VII Semester under the flexible curriculum has been discussed and finalized. AnnexureII

S.No	Category Code	Course Code	Name of The course
1	DE-3	**140751**	Digital Image Processing
2		**140754**	Microwave Engineering
3		**140755**	Analysis and Design Principles of Microwave Antennas
1	DE-4	**140761**	Fundamental of Wireless Communication
2		**140762**	Fiber Optic Communication Technology

	3		**140764**	Real Time Digital Signal Processing

Item 4

To prepare and finalize the syllabus of courses to be offered ***(for batch admitted in 2021-22)*** under ***Departmental Elective (DE) Course*** (in traditional mode) for B. Tech. ***VII Semester*** along with their COs .

Following subjects have been finalized as Departmental Electives to be offered through traditional teaching mode and the syllabi are given in AnnexureIII

S. No	Category	Subject Code	Subject Name
1	DE-II	140711	Satellite & Radar Communication
2	DE-II	140715	Embedded Systems Design
3	DE-II	140716	Stochastic Processes

Item 5

To prepare and finalize the syllabus of courses to be offered (**for batch admitted in 2021-22**) under the **Open Category (OC) Courses** (in traditional mode) for B.Tech. VII semester students of other departments along with their Cos

The syllabus of courses to be offered *(for batch admitted in 2021-22)* under the *Open Category (OC) Courses* (in 20 traditional modes) for B.Tech. *VII semester* students of other departments along with their COs has been discussed and finalized. AnnexureIV

S. No	Category	Subject Code	Subject Name
1	OC-II	910218	Mobile Communication and 5G Standard
2	OC-II	910217	Consumer Electronics

Item 6

To review and finalize the Experiment list/ Lab manual for Departmental Laboratory Course (DLC) to be offered in B. Tech. VII semester ***(for batches admitted in 2021-22).***

The Experiment list/ Lab manual for Departmental Laboratory Course (DLC) to be offered in B.Tech. VII semester has been finalized and approved by BOS members AnnexureV

S. No	Category	Subject Code	Subject Name
1	DLC	140703	Creative Problem Solving
2	DLC	140704	Embedded Systems Design

Item 7

To propose the list of "Additional Courses" which can be opted for getting an

(i) Honours (for students of the host department)
(ii) Minor Specialization (for students of other departments)

These courses will be offered through SWAYAM/NPTEL/MOOC based Platforms for the B.Tech. VII semester students (for the batch admitted in 2021-22) and for B.Tech. V semester (for the batch admitted in 2022-23)

AnnexureVI

Semester	Hons/Minor	Domain	Subject Name
V	Honors	Communication and Signal Processing	1. Principles and Techniques of Modern Radar Systems 2. Stochastic Control & Communication
		VLSI Design	1. Hardware modeling using Verilog 2. Analog VLSI Design
		Nano-Technology	1. Nano-Technology, Science and Application 2. Microelectronics: Devices to Circuits
	Minors	Control & Sensor Technology	1. Control System
		Communication and Signal Processing	1. Introduction to Wireless and Cellular Communications
VII	Honors	Communication and Signal Processing	1. Introduction To Adaptive Signal Processing 2. Stochastic Control & Communication
		VLSI Design	1. VLSI Interconnects 2. Analog VLSI Design 3. VLSI Design flow(RTL to GDS)
	Minors	Control & Sensor Technology	1. Design of Photovoltaic Systems
		Communication and Signal Processing	1. Microwave Engineering

Item 8

To review and finalize the ***scheme structure of B.Tech. V Semester under*** the flexible curriculum (***Batch admitted in 2022-23***).

The scheme structure of B.Tech. V Semester under the flexible curriculum (Batch admitted in 2022-23) has been discussed and finalized. Annexure VII

Item 9

To review and finalize the syllabi for all ***Departmental Core (DC) Courses*** of B. Tech. ***V Semester (for b*atch admitted in 2022-23)** under the flexible curriculum along with their COs.

The syllabi for all Departmental Core (DC) Courses of B.Tech. V Semester (for batch admitted in 2022-23) under the flexible curriculum along with their COs has been discussed and finalized. AnnexureVIII

S.No	Category	Subject Code	Subject Name
1	DC	2140511	Data Science
2		2140512	Mobile Communication & 5G Network
3		2140515	VLSI Design
4		2140519	Electromagnetic Theory
		2140520	Digital Signal Processing

Item 10

To review and recommend the Experiment list/ Lab manual for all the Laboratory Courses to be offered in B. Tech. ***V Semester (for batch admitted in 2022-23).***
The Experiment list/ Lab manual for all the Laboratory Courses to be offered in B.Tech.V semester **(for batch admitted in 2022-23) has been discussed and finalized. AnnexureIX**

S. No	Category	Subject Code	Subject Name
1	DC	2140511	Data Science
2	DC	2140512	VLSI Lab
3	DLC	2140516	Minor Project-I

Item 11

To review and recommend the list of projects which can be assigned under the 'Skill based mini-project' category in various laboratory components based courses to be offered in B.Tech. **V Semester *(for the batch admitted in* 2022-23*)***.

The skill based mini projects for various laboratory courses to be offered in V semester has been discussed and finalized. **AnnexureX**

Item 12

To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered ***(for batch admitted in 2022-23)*** in online mode under ***Self-Learning/ Presentation***, in the B.Tech. ***V Semester.***
The list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered ***(for batch admitted in 2022-23)*** in online mode under ***Self-Learning/ Presentation***, in the B.Tech. ***V Semester*** has been discussed and finalized. **AnnexureXI**

S. No	Semester	Subject Category	Subject Name	Duration (weeks)
1	V	Self Learning	Demystifying Networks	04
2			Basics of Software defined Radios and Practical applications	04
3			Foundation of Cognitive robotics	04

Item 13

To review and finalize the ***scheme structure of B.Tech. III Semester under*** the flexible curriculum (***Batch admitted in 2023-24***).
The scheme structure of B.Tech. III Semester under the flexible curriculum (Batch admitted in 2023-24) has been discussed and finalized. AnnexureXII

Item 14

To review and finalize the syllabi for all Departmental Core (DC) Courses of ***B. Tech. III Semester*** (for **batch admitted in 2023-24**) under the flexible curriculum along with their COs.
The syllabi for all Departmental Core (DC) Courses of B.Tech. III Semester (for batch admitted in 2023-24) under the flexible curriculum along with their COs has been discussed and finalized
AnnexureXIII

	S. No	**Category**	**Subject Code**	**Subject Name**
	1	**DC**	**3140320**	**Analog Communication**
	2		**3140322**	**Analog Integrated Circuits**
	3		**3140323**	**Communication Networks**
	4		**3140324**	**Data Communication**

Item 15

To review and recommend the list of experiments and skill-based mini projects of ***B.Tech. III semester*** **(**for **batch admitted in 2023-24) .**

The Experiment list/ Lab manual for all the Laboratory Courses to be offered in B.Tech.III semester ***(for batch admitted in 2023-24) has been discussed and finalized.*** **AnnexureXIV**

S. No	**Category**	**Subject Code**	**Subject Name**
1	**DC**	**3140320**	**Analog Communication**
2		**3140322**	**Analog Integrated Circuits**
3		**3140321**	**Hardware Lab**

Item 16

To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered in the ***B.Tech .III Semester (for batches admitted in 2023-24)*** in online mode under ***Self-Learning/ Presentation.*** **AnnexureXV**

S. No	**Semester**	**Subject Category**	**Subject Name**	**Duration (weeks)**
1	**III**	**Self Learning**	**C Programming and Assembly language**	**04**
2			**Fundamentals of Electronics Device Fabrication**	**04**
3			**Python for Data Science**	**04**

Item 19

To review and recommend the ***Scheme structure &Syllabi*** of **PG Programme** (M.E./M.Tech./MCA/MBA) along with their Course Outcomes (COs).

Not applicable

Item 20

To review and recommend the ***Scheme structure and Syllabus*** of **Ph.D. Course Work** (specific to Doctoral Research Scholars, if any).

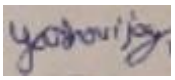
	Not applicable
Item 21	To review the CO attainments, to identify gaps and to suggest corrective measures for the improvement in the CO attainment levels for all the courses taught during **July-Dec 2023 session**. https://shorturl.at/3yYgi The review of the CO attainments, gaps and corrective measures for the improvement in the CO attainment for the courses taught in July-December 2023 has been finalized as per the discussion with BOS members.
Item 22	To review the PO attainments levels and suggest the actions to be taken for improvement in PO attainment https://shorturl.at/Sgw4O The PO attainment of 2019-2023 batch with attainments level and gap analysis has been discussed and finalized.
Item 23	To review and finalize the CO-PO mapping matrix for all the courses to be taught in July-Dec 2024. https://shorturl.at/Jorip CO-PO mapping matrix with attainments and gap analysis has been discussed and finalized.
Item 24	To review curricula feedback from various stakeholders, its analysis and impact https://shorturl.at/1Zsnk Curricula feedback from various stakeholders includes students, faculty, employer and alumni has been discussed and action taken report has been finalized.
Item 25	Any other matter. Target level of PO attainment was level 2.2 from July 2018. After review the PO attainment of last three pass-out batch (batch 2022, 2023 & 2024) the new target level for PO attainment is increased and set to the level 2.3 for next pass-out batch in year 2024.

The following suggestions were provided by the external BOS members:

1. **As per the suggestion given by external members, syllabus of Digital Signal Processing has been modified**
2. **As suggested by the external member, the list of experiments of Creative Problem Solving and Embedded System Design Lab has been modified.**

Dr. R.B Pachori **Professor, IIT Indore** **(External member)**	**Dr. Ashutosh Datar** **Professor, SATI, Vidisha** **(External member)**	**Dr. Jyoti Singhai** **Professor, MANIT, Bhopal** **(External member)**

Mr. Saurabh Kumar
MD, Hitsavi Ent, Noida
(Industry Representative)



Mr. Yasho Vijay Singh Yadav
Scientist, CSIR
(Alumni Member)

Dr. P. K. Singhal

Dr. Laxmi Shrivastava

Dr. R. P. Narwaria

Dr. Karuna Markam

Prof Madhav Singh

Prof Pooja Sahoo

Prof D K Parsedia

Dr. Vikas Mahor

Dr. Rahul Dubey

Dr. Hemant Choubey

Dr. Deepak Batham

Dr. Varun Sharma

Dr. Shubhi Kansal

Dr. Pawan Dubey

Dr. Tej Singh

Dr. Vikram

Dr. Vibha Tiwari

Dr. Priyanka Garg

Dr. NookalaVenu

Dr. R. Jenkin Suji

Prof. Prateek Bhadauria

Mr. Manoj Kumar

Prof. Rachit Jain

Dr. Vandana Vikas Thakare
Head of the Department

Annexure I

Item 2

To review and finalize the scheme structure of B.Tech. VII Semester with the provision of **Three (03) Departmental Electives (DEs) and Open Category (OC) Course. (Out of which One (01) Elective and 01 Open category course** is to be offered in traditional mode and remaining Two (02) Departmental Electives are to be offered in online mode with credit transfer for the batch admitted in 2021-22.

