Department of Electronics Engineering

Minutes of
Online Board of Studies Meeting
of Electronics Engineering
held on 31.05.2023

Agenda of the BoS Meeting

Instructions for preparing BoS Proceedings

{All information is to be uploaded on the webpage under suitable heading (such as Board of Studies) and separate links to be provided for each category mentioned below}

1.

Minutes should have a summary/cover page mentioning all the significant changes made in the following Given format

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
Data communication	140519	2023	31-05-2023	8%	9	31	Annexure XVII

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
Embedded Systems	140715	Improved technical skill (hardware/circuit design)	2	14	Annexure XIX
Digital Image Processing	140751	Image enhancement, Image restoration, object representation ,description and recognition	2	15	Annexure I
Consumer Electronics	910217	Consumer demand and target supply	2	18	Annexure I
Pattern Recognition and Applications	140763	Feature Extraction, neural network	2	15	Annexure I
Data Science	140511	Data analyst	9	28	Annexure XX

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
Embedded Systems Design	140715	Improved technical skill (hardware/circuit design)	2	14	Annexure XIX
Communication Networks	2140323	Filter Design	12	44	Annexure XVIII
Analog Integrated Circuits	2140322	Applications of Op-amp	12	43	**Annexure XI**

Feedback on curriculum received from stakeholders: Analysis& ATR*

Stakeholder	Student	Faculty	Alumni	Employer
No. of responses	II: 115, III: 79 IV: 78	10	31	40
Link of Analysis	-	-	http://surl.li/iauuk	http://surl.li/iauvj
ATR Link	-	-	http://surl.li/iauuk	http://surl.li/iauvj
Link showing Excel sheet of Google Form details of stakeholders	Through Moodle	Through Moodle	http://surl.li/iavop	http://surl.li/iavno

* *Separate page(s) for each of the above four points; Agenda point wise minutes to be appended with each point and a separate link to be given in the appropriate columnfor each point*

Minutes of the online Board of studies meeting on 31-05-2023

Following members have attended the online meeting;

1.	Dr. Vandana Vikas Thakare	Chairperson, Associate Professor and Head
2.	Dr. Jyoti Singhai	External Member, Professor, ECE Deptt., MANIT, Bhopal
3.	Dr. R. B. Pachori	External Member, Professor, Department of Electrical Engineering, IIT, Indore
4.	Dr. Ashutosh Datar	VC Nominee, RGPV, Professor, SATI, Vidisha
5.	Er. Saurabh Kumar	Industry Representative, Hitsavi Limited
6.	Er. Yasho Vijay Singh Yadav	Alumni, External member, Scientist, CSIR
7.	Dr. P. K. Singhal	Professor
8.	Dr. Laxmi Shrivastava	Associate Professor
9.	Dr. R. P. Narwaria	Assistant Professor
10.	Dr. Karuna Markam	Assistant Professor
11.	Prof. Madhav Singh	Assistant Professor
12.	Prof. D. K. Parsediya	Assistant Professor
13.	Prof. Pooja Sahoo	Assistant Professor
14.	Dr. Vikas Mahor	Assistant Professor
15.	Dr. Rahul Dubey	Assistant Professor
16.	Dr. Hemant Choubey	Assistant Professor
17.	Dr. Deepak Batham	Assistant Professor
18.	Dr. Varun Sharma	Assistant Professor
19.	Dr. Shubhi Kansal	Assistant Professor
20.	Dr. Sushmita Chaudhary	Assistant Professor
21.	Dr. Pawan Dubey	Assistant Professor
22.	Dr. Tej Singh	Assistant Professor
23.	Dr.Vikram	Assistant Professor
24.	Dr. Vibha Tiwari	Assistant Professor

25.	Dr. Priyanka Garg	Assistant Professor
26.	Dr. Nookala Venu	Assistant Professor
27.	Mr. Manoj Kumar	Assistant Professor

At the onset, the chairperson welcomed external members to the meeting of BoS and placed the agenda for the deliberation to the members. The following deliberations were made as per the items of circulated agenda:

BoS Agenda Items

Item 1

To confirm the minutes of previous BoS meeting held in the month of December 2022

The minutes of previous BOS held on 14 Dec 2022 has been finalized.

Item 2

To prepare and finalize the **scheme structure of B.Tech. VII Semester** with the provision of *Three Departmental Electives (DEs)* **(in which one Departmental Elective is to be offered in online mode with credit transfer)** *and one Open Category (OC) Course* for the batch admitted in 2020-21.

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 prepare and finalize the syllabus of courses to be offered ***(for batch admitted in 2020-21)*** 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 their Syllabi are given in AnnexureII

S. No	Category	Subject Code	Subject Name
1	DE-II	140711	Satellite & Radar Communication
2	DE-II	140714	Antenna and Wave Propagation
3	DE-II	140715	Embedded Systems Design

Item 4

To propose the list of courses which the students can opt from SWAYAM/NPTEL/MOOC based Platforms, to be offered in ***online mode under*** **Departmental Elective (DE)** Courses, with credit transfer in the B.Tech. ***VII Semester under*** the flexible curriculum (*Batch admitted in 2020-21)*

The list of courses which the students can opt from SWAYAM/NPTEL/MOOC based Platforms, to be offered in online mode under Departmental Elective (DE) Course, with credit transfer in the B.Tech. VII Semester under the flexible curriculum has been discussed and finalized. AnnexureIII

S. No	Category Code	Course Code	Name of The course
1	DE-III	140751	Digital Image Processing
		140754	Microwave Engineering
2	DE-IV	140761	Introduction to Wireless Cellular Communication
		140762	Fiber Optic Communication Technology

Item 5

To prepare and finalize the syllabus of courses to be offered ***(for batch admitted in 2020-21)*** 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 2020-21)* 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	910216	Satellite Systems
2	OC-II	910217	Consumer Electronics

Item 6

To prepare and finalize the Experiment list/ Lab manual for Departmental Laboratory Course (DLC) to be offered in B.Tech. VII semester ***(for batches admitted in 2020-21)***

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) Honors (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 2020-21)] and for* B.Tech. ***V semester*** *(for the batch admitted in 2021-22)] 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 prepare and recommend the ***scheme structure of B.Tech. V Semester under*** the flexible curriculum (*Batch admitted in 2021-22)*

The scheme structure of B.Tech. V Semester under the flexible curriculum (Batch admitted in 2021-22) has been discussed and finalized. AnnexureVII

Item 9

To prepare and recommend the syllabi for all ***Departmental Core (DC) Courses*** of B.Tech. ***V Semester (for batch admitted in 2021-22)*** 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 2021-22) under the flexible curriculum along with their COs has been discussed and finalized. AnnexureVIII

S. No	Category	Subject Code	Subject Name
1	DC	140511	Data Science
2		140512	Microprocessor and Interfacing
		140515	Electromagnetic Fields
3		140519	Data Communication
4		140520	Digital Signal Processing

Item 10

To prepare and recommend the suggestive Experiment list/ Lab manual and the list of projects which can be assigned under the 'Skill based mini-project' category in various laboratory component based courses to be offered in B.Tech.V semester ***(for batch admitted in 2021-22)***
The Experiment list/ Lab manual for all the Laboratory Courses to be offered in B.Tech.V semester ***(for batch admitted in 2021-22) has been discussed and finalized. AnnexureIX***

S. No	Category	Subject Code	Subject Name
1	DC	140511	Data Science
2	DC	140512	Microprocessor and Interfacing
3	DLC	140516	Minor Project-I

Item 11

To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered ***(for batch admitted in 2021-22)*** 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 2021-22) in online mode under Self-Learning/ Presentation, in the B.Tech. V Semester has been finalized with the concern of the BOS members. AnnexureX

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 12

To review, prepare, finalize and recommend the ***Scheme & Syllabi (along with the Course Outcomes) of III semester*** **B. Tech. programmes (batch admitted 2022-23 Session)**

Scheme & Syllabi (along with the Course Outcomes) of III semester B. Tech. programmes (batch admitted 2022-23 Session) has been discussed and finalized. ***AnnexureXI***

S. No	Category	Subject Code	Subject Name
1	DC	2140320	Analog Communication
2		2140322	Analog Integrated Circuits
3		2140323	Communication Networks
4		2140324	Data Communication

Item 13

To review, prepare, finalize and recommend the list of experiments/ Lab manual and skill based mini projects for various laboratory courses to be offered in III Semester ***(for the batch admitted in 2022-23)***.

The list of experiments/ Lab manual and skill based mini projects for various laboratory courses to be offered in III Semester has been discussed and finalized. AnnexureXII

S. No	Category	Subject Code	Subject Name
1	DC	2140320	Analog Communication
2		2140322	Analog Integrated Circuits
3		2140321	Hardware Lab

Item 14

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

The list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered (for batches admitted in 2022-23) in online mode under Self-Learning/ Presentation, in the III Semester has been discussed and finalized. AnnexureXIII

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 15

To review, prepare, recommend the ***Scheme structure & Syllabi (along with their course outcomes), list of experiments/lab manuals and skill based mini projects for various laboratories courses of I semester*** **B. Tech. programmes*(for the batch 2023-24 session)***.

The scheme, Syllabi, list of experiments and skill based mini projects of First semester of the B. Tech. programme (for the batch 2023-24) has been finalized. AnnexureXIV

S. No	Category	Subject Code	Subject Name
1.	DC	3140121	Electronic Engineering Materials
2.	DC	3140122	Electronic Devices
3.	DC	3140123	Network Theory
4.	DLC	3140124	Devices & Network Lab

<table>
<tr><td>Item 16</td><td>To review the CO attainments, to identify gaps and to suggest corrective measures for the improvement in the CO attainment levels for July-December 2022.

The review of the CO attainments, gaps and corrective measures for the improvement in the CO attainment levels July-December 2022 has been finalized as per the discussion with BOS members</td></tr>
<tr><td>Item 17</td><td>To review PO attainment of 2018-2022 batch, CO-PO mapping matrix with attainments and gap analysis

The PO attainment of 2018-2022 batch, CO-PO mapping matrix with attainments and gap analysis has been discussed and finalized.</td></tr>
<tr><td>Item 18</td><td>To prepare and recommend the syllabi of Mandatory Audit Course: Universal Human Values & Professional Ethics (UHVPE). (at institute level)

Not applicable</td></tr>
<tr><td>Item 19</td><td>To review curricula feedback from various stakeholders, its analysis and impact
{Stakeholder feedback analysis must also contain an Action Taken Report (ATR) and the details/data of the stakeholders who have responded through GOOGLE form (such as Name, organization, mail id, phone no., if available) must also be shared along with the feedback of the alumni/employer}

Curricula feedback from various stack holders includes students, faculty, employer and alumni has been discussed and action taken report has been finalized.</td></tr>
<tr><td>Item 20</td><td>To review the Course Outcomes (COs) feedback of various courses, its analysis, and ATR (for July-Dec 22 semester)

The Course Outcomes (COs) feedback of various courses, its analysis, and ATR has been liscussed and approved by BOS members.</td></tr>
<tr><td>Item 21</td><td>To discuss and recommend the scheme structure and syllabi of PG Programme (M.E./M.Tech./MCA/MBA) along with their Course Outcomes (COs)

The scheme structure and Syllabi of PG Programme (M.E../M.Tech./MCA/MBA) has been discussed and finalized and summary of first semester is given here.
AnnexureXV
<table>
<tr><th>S. No</th><th>Category</th><th>Subject Code</th><th>Subject Name</th></tr>
<tr><td>1.</td><td>DC</td><td>600111</td><td>Computational Techniques</td></tr>
<tr><td>2.</td><td>DC</td><td>600112</td><td>Computer Communication Networks</td></tr>
<tr><td>3.</td><td>DC</td><td>600113</td><td>Communication System Design and Applications</td></tr>
</table></td></tr>
<tr><td>Item 22</td><td>To recommend the scheme structure and Syllabus of Ph.D. Course Work (specific to doctoral research Scholars, if any)

The scheme structure and Syllabus of Ph.D. Course Work has been discussed with BOS members and finalized. AnnexureXVI</td></tr>
<tr><td>Item 23</td><td>Any other matter (Expert List)

Expert list for viva-voce examination has been discussed and finalized.</td></tr>
</table>

The following suggestions were provided by the external BOS members:

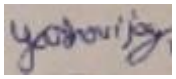
1. **As per the suggestion given by external members, syllabus of Communication Networks and data communication has been modified**
2. **As suggested by the external member, the list of experiments of Data Science and Python Programming has been modified.**

Dr. R. B. Pachori
Professor, IIT, Indore
External Member

Dr. Ashutosh Datar
Professor, SATI, Vidisha
RGPV Nominee

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. Sushmita Chaudhari**	**Dr. Pawan Dubey**
Dr. Tej Singh	**Dr. Vikram**	**Dr. Vibha Tiwari**

Dr. Priyanka Garg **Dr. NookalaVenu** **Mr. Manoj Kumar**

Dr. Vandana Vikas Thakare
Head of the Department

Annexure I

Item 2

To prepare and finalize the **scheme structure of B.Tech. VII Semester** with the provision of *Three Departmental Electives (DEs) and* **(in which two Departmental Elective is to be offered in online mode with credit transfer)** *one Open Category (OC) Course* for the batch admitted in 2020-21.