Scheme of Examination (B.Tech. Electronics Engineering)
B.Tech. VII Semester *[For batches admitted in Academic Session 2021-22 onwards*

S. N.	Subject Code	Category	Subject Name & Title	Maximum Marks Allotted							MOOCS		Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Online, Offline, Blended)	$$Mode of Exam.
				Theory Slot				Practical Slot											
				End Term Evaluation		Continuous Evaluation		End Sem.	Continuous Evaluation										
				End Sem.	Proficiency in Subject Course	Mid Sem. Exam	Quiz/ Assignment		Lab work & Sessionals	Skill based mini project	Assignment	Exams		L	T	P			
1.	**1407XX**	**DE**	**DE-2**	50	10	20	20	-	-	-			100	3	-	-	**3**	**Blended**	**PP**
2.	**1407XX**	**DE**	**DE -3***	-	-	-	-	-	-	-	25	75	100	3	-	-	**3**	**Online**	**MCQ**
3.	1407XX	**DE**	**DE -4***					-	-	-	25	75	100	3	-	-	**3**	**Online**	**MCQ**
4.		**OC**	**OC-2**	50	10	20	20	-	-	-	-	-	100	3	-	-	3	Blended	PP
6.	**140704**	**DLC**	**Embedded Systems Design lab**	-	-	-	-	60	20	20	-	-	100	-	-	6	3	Offline	SO
7.	**140702**	**DLC**	**SEP/Industry Internship/ Research Internship/ Innovation & Start-up**	-	-	-	-	60	-	-	-	-	60	-	-	4	2	Offline	SO
8.	**140705**	**DLC**	**Creative Problem Solving**	-	-	-	-	25	25	-	-	-	50	-	-	6	3	Offline	SO
			Total	**100**	20	**40**	40	145	**45**	**20**	**50**	**150**	**610**	**12**	**0**	**16**	**20**		
		MAC	**Universal Human Values & professional ethics**	50	10	20	20	-	-	-	-	-	100	2	-	-	**GRADE**	**Blended**	**MCQ**

*** This course must be run through SWAYAM/NPTEL/ MOOC**

Department Electives-2 (DE-2) (1407XX)	Satellite and Radar Communication Systems **(140711)**	Stochastic Processes **(140716)**	Embedded Systems Design **(140715)**
Department Electives-3 (DE-3) (MOOCS) (1407XX)	Digital Image Processing **(140751)**	Microwave Engineering **(140754)**	Analysis and Design Principles of Microwave Antennas **(140755)**
Department Electives-4 (DE-4) (MOOCS)	Fundamental of Wireless Communication	Fiber Optic Communication	Real Time Digital Signal Processing

(1407XX)	**(140763)**	Technology **(140762)**	**(140764)**
Open Course-2 (OC-2)	Mobile Communication and 5G Standard **(910218)**		Consumer Electronics **(910217)**

[$$]**MCQ:** Multiple Choice Question [$$]**AO:** Assignment + Oral [$$]**PP:** Pen Paper [$$]**SO:** Submission + Oral

Honors	Introduction To Adaptive Signal Processing	VLSI Interconnects
Minors	Design of Photovoltaic Systems	Microwave Engineering

Annexure II

Item 3

To propose the list of courses which the students can opt from SWAYAM/NPTEL/MOOC based Platforms, to be offered in **online mode for Two (02) Departmental Electives** (DE) Course, with credit transfer in the B.Tech. VII Semester under the flexible curriculum (Batch admitted in 2021-22).

S.No	Category Code	Course Code	Name of The course	Duration of the Course in weeks	Course Registration		Name of the Mentor Faculty
					Start Date	End Date	
Electronics Engineering							
1	DE-3	**140751**	Digital Image Processing	12	22-07-2024	11-10-2024	Prof. Pooja Sahoo
2		**140754**	Microwave Engineering	12	22-07-2024	11-10-2024	Prof. D. K. Parsediya
4		**140755**	Analysis and Design Principles of Microwave Antennas	8	19-08-2024	11-10-2024	Dr. Varun Sharma
1	DE-4	**140761**	Fundamental of Wireless Communication	8	22-07-2024	13-9-2024	Prof. Madhav Singh
2		**140762**	Fiber Optic Communication Technology	12	22-07-2024	11-10-2024	Dr. R. P. Narwaria
4		**140764**	Real Time Digital Signal Processing	12	22-07-2024	11-10-2024	Dr.Rahul Dubey

Annexure III

Item -4

To prepare and finalize the syllabus of courses to be offered ***(for batch admitted in 2021-22)*** under ***Departmental Elective (DE) Course*** (in traditional mode) for B. Tech. ***VII Semester*** along with their Cos.

S. No	Category	Subject Code	Subject Name
1	DE-II	140711	Satellite & Radar Communication
2	DE-II	140715	Embedded Systems Design
4	DE-II	140716	Stochastic Processes

B.Tech. VII Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
140711	DE	Satellite & Radar Communication	50	10	20	20	-	-	-	100	3	-	-	3

Satellite & Radar Communication (140711)

Course Objective: The main objective of the course is to provide a comprehensive and state of the art knowledge in the area of satellite communication and radar Systems.

Unit I Introduction: Introduction to Satellite Communication, Origin and History of Satellite Communication, Current State of Satellite Communication, Orbital Aspect of Satellite Communication , Orbital Mechanism, Equation of Orbit, Locating Satellite in Orbit , Orbital Elements ,Orbital Perturbation , Frequency Allocations and Applications.

Unit II Space Craft Sub System and Earth Station: Altitude and Orbit Control System , Telemetry Tracking and Commend Power System, Communication Sub System, Earth Station Design , Antenna Tracking, LNA, HPA,RF, Multiplexing Factor Affecting Orbit Utilization, Tracking, Equipment for Earth Station.

Unit III Satellite Link Design: Satellite Link Design, System Noise Temperature and G/T Ratio, Downlink Design, Domestic Satellite System, Uplink Design, Earth Path Propagation Effect, Losses in Link Design.

Unit IV Introduction to RADAR: Principles of RADAR, Radar Frequencies, Pulse RADAR, RADAR Range Equation, RADAR Application, RADAR Cross Section of Targets RADAR Indicator, Noise Figure of Receiver, Mixer Duplexer, Line Pulsar.

Unit V Operational RADAR: MTI RADAR, Delay Line Canceller, Digital Signal Processing, Limitation of MTI RADAR, CW RADAR, FM CW RADAR.

Text Book:

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.
2. RADAR System –Skolnik, 4th Edition, Tata McGraw-Hill, 2006.

References Books:

1. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, 2nd Edition, Pearson Publications, 2003.
2. Satellite Communication - D.C Agarwal, Khanna Publications, 5th Ed, 2007.
3. Satellite Communications – Dennis Roddy, McGraw Hill, 2nd Edition, 1996.

Course Outcomes

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

CO1. **Explain** the terminologies of Satellite Communication
CO2. **Analyze** the working of Earth Station and Space Craft Sub Systems
CO3. **Calculate** the Link Power Budget in Satellite communication.
CO4. **Evaluate** the RADAR performance factors.
CO5. **Distinguish** CW and MTI RADAR.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	3	-	-	-	1	-	3	2	2
CO2	3	2	2	2	1	2	1	2	2	1	1	3	2	2
CO3	3	2	2	2	2	2	1	2	2	1	1	3	2	2
CO4	3	2	1	1	2	3	1	2	2	1	-	3	2	2
CO5	3	2	1	1	-	2	1	1	1	1	-	3	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech. VII Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
140715	DE	Embedded Systems Design	50	10	20	20	-	-	-	100	3	-	_	3

Embedded Systems Design (140715)

Course Objectives: To introduce the basic concepts of microcontroller and to develop assembly language programming skills along with the introduction of microcontroller applications.

UNIT-I: Introduction: Embedded system architecture, classification, challenges and design issues, fundamentals of embedded processor and microcontrollers, Von Neumann/Harvard architectures, CISC vs. RISC, microcontrollers types and their selection, Overview of the 8051 family, architecture, pin description, Flags, Register Banks, Internal Memory Organization, I/O configuration, Special Function Registers, addressing modes.

UNIT II: **Assembly programming and instruction of 8051:** An Overview of 8051 instruction set, Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming.

UNIT III: Introduction to ARM Microcontroller: Introduction to pipelining based processors, applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, exceptions, interrupts, and stack operation.

UNIT IV: Interfacing real world devices with 8051 microcontroller: Memory address decoding, 8051 interfacing with memory, 8051 interface with 8255 PPI and various interfacings like: LCD and Matrix Keyboard interfacing with 8051 microcontroller, ADC, DAC and Temperature Sensor interfacing with 8051 microcontroller, Stepper motor interfacing.

Unit V: Embedded System Design with Arduino Board: Overview of Arduino, Configuration, Interfacing, Board layout, Atmega328 specifications, Interfacing of Arduino with LED, Switches, Light dependent resistor (LDR), PWM, 16*2 LCD, Serial, L293D for motor interfacing, ADC.

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. Mckinlay, “The 8051 Microcontroller and Embedded Systems using Assembly and C” Pearson Education India, 2nd Edition.
2. Shibu K V,” Introduction to Embedded Systems”, Tata McGraw Hill Education Private Limited.

Reference Books:

1. Kenneth Ayal, “The 8051 Microcontroller”, Architecture, Programming and Applications.
2. Subrata Ghoshal, “Embedded Systems and Robots, Projects using the 8051 Microcontroller”.
3. David A Patterson and John L. Hennessy, “Computer Organization and Design ARM edition”.

Course Outcomes:

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

CO1. **Explain** the features of the embedded system and 8051 microcontroller.
CO2. **Develop** programming skill for 8051 microcontroller.
CO3. **Describe** the 32-bit pipelined architecture of ARM microcontroller & their applications.
CO4. **Design** Interfacing circuitry for memory and I/O devices using different interfacing with 8051.
CO5. **Develop** skill in programming for Arduino with different peripherals.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	2	2	1	2	1	2	3	3	2	2
CO2	3	3	3	2	3	3	-	1	1	1	3	3	2	2
CO3	2	2	2	2	3	2	1	-	1	1	1	2	2	2
CO4	2	2	2	1	2	2	-	2	1	1	1	2	2	2
CO5	3	3	3	2	3	3	1	1	1	1	2	3	2	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
140716	DE	Stochastic Processes	50	10	20	20	-	-	-	100	3	-	_	3

Stochastic Processes (140716)

Course Objectives: To understand the concepts of basic probability, random variables,some standard distributions and random process.

Unit I Probability
Introduction, Experiment, Sample Space, Event, Properties of probability, Joint Probability & MAP detection, Conditional probability, Probability of statistically independent events, Bay's theorem.

Unit II Random Variables
Discrete random variable, Continuous random variable, Probability distribution function of discrete random variable, Cumulative distribution function, properties of CDF, CDF for discrete random variables, Probability density function (PDF), properties of PDF, Joint cumulative distribution function, properties of joint CDF, Joint Probability density function, properties of joint PDF, relationship between joint PDF and probability.

Unit III Statistical Average of random variable
Mean value of continuous random variable, Mean value of discrete random variable, Moments and variance, Uniform distribution, Gaussian distribution, Properties of Gaussian PDF, Rayleigh distribution, complementary error function.

Unit IV Random Process
Ensemble averages, time averages, Random process, Stationary and Non stationary random processes, Wide Sense Stationary process, Ergodic process, Gaussian process, sum of random processes.

Unit V Spectral Density Functions
Correlation function, Autocorrelation function, properties of Autocorrelation, Power spectral densities, Energy spectral densities, response of linear systems to random inputs.

Text Books:
1. John G. Proakis and Masoud Salehi, Digital Communications, TataMcGraw-Hill, 5th Edition, 2014.
2. Simon Haykin, Digital Communications, John Wiley India Pvt., Ltd, 2008.
3. Singh, R.P. & Sapre, S.D, "Communication Systems: Analog & Digital", Tata McGraw-Hill, 5th reprint, 2000.

Reference Books:
1. A. Papoulis, and Unni krishna Pillai, "Probability, Random Variables and Stochastic Processes", Fourth Edition, McGraw Hill, 2002.
2. J. Ravichandran, "Probability and Random Processes for Engineers", First Edition, IK International,2015.

Course Outcomes
After the completion of course student will be able to
CO1: Calculate the probability of events.
CO2: Compute the probability distribution for random variables.
CO3: Analyze Statistical Average of random variables.
CO4: Differentiate between stationary and nonstationary random processes.
CO5: Analyze spectral density function.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	2	1	1	1	2	3	1	3	2	1
CO2	3	3	2	2	2	1	1	1	2	3	1	3	2	1
CO3	3	3	2	2	2	1	1	1	2	3	1	3	2	1
CO4	3	3	1	1	2	1	1	1	2	3	1	3	2	1
CO5	3	3	2	2	2	1	1	1	2	3	1	3	2	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Annexure IV

Item 5

To prepare and finalize the syllabus of courses to be offered (**for batch admitted in 2021-22**) under the **Open Category (OC) Courses** (in traditional mode) for B.Tech. VII semester students of other departments along with their Cos.

S.No	Category	Subject Code	Subject Name
1.	OC-2	910218	Mobile Communication and 5G Standard.
2.	OC-2	900217	Consumer Electronics

B.Tech. VII Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
910218	OC	Mobile Communication and 5G Standard	50	10	20	20	-	-	-	100	3	-	-	3

Mobile Communication and 5G Standard (910218)

Course Objective: The objective of the course is to provide an understanding of wireless communication system, its evolution, standards, and comparison of recent technologies and overview of 5G technology.

Unit I: Introduction to cellular mobile systems: Basic Cellular System, Cellular communication infrastructure: Cells, Clusters, Cell Splitting, Frequency reuse concept, Cellular system components, Operations of cellular systems, Handoff/Handover, Channel assignment, Fixed and dynamic, Cellular interferences: Co-Channel and adjacent channel and sectorization.

Unit II: Channel Models: Properties of mobile radio channels – Intersymbol interference – Multipath and fading effects – Interleaving and diversity – Multiple access schemes (TDMA, FDMA, CDMA, SDMA,OFDMA) – Interuser interference – Traffic issues and cell capacity.

Unit III: Modulations techniques for mobile communication: Pulse shaping, Linear and non-linear Modulation techniques, constant envelop modulation, QPSK, MSK, GMSK. Spread spectrum modulation techniques - Direct sequence and Frequency Hopping Spread Spectrum and their applications.

Unit IV: Introduction to modern cellular standards: 2G Architecture such as GSM and CDMA based – 2.5G – GPRS: GPRS and its features –3G standard details such as UMTS – Introduction to LTE, Basic concept of massive MIMO.

Unit V: Overview of 5G Broadband Wireless Communications: 5G potential and applications; Usage scenarios: enhanced mobile broadband (eMBB), ultra reliable low latency communications (URLLC), massive machine type communications (MMTC), D2D communications, V2X communications; Spectrum for 5G and sharing.

Text Books:

1. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", John Wiley & Sons.
2. 4G, LTE-Advanced Pro and The Road to 5G Third Edition, Elsevier publication

Reference Books:

1. V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.
2. T.S. Rappaport ,"Wireless Communications: Principles and Practice", second edition, Prentice Hall publication, 2002.

Course Outcomes:

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

CO1. **Describe** mobile communication system.
CO2. **Compare** multiple access techniques for signal transmission.
CO3. **Analyze** modern cellular standards.
CO4. **Discuss** 5G technology in mobile communication.
CO5. **Ability** to analyze the spectrum management and security in 5G technology.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	2	1	1	-	2	-	2	2	2
CO2	3	2	2	3	2	2	1	-	-	2	2	2	2	2
CO3	3	2	1	1	2	2	1	1	1	1	1	2	2	2
CO4	3	2	2	3	2	2	1	1	1	1	1	2	2	2
CO5	3	2	2	1	2	2	1	1	1	1	1	2	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech. VII Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
910217	OC	Consumer Electronics	50	10	20	20	-	-	-	100	3	-	_	3

Consumer Electronics (910217)

Course objectives: Objective of this course is to make the students understand the technology behind consumer electronics appliances. The units in the course are designed to impart the concepts of Audio Video systems, Television and other domestic appliances like Microwave ovens and air-conditioning system.

Unit I Introduction to Audio Systems: Microphone, Carbon, Crystal and Moving Coil Microphone. Loudspeakers: Permanent Magnet Loudspeaker and its Construction, Introduction to Woofers and it's Operation, Audio System, Anatomy of Hi-Fi System.

Unit II Television System: Elements of Television System, Scanning Process, Persistence of Vision and Flicker, Vertical and Horizontal Resolution. Introduction to LCD and Plasma Display. Introduction to LED TV Technology.

Unit III Landline and Mobile Telephony: Telecommunication Systems, Modulation Techniques: Analog and Digital Methods, Radio System Characteristics, Telephone Receiver and Handset.

Unit IV Cellular and Mobile Communication: Cellular Communications, Transmitting Receiving Antenna, Digital Cellular Phone Block Diagram, Types of Mobile Phones, Cellular Systems.

Unit V Domestic Appliances: Microwave Oven: Microwaves, Transit Time, Magnetrons, Wave Guides, Microwave Oven Block Diagram. Air Conditioning System: Components of Air Conditioning System, All-Water Air Conditioning System, All-Air Air Conditioning System.

Text Book:

1. S. P. Bali, "Consumer Electronics" Pearson Education India, 2nd Edition.

Reference Books:

1. Electronic communication systems by Roy Blake, Thomson Delmar, Cengage Learning, inc; 2nd edition, 2011
2. Color Television by R.R. Gulati, New Age international; Second edition, 2007
3. How Electronic Things Work.& What to Do When They Don't –Robert L. Goodman, TMH, 1998
4. Digital Satellite Television Handbook By Mark E. Long, Newnes; Pap/Cdr edition, 1999.

Course Outcome:

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

CO1. **Describe** various types of Audio Systems.
CO2. **State** the working principle of Television System.
CO3. **Analyze** the operation of a Landline Telephone System.
CO4. **Explain** the working of Cellular and Mobile System.
CO5. **Explain** the working of various Consumer Electronic appliances.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	3	2	2	1	2	1	2	2	2
CO2	3	3	3	1	2	2	2	1	1	1	1	2	2	2
CO3	3	3	3	2	2	3	2	1	2	1	1	2	2	2
CO4	3	3	3	2	2	2	2	2	1	2	1	2	2	2
CO5	3	3	3	2	2	3	2	2	2	2	2	2	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Annexure V

Item 6

To review and finalize the Experiment list/ Lab manual for Departmental Laboratory Course (DLC) to be offered in B. Tech. VII semester ***(for batches admitted in 2021-22).***

S. No	Category	Subject Code	Subject Name
1	DLC	140703	Creative Problem Solving
2	DLC	140704	Embedded Systems Design Lab

B.Tech. VII Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Mark	Lab work & Sessional Marks	Skill based mini project		L	T	P	
140705	DLC	Creative Problem Solving	25	25	-	50	-	-	6	3

Creative Problem Solving (140705/ 200705)

Lab Objective:

The lab comprises two modules each of which students need to finish passing this course. These 02 modules are named as

1. Communication Systems
2. Antenna Design

Tools Required:

Network Simulator, QualNet, CST Design Studio

List of Experiments

Communication Module:

1. Program in NS(network simulator)/QualNet to implement different topology
2. Program in NS(network simulator)/QualNet for connecting multiple routers and nodes and building a hybrid topology
3. Program in NS(network simulator)/QualNet to implement FTP using TCP bulk transfer
4. Program in NS(network simulator)/QualNet for connecting multiple routers and nodes and building a hybrid topology and then calculating network performance
5. To analyse network traces using Wireshark software.

Antenna Module

1. Study and overview of CST simulation tool.
2. Design and Simulation of Microstrip Antenna Using CST Tool.
3. Design and Simulation of Microstrip Transmission Line Using CST Tool.
4. Design and Simulation of Waveguide Using CST Tool.
5. Design and Simulation of Half Wave Dipole Antenna Using CST Tool.

Course Outcomes:

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

CO1. **Write** a program in Network Simulator for various topologies.
CO2. **Design** a network using NS2 or QualNet.
CO3. **Design** an antenna of given specification.

B.Tech. VII Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
140704	DLC	Embedded Systems Design Lab	60	20	20	100	-	-	6	3

Embedded Systems Design Lab (140704)

Course Objectives: The objective of this course is to provide students with hands-on experience in designing, implementing, and testing embedded systems using microcontrollers.

List of Experiments

1. Write an assembly language program to transfer a block of data bytes from source memory to destination memory and demonstrate on 8051 microcontroller board.
2. Write an assembly language program to perform Addition/subtraction of a given number and demonstrate on 8051 microcontroller board.
3. Write an assembly language program to demonstrate conditional bit jump, conditional byte jump, unconditional jump, call and return instructions on 8051 microcontroller board.
4. Write an assembly language program to demonstrate the basic interface between an LCD display and 4 x 4matrix key board and demonstrate on 8051 microcontroller board.
5. Write an assembly language program to implement a basic temperature sensor using an ADC output is displayed on a 2x16 LCD and demonstrate on 8051 microcontroller board.
6. Write an assembly language program to implement the basic wave form generation using DAC, output is displayed on a CRO and demonstrate on 8051 microcontroller board.
7. Write an Arduino IDE program for Blinking an LED with a delay of 2 seconds and demonstrate on 8051 microcontroller Ardunio board.
8. Write an Arduino IDE program for to demonstrate automatic traffic light control using Ardunio board. Turn ON Red LED for 4 seconds, Green LED for 5 seconds, Yellow for 2seconds.
9. Write an Arduino IDE program for Blinking an 5 LEDs with a delay of 2 seconds in a sequence.
10. Write an Arduino IDE program for connecting a servo motor to Arduino board and rotate in clockwise and anti-clockwise direction using switches.

Course Outcomes:

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

CO1. **Develop** 8051 assembly language programming skills for the various arithmetic and logical operations.
CO2. **Demonstrate** interfacing of 8051 microcontroller board with various interfacing devices.
CO3. **Design** Arduino board based automated electronic systems.

Skill based mini project

1. Design and simulate Arduino based Temperature and Humidity monitoring system with DHT22 sensor on Proteus.
2. Design and simulate Arduino Password Based Door Lock System on Proteus.
3. Design and simulate Digital voltmeter using Arduino UNO Range: 0-50 volt Using SIMULINO UNO on Proteus.
4. Design and simulate Automatic Door Open System With Vistor Counter using ARDUINO UNO R3 on Proteus.
5. Design and simulate Arduino based light sensor using LDR on Proteus.