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Scheme of Examination (B.Tech. Electronics Engineering)

B.Tech. VII Semester *[For batches admitted in Academic Session 2020-21 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**	**Summer Internship Project-III**	-	-	-	-	60	-	-	-	-	60	-	-	4	2	Offline	SO
8.	**140703**	**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**	**Online**	**MCQ**

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

$^{\$\$}$**MCQ:** Multiple Choice Question $^{\$\$}$**AO:** Assignment + Oral $^{\$\$}$**PP:** Pen Paper $^{\$\$}$**SO:** Submission + Oral

Department Electives-2 (DE-2) (1407XX)	Satellite and Radar Communication Systems **(140711)**	Antenna and Wave Propagation **(140714)**	Embedded Systems Design **(140715)**
Department Electives-3 (DE-3) (MOOCS) (1407XX)	Digital Image Processing **(140751)**	Microwave Engineering **(140754)**	
Department Electives-4 (DE-4) (MOOCS) (1407XX)	Introduction to Wireless Cellular Communication **(140761)**	Fiber Optic Communication Technology **(140762)**	
Open Course-2 (OC-2)	Satellite System **(910216)**	Consumer Electronics **(910217)**	

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

Annexure II

Item 3

To prepare and finalize the syllabus of courses to be offered ***(for batch admitted in 2020-21)*** 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	140714	Antenna and Wave Propagation
3	DE-II	140715	Embedded Systems Design

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	DC	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** Basic Concepts and Terminologies of Satellite Communication
- **CO2.** **Design** the Earth Station and Space Craft System
- **CO3.** **Calculate** the Link Power Budget Including Propagation Effects in Satellite.
- **CO4.** **Evaluate** the Various Performance Factors Related to the RADAR
- **CO5.** **Explain** target Detection and Tracking using Radar Systems.

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	
140714	DC	Antenna & Wave Propagation	50	10	20	20	-	-	-	100	3	-	-	3

ANTENNA & WAVE PROPAGATION (140714)

Course objectives: To develop the students' basic understanding of antenna operation and develop the students' ability to calculate and interpret basic antenna performance parameters.

Unit I Introduction to antenna: Definition of antenna parameters – Radiation Density, Radiation Intensity, Gain, Directivity, Radiation Resistance, Band width, Beam width, Input Impedance, Effective Height, Effective aperture, Network theorems applied to antenna, Self and mutual impedance of antenna.

Unit II Radiation Fields of Wire Antennas: Radiation from current element, Short dipole, Quarter wave Monopole and Half wave Dipole, Loop antenna, helical antenna.

Unit III Antenna Arrays: Antenna arrays of point sources, two element array, End fire and Broad side arrays, Principle of Pattern multiplication, Uniform linear arrays of N-elements, Linear arrays with non-uniform amplitude distribution (Binomial distribution and Chebyshev optimum distribution). Arrays of two-driven half wave length elements (Broad side and end fire case).

Unit IV Aperture and special Antennas: Radiation from rectangular apertures, Horn antenna, Reflector antenna, Babinet's principles and complimentary antennas, Slot antennas, Log periodic antenna, Yagiuda antenna, Travelling wave antenna, Image antenna.

Unit V Propagation of radio wave: Modes of propagation , Structure of atmosphere , Ground wave propagation , Tropospheric propagation , Duct propagation, Flat earth and Curved earth concept, Sky wave propagation – Virtual height, Critical frequency , Maximum usable frequency – Skip distance, Fading , Multi hop propagation.

Text Books:

1. Antenna theory- J.D. Kraus, 4th edition, Tata Mc-Graw Hill
2. Electromagnetic Fields & Radiating System - Jordan &Balmain, 2nd edition, PHI

Reference Books:

1. Antennas(for all applications)-Kraus, Marshfka, khan, Tata Mc-Graw Hill
2. Antenna Wave Propagation-K D Prasad, New Delhi : Satya Prakashan

Course Outcome:

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

CO1. **Evaluate** various parameters of the antenna.
CO2. **Analyze** the design parameters and radiation mechanism of wire antennas.
CO3. **Design** antenna array for the given radiation characteristics.
CO4. **Analyze** the design parameters and radiation characteristics of Aperture and special antennas.
CO5. **Describe** effects of earth and its atmosphere on radio wave propagation.

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	DC	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 architecture of embedded system and 8051 microcontroller.
CO2. **Develop** programming skill for 8051 microcontroller.
CO3. **Understand** the 32-bit pipelined architecture of ARM microcontroller.
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.

Annexure III

Item 4

To propose the list of courses which the students can opt from SWAYAM/NPTEL/MOOC based Platforms, to be offered in ***online mode under*** **Departmental Elective (DE)** Courses, with credit transfer in the B.Tech. ***VII Semester under*** the flexible curriculum (*Batch admitted in 2020-21)*

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	24-07-2023	13-10-2022	Prof. Pooja Sahoo
2		**140754**	Microwave Engineering	12	24-07-2023	13-10-2022	Prof. D. K. Parsediya
3	DE-4	**140761**	Introduction to Wireless and Cellular Communication	12	24-07-2023	13-10-2022	Prof. Madhav Singh
4		**140762**	Fiber Optic Communication Technology	12	24-07-2023	13-10-2022	Dr. R. P. Narwaria

Annexure IV

Item 5

To prepare and finalize the syllabus of courses to be offered ***(for batch admitted in 2020-21)*** 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	900216	Satellite Systems
2.	OC-2	900217	Consumer Electronics

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	
910216	OC	Satellite systems	50	10	20	20	-	-	-	100	3	-	–	3

Satellite Systems (910216)

Course objective: The main objective of the course is to provide a comprehensive knowledge in the area of satellite system. The course emphasis is on the study of orbital mechanics, launching techniques, working of Indian Regional Navigation Satellite System.

Unit I Introduction: Introduction of 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.

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, Frequency Allocation in Satellite Communication.

Unit III Indian Satellite Launch Vehicle: SLV (Satellite Launch Vehicle), ASLV (Augmented Satellite Launch Vehicle), PSLV (Polar Satellite Launch Vehicle), GSLV (Geosynchronous Satellite Launch Vehicle), GSLV Mk III, Sounding Rockets.

Unit IV Satellite Link Design: Satellite Link Design, System Noise Temperature and G/T Ratio, Downlink Design, Domestic Satellite System, Uplink Design

Unit V Indian Regional Navigation Satellite System: IRNSS System Overview, IRNSS Signal Characteristics, IRNSS Data Structure, Sub Frame Structure.

TEXT BOOK:

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.
2. https://www.isro.gov.in/update/06-nov-2015/book-indian-space-programme-released-second-anniversary-of-mars-orbiter

REFERENCES BOOKS:

3. Satellite Communications – Dennis Roddy, McGraw Hill, 2nd Edition, 1996.
4. IRNSS SIS ICD for standard positioning service, version 1.1, August 2017, ISRO Satellite Centre Indian Space Research Organization Bangalore

Course Outcomes

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

- **CO1.** **Explain** basic concepts and terminologies of Satellite Communication.
- **CO2.** **Design** the Earth station and Space Craft System.
- **CO3.** **Explain** the Indian Satellite Launchers.
- **CO4.** **Calculate** the Link power budget including Propagation effects in Satellite.
- **CO5.** **Examine** the Indian Regional Navigation Satellite System.

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.

Annexure V

Item 6

To prepare and finalize the Experiment list/ Lab manual for Departmental Laboratory Course (DLC) to be offered in B. Tech. VII semester ***(for batches admitted in 2020-21)***

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

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	
140703	DLC	Creative Problem Solving	25	25	-	50	-	-	6	3

Creative Problem Solving (140703)

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) Honors (for students of the host department)

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

[These will be offered through SWAYAM/NPTEL/MOOC basedPlatforms for the B.Tech. ***VII semester students*** *(for the batch admitted in 2020-21)] and for* B.Tech.***Vsemester****(for the batch admitted in 2021-22)]*

Semester	Honors/ Minor	Domain	Subject Name
V	Honors	Communication and Signal Processing	Principles and Techniques of Modern Radar Systems
		VLSI Design	Hardware modeling using verilog
	Minor	Control & Sensor Technology	Control System
		Communication and Signal Processing	Introduction to Wireless and Cellular 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	24-07-2023	13-10-2023	Prof Madhav Singh
	V	Hardware modeling using verilog	08	24-07-2023	15-09-2023	Dr. Varun Sharma
Minors	V	Control System	12	24-07-2023	13-10-2023	Dr. R P Narwaria
	V	Introduction to Wireless and Cellular Communications	12	24-07-2023	13-10-2023	Prof Madhav Singh
Electronics Engineering (VII Semester)						
Honors	VII	Introduction To Adaptive Signal Processing	08	24-07-2023	15-09-2023	Dr. Rahul Dubey
	VII	VLSI Interconnects	08	24-07-2023	15-09-2023	Dr. VikasMahor
Minors	VII	Microwave Engineering	12	24-07-2023	13-10-2023	Dr. D. K. Parsediya
	VII	Design of Photovoltaic Systems	12	24-07-2023	13-10-2023	Dr. Sushmita Chaudhari

Annexure VII

Item 8

To prepare and recommend the ***scheme structure of B. Tech V Semester under*** the flexible curriculum (*Batch admitted in 2021-22)*

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Scheme of Examination (For the Batch Admitted in the Year 2021-2022)

B.Tech. (Electronics Engineering) V Semester *[For batches admitted in Academic Session 2021-22 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.	140511	DC	Data Science	50	10	20	20	60	20	20	200	3	-	2	4	Offline	MCQ
2.	140512	DC	Microprocessor & Interfacing	50	10	20	20	60	20	20	200	2	1	2	4	Offline	PP
3.	140515	DC	Electromagnetic Fields	50	10	20	20	-	-	-	100	2	1	-	3	Offline	PP
4.	140519	DC	Data Communication	50	10	20	20	-	-	-	100	2	1	-	3	Offline	PP
5.	140520	DC	Digital Signal Processing	50	10	20	20	-	-	-	100	2	1	-	3	Offline	PP
6.	140516	DLC	Minor Project-I	-	-	-	-	60	40	-	100	-	-	4	2	Offline	SO
7.	140517	DLC	Self-learning/ Presentation*	-	-	-	-	-	40	-	40	-	-	2	1	Online +Mentoring	SO
8.		CLC	Novel Engaging Course	-	-	-	-	50	-	-	50	-	-	2	1	Interactive	SO
9.	140518	DLC	Summer Internship Project–II (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	Online	MCQ

Honors	1. Principles and Techniques of Modern Radar Systems 2. Stochastic Control & Communication	1. Hardware modeling using Verilog 2. Analog VLSI Design	1. Nano-Technology, Science and Application 2. Microelectronics: Devices to Circuits
Minors	Control System	Introduction to Wireless and Cellular Communications	

Annexure VIII

Item 9

To prepare and recommend the syllabi for all ***Departmental Core (DC) Courses*** of B. Tech. ***V Semester (for b*atch admitted in 2021-22)** under the flexible curriculum along with their COs.