Annexure VI

Item 7

To propose the list of "Additional Courses" which can be opted for getting an

(i) Honours (for students of the host department)

(ii) Minor Specialization (for students of other departments)

These will be offered through SWAYAM/NPTEL/MOOC based Platforms for the B.Tech. ***VII semester students*** *(for the batch admitted in 2021-22) and for* B.Tech. ***V semester*** *(for the batch admitted in 2022-23)*

Semester	Honors / Minor	Domain	Subject Name
V	Honors	Communication and Signal Processing	1.Principles and Techniques of Modern Radar Systems 2.Stochastic Control and Communication 3. Nano-Technology,Science and Application
		VLSI Design	1. Digital VLSI Testing 2. Analog VLSI Tesing 3. Microelectronics:Devices to Circuits
	Minor	Control & Sensor Technology	Control System
		Communication and Signal Processing	Fundamental of Wireless Communications.
VII	Honors	Communication and Signal Processing	Introduction To Adaptive Signal Processing
		VLSI Design	VLSI Interconnects
	Minor	Control & Sensor Technology	Design of Photovoltaic Systems
		Communication and Signal Processing	Microwave Engineering

Category	Semester	Name of the course	Duration of the Course in weeks	Course Registration		Name of the Mentor Faculty
				Start Date	End Date	
Electronics Engineering (V Semester)						
Honors	V	Principles and Techniques of Modern Radar Systems	12	22-07-2024	11-10-2024	Prof Madhav Singh
	V	Stochastic Control and Communication	12	22-07-2024	11-10-2024	
	V	Digital VLSI Testing	08	22-07-2024	11-10-2024	Dr. Varun Sharma
	V	Analog VLSI Tesing	12	22-07-2024	11-10-2024	
	V	Nano-Technology,Science and Application	08	22-07-2024	13-9-2024	
	V	Microelectronics:Devices to Circuits	12	22-07-2024	13-9-2024	
Minors	V	Control System	12	22-07-2024	11-10-2024	Dr. R P Narwaria
	V	Fundamental of Wireless Communications	8	22-07-2024	13-9-2024	Prof Madhav Singh
Electronics Engineering (VII Semester)						
Honors	VII	Introduction To Adaptive Signal Processing	08	19-08-2024	11-10-2024	Dr. Rahul Dubey
	VII	VLSI Interconnects	08	22-07-2024	13-9-2024	Dr. Vikas Mahor
Minors	VII	Microwave Engineering	12	22-07-2024	11-10-2024	Dr. D. K. Parsediya
	VII	Design of Photovoltaic Systems	12	22-07-2024	11-10-2024	Prof. Pooj Sahoo

Annexure VII

Item 8

To review and finalize the ***scheme structure of B.Tech. V Semester under*** the flexible curriculum (***Batch admitted in 2022-23***).

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR
(Deemed University)
(Declared Under Distinct Category by Ministry of Education, Government of India)
NAAC Accredited with A++ Grade

Scheme of Examination (For the Batch Admitted in the Year 2022-2023)

B.Tech. (Electronics Engineering) V Semester *[For batches admitted in Academic Session 2022-23 onwards]*

S. No.	ubject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Offline/ Online)	Mode of Exam.
				Theory Slot				Practical Slot									
				End Sem.		Mid Sem. Exam.	Quiz/ Assignment	End Sem	Lab Work & Sessional	Skill Based Mini Project		L	T	P			
				End Term Evaluation	$Proficiency in subject /course												
1.	2140511	DC	Data Science	50	10	20	20	60	20	20	200	3	-	2	4	Blended	MCQ
2.	2140512	DC	Mobile Communication & 5G Network	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
3.	2140515	DC	VLSI Design	50	10	20	20	60	20	20	200	3	-	2	4	Blended	PP
4.	2140519	DC	Electromagnetic Theory	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
5.	2140520	DC	Digital Signal Processing	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
6.	2140516	DLC	Minor Project-I	-	-	-	-	60	40	-	100	-	-	4	2	Offline	SO
7.	2140517	DLC	Self-learning/ Presentation[#]	-	-	-	-	-	40	-	40	-	-	2	1	Online +Mentoring	SO
8.		CLC	Novel Engaging Course	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO
9.	2140518	DLC	Soft Skill Internship (Institute Level Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
Total				250	50	100	100	290	120	40	950	11	4	16	23		
Additional Courses for obtaining Honors/Minor Specialization by desirous students							Permitted to opt for maximum two additional courses for the award of Honours or Minor specialization										
[#]compulsory registration for one online course using SWAYAM/NPTEL/ MOOC, evaluation through attendance, assignments and presentation																	
10.	1000006	MAC	Disaster Management	50	10	20	20	-	-	-	100	2	-	-	Grade	Blended	MCQ

Honors	1. Principles and Techniques of Modern Radar Systems 2. Stochastic Control & Communication	3. Digital VLSI Testing 4. Analog VLSI Design	1. Nano-Technology, Science and Application 2. Microelectronics: Devices to Circuits
Minors	Control System	Fundamental of Wireless communication	

Annexure VIII

Item 9

To review and finalize the syllabi for all ***Departmental Core (DC) Courses*** of B. Tech. ***V Semester (for b*atch admitted in 2022-23)** under the flexible curriculum along with their COs.

S.No	Category	Subject Code	Subject Name
1	DC	2140511	Data Science
2		2140512	Mobile Communication & 5G Network
3		2140515	VLSI Design
4		2140519	Electromagnetic Theory
		2140520	Digital Signal Processing

B.Tech. V Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
2140511	DC	Data Science	50	10	20	20	60	20	20	200	3	-	2	4

Data Science (2140511)

Course Objective: To equip students with the necessary skills and knowledge to effectively analyze and interpret data using Python, enabling them to make data-driven decisions and contribute to the field of data science.

Unit 1: Need for data science, benefits and uses, facets of data, data science process, Introduction of basics python tool, Setting working Directory, Creating and saving a script file, File execution, removing variables from environment, clearing environment, Commenting script files, Variable creation, Data types and associated operations, Arithmetic and logical operators.

Unit 2: Control structures, loop, Functions, data structures: Lists, Arrays, Tuples, Dictionary, Sets, NumPy library, Data Collection: Getting to know your data, Types of Data, Data collection strategies, Data Pre-processing, Feature engineering, Exploratory Data Analytics.

Unit 3: Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, inferential statistics: hypothesis testing, probability: probability theory, conditional probability, Pandas library, dataframe and dataframe related operations, Reading files.

Unit 4: Data Cleaning and Preparation, Handling Missing Data, Data Transformations using pandas and sklearn library, Removing Duplicates, Replacing Values, Detecting Outliers. Data visualization on different dataset using matplotlib and seaborn libraries, Scatter plot, Line plot, Bar plot, Histogram, Box plot, Pair plot.

Unit 5: Supervised learning: Regression, classification, Linear regression, logistic regression, decision tree, tree creation with entropy and information gain, ID3 algorithm, random forest, naïve bayes theorem, K-nearest neighbor and ensemble methods for solving real world problems, Unsupervised learning: Clustering, Reinforcement learning.

BOOKS AND REFERENCES

1. Mastering python for data science, Samir Madhavan
2. Introduction to linear algebra - by Gilbert Strang
3. Applied statistics and probability for engineers – by Douglas Montgomery
4. Pattern Recognition and Machine Learning, Christopher M. Bishop

COURSE OUTCOMES:

After completing the course, the student will be able to:

- **CO1.** **Analyze** data science basics and apply python for data manipulation
- **CO2.** **Apply** data structure for preprocessing and analysis of data
- **CO3.** **Build** exploratory data analysis for Data Science methods.
- **CO4.** **Apply** data visualization techniques to solve real world problems.
- **CO5.** **Apply** Data Science techniques for solving real world problems.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	3	1	1	1	2	2	3	3	3
CO2	3	3	3	2	3	3	1	1	2	2	2	3	3	3
CO3	3	3	3	2	3	3	2	2	3	2	2	3	3	3
CO4	3	3	3	2	3	3	3	2	3	2	2	3	3	3
CO5	3	3	3	2	3	3	3	2	3	2	2	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech. V Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
2140512	DC	Mobile Communication & 5G Networks	50	10	20	20	-	-	-	100	3	-	-	3

Mobile Communication & 5G Networks (2140512)

Course Objective: The objective of the course is to provide an understanding of wireless communication system, its evolution, standards, and comparison of recent technologies and overview of 5G technology.

Unit I: Introduction to cellular mobile systems: Basic Cellular System, Cellular communication infrastructure: Cells, Clusters, Cell Splitting, Frequency reuse concept, Cellular system components, Operations of cellular systems, Handoff/Handover, Channel assignment, Fixed and dynamic, Cellular interferences: Co-Channel and adjacent channel and sectorization.

Unit II: Channel Models: Properties of mobile radio channels – Intersymbol interference – Multipath and fading effects – Interleaving and diversity – Multiple access schemes (TDMA, FDMA, CDMA, SDMA,OFDMA) – Interuser interference – Traffic issues and cell capacity.

Unit III: Modulations techniques for mobile communication: Pulse shaping, Linear and non-linear Modulation techniques, constant envelop modulation, QPSK, MSK, GMSK. Spread spectrum modulation techniques - Direct sequence and Frequency Hopping Spread Spectrum and their applications.

Unit IV: Introduction to modern cellular standards: 2G Architecture such as GSM and CDMA based – 2.5G – GPRS: GPRS and its features –3G standard details such as UMTS – Introduction to LTE, Basic concept of massive MIMO.

Unit V: Overview of 5G Broadband Wireless Communications: 5G potential and applications; Usage scenarios: enhanced mobile broadband (eMBB), ultra reliable low latency communications (URLLC), massive machine type communications (MMTC), D2D communications, V2X communications; Spectrum for 5G and sharing.

Text Books:

1. Jonathan Rodriguez, “Fundamentals of 5G Mobile Networks”, John Wiley & Sons.
2. 4G, LTE-Advanced Pro and The Road to 5G Third Edition, Elsevier publication

Reference Books:

1. V.K.Garg, J.E.Wilkes, “Principle and Application of GSM”, Pearson Education, 5th edition, 2008.
2. T.S. Rappaport ,“Wireless Communications: Principles and Practice”, second edition, Prentice Hall publication, 2002.

Course Outcomes:

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

CO1. **Describe** mobile communication system.
CO2. **Compare** multiple access techniques for signal transmission.
CO3. **Explain** modulation techniques for mobile communication system.
CO4. **Analyze** modern cellular standards.
CO5. **Discuss** 5G technology in mobile communication.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	2	1	-	-	-	-	-	2	2
CO2	2	2	2	3	1	2	-	-	-	-	-	-	2	2
CO3	2	2	2	2	1	2	1	-	-	-	-	-	2	2
CO4	2	3	2	1	2	2	-	-	-	-	-	-	2	2
CO5	3	2	2	3	2	2	1	-	-	-	-	-	2	3

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech. V Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency in Subject course	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work& Sessional Mark	Skill based mini project		L	T	P	
2140515	DC	VLSI Design	50	10	20	20	60	20	20	200	3	-	2	4

VLSI Design (2140515)

Course objectives: To understand the fundamental properties of digital CMOS logic circuits using basic MOSFET equations and to develop skills for various logic circuits using CMOS design.

Unit I: MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structureand Operation of MOS Transistor (MOSFET), MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small- Geometry Effects, MOSFET Capacitances.

Unit II: MOS Inverters Static Characteristics: Introduction, Voltage Transfer Characteristic (VTC), Noise Immunity and Noise margins, Resistive-Load Inverter, Inverters with n-Type MOSFET Load and CMOS Inverter, DC Characteristics of CMOS Inverter, Calculation of VIL, VIH, VOL, VOH and Vth, Design of CMOS Inverters, Supply Voltage Scaling in CMOSInverters, Power and Area considerations.

Unit III: MOS Inverters Dynamic Characteristics: Switching Characteristics and Interconnect Effects, Switching Characteristics of CMOS Inverter- Delay-Time Definitions, CMOS Propagation Delay, Calculation of Delay times, Power Dissipation-Switching, Short-Circuit and Leakage Components of Energy and Power, Power-Delay Product.

Unit IV: CMOS Logic Structures and Layout Design: Combinational MOS logic circuits- CMOS Logic circuits (NAND, NOR and Complex Logic Gates, Multiplexers etc.), CMOS Transmission Gates (Pass Gates). CMOS n-Well Process, layout design rules, layout design of CMOS Inverter, designing of stick diagram.

Unit V: Semiconductor Memories and Low-Power CMOS Logic Circuits: Semiconductor memories: non- volatile and volatile memory devices, flash memories, SRAM cell design, 1T DRAM cell design, dynamic CMOS logic circuits, domino logic CMOS circuits.

Text Books

1. Sung-Mo Kang & Yusuf Leblebici, “CMOS Digital Integrated Circuits – Analysis and Design”, 3rd Edition, Tata McGraw- Hill, New Delhi, 2003.
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, “Digital Integrated Circuits: a design perspective”, 2nd Edition,Pearson Education, 2003.

Reference Books

1. David A. Hodges, Horace G. Jackson, Resve A. Saleh, “Analysis and Design of Digital Integrated Circuits: In Deep Submicron Technology”, McGraw, 2003.
2. David A. Johns and Ken Martin, “Analog Integrated Circuit Design” John Wiley and Sons Inc., 1997. Neil Weste and David Harris, “CMOS VLSI Design: A Circuits and Systems Perspective”, 4th Edition, Addison-Wesley,2010.

Course Outcomes:

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

CO1. **Analyze** operating modes of CMOS transistors
CO2. **Compute** static characteristic parameters of CMOS inverters.
CO3. **Evaluate** the propagation delay and power dissipation of CMOS inverter.
CO4. **Design** CMOS logic circuit and layout.
CO5. **Compare** Semiconductor memories.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	3	1	-	2	3	1	2	3	3
CO2	3	3	3	3	3	3	1	-	2	2	1	3	3	3
CO3	3	3	3	3	3	3	1	-	2	2	1	3	3	3
CO4	3	3	3	3	3	3	1	-	2	3	1	2	3	3
CO5	3	3	3	2	2	3	1	-	2	3	1	2	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech. V Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Session al Mark	Skill based mini project		L	T	P	
2140519	DC	Electromagnetic Theory	50	10	20	20	-	-	-	100	2	1	_	3

Electromagnetic Theory (2140519)

Course objectives: To develop an understanding of fundamental concepts of electromagnetic fields with an emphasis on wave propagation and to create ability to relate basic electromagnetic concepts to the performance of devices, circuits, and systems.

Unit I Electrostatics: Coulomb‘s Law, Electric field intensity, Electric flux and flux density, Gauss law, Boundary relations, Concept of divergence, Curl, Scalar and vector potential, Divergence theorem, Stokes theorem, Electric field in dielectric and conductor, Continuity equation, Poisson‘s and Laplace‘s equations.

Unit II Magnetostatics: Lorentz force, Magnetic field intensity (H) – Biot–Savart‘s Law– Ampere‘s Circuit Law – H due to straight conductors, Circular loop, Infinite sheet of current, Magnetic flux density (B) –in free space and conductor, Magnetic materials – Magnetization.

Unit III Electrodynamic Fields: Magnetic field in multiple media – Boundary conditions, Scalar and vector potential, Poisson‘s equation, Magnetic force, force between current carrying wires, Magnetic circuits – Faraday‘s law, Displacement current – Maxwell‘s equations (differential and integral form) – for steady, time varying and time harmonic fields.

Unit IV Electromagnetic Wave Equation: General wave equation, Uniform plane wave in free space, Perfect dielectric, Lossy dielectric and conducting medium, Skin depth, Poynting vector and Poynting theorem.

Unit V Polarization and Reflection of Wave: Wave Polarization- linear-elliptic-circular, Reflection of uniform plane waves, Normal incidence and Oblique incidence, Brewster angle, Total internal reflection.

Text Books:

1. Elements of Engineering Electromagnetic Third Edition- N.N. Rao- Prentice Hall, India.
2. Elements of Electromagnetic, Second Edition- Matthew N.O. Sadiku- Saunders coll Publishing.

Reference Books:

1. Fields & Waves in Communication Electronics - S.Ramo, J.R. Whinnery& T. Van Duzer- John Wiley & Sons.
2. Electromagnetic - J.D. Kraus-McGraw Hill.
3. Electromagnetic Waves & Radiating Systems - E.C. Jordan & K.G. Balmain- Prentice Hall.

Course Outcomes:

After successful completion of the course,students will be able to:
CO1. Analyze the concepts of electrostatic fields in practical applications.
CO2. Analyze magnetic fields generated by steady currents and the influence of magnetic materials.
CO3. Apply the maxwell equations to solve problems of time varying fields.
CO4. Analyze electromagnetic wave propagation in different media.
CO5. Analyze polarization and reflection of electromagnetic waves in a practical field.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	3	2	1	2	3	3	3	3	3
CO2	3	3	3	2	2	3	2	1	2	3	3	3	3	3
CO3	3	3	3	3	2	3	2	1	2	3	3	3	3	3
CO4	3	3	3	3	2	3	2	1	2	3	3	3	3	3
CO5	3	3	3	3	2	3	2	1	2	3	3	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech. V Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot				Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks	Skill based mini project		L	T	P	
2140520	DC	Digital Signal Processing	50	10	20	20	-	-	-		2	1	-	3

Digital Signal Processing (2140520)

Course Objectives: Understanding of the fundamental concepts of digital signal processing, designing of digital filters, and brief knowledge about the Multirate digital signal processing.

Unit I Review of Transform Domain Techniques: Review of discrete time signals and systems, Properties and applications of discrete time Fourier transform, Review of Z transform, Analysis of minimum phase, maximum phase and inverse system.

Unit II Discrete Fourier Transform (DFT): Introduction and properties of DFT, Computation of circular convolution using DFT, Decimation in time FFT algorithm, Decimation of frequency FFT algorithm with radix-2, and radix-4.

Unit III Digital Filters (Part-I): Characteristics of practical frequency selective filters, various **s**ignal flow graph structure of IIR filters. **IIR Filter design:** Overview of Butterworth, Chebyshev and Elliptic approximations, Design of discrete time IIR filters using Impulse invariant, and Bilinear transformation methods,

Unit IV Digital Filters (Part-II): Introduction and Signal flow graph structure of FIR Filter.

FIR Filter design: Symmetric, and Asymmetric FIR filters, Design of linear phase FIR filters using windows, and Frequency sampling method.

Unit V Multirate Digital Signal Processing: Introduction, Decimation and Interpolation, Sampling rate conversion by a Rational factor.

Implementation of Sampling rate Conversion: Sampling rate conversion with Cascaded integrator, Comb filters , Polyphase structures for decimation, and interpolation filters, Application of multirate signal processing.

Text Books:

1. John. G. Proakis, “Digital Signal Processing”, 4th Edition, Pearson Education.
2. Oppenheim and Schafer, “Digital Signal Processing”, 2nd Edition, PHI Learning.

Reference Books:

1. Johnny R. Johnson, “Introduction to Digital Signal Processing”, 1st Edition, PHI Learning.
2. Rabiner and Gold, “Theory and Application of Digital Signal Processing”,3rd Edition, PHI Learning.
3. Ingle and Proakis, ”Digital Signal Processing- A MATLAB based Approach”, 3rd Edition, Thompson, Cengage Learning.

Course Outcomes:

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

CO1. **Analyze** discrete-time systems using transform methods.
CO2. **Compute** DFT using FFT algorithms.
CO3. **Design** IIR Filters.
CO4. **Design** FIR Filters.
CO5. **Apply** multi-rate signal processing techniques to design the systems.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	1	1	2	1	1	-	3	3	2
CO2	3	3	3	2	3	1	1	2	1	1	-	3	3	2
CO3	3	3	3	2	3	2	1	2	1	1	1	3	3	2
CO4	3	3	3	2	3	2	1	2	1	1	1	3	3	2
CO5	3	3	3	2	3	2	1	2	1	1	1	3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Annexure IX

Item 10

To review and recommend the Experiment list/ Lab manual for all the Laboratory Courses to be offered in B. Tech. ***V Semester (for b*atch admitted in 2022-23).**

S.No	Category	Subject Code	Subject Name
1	DC	2140511	Data Science
2	DC	2140512	VLSI Lab
3	DLC	2140516	Minor Project-I

B.Tech. V Semester (Electronics Engineering)

Subject Name: Data Science

L	T	P	C
-	-	2	1

Subject Code: 2140511

Course Objective: To equip students with the necessary skills and knowledge to effectively analyze and interpret data using Python, enabling them to make data-driven decisions and contribute to the field of data science.

LIST OF EXPERIMENTS

1. Write a Python Program to perform various arithmetic operations (+, -, * / …) and display the results.
2. Create a List using Python program and perform following operations:
   (a) Reverse the items of the list
   (b) Find consonants and vowels in the list
   (c) Change a particular character/number in the list
3. Write a Python Program to create a Matrix (using Numpy Library) and perform multiplication of two matrices.
4. Write a Python Program to create a Matrix (using Numpy Library) and perform Transpose of a matrix.
5. Write a Python Program to create a Matrix (using Numpy Library) perform inverse of a matrix.
6. Write a Python Program using Pandas Library to perform arithmetic operations on two Pandas Series.
7. Write a Python Program using Pandas Library to join the two given dataframes along rows and assign all data.
8. Write a Python program to generate a Line Plot for random data points using MatPlotLiB Library, also customize line style, color, markers and labels.
9. Write a Python program to generate a Bar Plot for random data points using MatPlotLiB Library, also customize line style, color, markers and labels.
10. Write a Python program to create multiple subplots (for standard functions like sine, cosine…) and display it in a single figure, also customize titles, layouts and axes of subplots.

Course Outcomes:

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

CO1. Write a program in Python.
CO2. Analyze and evaluate datasets using Python for data science tasks.

VLSI Design Lab (2140512)

Course Objectives

To learn the fundamental principles of CMOS VLSI circuit design using SYMICA EDA CAD tool.

List of Experiments:

Digital CMOS logic circuit design using SYMICA CAD tool:

1. Write and simulate basic CMOS logic Gates: AND, OR, NOT.
2. Write and simulate CMOS logic universal gates: NAND and NOR.
3. Write and simulate CMOS logic 2:1 MUX.
4. Write and simulate CMOS logic 2 x 4 Decoder.
5. Write and simulate CMOS logic Half-Adder and Full Adder.
6. Write and simulate CMOS logic RS, JK and D flip-flops.