S.No	Category	Subject Code	Subject Name
1	DC	140511	Data Science
2		140512	Microprocessor and Interfacing
3		140515	Electromagnetic Fields
4		140519	Data Communication
		140520	Digital Signal Processing

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	
140511	DC	Data Science	50	10	20	20	60	20	20	200	3	-	2	4

Data Science (140511)

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.** **Define** different Data Science techniques.
- **CO2.** **Illustrate** various tools used for Data Science technique.
- **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.

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	
140512	DC	Microprocessor & Interfacing	50	10	20	20	60	20	20	200	2	1	2	4

Microprocessor and Interfacing (140512)

Course objectives: To introduce the basic concepts of microprocessor and microcontroller and to develop assembly language programming skills along with their use in various applications.

Unit I: Introduction to Microprocessor: History and evolution of microprocessor and their classification, Introduction to microprocessors and microcomputers, Study of 8 bit Microprocessor, 8085 pin configuration, Internal Architecture and operations, Interrupts, Interrupts and interrupt service routine.

Unit II: 8085 Assembly Language Programming: 8085 instruction set, 8085 assembly language programming, Addressing modes, Counters and Time delays, Instruction cycle, Machine cycle, T-states, timing diagram for 8085 instructions.

Unit III: Peripheral Devices and their Interfacing: Introduction to memory interfacing and various interfacings chips like: Programmable input/output ports 8155/8255, Programmable interval timer 8253/8254, keyboard/display controller 8279, Programmable communication interface 8251 USART, Programmable interrupt controller 8259, DMA controller 8257.

Unit IV: Architecture and Programming of 16-Bit Microprocessor: 8086 Block diagram and Architecture, Pin configuration of 8086, Execution Unit (EU) and Bus Interface Unit(BIU), Minimum mode & Maximum mode operation, Memory segmentation, Instruction set and addressing modes of 8086, Introduction to 8086 assembly language programming.

Unit V: Microcontrollers & Embedded Systems: Introduction to microcontrollers and embedded systems, 8051 architecture, Pin description, I/O configuration, Interrupts, Addressing modes, an overview of 8051 instruction set, use of microcontrollers in real time embedded system design.

Text Book:

1. Ramesh. S. Gaonkar, Microprocessor architecture Programming and Application with 8085 Penram International Publishing, 4th Edition.
2. B. Ram, "Fundamentals of Microprocessors and Microcomputer" DhanpatRai, 5th Edition.

Reference Books:

1. Douglas V Hall., "Microprocessor and Interfacing" Tata Mcgraw Hill
2. A.K. Ray and K. M. Bhurchandi , "Advance Microprocessor and Peripheral", Tata Mcgraw Hill

Course Outcomes

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

- **CO1.** **Explain** the architecture and organization of 8085 microprocessors.
- **CO2.** **Develop** assembly language programming skill for 8085.
- **CO3.** **Design** the Interfacing circuitry of memory and I/O devices using interfacing chips/PICs with 8085.
- **CO4.** **Discuss** the architecture and organization of 8086 microprocessors.
- **CO5.** **Describe** the instruction set and architecture of 8051 microcontroller.

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	
140515	DC	Electromagnetic Fields	50	10	20	20				100	2	1	-	3

Electromagnetic Fields (140515)

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. **Solve** the problems associated with static electromagnetic fields in different engineering situation.
- CO2. **Describe** static and dynamic electric and magnetic field.
- CO3. **Apply** boundary conditions for electric and magnetic fields at the interface of two different media.
- CO4. **Solve** diverse engineering problems with the help of Maxwell equations.
- CO5. **Analyze** the behavior of plane waves in different media.

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	
140519	DC	Data Communication	50	10	20	20	-	-	-	100	2	1	-	3

Data Communication (140519)

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.

Physical Layer: Signals and Transmission, Data Encoding, Transmission Media, Transmission Impairments, Multiplexing, Transmission Modes, Networking Devices, Error Detection and Correction, Physical Layer Protocols, Link Budget and Signal-to-Noise Ratio (SNR).

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,TataMc-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. **Analyze** the error and flow control in communication network.
CO2. **Explain** the concepts of MAC layer.
CO3. **Identify** the different types of routing used in IP.
CO4. **Classify** the transport mechanism in TCP/UDP.
CO5. **Explore** the different application protocol used in internetworking.

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	
140520	DC	Digital Signal Processing	50	10	20	20	-	-	-	100	2	1	-	3

Digital Signal Processing (140520)

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, 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:

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 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.

Annexure IX

Item 10

To prepare and recommend the suggestive Experiment list/ Lab manual and 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 batch admitted in 2021-22)***

S.No	Category	Subject Code	Subject Name
1	DC	140511	Data Science
2	DC	140512	Microprocessor and Interfacing
3	DLC	140516	Minor Project-I

Subject Name: Data Science

L	T	P	C
-	-	2	1

Subject Code: 140511

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.

Skill based Mini Project

1. Develop a machine learning model that predicts the prices of houses based on the features such as –size, location and number of rooms in the house.
2. Develop a machine learning model to categorize iris flower from iris flower dataset into different species based on petals and sepal measurements.
3. Develop a machine learning model to predict whether the credit card holder will default on their payments based on the historical credit data.
4. Develop a machine learning model that predicts that patients have diabetes or not based on various medical measurements.
5. Develop a machine learning model to classify fake images based on features of the faces.

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.

B.Tech. V Semester (Electronics Engineering)

L	T	P	C
-	-	2	1

Subject Name: Microprocessor and Interfacing
Subject Code: 140512

Course Objectives
This course gives the ability to the students to learn the assembly language programming of 8085, 8086 microprocessor and 8051 microcontroller and their interfacing with different peripherals.

List of Experiments

1. Write an assembly language program to perform different arithmetic operations on 8 bit numbers using 8085 microprocessor.
2. Write an assembly language program to find whether the number is even or odd using 8085 microprocessor.
3. Interface a Stepper Motor to the 8085 microprocessor system and write an 8085 assembly language program to control the Stepper Motor.
4. Write an assembly language program to generate standard waveforms using DAC and display waveforms on CRO with 8085 microprocessor.
5. Write an assembly language program to obtain 2's complement of a given number using 8086 microprocessor.
6. Write an assembly language program to perform arithmetic operations of two BCD numbers using 8086 microprocessor.
7. Write an assembly language program to interfacing 8253 Timer with 8086 microprocessor in different modes.
8. Write an assembly language program to interfacing temperature measurement card with 8086 and display the temperature on LCD.
9. Write an assembly language program to interface ADC card with 8051 microcontroller and display the digital value of the LCD.
10. Write an assembly language program to interface 7 segment display with 8051 Microcontroller.

Value added Experiments:

1. Write an assembly language program to interfacing temperature measurement card with 8086 and display the temperature on LCD.
2. Write an assembly language program to interface 7 segment display with 8051 Microcontroller.

Course Outcomes:

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

CO1. Develop the assembly language programs for the different arithmetic and logical operations using 8085, 8086 microprocessor and 8051 microcontroller.
CO2. Design interfacing circuits for different I/O devices using PPIs with 8085, 8086 microprocessors and 8051 microcontroller.

Skill based mini project

1. Develop an 8085 microprocessor assembly language program to generate Fibonacci series using 8085 Simulator.
2. Develop an 8085 microprocessor assembly language program to calculate the square root using 8085 Simulator.
3. Develop an 8086 microprocessor assembly language program to interface virtual stepper motor with 8086 on Emu86 simulator.
4. Develop an 8086 microprocessor assembly language program to check a string as palindrome or not on Emu86.
5. Write an assembly language program to interface virtual ADC card with 8085 and display the digital value on the LCD using 8085 Simulator on 8085 Simulator.
6. Develop an 8051 microcontroller assembly language program to display counting from 01 to 10 on virtual Seven Segment Display using EdSim 51 Simulator.
7. Develop an 8051 microcontroller assembly language program to interface virtual ADC with 8051 and perform analog to digital conversion operation on EdSim 51 Simulator.
8. Develop an 8051 microcontroller assembly language program to interface virtual Stepper Motor with 8051 and perform clockwise rotation at defined RPM on EdSim 51 Simulator.
9. Develop an 8051 microcontroller assembly language program to interface virtual DAC with 8051 and perform digital to analog conversion operation on EdSim 51 Simulator.
10. 10.Develop an 8051 microcontroller assembly language program to interface virtual LCD display with 8051 and show real time entered number on LCD using EdSim 51 Simulator.

Departmental Lab Course

L	T	P	C
-	-	2	1

Subject Name: Minor Project-I
Subject Code: 140516

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 propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered ***(for batch admitted in 2021-22)*** 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	24-07-2023	18-08-2023	Dr. Deepak Batham
	V	Basics of Software defined Radios	4	24-07-2023	18-08-2023	Dr. Shubhi Kansal
	V	Foundations of Cognitive robotics	4	20-05-2022	01-08-2022	Dr. Vikas Mahor

Annexure XI

Item 12

To review, prepare, finalize and recommend the ***Scheme & Syllabi (along with the Course Outcomes) of III semester*** **B. Tech. programmes (batch admitted 2022-23 Session)**

S.No	Category	Subject Code	Subject Name
1	DC	2140320	Analog Communication
2		2140322	Analog Integrated Circuits
3		2140323	Communication Network
4		2140324	Data Communication

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Department of Electronics Engineering

Scheme of Examination (For Batch admitted in Year 2022-23)

B.Tech. (Electronics Engineering) III Semester *[For batches admitted in Academic Session 2022-23 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.	21000025	BSC	Engg Mathematics-II	50	10	20	20	-	-	-	100	2	1	-	3	Offline	PP
2.	2140320	DC	Analog Communication	50	10	20	20	60	20	20	200	2	1	2	4	Offline	PP
3.	2140322	DC	Analog Integrated Circuits	50	10	20	20	60	20	20	200	2	1	2	4	Offline	PP
4.	2140323	DC	Communication Networks	50	10	20	20	-	-	-	100	2	1	-	3	Offline	PP
5.	2140324	DC	Data Communication	50	10	20	20	-	-	-	100	2	1	-	3	Offline	PP
6.	2140321	DLC	Hardware Lab	-	-	-	-	60	20	20	100	-	-	2	1	Offline	SO
7.	2140316	DLC	Self-learning/ Presentation#	-	-	-	-	-	40	-	40	-	-	2	1	Online +Mentoring	SO
8.		CLC	Novel Engaging Course	-	-	-		50	-	-	50	-	-	2	1	Interactive	SO
9.	2140317	DLC	Summer Internship Project–I (Institute Level Evaluation)	-	-	-	-	60	-	-	60	-	-	4	2	Offline	SO
Total				**250**	**50**	**100**	**100**	**290**	**100**	**60**	**950**	**10**	**5**	**14**	**22**		
10.	3000003	Natural Science & Skill	Environmental Engineering	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	MCQ
11	1000001	MAC	Indian Constitution and Traditional Knowledge	50	10	20	20	-	-	-	100	2	-	-	Grade	Online	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 %

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	
140320	DC	Analog Communication	50	10	20	20	60	20	20	200	2	1	2	4

Analog Communication (2140320)

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.** **Describe** amplitude modulation, their generation & detection methods.
- **CO3.** **Explain** the generation and detection techniques for angle modulated signal.
- **CO4.** **Evaluate** the statistical parameters for general PDF/CDF.
- **CO5.** **Evaluate** the effects of noise on modulation techniques

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	
2140322	DC	Analog Integrated Circuits	50	10	20	20	60	20	20	200	2	1	2	4

Analog Integrated Circuits (2140322)

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

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.