Gate level design using SYMICA CAD tool:

1. Write and simulate a Verilog program for the following combinational designs: a) 2 to 4 decoder
   b) 8 to 1 multiplexer
   c) 4 bit binary to gray converter
2. Write and simulate a Verilog code to describe the functions of a full adder using three modeling styles.
3. Write and simulate a model for 32 bit ALU.

Course Outcomes

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

CO1. **Demonstrate** a clear understanding in hardware design language Verilog and SPICE.

CO2. Model a combinational circuit using hardware description language Verilog and SPICE Netlist.

CO3. Model a sequential circuit using hardware description language Verilog and SPICE Netlist.

CO4. **Model** a computational circuit using hardware description language verilog and SPICE Netlist.

CO5. Simulate and validate the functionality of the CMOS VLSI circuits using CAD tools.

B.Tech. V Semester (Electronics Engineering)

Departmental Lab Course

L	T	P	C
-	-	2	1

Subject Name: Minor Project-I
Subject Code: 2140516

Course objective

This course gives the basic introduction of electronics hardware system and provides hands-on training with familiarization, identification, testing, assembling, dismantling, fabrication and repairing such system by making use of the various tools and instruments available in the electronics workshop.

List of Exercise/ Experiments

1. Familiarization/Identification of electronics component with specification (Functionally, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electronic-Mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.]
2. Drawing of electronic circuit diagrams using symbols, Interpret data sheets of discrete components and IC's, Estimation and costing.
3. Familiarization/application of testing instruments and commonly used tools. (Multimeter, function generator, power supply, CRO etc.) (soldering iron, De-soldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de-soldering station etc.)
4. Testing of electronic component (Resistor, Capacitor, Diode, Transistor, UJT and JFET using multimeter.)
5. Inter-connecting methods and soldering practices.[Bread board, Wrapping, Crimping, Soldering – types-selections of materials and safety precautions, Soldering practice in connectors and general purpose PCB, Crimping.]
6. Printed circuit board (PCB) [Types, Single sided, Double sided, Processing methods, Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.]

Course Outcomes

After successful completion of the workshop, students will be able to:

CO1. **Identify** electronics components and their testing.

CO2. **Operate** measuring instruments (such as multi-meter) and electronics equipments likes CRO, dual-power tracking power supply & function generator.

CO3. **Design** the electronics circuits on bread-board.

CO4. **Perform** soldering and de-soldering of the circuit components properly.

CO5. **Troubleshoot** a not working electronic circuit and to rectify it.

Annexure X

Item 11

To review and recommend the list of projects which can be assigned under the 'Skill based mini-project' category in various laboratory components based courses to be offered in B.Tech. **V Semester** ***(for the batch admitted in*** **2022-23*)***.

Data Science (2140511)
Skill Based Mini Project

1. Download the IRIS dataset from kaggel and read detail/information, draw boxplot for any column, find mean for all column
2. Download the IRIS dataset from kaggel and read detail/information, draw scatter plot for any column, find median for all column
3. Download the diabetes dataset from kaggel and read detail/information, draw boxplot for any column, find mean for all column
4. Download the diabetes dataset from kaggel and read detail/information, draw scatter for any column, find median for all column
5. Download the ODI men's cricket match data from kaggel and read detail/information, draw boxplot for any column, find mean for all column
6. Download the ODI men's cricket match data from kaggel and read detail/information, draw scatter for any column, find median for all column
7. Load the Toyota dataset from kaggle/Internet, find the correlation between numerical variables and do the plotting pair-wise using SEABORN Library.
8. Load the Diabetes data analysis dataset from Kaggle, find the correlation between numerical variables and do the plotting pair-wise using SEABORN Library.
9. Load the IRIS dataset from Kaggle, find the correlation between numerical variables and do the plotting pair-wise using SEABORN Library.
10. Load the given TITANIC dataset from Kaggle, find the correlation between any two columns values and do the plotting pair-wise using SEABORN Library.
11. Download the IRIS dataset from kaggel and read detail/information, draw boxplot for any column, find mean for all column
12. Download the IRIS dataset from kaggel and read detail/information, draw scatter plot for any column, find median for all column
13. Download the diabetes dataset from kaggel and read detail/information, draw boxplot for any column, find mean for all column
14. Download the diabetes dataset from kaggel and read detail/information, draw scatter for any column, find median for all column
15. Download the ODI men's cricket match data from kaggel and read detail/information, draw boxplot for any column, find mean for all column
16. Download the ODI men's cricket match data from kaggel and read detail/information, draw scatter for any column, find median for all column
17. Load the Toyota dataset from kaggle/Internet, find the correlation between numerical variables and do the plotting pair-wise using SEABORN Library.
18. Load the Diabetes data analysis dataset from Kaggle, find the correlation between numerical variables and do the plotting pair-wise using SEABORN Library.
19. Load the IRIS dataset from Kaggle, find the correlation between numerical variables and do the plotting pair-wise using SEABORN Library.
20. Load the given TITANIC dataset from Kaggle, find the correlation between any two columns values and do the plotting pair-wise using SEABORN Library.

VLSI Design Lab (2140512)

Skill Based Mini Project

1. Design and Verify the 180 nm CMOS based NAND gate on LTSpice.
2. Design and Verify the 180 nm CMOS based NOR gate on LTSpice.
3. Design and Verify the 180 nm CMOS based Half-adder on LTSpice.
4. Design and Verify the 180 nm CMOS based 1-bit Shift Register on LTSpice.
5. Design and Verify the 180 nm CMOS based XOR gate on LTSpice.
6. Design and Verify the 180 nm CMOS based EXNOR gate on LTSpice.
7. Design and Verify the 180 nm CMOS based Full-adder on LTSpice.
8. Design and Verify the 180 nm CMOS based 2-bit Shift Register on LTSpice.
9. Design and Verify the 180 nm CMOS based OR gate on LTSpice.
10. Design and Verify the 180 nm CMOS based AND gate on LTSpice.
11. Design and Verify the 180 nm CMOS based half-substractor on LTSpice.
12. Design and Verify the 180 nm CMOS based 1 bit comparator on LTSpice.
13. Design and Verify the 180 nm CMOS based Inverter on LTSpice and measure the delay at 100 MHz Frequency.
14. Design and Verify the 180 nm CMOS based Inverter on LTSpice and measure the total power dissipation at 100 MHz Frequency.
15. Design and Verify the 180 nm CMOS based full-substractor on LTSpice.
16. Design and Verify the 180 nm CMOS based 2 bit comparator on LTSpice.
17. Design and Verify the 180 nm CMOS based domino logic 2- input NAND gate on LTSpice.
18. Design and Verify the 180 nm CMOS based domino logic 2- input NOR gate on LTSpice.
19. Design and Verify the 180 nm CMOS based domino logic 4- input NAND gate on LTSpice.
20. Design and Verify the 180 nm CMOS based domino logic 2- input NOR gate on LTSpice.

Annexure XI

Item-12

To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered ***(for batch admitted in 2022-23)*** in online mode under ***Self-Learning/ Presentation***, in the B.Tech. ***V Semester.***

S. No	Semester	Subject Category	Subject Name	Duration (weeks)
1	V	Self Learning	Demystifying Networks	04
2			Basics of Software defined Radios and Practical applications	04
3			Foundation of Cognitive robotics	04

Category	Semester	Name of The course	Duration of the Course in weeks	Course Registration		Name of the Mentor Faculty
				Start Date	End Date	
Electronics Engineering (V Semester)						
Self Learning	V	Demystifying Networking	4	22-07-2024	16-08-2024	Dr. Deepak Batham
	V	Basics of Software defined Radios and practical applications	4	22-07-2024	16-08-2024	Dr. Shubhi Kansal
	V	Foundations of Cognitive robotics	4	22-07-2024	16-08-2024	Dr. Vikas Mahor

Annexure XII

Item 13

To review and finalize the ***scheme structure of B.Tech. III Semester under*** the flexible curriculum (***Batch admitted in 2023-24***).

Scheme of Examination (For Batch admitted in Year 2023-24)
B.Tech. (Electronics Engineering) III Semester *[For batches admitted in Academic Session 2023-24 onwards]*

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching (Offline/ Online)	Mode of Exam.
				Theory Slot				Practical Slot									
				End Sem.		Mid Sem. Exam.	Quiz/ Assignment	End Sem	Lab Work & Sessional	Skill Based Mini Project		L	T	P			
				End Term Evaluation	[$]Proficiency in subject /course												
1.	31000025	BSC	Engg Mathematics-II	50	10	20	20	-	-	-	100	2	1	-	3	Offline	PP
2.	3140320	DC	Analog Communication	50	10	20	20	40	30	30	200	2	1	2	4	Blended	PP
3.	3140322	DC	Analog Integrated Circuits	50	10	20	20	40	30	30	200	2	1	2	4	Blended	PP
4.	3140323	DC	Communication Networks	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
5.	3140324	DC	Data Communication	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP
6.	3140321	DLC	Hardware Lab	-	-	-	-	40	30	30	100	-	-	2	1	Offline	SO
7.	3140316	DLC	Self-learning/ Presentation[#]	-	-	-	-	-	40	-	40	-	-	2	1	Online +Mentoring	SO
8.		CLC	Novel Engaging Course	-	-	-		50	-	-	50	-	-	2	1	Interactive	SO
9.	3140317	DLC	Skill Internship Proje (Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
Total				**250**	**50**	**100**	**100**	**290**	**100**	**60**	**950**	**10**	**5**	**14**	**22**		
10.	3000005	Natural Science & Skill	Environmental Engineering	50	10	20	20	-	-	-	100	2	-	-	Grade	Blended	MCQ
11	1000001	MAC	Indian Constitution and Traditional Knowledge	50	10	20	20	-	-	-	100	2	-	-	Grade	Blended	MCQ

[$]**Proficiency in course/subject – includes the weightage towards ability/ skill/ competence /knowledge level /expertise attained /attendance etc. in that particular course/subject**
[#]**compulsory registration for one online course using SWAYAM/NPTEL/ MOOC, evaluation through attendance, assignments and presentation**

Mode of Teaching						Mode of Examination					Total Credits
Theory				Lab	NEC	Theory			Lab	SIP/ SLP/ NEC	
Offline	Online	Blended		Offline	Interactive	PP	A+O	MCQ	SO	SO	
		Offline	Online								
17	0	0	0	4	1	**17**	**0**	**0**	**2**	**3**	**22**
77.27%	0	0	0	18.1%	4.54%	77.27%	0%	0%	9.09%	13.63%	Credits %

Annexure -XIII

Item-14

To review and finalize the syllabi for all Departmental Core (DC) Courses of ***B. Tech. III Semester*** (for **batch admitted in 2023-24**) under the flexible curriculum along with their COs.

S. No	Category	Subject Code	Subject Name
1	DC	3140320	Analog Communication
2		3140322	Analog Integrated Circuits
3		3140323	Communication Networks
4		3140324	Data Communication

B.Tech. III Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
3140320	DC	Analog Communication	50	10	20	20	40	30	30	200	2	1	2	4

Analog Communication (3140320)

Course objective: To understand the concept of modulation, various types of modulation, application, standards, analysis of modulation and demodulation process, probability theory and probability function, and concept of noise.