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, Clapp 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.** **Design** the circuits of differential amplifiers.
- **CO2.** **Design** the applications using Operational amplifier IC.
- **CO3.** **Implement** the active filters based on given specifications.
- **CO4.** **Design** Oscillator using OPAMP.
- **CO5.** **Design** Multivibrator circuits using IC 555.

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	
2140323	DC	Communication Networks	50	10	20	20	-	-	-	100	2	1	_	3

Communication Networks (2140323)

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. **Design** the symmetrical and asymmetrical attenuators.
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 various transmission lines.
CO5. **Calculate** the impedance and SWR graphically /analytically.

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	
2140324	DC	Data Communication	50	10	20	20	-	-	-	100	2	1	_	3

Data Communication (2140324)

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.** **Analyze** the error and flow control in communication network.
- **CO2.** **Explain** the concepts of MAC layer.
- **CO3.** **Identify** the different types of routing used in IP.
- **CO4.** **Classify** the transport mechanism in TCP/UDP.
- **CO5.** **Explore** the different application protocol used in internetworking.

Annexure XII

Item 13

To review, prepare, finalize and recommend the list of experiments/ Lab manual and skill based mini projects for various laboratory courses to be offered in III Semester ***(for the batch admitted in 2022-23)***.

S. No	Category	Subject Code	Subject Name
1	DC	2140320	Analog Communication
2		2140322	Analog Integrated Circuits
3		2140321	Hardware Lab

L	T	P	C
-	-	2	1

Subject Name: Analog Communication
Subject Code: 2140320

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 Amplitude demodulator
6.Design of Sinusoidal signal generator
7.Design of Square wave generator
8.Design of Signal multiplier
9.Design of Frequency modulator
10. Design of Frequency demodulator

L	T	P	C
-	-	2	1

Subject Name: Analog Integrated Circuits
Subject Code: 2140322

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.

B.Tech. III Semester (Electronics Engineering)

L	T	P	C
-	-	2	1

Subject Name: Hardware Lab
Subject Code: 2140321

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.

Annexure XIII

Item 14

To propose the list of courses from SWAYAM/NPTEL/MOOC Platforms to be offered ***(for batches admitted in 2022-23)*** 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	21-08-2023	15-09-2023	Prof Pooja Sahoo
	III	Fundamentals of Electronic Device Fabrication	4	24-07-2023	18-08-2023	Dr. Hemant Chaubey
	III	Python for Data Science	4	24-07-2023	18-08-2023	Dr. Rahul Dubey

Annexure XIV

Item 15

To review, prepare, recommend the ***Scheme structure & Syllabi (along with their course outcomes), list of experiments/lab manuals and skill based mini projects for various laboratories courses of I semester*** **B. Tech. programmes** ***(for the batch 2023-24 session)***.

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

Department of Electronics Engineering

Scheme of Examination (For Batch admitted in Year 2023-24)

B.Tech. I Semester (Electronics Engineering) *[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	Mode of Exam.	Duration 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.	3100022	BSC	Basic Electrical & Electronics Engg	50	10	20	20	40	30	30	200	2	1	2	4	Blended	PP	2 Hrs
2.	3140121	DC	Electronic Engineering Materials	50	10	20	20	-	-	-	100	3	-	-	3	Blended	PP	2 Hrs
3.	3140122	DC	Electronic Devices	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP	2 Hrs
4.	3140123	DC	Network Theory	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP	2 Hrs
5.	3140125	DC	Computer Programming	50	10	20	20	40	30	30	200	2	1	2	4	Blended	AO	2 Hrs
6.	3140124	DLC	Devices & Network Lab	-	-	-	-	40	30	30	100	-	-	4	2	Offline	SO	2 Hrs
Total				**250**	**50**	**100**	**100**	**120**	**90**	**90**	**800**	**11**	**4**	**8**	**19**			
6	**3000002**	**Natural Sciences and Skills**	**Engineering Chemistry**	50	10	20	20	**30**	**10**	**10**	**150**	1	-	2	**GRADE**	Blended	MCQ	1.5 Hrs
Induction programme of three weeks (MC):Physical activity, Creative Arts,Universal Human Values,Literary,ProficiencyModules,Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations.																		

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject Natural Sciences& Skills: Engineering Physics / Engineering Chemistry / Environmental Science/ Language

MCQ: Multiple Choice Question **AO:** Assignment + Oral **OB:** Open Book **PP:** Pen Paper **SO:** Submission + Oral

Mode of Teaching					Mode of Examination				Total Credits
Theory				Lab	Theory			Lab	
Offline	Online	Blended		Offline	PP	A+O	MCQ	SO	
		Offline	Online						
0	0	10	5	4	13	4	0	2	19
0%	0%	52.63%	26.31%	21.05%	68.42%	21.05%	0%	10.52%	

Subject Code	Category Code	Subject Name	Theory Slot			Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
100022	BSC	Basic Electrical & Electronics Engineering	60	20	20	60	20	20	200	2	1	2	4

Basic Electrical & Electronics Engineering (100022)

Course Objectives:

- To impart the basic knowledge of the DC and AC circuits and their applications.
- To familiarize the students with the basic knowledge of magnetic circuits, transformer and its terminology.
- To make familiarize the students about the working of rotating electrical machine, various electronic circuits and its importance.

Unit I - D.C. Circuits Analysis: Voltage and Current Sources: Dependent and independent source, Source conversion, Kirchhoff's Law, Mesh and Nodal analysis. Network theorems: Superposition theorem, Thevenin"s theorem & Norton's theorem and their applications.

Unit II –Single-phase AC Circuits: Generation of sinusoidal AC voltage, definitions: Average value, R.M.S. value, Form factor and Peak factor of AC quantity, Concept of Phasor, analysis of R-L, R-C, R-L-C Series and Parallel circuit, Power and importance of Power factor.

Unit III- Magnetic Circuits: Basic definitions, AC excitation in magnetic circuits, self-inductance and mutual inductance, Induced voltage, laws of electromagnetic Induction, direction of induced E.M.F. Flux, MMF and their relation, analysis of magnetic circuits.

Unit IV- Single-phase Transformer & Rotating Electrical Machines: Single phase transformer, Basic concepts, construction and working principal, Ideal Transformer and its phasor diagram at No Load, Voltage, current and impedance transformation, Equivalent circuits and its Phasor diagram, voltage regulation, losses and efficiency, testing of transformers, Construction & working principle of DC and AC machine.

Unit V - Digital Electronics, **Devices & Circuits:** Number systems used in digital electronics, decimal, binary, octal, hexadecimal, their complements, operation and conversion, Demorgan's theorem, Logic gates- symbolic representation and their truth table, Introduction to semiconductors, Diodes, V-I characteristic, Bipolar junction transistors and their working, Introduction to CB, CE & CC transistor configurations

Recommended Books:

1. Basic Electrical and Electronics Engineering, D.P. Kothari & I.J. Nagrath-Tata McGraw Hill
2. Basic Electrical and Electronics Engineering, S. K Bhattacharya -Pearson
3. Electrical Machinery- A.E. Fitzgerald, C. Kingsley and Umans - TMH 4. Principles of Electrical Engineering- Vincdent Del Toro- Prentice Hall.
5. Basic Electrical Engineering -A,E. Fitzgerald, Higginbotham and Grabel -TMH
6. Integrated Electronics- Millmann & Halkias

Course Outcomes

After the completion of the course, the student will be able to –

CO1. **Solve** dc & ac circuits by applying fundamental laws & theorems

CO2. **Compare** the behavior of electrical and magnetic circuits for given input

CO3. **Explain** the working principle, construction, applications of rotating electrical machines

CO4. **Explain** the working principle, constructional details, losses & applications of single phase transformer.

CO5. **Select** the logic gates for various applications in digital electronic circuits.

CO6. **Explain** characteristics of Diode and Transistor.

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	
3140212	DC	Electronics Engineering Materials	50	10	20	20				100	2	1		3

Electronics Engineering Materials (3140121)

Course objective: To introduce the student with different material and their characteristics used in manufacturing of various electrical and electronics components

Unit I Introduction to Engineering Materials: Classification of Engineering Materials, Crystal Structure of Material, Level of Materials, Structure-Property Relationships in Material.

Unit II Conducting, Dielectric & Insulating Materials: Conducting Material- Properties of Conductor, Characteristics of Good Conductor Material, Definition and Classification of Dielectric and insulating materials, Superconductor.

Unit III Semiconductors: Introduction to Semiconductors and their properties, Effect of Temperature on Semiconductor, Mechanism of Conduction in Electrons and Holes, Carrier Generation and Recombination, Intrinsic Semiconductor & its Atomic Models, Extrinsic Semiconductor Material & its Atomic Models, Types of Impurity: Pentavalent and Trivalent Impurities, Majority and Minority Charge Carriers, Mobile Charge Carriers & Immobile Ions, Mass-Action Law.

Unit IV: Energy Levels & Bands: Atomic Structure, Bohr's Theory of Hydrogen Atom Excitation and Ionization of Atoms, Valence Band, Conduction Band and Forbidden Energy Gap, Energy Band for Insulators, Semiconductors and Conductors, Fermi-Dirac Distribution Function, Fermi-Level in Intrinsic and Extrinsic Semiconductors, Energy Band gap.

Unit V Nanomaterial: Introduction of Nanomaterial, Classification of Nanomaterial, Electrical, Optical, Mechanical and Magnetic Properties, Methods for Creating Nanostructures, Application & Advantages.

Text Books:

1. S.K Bhattacharya,"Electrical and Electronic Engineering Material", Ist edition, Khanna Publishers, Delhi, 2006.
2. A. J. Dekker, "Electrical Engineering Material", Reprint Ist Edition, PHI, 2006.
3. Nanomaterial- B.Vishwanatham, published by Narosa Publishing House.

Reference Books:

1. Sahdev," Electrical Engineering Material", Unique International Publications.
2. C.S Indulkar & S. Thiruvengadam, "Electrical Engineering Material", Reprint Ist Edition,2013,S. Chand & Com,Ltd,New Delhi-55.
3. S.P Seth, P. V. Gupta, "A course in Electrical Engineering Materials", 4th Edition,2017, Dhanpat Rai & Sons.

Course Outcome:

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

- **CO1.** Classify Engineering Materials.
- **CO2.** Analyze the characteristics of conducting, dielectric and insulating materials.
- **CO3.** Analyze the characteristics of Semiconducting Materials.
- **CO4.** Describe the Energy Level for Semiconductor Materials.
- **CO5.** Describe Nanomaterials with their applications.

B.Tech. I Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark		L	T	P	
3140122	DC	Electronics Devices	60	20	20	-	-	100	2	1	-	3

Electronics Devices (3140122)

Course Objective: To understand construction, principal and operation of different semiconductor devices.

Unit I: Fundamental of Electronic Devices: Elemental & Compound Semiconductor Materials , Bonding Forces and Energy Bands in Intrinsic and Extrinsic Silicon, Charge Carrier in Semiconductors , Carrier Concentration, Extrinsic Semiconductor, Hall Effect, Mechanism of Current Flow, Drift Current, Diffusion Current, Einstein Relation, Continuity Equation.

Unit II: Semiconductors Diodes: P-N Junction properties, Diode Characteristics, Equilibrium condition, biased junction, Steady state condition, P-N Junction breakdown mechanism, Capacitance of junction barrier, Diode circuit parameters, Basic circuits of Rectifier, Clippers and Clampers.

Unit III: Bipolar Junction Transistors: Construction, basic operation, current components and equations, CB, CE and CC configuration, input and output characteristics, Early effect, Region of operations: active, cut-off and saturation region.

Unit IV: Field effect transistors: Construction and characteristics of JFET, working principle of JFET.MOSFET construction and characteristics, MOSFET enhancement and depletion mode.

Unit V: Power Electronics Devices: Basic principle and working of SCR, IGBT, Uni-junction Transistor (UJT) and Thyristors. UJT: Principle of operation, characteristics.

Text Books:

1. Electronics Devices and Circuits: Boylested & Nashelsky, 11th Edition**,** Pearson Education India
2. Electronic devices and circuits: S. Salivahanan, 2nd Edition, Tata McGraw-Hill Education, 2011.
3. Microelectronic Circuits: Theory and Application: Sedra & Smith, 7th Edition**,** Oxford University Press.

Reference Books:

1 Micro Electronics: Millman, & Grabel, 2nd Edition, McGraw Hill Education
2 Integrated Electronics: Millman & Halkias, McGraw Hill Education.

Course Outcomes

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

CO1. **Analyze** the properties of semiconductor materials.
CO2. **Understand** construction and working of different diodes.
CO3. **Analyze** the operation of Bi-polar junction transistors.
CO4. **Examine** the working of Field Effect Transistors.
CO5. **Analyze** the working of Power electronics devices.

Subject Code	Category Code	Subject Name	Theory Slot			Practical Slot		Total Mark s	Contact Hr/week			Total Credit s
			End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark		L	T	P	
3140123	DC	Network Theory	60	20	20	-	-	100	2	1	-	3

Network Theory (3140123)

Course objective: To understand basic electric circuits, study of network theorems, transient analysis, graph theory, analysis of two port networks.

Unit-I Introduction – Basics of Circuit Elements**,** Characteristics of Independent & Dependent Sources, KCL & KVL for circuits with dependent & independent sources, Dot convention for coupled inductor and their characteristics, co-efficient of coupling.

Unit-II Network theorems: Superposition, Thevenin, Norton, Millman, Reciprocity and Maximum Power Transfer theorems.

Unit-III Laplace Transform & Passive Filters: The Laplace transforms, Properties of Laplace transform, Initial and final value theorem. Waveform synthesis & Laplace Transform of various waveform function, Low pass, high pass, band pass and band elimination filters,

Unit-IV Transient analysis: Transients in RL, RC and RLC circuits, initial conditions, time constants, Steady state analysis, Node and mesh analysis of RL, RC and RLC networks with sinusoidal sources.

Unit-V Two Port Network: Concept of Ports, Calculation of network functions for one port and two port, Two port parameters – Z, Y, hybrid and chain Parameters, Relationship between two port network parameters, T and π networks, Characteristics impedance & propagation constant.

Text Books:

1. Network Analysis: M.E. Van Valkenberg, 3rd Edition, Prentice Hall of India.
2. Network and Systems: D. Roy Chaudhary, 2nd Edition**,** New Academic Science Ltd.

Reference Books:

1. Introduction to Modern Network Synthesis: M.E. Van Valkenberg, Prentice Hall of India.
2. Network Analysis & Synthesis: F. Kuo, 2nd Edition, Wiley & Sons.
3. Network Analysis & Synthesis: Ravish R Singh, 1st Edition, and McGraw Hill Education.

Course Outcomes

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

CO1. **Analyze** the circuits using Kirchoff‟s laws.
CO2. **Apply** Network theorems for the simplification of circuits. .
CO3. **Apply** the Laplace transform to linear circuits and systems.
CO4. **Evaluate** transient response and steady state response.
CO5. **Determine** ABCD, Z, Y and h parameters of an electrical circuit.

B.Tech. I Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot			Practical Slot			Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark	Skill based mini project		L	T	P	
3160122	ESC	Computer Programming	60	20	20	60	20	20	200	2	1	2	4

Computer Programming (3160122)

COURSE OBJECTIVES:

- To develop the understanding of algorithms, programming approaches and program documentation techniques.
- To study the concepts of procedural and object oriented programming.
- To design and implement basic programming solutions using programming constructs.

Unit I Introduction to Programming, types of computer programming languages, Program Execution and Translation Process, Problem solving using Algorithms and Flowcharts. Introduction to C++ Programming: Data Types, Constants, Keywords, variables, input/output, Operators & Expressions, Precedence of operators.

Unit II Control Statements and Decision Making: go to statement, if statement, if-else statement, nesting of if statements, The switch statement, while loop, do...while loop, for loop, nesting of for loops, break and continue statement. Function Basics, Function Prototypes, Passing Parameter by value and by reference, Default Arguments, Recursion. Arrays: One dimensional Arrays, Multidimensional Arrays, Passing Arrays to Functions.

Unit III Strings, Pointers, Structures and File handling:, operations on Strings, Basics of Pointers & Addresses, reference variable, Pointer to Pointer, Pointer to Array, Array of Pointers, Pointer to Strings. Dynamic memory allocation using new and delete operators. Structures & Union, Pointer to Structure, Self-Referential Structures. File Concepts, Study of Various Files and Streams, operations on files.

Unit IV Object Oriented Paradigm, Features of OOPS, Comparison of Procedural Oriented Programming with Object Oriented Programming, Abstract Data Types, Specification of Class, Visibility Modes, Defining Member Functions, Scope Resolution Operator, Constructors, its types, and Destructors, Creating of Objects, Static Data Member, Static Member Function, Array of Objects, Object as Arguments, Inline Function, Friend Function.

Unit V Polymorphism: Introduction, Type of Polymorphism: Compile Time Polymorphism & Run Time Polymorphism, Function Overloading, Operator Overloading. Inheritance: Introduction, Visibility Modes, Types of Inheritance: Single Level, Multilevel, Multiple, Hybrid, Multipath.

RECOMMENDED BOOKS:

- C++ How to Program, H M Deitel and P J Deitel, Prentice Hall.
- Programming with C++, D Ravichandran, T.M.H.
- Computing Concepts with C++ Essentials, Horstmann, John Wiley.
- The Complete Reference in C++, Herbert Schildt, TMH.
- Object-Oriented Programming in C++, E Balagurusamy.
- Fundamentals of Programming C++, Richard L. Halterman.

COURSE OUTCOMES:

After completing this, the students will be able to:

- **CO1.** **Identify** situations where computational methods and computers would be useful.
- **CO2.** **Develop** algorithms and flowchart for a given problem.
- **CO3.** **Understand** the concepts of procedural programming.
- **CO4.** **Explain** the concepts of object oriented programming and its significance in the real world.
- **CO5.** **Analyze** the problems and choose suitable programming techniques to develop solutions. CO6: develop computer programs to solve real world problems.

B.Tech. I Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark		L	T	P	
3100022	DLC	BEEE Lab	-	-	-	60	40	100	-	-	4	2

Basic Electrical & Electronics Engineering Lab (3100022)

Course Objective: To provide students a foundational understanding of electrical and electronics principles and concepts, and apply them in basic electrical and electronic systems

LIST OF EXPERIMENT

1. To study multimeter & measure various electrical quantities.
2. To verify Kirchhoff‟s Current Law & Kirchhoff‟s Voltage Law.
3. To verify Superposition Theorem.
4. To determine resistance & inductance of a choke coil.
5. To determine active & reactive power in a single phase A.C circuit.
6. To determine voltage ratio & current ratio of a single phase transformer.
7. To determine the polarity of a single phase transformer.
8. To perform open circuit & short circuit test on a single phase transformer.
9. To study of constructional details of DC machine.
10. To determine the V-I characteristics of diode in forward bias & reverse bias condition.

Course Outcomes:
After the completion of the lab, the student will be able to -

CO1. **Verify** circuit theorems.
CO2. **Perform** tests on transformer for determination of losses, efficiency & polarity.
CO3. **Acquire** teamwork skills for working effectively in groups
CO4. **Prepare** an organized technical report on experiments conducted in the laboratory.

B.Tech. I Semester (Electronics Engineering)

Subject Code	Category Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
			End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Mark	Lab work & Sessional Mark		L	T	P	
3140124	DLC	Devices & Network Lab	-	-	-	60	40	100	-	-	4	2

Devices & Network Lab (3140124)

Course Objectives: Students will be able to learn the practical aspects of the basic electronic devices and also to verify the network theorems.

List of Experiment

1. Verify and plot the VI characteristic of PN junction and Zener Diode.
2. Design a half and full wave rectifier circuits.
3. Verify and plot the Input and Output characteristics of CE, CB,CC Configuration of BJT.
4. Verify and plot the Transfer and Output characteristics of CS, CG, CD Configuration of MOSFET.
5. Verification of KVL and KCL on bread board.
6. Verification of Thevenin„s & Nortons Theorems.
7. Verification of Superposition Theorem.
8. Verification of Millman's Theorem.
9. Verification of Reciprocity Theorem.
10. Verification of Maximum Power Transfer Theorem.

Course Outcome:

After completing the course, students will be able to

CO1. **Verify** the characteristics of diodes, BJT and MOSFET.
CO2. **Analyze** circuits using Kirchauff‟s laws and Network theorems.

Skill based mini project

1. Design a circuit for BJT as a switch.
2. Design a circuit for Water Level Indicator.
3. Design a circuit for LED Blinker Circuit.
4. Design a circuit for Automatic Night Light.
5. Design a circuit for verification of Thevenin theorem.
6. Design a circuit for verification of Norton theorem.
7. Design a circuit for verification of Superposition theorem.
8. Design a circuit for verification of Maximum power transfer theorem.
9. Design a circuit for verification of Reciprocity theorem.
10. Design a circuit for verification of Millman theorem.

Annexure XV

Item 21

To discuss and recommend the scheme structure and syllabi of PG Programme (M.E../M.Tech./MCA/MBA) along with their Course Outcomes (COs)

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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M. E. Communication Control &Networking (Semester – I)

Scheme of Examination

S. No.	Subject Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Periods per week			Total Credits	Mode of Exam
			Theory Slot			Practical Slot		MOOCs							
			End Sem	Mid Sem	Quiz/ Assignment	End Sem	Lab work/ Sessional	Assignment	Exam		L	T	P		
1.	600111	Computational Techniques	70	20	10	-	-	-	-	100	3	-	-	3	PP
2.	600112	Computer Communication Networks	70	20	10	-	-	-	-	100	3	-	-	3	PP
3.	600113	Communication System Design and Applications	70	20	10	-	-	-	-	100	3	-	-	3	PP
4.	600114-116	**Elective-I**	70	20	10	-	-	-	-	100	3	-	-	3	PP
5.	800102-104	***Open Category Course -1 (OC-1)**	70	20	10	-	-	-	-	100	3	-	-	3	PP
6.	600120	Project Lab- I	-	-	-	90	60	-	-	**150**	-	-	4	4	AO
7.	600121	$ Self Learning / Presentation	-	-	-	-	100	-	-	**100**	-	-	2	2	AO
		Total	**350**	**100**	**50**	**90**	**160**	-	-	**750**	**15**	-	**6**	**21**	

During labs, students have to perform practical/assignments/ minor projects related to theory subjects/theoretical concepts of respective semester using recent technologies / languages / tools etc.