Unit I: Spectral Analysis: Introduction to signals and classifications, Introduction to Fourier series, Introduction to Fourier Transforms and its properties, Fourier transform of important functions, Autocorrelation, Cross correlation and their properties.

Unit II: Amplitude Modulation: Needs of modulation, Amplitude modulation, SSB, DSB,VSB suppressed carrier modulation, Modulation techniques their generation, detection and spectral analysis, square law modulators, switching modulator, envelope and square law detector, balanced modulator, Power calculation for AM, DSB-SC & SSB-SC.

Unit II Angle Modulation: Relationship between Frequency and phase modulation, frequency and phase deviation, types of FM, comparison between NBFM & AM signal., Carson's rule, spectrum of FM signal, comparison of narrow band and wide band FM, generation of FM.

Unit IV Probability and random variables: Random variable, sample space and events, probability and its properties, cumulative distribution function, probability density function, statistical average, variance, moment, Distributions: Binomial, Poisson, Gaussian and Rayleigh probability density function.

Unit V Noise Analysis: Various sources of noise, types of noise with their characteristics, Mathematical representation of noise figure, Noise bandwidth, Noise temperature and noise figure of amplifiers in cascades, Figure of merit of modulation techniques, comparison of modulation scheme for noise.

Text Books:

1. Communication System: Simon Haykins, Wiley & Sons.
2. Communication Systems - B. P. Lathi, BSP Publication

Reference Books:

1. Electronic Communication System: Kennedy-Devis, Tata McGraw-Hill Education.
2. Modern Digital & Analog Communication System: B.P. Lathi ,Oxford University Press.
3. Principles of Communication System: Taub and Schilling McGraw-Hill Education.

Course Outcomes

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

CO1. **Analyze** the frequency domain representation of various signals.
CO2. **Analyze** amplitude modulated signals, their generation & detection methods.
CO3. **Explain** the generation and detection techniques for frequency modulated signals.
CO4. **Evaluate** the statistical parameters for general PDF/CDF.
CO5. **Evaluate** the effects of noise on modulation techniques.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	1	-	1	2	3	1	2	3	3
CO2	3	3	3	3	3	1	1	1	2	3	1	3	3	3
CO3	3	3	3	3	3	1	1	-	-	3	1	3	3	3
CO4	3	3	3	3	1	-	-	1	2	3	-	2	3	3
CO5	3	3	3	2	2	1	2	1	2	3	1	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech. III Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
3140322	DC	Analog Integrated Circuits	50	10	20	20	40	30	30	200	2	1	2	4

Analog Integrated Circuits (3140322)

Course objective: Students will be able to learn the concepts of operational amplifiers. Further, they will learn to design multi-vibrators using IC 555 and active filter design using Op-amp.

Unit I Differential Amplifiers: Introduction to differential amplifier, Differential gain, Common Mode Rejection Ratio (CMRR), Types of differential amplifier: Dual input unbalanced output, Single input balanced output, Dual input balanced output, Single input unbalanced output.

Unit II Operational Amplifier: Introduction of op-amp, Block diagram, characteristics and equivalent circuits of an op-amp, Power supply rejection ratio for op-amp(PSRR), common-mode rejection ratio (CMRR), Slew rate and its Effect, Input and output offset voltages. Open and Closed loop configuration of Op-amp, Inverting and non-inverting amplifier configurations, Summing amplifier, Integrators and differentiators, Schmitt Trigger, Logarithmic and anti-logarithmic amplifier etc.

Unit III Active Filter Design: Characteristics of filters, Classification of filters, Magnitude and frequency response, 1st and 2nd order Low pass and High pass ,Band pass filters and Band reject filters.

Unit IV Oscillators using OPAMP: Phase shift oscillator, Wien bridge oscillator, Hartley Oscillator, Colpitt's oscillator, crystal oscillator.

Unit V Multivibrator Design using 555 IC: The 555 IC Circuit, 555 IC block diagram, Using the 555 IC as Astable , Monostable and Bistable Multivibrator Circuits and its applications.

Text Books:

1. Electronics Devices and Circuits: Boylested & Nashelsky,11th Edition**,** Pearson Education India
2. Op-Amp and Linear Integrated Circuit: R. A. Gayakwad, 4th Edition, Prentice Hall of India.

Reference Books:

1. Integrated Electronics: Millman & Halkias, 2nd Edition, McGraw Hill Education
2. Electronics Devices and Circuits: Shalivanan, 2nd Edition, Tata Mcgraw Hill Education.
3. Microelectronic Circuits- Theory and Application: Sedra & Smith, 7th Edition**,** Oxford Press.

Course Outcomes

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

CO1. **Analyze** differential amplifier configurations.
CO2. **Design** the applications using Operational amplifier.
CO3. **Design** the active filters based on given specifications using OP-Amp.
CO4. **Design** Oscillator circuits using OPAMP.
CO5. **Design** Multivibrator circuits using IC 555.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	2	2	3	2	2	2	2	2
CO2	3	3	3	3	2	3	2	2	3	2	2	2	2	2
CO3	3	3	3	3	2	3	2	2	3	1	2	2	2	2
CO4	3	3	3	3	2	3	3	2	3	1	2	2	2	2
CO5	3	3	3	3	2	3	2	2	3	2	2	2	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech. III Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks	Skill based mini project		L	T	P	
3140323	DC	Communication Networks	50	10	20	20	-	-	-	100	2	1	_	3

Communication Networks (3140323)

Course objective: To make the students capable of analyzing electrical network and how to synthesize an electrical network from a given impedance/admittance function.

Unit I Basic Parameters of Networks: Characteristic impedance, iterative impedance, Propagation constant, analysis of symmetrical T, π, Lattice and Bridged-T networks, image impedance, attenuators and their design.

Unit II-Network Synthesis: Positive real function, LC, RL, RC and RLC network synthesis, Foster and Cauer form realization , Minimum positive real function, Brune's method, Bott-Duffin method, Insertion Loss Synthesis, and Coefficient matching technique.

Unit III- Passive Filters: Constant K prototype Filters: Low pass, high pass, band pass and band elimination filters, m-derived filters, composite filters, frequency transformation.

Unit IV-.Transmission Line: Voltage and current on a transmission line; characteristic impedance and propagation constant of a transmission line, Lossless & Distortion less line, reflection on a line, Standing wave ratio, and Transient analysis of terminated transmission line.

Unit V- Lines at radio frequency: Dispersion less line, Input impedance of open circuit and short circuit line, power and impedance measurement, λ/8, λ/4, λ/2 lines, Smith chart and application, Single stub matching.

Text Books:

1. Introduction to Modern Network Synthesis: Van Valkenberg, 1st Edition, John Wiley & Sons.
2. Communication Network and Transmission Lines by Bakshi & Bakshi, Technical Publication

Reference Books:

1. Principles of Active Network Synthesis and Design: G. Daryanani,1st Edition, John Wiley & Sons.
2. Network Analysis and Synthesis - F.F. Kuo,2nd Edition, John Wiley & Sons.
3. Networks, Lines, & Fields: J.D. Ryder, 2nd Edition, Prentice Hall of India.
4. Elements of Electromagnetics: Mathew N. O.Sadiku, 3rd Edition, Oxford Publication Press.

Course Outcomes

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

CO1. **Analyze** the electrical properties of different passive networks.
CO2. **Synthesize** the network for a given positive and minimum positive real function.
CO3. **Design** passive filters for the given specifications.
CO4. **Analyze** the characteristics of transmission lines.
CO5. **Calculate** the impedance and SWR graphically and analytically.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	1	2	-	2	2	-	2	3	3
CO2	3	3	3	3	2	1	-	2	2	2	-	3	3	3
CO3	3	3	3	3	2	1	-	1	2	2	2	3	3	3
CO4	3	3	2	2	2	1	1	1	2	2	1	3	3	3
CO5	2	2	2	3	1	1	-	-	2	2	-	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

B.Tech. III Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Proficiency	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
3140324	DC	Data Communication	50	10	20	20	-	-	-	100	2	1	_	3

Data Communication (3140324)

Course objectives: To provide an introduction to fundamental computer network architecture concepts and their applications.

Unit I Introduction to Switching Techniques: Circuit switching, Message switching, Packet switching, Protocols, Layered network architecture and architecture OSI & TCP/IP reference model, Physical layer transmission medium, RS 232 C, Modem, Topologies.

Unit II Data Link Layer: Framing BSC, HDLC. ARQ: Stop and wait, Sliding window, Efficiency, Error detection and Error correction, Hamming codes, Parity checks – CRC, Checksum, HARQ.

Unit III MAC Layer: MAC sub layer – LAN protocols, ALOHA, Slotted and pure ALOHA, CSMA, CSMA/CD, Token bus, Token Ring, TDMA, CDMA, FDMA, Ethernet, Bridge, Router, Gateway, Switch.

Unit IV Network Layer: Routing – Data gram and Virtual Circuit, Distance vector and Link state Routing, Dijkstra's Algorithms, Congestion Control: Leaky bucket algorithm, Slow start, ATM model and ATM traffic management – AAL, X.25, IP layer, IP addressing.

Unit V Transport Layer: Connection oriented transport protocol mechanism, TCP, Transport flow regulation, UDP Segmentation & Reassemble, Session and Transport Interaction, Synchronization, Session protocols, FTP, Remote login.

Text Books:

1. Data Communication & Networking – B.A. Forouzan, Tata Mc-Graw Hill
2. Data and Computer Communication – W. Stallings, Pearson

Reference Books:

1. LANs – Keiser, Tata Mc-Graw Hill
2. Internetworking with TCP/IP – VOL-I – D.E. Comer, PHI
3. ISDN and Broad band ISDN with Frame Relay & ATM – W. Stalling, Pearson

Course Outcome:

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

CO1: Apply various switching techniques in a layered network architecture.

CO2: Analyze protocols and techniques related to the Dynamic Link Layer.

CO3: Explain MAC sub-layer protocols to design and manage efficient LAN.

CO4: Analyze routing algorithms, congestion control mechanisms, and IP addressing techniques.

CO5: Explore transport-layer protocols for flow and error control.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	0	2	1	1	1	3	1	3	3	2
CO2	3	3	2	2	0	1	1	1	2	1	2	3	3	1
CO3	3	1	1	1	0	2	1	1	1	2	1	3	3	2
CO4	3	3	2	2	0	1	2	1	2	1	2	2	3	1
CO5	3	3	1	1	0	1	2	1	2	1	2	2	3	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Annexure XIV

Item 15

To review and recommend the list of experiments and skill-based mini projects of ***B.Tech. III semester*** **(**for **batch admitted in 2023-24) .**

S. No	Category	Subject Code	Subject Name
1	DC	3140320	Analog Communication
2		3140322	Analog Integrated Circuits
3		3140321	Hardware Lab

B.Tech. III Semester (Electronics Engineering)

L	T	P	C
-	-	2	1

Subject Name: Analog Communication
Subject Code: 3140320

Analog Communication - To enable students to understand the fundamental techniques for the transmission, reception, and processing of continuous analog signals using MATLAB.

List of Experiments

1. Perform Fourier transform of continuous time signals.
2. Perform Amplitude modulation and demodulation using MATLAB Software.
3. Perform Amplitude demodulation using MATLAB Software.
4. Perform DSB-SC Modulator using MATLAB Software.
5. Perform DSB-SC Detector using MATLAB Software.
6. Perform SSB-SC Modulator & Detector using MATLAB Software.
7. Perform Frequency modulation using MATLAB Software.
8. Analysis of AM & FM Spectrum using MATLAB Software.