***Open Category course (OC-1) will have to be opted from the pool of open courses (offered by other than parent department) and based on interdisciplinary aspects.**

$Self learning / presentation through SWAYAM / NPTEL

*Elective-I (1) Communication Protocols (600114) (2) RADAR Signal Processing (600115) (3) Adaptive Control System (600116)

**OC: (1) Soft Computing Techniques for RF Engineering (800102) (2) 5G Networks (800103) (3) Image and Video Signal Processing (800104)

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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M.E. Communication Control & Networking (Semester-II)

Scheme of Examination

S. No.	Subject Code New	Subject Name	Maximum Marks Allotted							Total Marks	Contact Periods per week			Total Credits	Mode of Exam
			Theory Slot			Practical Slot		MOOCs							
			End sem	Mid sem	Quiz/ Assignment	End Sem	Lab work/ sessional	Assignment	Exam		L	T	P		
1.	600211	Information Coding Theory	70	20	10	-	-	-	-	100	3	-	-	3	PP
2.	600212	Computer Aided Control System	70	20	10	-	-	-	-	100	3	-	-	3	PP
3.	600213	Digital Filter Design and Algorithms	70	20	10	-	-	-	-	100	3	-	-	3	PP
4.	600214-217	**#Elective-II**	-	-	-	-	-	**25**	**75**	100	3	-	-	3	MCQ
5.	800201-800203	**##Open Category Course -2 (OC-2)**	-	-	-	-	-	**25**	**75**	100	3	-	-	3	MCQ
6.	600222	Project Lab - II	-	-	-	90	60	-	-	150	-	-	2	2	AO
7.	600223	$Self Learning / Presentation	-	-	-	-	100	-	-	100			1	1	AO
		Total	**210**	**60**	**30**	**90**	**160**	**50**	**150**	**750**	**15**	**-**	**3**	**18**	

During labs, students have to perform practical/assignments/ minor projects related to theory subjects/theoretical concepts of respective semester using recent technologies / languages / tools etc.

#Elective-II course *will run through SWAYAM / NPTEL /MOOC based learning platform (with credit transfer facility)*

##Open Category course will have to be opted from the pool of open courses (offered by other than parent department) and based on interdisciplinary aspects. [This course may be run through SWAYAM/NPTEL based platform *(with credit transfer facility)* and accordingly, OC- 2 pool may be created from the list of SWAYAM/NPTEL courses) $Self learning / presentation through SWAYAM / NPTEL

#Elective-II: (1) Fundamental of Power Electronics (2) Biomedical Signal Processing (3) Power Management Integrated Circuit

##OC-2: (1) Linear Dynamical Systems (2) Sensors and Actuators

M.E. Communication Control &Networking (Semester-III)

Scheme of Examination

S. No.	Subject Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits
			Theory Slot			Practical Slot		MOOCs						
			End sem. Exam.	Mid sem.	Quiz/ Assignment	End Sem. /Practical Viva	Sessional Work/ Practical Record/ Assignment/ Quiz/ Presentation	Assignment	Exam		L	T	P	
1.	600311	**Dissertation Part-I** (Literature Review/ Problem Foundation/ Synopsis/survey paper, etc.)	-	-	-	150	100			250	-	-	10	10
2.		***MOOC Course**	-	-	-	-	-	**25**	**75**	100	-	02	-	02
		Total	**-**	**-**	**-**	**150**	**100**	**25**	**75**	**350**	**-**	**02**	**10**	**12**

***MOOC course will be treated as the course of open nature and will be decided by concerning department / BoS**

M.E. Communication Control &Networking (Semester-IV)

Scheme of Examination

S.No.	Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
			Theory Slot			Practical Slot						
			End sem. Exam.	Mid sem.	Quiz/ Assignment	End Sem. /Practical Viva	Sessional Work/ Practical Record/ Assignment/ Quiz/ Presentation		L	T	P	
1.	600411	**Dissertation Part-II**	-	-	-	300	200	500	-	-	14	14
		Total	**-**	**-**	**-**	**300**	**200**	**500**	**-**	**-**	**14**	**14**

Subject Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
		End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks		L	T	P	
600111	Computational Techniques	70	20	10	-	-	100	3	-	-	3

COMPUTATIONAL TECHNIQUES

600111/610111

Course Objectives: Build an understanding of the fundamental concepts of probability, Stochastic Process, Orthogonality, different transforms and Advanced Numerical Methods

Unit I Theory of Probability: Concept of probability, Random variable, Discrete probability distribution, Continuous probability distribution, Moment generating function, Probability density function, some special distribution, Concept of reliability.

Unit II Stochastic Process: Markov process, Markov chain, Classification of states, Matrix of transition probabilities, n-step transition probabilities, Chapma n-Kolmogorov equation, The Gambler's Ruin, Poisson processes, Birth-Death process, Markovian queuing models: M/M/1/oo, M/M/S/oo, M/M/S/N.

Unit III Inner product space: Vector space, Inner product, Complex inner product, Inner product space, Completeness, Schwarz's inequality, Complete orthonormal sets, Norm and its properties.

Unit IV Integral Transform: Z-Transform and their properties inverse Z-Transform, Convolution theorem, Solution of difference equations by Z-Transform, Basic concept of Bessel's function, Hankel transform and their properties, Parseval's theorem.

Unit V Advanced Numerical Methods: Difference equations Splines Hermite, Chebyshev& Bivariate interpolation, Fast Fourier transform classification of partial differential equations and its applications Parabolic, Hyperbolic and Elliptic equations.

Text Books:

1. Linear Algebra by Paul R Halmos, Published by The Mathematical Society of America, Jan 1, 1995.
2. Numerical Methods for Science and Engineering by R. W. Hamming, Published by Dover Publications Inc., March 1, 1987.
3. Numerical Methods for Science and Engineering by R.G Stanou.

Reference Books:

1. Operations Research an Introduction by H.A Taha, Published by Pearson Education India, January 1, 2014.
2. Introduction to Probability Models by S.M Ross, Published by Academic Press, March 9, 2019.
3. Stochastic Processes by J. Medhi, Published by New Age International Private Limited, Jan 1, 2019.

Course Outcomes:

After completion of the course, the student will be able to:

CO 1. **Build** an understanding of the fundamental concepts of probability.
CO 2. **Analyze** stochastic process.
CO 3. **Learn** orthogonality.
CO 4. **Study** different transforms.
CO 5. **Understand** advanced numerical methods.

Subject Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
		End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks		L	T	P	
600112	Computer Communication networks	70	20	10	-	-	100	3	-	-	3

COMPUTER COMMUNICATION NETWORKS

600112

To develop an understanding of computer networking basics and different components of computer networks, various protocols, modern technologies and their applications.

Unit I Computer Networks and its Standards: Computer Network, Types of Computer Networks, Network Addressing, Routing, Reliability, Interoperability and Security, Network Standards.

Unit II Network Models: Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, OSI Versus TCP/IP.

Unit III Data-Link Layer: Introduction: Nodes and Links, Services, Categories of link, Sublayers, Link Layer addressing: Types of addresses, ARP, Data Link Control (DLC) services: Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol.

Unit IV Media Access Control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. Controlled Access: Reservation, Polling, Token Passing.

Unit V Wireless LANs: Introduction: Architectural Comparison, Characteristics, IEEE 802.11: Architecture, MAC Sublayer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture, Layers, Connecting Devices: Hubs, Switches.

Text Books:

1. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.
2. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.
3. Computer Networks by Andrew S. Tanenbaum (Fifth Edition), Pearson Education.

Reference Books:

1. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.
2. Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw Hill, 2011.

Course Outcomes:

After the completion of the course, student will able to:

CO 1. **Analyze** various Computer Networks
CO 2. **Describe** Network model and their Architectures.
CO 3. **Describe** Data link layer and its protocols.
CO 4. **Illustrate** Media Access Control Systems.
CO 5. **Analyze** Wireless LAN architecture and its Connecting devices.

Department of Electronics Engineering

Subject Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
		End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks		L	T	P	
600113	Communication System Design And Applications	70	20	10	-	-	100	3	-	-	3

COMMUNICATION SYSTEM DESIGN AND APPLICATIONS
600113

Course Objectives: To understand and analyze the concepts of digital modulation techniques and communication through band limited linear filter channels.

Unit I Random Variables and Random Process: Random Variables, Discrete and Continuous random variable, PDF, CDF, properties of PDF and CDF, Joint CDF, Cauchy PDF, Rayleigh PDF, Centre limit theorem, Random process, Stationary and Non stationary random processes, Wide Sense Stationary process, Ergodic process, Gaussian process.

Unit II Digital Transmission Techniques: Geometric Representation of Signal Waveforms, Gram-Schmidt Orthogonalization procedure, BPSK ,BFSK, QPSK, DPSK, , Matched-Filter receiver, Correlation Receiver.

Unit III Communication Through Band Limited Linear Filter Channels: Baseband binary data transmission system, The Power Spectrum of the Baseband Signal, Optimum Receiver for Channels with ISI and AWGN Linear Equalization, Minimum Mean Square Error Equalizer, Adaptive Equalizer, Decision Feedback Equalization.

Unit IV Spread Spectrum Signals for Digital Communication: Principle of Spread spectrum, Pseudo noise sequence, direct sequence spread spectrum signals, Frequency hopped spread spectrum signals, Synchronization.

Unit V Multicarrier Communication: Generation and detection of OFDM, Cyclic prefix, Importance of Orthogonality, Difference between FDM and OFDM, advantages and disadvantages, applications.

Text Books:

1. John G. Proakis and MasoudSalehi, Digital Communications, Tata McGraw-Hill, 5th Edition, 2014.
2. Simon Haykin, Digital Communications, John Wiley India Pvt., Ltd, 2008.

Reference Books:

1. Richard Van Nee &Ramjee Prasad, 'OFDM for Multimedia Communications' Artech House Publication, 2001
2. Bernard Sklar, Digital communication, Pearson education, 2009.

Course Outcomes:

After the completion of the course, student will able to:

CO 1. **Analyze** random variables and random processes.
CO 2. **Explain** base band transmission and reception schemes.
CO 3. **Illustrate** communication through band limited linear filter channels.
CO 4. **Discuss** spread spectrum signals and its synchronization.
CO 5. **Describe** the generation and the processing of OFDM signals.

Subject Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
		End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks		L	T	P	
600114	COMMUNICATION PROTOCOLS	**70**	**20**	**10**	**-**	**-**	**100**	**3**	**-**	**-**	**3**

COMMUNICATION PROTOCOLS (600114)

Course Objectives: The students will be able to understand the fundamentals of Wireless Network Protocols and recent wireless technologies including Ad-hoc Networks.

Unit I Overview of Wireless Communication: Cellular Communication, Different generations and standards in Cellular Communication Systems. Wireless Network Architecture: Logical Architecture OSI Network Model, Network Layer Technologies, Data Link Layer Technologies, Physical Layer Technologies, Physical Architecture: Wireless Network Topologies, Wireless Devices.

Unit II Wireless LAN Standards: 802.11 WLAN Standards, 802.11 MAC Layer Standard, 802.11 PHY Layer, Implementing Wireless LANs: Evaluating Wireless LAN Requirements, Planning and Designing the Wireless LAN.

Unit III Wireless MAN Standards: Bluetooth (IEEE 802.15.1), Wireless USB, ZigBee (IEEE 802.15.4), IrDA, Near Field Communication. Wireless MAN Standards: IEEE 802.16 Wireless MAN Standard (WiMAX). Implementing Wireless MAN: Technical Planning.

Unit IV Ad-hoc Wireless Networks: Design Challenges in Ad-hoc wireless networks, concept of cross layer design, security in wireless networks, Energy constrained networks, MANET and WSN, Wireless Mobile Network Layer Protocol (Mobile IP, IPv6, Dynamic Host Configuration Protocol), Mobile Transport Layer Protocol (Traditional TCP, Classical TCP improvements).