Course Outcomes

After performing experiments students will able to:

CO1. **Execute** modulation and demodulation using MATLAB.
CO2. **Analyze** the waveform of various modulation techniques.
CO3. **Express** the working of DSB and SSB modulator and demodulator.

Skill Based Mini Project

1. Design of Envelope Detector
2. Design of Switching Modulator
3. Design of Balance Modulator
4. Design of Amplitude Modulator
5. Design of DSB-SC Amplitude Modulator
6. Design of SSB-SC Amplitude Modulator
7. Design of Amplitude Demodulator
8. Design of Sinusoidal Signal Generator
9. Design of Square Wave Generator
10. Design of Triangular Wave Generator
11. Design of Sawtooth Wave Generator

12. Design of Signal Multiplier
13. Design of Frequency Modulator
14. Design of Frequency Demodulator
15. Design of Frequency Multiplier Circuit
16. Design of Phase Modulator
17. Design of Voltage Multiplier Circuit.
18. Design of Square Wave Generator using 741 IC
19. Design of Multiplexer circuit
20. Design of De-multiplexer circuit

B.Tech. III Semester (Electronics Engineering)

L	T	P	C
-	-	2	1

Subject Name: Analog Integrated Circuits
Subject Code: 3140322

Course Objective: This course gives the ability to the students to design various Analog Integrated Circuits using OPAMP and 555 timer.

List of Experiments

1. Design of the circuit using IC 741 Op-amp.
   (a) Summer and Subtractor
   (b) Inverting and Non Inverting Amplifier
   (c) Voltage Follower
   (d) Comparator and Schmitt trigger
   (e) Integrator and Differentiator

2. To Design the Multivibrator circuit using 555 timers IC.
   (a) Astable Multivibrator
   (b) Bistable Multivibrator
   (c) Monostable Multivibrator

3. To design RC low pass and high pass filter.

Course Outcomes

After performing experiments students will able to:

CO1. **Design** various applications using Op-amp.
CO2. **Troubleshoot** fabricated circuit individually and in a team.
CO3. **Design** various amplifier circuits.

Skill Based mini project

1. Design an Oscillator using 555 timer IC.
2. Design pulse generator using 555 timer IC
3. Design one bit memory storage element using 555 timer IC.
4. Design frequency divider circuit using 555 timer IC.
5. Design phase lock loop using 555 timer IC.
6. Design logarithmic and antilog operator using 741 IC.
7. Design a DC Volt Polarity Indicator Using IC 741.
8. Design an Active low pass filter using IC 741.
9. Design a 741 IC Tester.
10. Design an automatic Light Operated Switch Using LDR and 741.
11. Design microphone amplifier using 741IC.
12. Design operational amplifier tester.
13. Design triangular wave generator circuit using 741IC.
14. Design square wave generator circuit using 741IC.
15. Design a circuit for Simple Temperature Monitor.

16. Design a circuit for Invisible Burglar Alarm.
17. Design a circuit for Automatic Door Bell Ringer.
18. Design a circuit for electronic fuse.
19. Design a circuit for water sensor alarm.
20. Design a circuit for Flashing Lamps Using 555 Timer.

B.Tech. III Semester (Electronics Engineering)

L	T	P	C
-	-	2	1

Subject Name: Hardware Lab
Subject Code: 3140321

Course Objective: The lab aims to provide hands-on experience in designing and creating printed circuit boards. Students learn about schematic capture, component selection, layout design, and the use of PCB design software tools.

Lab Experiments

1. Introduction to PCB Design software.
2. Design of Low Pass Filter using PCB Design software.
3. Design of High Pass Filter using PCB Design software.
4. Design of Band Pass Filter using PCB Design software.
5. Fabrication of the Regulated Power Supply circuit on PCB.
6. Fabrication of the Half wave Rectifier circuit on PCB.
7. Fabrication of the Full wave Rectifier circuit on PCB.
8. Design hardware model for Half Wave and Full Wave Rectifier without Filter.
9. Design hardware model for Half Wave and Full Wave Rectifier with Filter.
10. Design hardware model for Electronic EYE.

Course Outcomes
After completing the experiments students will be able to

- **CO1. Design** various applications using electronics Components.
- **CO2. Learn** use of sensors, filters and 555 Timers.
- **CO3. Troubleshoot** fabricated circuit individually and in a team.

Skill Based mini project

1. Design hardware model for Simple Rain Water Alarm System.
2. Design hardware model for Flashing Lamps Using 555 Timer.
3. Design hardware model for Night Sensing Light.
4. Design hardware model for Simple Light Sensitivity Metronome Using Transistors.
5. Design hardware model for Simple Temperature Monitor.
6. Design hardware model for Invisible Burglar Alarm.
7. Design hardware model for Automatic Door Bell Ringer.
8. Design hardware model for electronic fuse.
9. Design hardware model for Geyser timer circuit
10. Design hardware model for water sensor alarm.
11. Design a Variable Power Supply With Adjustable Voltage and Current
12. Design a high current Regulated Dc Power supply circuit.
13. Light Dimmer Circuit Using Triac with BTA26 | DB3 | AC Voltage Regulator
14. Design a audio amplifier for home using LM 386 audio amplifier with bass boost
15. Design a Adjustable Battery Charger with Charge Protection
16. Design a Capacitor Dropper Circuit using Transformerless Power Supply
17. Design an Oscillator using 555 timer IC
18. Design pulse generator using 555 timer IC
19. Design one bit memory storage element using 555 timer IC
20. Design a fully Automatic Inverter with Smart Switch Inverter with Battery Charger

Annexure XV

Item 16

To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered ***(for batches admitted in 2023-24)*** in online mode under ***Self-Learning/ Presentation***, in the ***III Semester***

S.No	Semester	Subject Category	Subject Name	Duration (weeks)
1	**III**	**Self Learning**	**C Programming and assembly language**	**04**
2			**Fundamentals of Electronics Device Fabrication**	**04**
3			**Python for Data Science**	**04**

Category	Semester	Name of The course	Duration of the Course in weeks	Course Registration		Name of the Mentor Faculty
				Start Date	End Date	
Electronics Engineering (III Semester)						
Self Learning	III	C Programming and assembly language	4	19-08 - 2024	13-09-2024	Prof Pooja Sahoo
	III	Fundamentals of Electronic Device Fabrication	4	22-07-2024	16-08-2024	Dr. Hemant Choubey
	III	Python for Data Science	4	22-07-2024	16-08-2024	Dr. Rahul Dubey

Annexure XVI

Courses where revision was carried out

(Course/subject name)	Course Code	Year/Date of introduction	Year/Date of revision	Percentage of content added or replaced
Digital Signal Processing	2140520	2023	24-05-2024	15%

New Syllabus*

Digital Signal Processing (2140520)

Course Objectives: Understanding of the fundamental concepts of digital signal processing, designing of digital filters, and brief knowledge about the Multirate digital signal processing.

Unit I Review of Transform Domain Techniques: Review of discrete time signals and systems, Properties and applications of discrete time Fourier transform, Review of Z transform, Analysis of minimum phase, maximum phase and inverse system.

Unit II Discrete Fourier Transform (DFT): Introduction and properties of DFT, Computation of circular convolution using DFT, Decimation in time FFT algorithm, Decimation of frequency FFT algorithm with radix-2, and radix-4.

Unit III Digital Filters (Part-I): Characteristics of practical frequency selective filters, various signal flow graph structure of IIR filters. **IIR Filter design:** Overview of Butterworth, Chebyshev and Elliptic approximations, Design of discrete time IIR filters using Impulse invariant, and Bilinear transformation methods,

Unit IV Digital Filters (Part-II): Introduction and Signal flow graph structure of FIR Filter.

FIR Filter design: Symmetric, and Asymmetric FIR filters, Design of linear phase FIR filters using windows, and Frequency sampling method.

Unit V Multirate Digital Signal Processing: Introduction, Decimation and Interpolation, Sampling rate conversion by a Rational factor.

Implementation of Sampling rate Conversion: Sampling rate conversion with Cascaded integrator, Comb filters , Polyphase structures for decimation, and interpolation filters, Application of multirate signal processing.

Text Books:

3. John. G. Proakis, "Digital Signal Processing", 4th Edition, Pearson Education.
4. Oppenheim and Schafer, "Digital Signal Processing", 2nd Edition, PHI Learning.

Reference Books:

4. Johnny R. Johnson, "Introduction to Digital Signal Processing", 1st Edition, PHI Learning.
5. Rabiner and Gold, "Theory and Application of Digital Signal Processing",3rd Edition, PHI Learning.
6. Ingle and Proakis, "Digital Signal Processing- A MATLAB based Approach", 3rd Edition, Thompson, Cengage Learning.

Course Outcomes:

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

- **CO1.** **Analyze** discrete time system using transform methods.
- **CO2.** **Compute** DFT using FFT algorithms.
- **CO3.** **Design** IIR Filters.
- **CO4.** **Design** FIR Filters.
- **CO5.** **Apply** the concept of multi-rate signal processing in practical applications.

Old Syllabus*

Digital Signal Processing (2140520)

Unit I Review of Transform Domain Techniques: Review of discrete time signals and systems, Properties and applications of discrete time Fourier transform, Review of Z transform, Analysis of minimum phase, maximum phase and inverse system.
Unit II Discrete Fourier Transform (DFT): Introduction and properties of DFT, Computation of circular convolution using DFT, Decimation in time FFT algorithm, Decimation of frequency FFT algorithm with radix-2, and radix-4.
Unit III Digital Filters (Part-I): Characteristics of practical frequency selective filters, Various signal flow graph structure of IIR filters. **IIR Filter design:** Overview of Butterworth, Chebyshev and Elliptic approximations, Design of discrete time IIR filters using Impulse invariant, and Bilinear transformation methods, Spectral transformation of IIR filters.
Unit IV Digital Filters Part-II: Introduction and Signal flow graph structure of FIR Filter.
FIR Filter design: Symmetric, and Asymmetric FIR filters, Design of linear phase FIR filters using windows, and Frequency sampling method, Design of Optimum Equiripple linear phase FIR filters, Design of FIR differentiators.
Unit V Multirate Digital Signal Processing: Introduction, Decimation and Interpolation, Sampling rate conversion by a Rational factor.
Implementation of Sampling rate Conversion: Sampling rate conversion with Cascaded integrator, Comb filters,Polyphase structures for decimation, and interpolation filters, Application of multirate signal processing.
Text Books:
7. John. G. Proakis, "Digital Signal Processing", 4th Edition, Pearson Education.
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Reference Books:
1. Johnny R. Johnson, "Introduction to Digital Signal Processing", 1st Edition, PHI Learning.
2. Rabiner and Gold, "Theory and Application of Digital Signal Processing",3rd Edition, PHI Learning.
3. Ingle and Proakis, "Digital Signal Processing- A MATLAB based Approach", 3rd Edition, Thompson, Cengage Learning.

Course Outcomes:
After successful completion of the course, students will be able to:
CO1. Analyze discrete time system using transform methods.
CO2.Compute DFT using FFT algorithms.
CO3.Design IIR Filters.
CO4. Design FIR Filters.
CO5.Apply the concept of multi-rate signal processing in practical applications