Unit V Recent Wireless Technologies: multicarrier modulation, OFDM, MIMO system, diversity multiplexing trade-off, MIMO-OFDM system, Smart-antenna, Beamforming and MIMO, Cognitive radio, Software defined radio, Communication relays, Spectrum sharing.

Text Books:

1. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005.
2. Steve Rackley, "Wireless Networking Technologies: From Principles to Successful Implementation", Newness Publication, 2007.
3. Sanjay Kumar, "Wireless Communication the Fundamental and Advanced Concepts" River Publishers, Denmark, 2015 (Indian reprint).

Reference Books:

1. Vijay K Garg, "Wireless Communications and Networks", Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009 (Indian reprint)
2. J. Schiller, "Mobile Communication", Pearson Education, 2012.
3. ItiSahaMisra, "Wireless Communication and Networks: 3G and Beyond", McGraw Hill Education (India) Private Ltd, New Delhi, 2013.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1. **Explain** basics of Network Architecture.
CO 2. **Implement** Wireless LAN for Corresponding Protocols.
CO 3. **Analyze** PAN and MAN Wireless Network Protocols.
CO 4. **Understand** Ad-hoc Network and Mobile Network Technology.
CO 5. Illustrate Recent Wireless Technologies**.**

Subject Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
		End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks		L	T	P	
600115	Elective-I	70	20	10	-	-	100	3	-	-	3

RADAR SIGNAL PROCESSING
600115/610115

Course Objectives: To understand and analyze the concepts of Radar signal processing which includes Radar signals and Networks, Pulse Compression, Range Resolution, Detection and Measurements.

Unit I Radar Signals and Networks: Real Radar Signals, Complex Radar Signals, Analytic Radar Signals, Duration Frequency and Bandwidth of signal, Transmission of signal through Networks, Match Filter for Non white Noise, Match filter for white noise, Ambiguity Function.

Unit II Pulse Compression with Radar Signals: Liner FM Pulse, Mismatch Filter for Sidelobe Control, Signal Design for Low Sidelobes, Example Signal Designs, Other Pulse Compression Waveforms, Pulse Compression by Costas FM, Pulse Compression by Binary Coding.

Unit III Radar Resolution: Range Resolution, Doppler Frequency Resolution, Simultaneous Rang and Doppler Resolution, Resolution and RMS Uncertainty, Overall Radar and Angle Resolution.

Unit IV Radar Detection: Bayes's Concepts, Detection Criteria for Several Target Models, Detection of Known Target, Detection of Steady Target with Random Initial Phase, Detection of Steady Target with N Pulse having Random Phases, Detection of Targets with Pulse-to-Pulse Fluctuation, Binary Detection, Detection in Clutter.

Unit V Radar Range Measurement: Parameter Estimation, Cramer-Rao Bound, Limiting Accuracies of Radar Measurements, Range from Delay Measurements, Filter Mismatch and Fine-Line Measurements.

Text Books:

1. Peyton Z. Peebles Jr, "Radar Principles", John Wiley, 2004.
2. Mark. A. Richards, "Fundamentals of Radar Signal Processing", TMH, 2005.

Reference Books:

1. Fred E. Nathanson, "Radar Design Principles: Signal Processing and the Environment", 2nd ed., PHI, 1999.
2. Mark. A. Richards, "Fundamentals of Radar Signal Processing", TMH, 2005.
3. R. Nitzberg, "Radar Signal Processing and Adaptive Systems", Artech House, 1999.
4. M.I. Skolnik, "Introduction to Radar Systems", 3rd ed., TMH, 2001.

Course Outcomes:

After the completion of the course, student will able to:

CO 1. **Analyze** the Radar Signals and Networks**.**
CO 2. **Describe** the Pulse Compression in Radar Signals Processing.
CO 3. **Calculate** the Radar Resolution.
CO 4. **Estimate** the Radar Signals.
CO 5. **Explain** the Radar Range Measurement and Limiting Accuracies of Radar.

Subject Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
		End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks		L	T	P	
600116	Elective-I	70	20	10	-	-	100	3	-	-	3

ADAPTIVE CONTROL SYSTEM (600116)

Course Objectives: The students will be able to understand the concepts of Control Systems, Mathematical Modeling and analyze the behavior of Adaptive Control systems.

Unit I State Space Analysis: Concepts of State, State variables, State Model of Linear Systems, State Space Representation using Physical Variables, State Space Representation using Phase Variables, Decomposition of Transfer Function, Diagonalization.

Unit II Solution of State Equation: State Transition Matrix and State Transition Equation, Computation of the State Transition Matrix, Transfer Function from the State Model, Stability, Controllability and Observability of Linear Systems.

Unit III Adaptive Control: Linear Feedback, Effects of Process Variations, Adaptive Schemes- Gain Scheduling, Model Reference Adaptive Systems, Self Tuning Regulators, Dual Control, Applications of Adaptive Control.

Unit IV Real Time Parameter Estimation: Least Squares and Regression Models, Estimating Parameters in Dynamical Systems, Experimental conditions, Simulation of Recursive Estimation, Prior information.

Unit V Z-Plane Analysis of Discrete Time Control Systems: Impulse Sampling and Data Hold, Reconstructing Original Signal from Sampled Signals, Mapping Between S Plane and Z Plane, Concept of Pulse Transfer Function, Stability Analysis of Closed-Loop Systems in the Z-Plane, Jury Stability Test.

Text Books:

1. Katsuhiko Ogata, "Modern Control Engineering" 5th Edition, Prentice Hall, 2010
2. M. Gopal, "Modern Control System Theory" Revised 2nd Edition New Age International Publishers, 2005
3. Karl J. Astron and Bjorn Wittenmark, " Adaptive Control" 2nd Edition, Dover Publications, 2008
4. Katsuhiko Ogata " Discrete Time Control Systems" 2nd Edition Pearson Education,2002

Reference Books:

1. H. K. Khalil, "Nonlinear Systems", Pearson India, 2019
2. Gang Tao, "Adaptive Control Design and Analysis" Wiley, 2003
3. G. Feng and R. Lozano, "Adaptive Control Systems" Oxford University Press, 1999.

Course Outcomes:

After completion of the course, the student will be able to:

CO 1. **Apply** the State Space Techniques in Control Systems.
CO 2. **Design** the Compensators to meet the Control System specifications.
CO 3. **Demonstrate** the behavior of Adaptive Control System.
CO 4. **Analyze** the Adaptive Model for Control System.
CO 5. **Derive** Discrete-Time Mathematical Models in Z Domain.

Subject Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
		End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks		L	T	P	
600117	OC I	70	20	10	-	-	100	3	-	-	3

SOFT COMPUTING TECHNIQUES FOR RF ENGINEERING 600117/610117

Course Objective: To make students understand about the application of Neural Network techniques for RF circuits modelling.

Unit IModelling and Optimization for RF Design: The Design Process: Anatomy of the Design Process, Conventional Design Procedures, CAD Approach, Knowledge-Aided Design (KAD) Approach, RF and Microwave Circuit CAD, Modelling of Circuit Components, Computer-Aided Analysis Techniques , Circuit Optimization, CAD for Printed RF and Microwave Antennas, Role of ANN's in RF and Microwave CAD.

Unit II Neural Network Structures: Generic Notation, Highlights of the Neural Network Modelling Approach, Multilayer Perceptrons (MLP), Radial Bias Function Networks (RBF), Comparison of MLP and RBF Neural Network and Self-Organizing Maps, Recurrent Neural Networks.

Unit III Training of Neural Networks: Key Issues in Neural Model Development, Neural Network Training, Back Propagation Algorithm and Its Variants, Non gradient-Based Training: Simplex Method, Training with Global Optimization Methods, , Feed forward Neural Network Training.

Unit IV Modelling for RF and Microwave Components-I: Modelling Procedure, Selection of Model Inputs and Outputs, Training Data Generation, Error Measures, Integration of EM- ANN Models with Circuit Simulators, Microstrip Transmission Line Model ,Broadband, Stripline-to-Stripline Multilayer Interconnect, Integration of EM-ANN Models with a Network Simulator.

Unit V Modelling for RF and Microwave Components-II: EM-ANN Models for CPW Components, EM-ANN Modelling of CPW Transmission Lines, CPW Symmetric T-junctions, Microstrip Patch Antennas and Waveguide Filter Components

Text Book:

1. Q J Zhang, K C Gupta,Neural Networks for RF and Microwave Design, Artech House, 2000.

Reference Books:

1. Rajasekaran and G. A. VijaylakshmiPai S. Neural Networks Fuzzy Logic, and Genetic Algorithms, Prentice Hall of India. 2003
2. Christos Christodoulou, Michael Georgiopoulos, Application of Neural Networks in Electromagnetics, Artech House Publication,2001

Course Outcomes:

After the completion of the course, student will able to:

CO 1. **Illustrate** the concept of Modelling and Optimization for RF Design.
CO 2. **Explain** Neural Network Structures.
CO 3. **Evaluate** the performance of Neural Networks.
CO 4. **Describe** RF and Microwave circuits.
CO 5. **Apply** Neural Network techniques for the Modelling of RF and Microwave Components.

Subject Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
		End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks		L	T	P	
600118	OC I	70	20	10	-	-	100	3	-	-	3

5G NETWORKS

600118/610118

Course Objective: To analyze the concepts of 5G communications, networking transmission with multiple access techniques, millimeter-wave communications and device-to-device type communications.

Unit I Overview of 5G Broadband Wireless Communications: Introduction of Networks, LAN,WAN,MAN,TCP/IP Protocol, Application of TCP/IP Protocols, Evolution of Mobile Technologies 1G to 4G, Need of 5G, Regulations ,Spectrum Analysis and Sharing for 5G Technology.

Unit II Wireless Propagation Channels and Transmission: Channel Modeling Requirements, Propagation Scenarios and Challenges in the 5G Modeling, Channel Models for MIMO Systems, Basic Requirements for 5G Technology.

Unit III Multiplexing Techniques for 5G: Orthogonal Frequency Division Multiplexing (OFDM), Generalized Frequency Division Multiplexing (GFDM), Filter Bank Multi- Carriers (FBMC) and Universal Filtered Multi-Carrier (UFMC) Techniques.

Unit IV Multiple Accesses Techniques for 5G: Orthogonal Frequency Division Multiple Accesses (OFDMA), Generalized Frequency Division Multiple Accesses (GFDMA), Non-Orthogonal Multiple Accesses (NOMA). Millimeter Wave Communications: Spectrum Regulations, Deployment Scenarios, Beam-Forming, Physical Layer Techniques, Interference Management.

Unit V Device-to-Device (D2D) and Machine-to-Machine (M2M) Type Communications: Extension of 4G D2D Standardization to 5G, Radio Resource Management for Mobile Broadband D2D, Multi-Hop and Multi-Operator D2D Communications.

Textbooks:

1. Martin Sauter "From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband", Wiley-Blackwell, 3rd Edition.
2. AfifOsseiran, Jose.F.Monserrat, Patrick Marsch, "Fundamentals of 5G Mobile Networks", Cambridge University Press, 1st Edition.
3. Theodore S. Rappaport, Robert W. Heath, Robert C. Danials, James N. Murdock "Millimeter Wave Wireless Communications", Prentice Hall Communications, 2nd Edition.

References Books:

1. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", John Wiley & Sons, 1995.
2. Athanasios G. Kanatos, Konstantina S. Nikita, Panagiotis Mathiopoulos, "New Directions in Wireless Communication Systems from Mobile to 5G", CRC Press, 2017.

Course Outcomes:

After the end of the course the student will be able to

CO 1. **Compare** Mobile Technologies.
CO 2. **Describe** 5G Wireless Propagation Channels and Transmission.
CO 3. **Explain** Multiplexing Techniques for 5G.
CO 4. **Illustrate** the Multiple Access Techniques & Millimeter Wave Communication for 5G.
CO 5. **Understand** the Device-to-Device and Machine-to-Machine Communications.

Subject Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
		End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks		L	T	P	
600119	OC I	70	20	10	-	-	100	3	-	-	3

IMAGE AND VIDEO SIGNAL PROCESSING

600119/610119

Course Objectives: The objective of this course to provide in depth knowledge various approaches of image and video processing with knowledge of transform domain as well.

Unit I Introduction to Image Processing System: Image sampling, Quantisation, Classification of Digital Images, Image file formats, 2-D Signals, 2D systems, 2D convolution, correlation.

Unit II Image Transforms: 2D Z-transforms, 2-D DFT, Walsh Transform, Hadamard Transform, Haar Transform, Discrete Cosine Transform, Karhunen-Loeve Transform (KL transform).

Unit III Image Enhancement, Restoration and Denoising: Image Enhancement in Spatial Domain, Enhancement through Point Operation, Histogram Manipulation, Gray-level Transformation, Local operation, Median filter, Bit-plane slicing, Image Enhancement in frequency domain. Image Degradation, Types of Blur, Image Restoration model, Linear and Non-Linear Restoration Techniques, Blind Deconvolution, Image Denoising.

Unit IV Video processing: Basics of Analog and Digital Video, Color Video formation and Specification, Analog TV Systems, Video Raster, Digital Video formats, Frequency domain analysis of Video Signals, Spatial and Temporal frequency response of the human visual system.

Unit V Video Compression and Motion Estimation: Multimedia Information Representation, Text and Image Compression, Standards for Multimedia Communications, 2D Motion Estimation, Optical Flow Equation, Different Motion Estimation methods, Basic Compression Techniques, Information bounds for Lossless and Lossy Source Coding, Binary Encoding, Scalar/Vector Quantization.

Text Books:

1. Jayaramana S, Veerakumar T, et al, Digital Image Processing, McGraw Hill Education, 1st edition, 2017.
2. A Murat Tekalp, Digital Video Processing, Pearson Education, 2010.

Reference Books:

1. Ralph Gonzalez, Richard Woods, et al, Digital Image Processing, McGraw Hill Education, 2nd edition, 2017
2. SuhelDhanani and Michael Parker, Digital Video Processing for Engineer, Newnes Publication, 2012.

Course Outcomes:

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

CO 1. **Differentiate** between Image, Signal and Video Processing.
CO 2. **Analyze** the principal working of various transform on the Images.
CO 3. **Implement** Image enhancement techniques.
CO 4. **Examine** the fundamental principal of video processing.
CO 5. **Implement** Video compression and Motion estimation techniques.

Subject Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
		End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks		L	T	P	
600211	Information Coding Theory	70	20	10	-	-	100	3	-	-	3

INFORMATION CODING THEORY (600211)

Course objective: To acquire knowledge about Information Coding Theory and techniques.

Unit I Source Coding & Galois Field: Extension of Zero memory Source Coding Markov Sources, Discrete Channel with Discrete Noise, Discrete Channel with Continuous Noise, Group, Fields, Construction & properties of Galois field GF (2^m), Vector Space and Matrices.

Unit II Linear Block & Cyclic Code: Non Systematic & Systematic Code, Generator & Parity check matrices, Properties of Generator polynomial, Encoders, Syndrome & Error detection, Minimum Distance and Error Detecting & Correcting capabilities, Standard array & Syndrome Decoding, Meggitt Cyclic Decoder, Hamming Coded, Shortened Cyclic Code.

Unit III BCH Codes: Description, Generator Polynomial, Parity check matrix, Decoding of BCH Code, Algorithm for finding the Error location Polynomial, Implementation of Galois field Arithmetic, Non Binary BCH code and Reed Solomon Code, Reed - Muller Code, Interleave.

Unit IV Convolution Codes: Encoder for Systematic & Non Systematic Code, Generator Matrix, Generator Polynomial, State diagram and Tree, Structural & Distance Properties, Maximum likelihood Decoding, Viterbi algorithm, Code Performance Sequential Decoding, Majority logic Decoding of Convolution Code. Burst - Error Correct Convolution Code.

Unit V Turbo codes: Low Density Parity Check Codes, Decoding of Low Density Parity Check Codes, Turbo Codes, Turbo decoding, Distance Properties of Turbo Codes, Convergence of Turbo Codes, Automatic Repeat Request Schemes, Applications of Linear Codes.

Text Books:

1. Shu Lin and Daniel J. Costello, Jr., "Error Control Coding", Second edition, Prentice Hall, 2004.
2. Das Mullick&Chatterjee, Principle of Digital Communication, Wiley, 1986.
3. Richard Wesley, Coding and Information Theory, Prentice-Hall, 1980.

Reference Books:

1. Todd K. Moon, "Error Correction Coding", 1st Edition, Wiley-Interscience, 2006.
2. F. J. MacWilliams, N. J. A. Sloane, "The Theory of Error-Correcting Codes", North-Holland, Amsterdam, 1977
3. R. E. Blahut, "Algebraic Codes for Data Transmission", 1st Edition, Cambridge University Press 2003.
4. Cary W. Huffman, Vera Pless, "Fundamentals of Error-Correcting Codes", 1st Edition, Cambridge University Press, 2003.

Course Outcomes:

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

CO 1. **Explain** the Concepts of Source Coding and Galois field GF (2^m).
CO 2. **Implement of** BCH code and Reed Solomon Code.
CO 3. **Compute** Entropy, Channel Capacity, Bit Error Rate, Code Rate, Steady-State Probability.
CO 4. **Design** the Encoder and Decoder of Convolution Code.
CO 5. **Apply** the Mathematical tools for Designing Error Correcting Codes including finite fields.

Subject Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
		End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks		L	T	P	
600212	Computer Aided Control System	70	20	10	-	-	100	3	-	-	3

COMPUTER AIDED CONTROL SYSTEM (600212)

Course Objectives: To understand the basics of computer-based control system, Adaptive control, ANN with designing of ladder logics for process control applications using PLC, and Fuzzy Controllers.

Unit I Computer Based Control Systems: Computer-based measurement and control systems, Basic components, Architecture and Hardware of computer-based process control system, Role of computers in process control, Human Machine Interface, and Interfacing computer system with process.

Unit II Programmable Logic Controllers (PLC): Introduction of programmable controllers, Continuous versus Discrete Process Control, ladder diagram using standard symbols, Architecture of PLC, PLC ladder diagram and instructions, PLC Programming for process control applications.

Unit III Adaptive Control: Introduction, close loop and open loop adaptive control, Self-tuning controller, parameter estimation using least square and recursive least square techniques; Gain scheduling; Model Reference Adaptive Control (MRAC); Self Tuning Regulators, Adaptive Smith predictor control: Auto tuning and self-tuning Smith predictor.

Unit IV Artificial Neural Network (ANN) Based Control: Representation and identification, modeling the plant, control structures– supervised control, Model reference control, Internal model control, Predictive control, Indirect and direct adaptive controller design using neural network.

Unit V Fuzzy Logic Based Control: Fuzzy Controllers: Preliminaries–Mamdani and Sugeno inference methods, Fuzzy sets in commercial products – basic construction of fuzzy controller – fuzzy PI,PD and PID control; analysis of static properties of fuzzy controller – Analysis of dynamic properties of fuzzy controller – simulation studies – case studies - Stability issues in fuzzy control.

Text Books:

1. Astrom .K, Adaptive Control, Second Edition, Pearson Education Asia Pvt. Ltd, 2002.
2. Shivanandan, Introduction to Artificial Neural Network with MATLAB 6.0.1, ThirdEdition,McGraw Hill India Ltd, 2015.

Reference Books:

1. Gary Dunning and Thomson Delmar, "Programmable Logic Controller", Ceneage Learning, 3rd Edition, 2005.
2. C. D. Johnson, "Process Control Instrumentation Technology", Prentice Hall India, 8th Edition, 2006.

Course Outcomes:

After the completion of the course, student will able to:

CO 1. **Explain** the fundamental principle of Computer based Control System.
CO 2. **Design** ladder logics of process control applications using PLC.
CO 3. **Describe** the principal of Adaptive Controls.
CO 4. **Estimate** the parameters of control system using ANN.
CO 5. **Design** fuzzy controllers.

Subject Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
		End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks		L	T	P	
600213	Digital Filter Design And Algorithms	70	20	10	-	-	100	3	-	-	3

DIGITAL FILTER DESIGN AND ALGORITHMS (600213)

Course Objectives: Understanding of the concepts of digital signal processing and able to apply DSP algorithms.

Unit I Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT): Discrete Fourier Transform and its Properties, Efficient Computation of DFT using FFT algorithms, Radix -4 decimation in time algorithm (DIT FFT), Radix -4 decimation in frequency algorithm (DIF FFT), Split Radix.

Unit II Design of Digital Filters: Design of IIR filters using bilinear transformation, impulse invariance methods and derivative method, IIR filter design using Butterworth Approximation, FIR filter design using Rectangular window, Hanning window, Hamming window, Triangular window, Blackman window and Kaiser Window methods. FIR filters design using Fourier series method.

Unit III MultiMate Signal Processing: Decimation and interpolation, Polyphase decomposition, Uniform DFT filter banks, Quadrature mirror filters and Perfect reconstruction.

Unit IV Adaptive Signal Processing: Time adaptive systems, LMS algorithm. Recursive least squares (RLS) algorithms, Least square lattice (LSL) algorithm.

Unit V Analysis of Finite Word-length Effects: Introduction, the quantization process and errors, Analysis of coefficient quantization effects in FIR filters, A/D conversion noise analysis, Dynamic range scaling, Low sensitivity digital filters, Applications: Dual-tone multi frequency signal detection, Spectral analysis using DFT, Short term DFT.

Text Books:

1. Proakis, J.G. and Manolakis, D.G., Digital Signal Processing, Prentice-Hall of India Private Limited (1996).
2. Antonion, A., Digital Filters: Analysis Design and Application, Prentice-Hall of India Private Limited (1999). Oppenheim, A.V. and Schafer, R.W., Digital Signal Processing, Prentice-Hall of India Private Limited (1998)

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:

CO 1. **Compute** DFT using FFT algorithms.
CO 2. **Design** digital filters.
CO 3. **Understand** the concept of multi-rate signal processing in practical applications.
CO 4. **Apply** various algorithms in DSP application.
CO 5. **Analysis** of Finite Word-length Effects.

Subject Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
		End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks		L	T	P	
600120	Project Lab-I	-	-	-	90	60	150	-	-	4	4

PROJECT LAB-I
600120

To simulate following programs using MATLAB script:

1. Probability density function (PDF) of Rayleigh and Rician fading channel model.
2. Bit error rate (BER) computation of BPSK in Rayleigh fading channel.
3. Bit error rate (BER) computation of 16PSK in AWGN channel.
4. Power spectral density (PSD) of Line codes.
5. Design of digital low pass FIR filter using window technique.
6. Design of digital high pass FIR filter using window technique.
7. Design of digital band pass FIR filter using window technique.
8. Design of digital FIR differentiator using window technique.

Course Outcome:

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

CO 1. **Simulate** the fading channel models.
CO 2. **Compare** the simulated BER with the theoretical BER for digital modulation schemes.
CO 3. **Compare** the PSD of Line coding schemes.
CO 4. **Design** FIR filters for specific applications.

Subject Code	Subject Name	Theory Slot			Practical Slot		Total Marks	Contact Hr/week			Total Credits
		End Sem Marks	Mid Sem Marks	Quiz/ Assignment Marks	End Sem Marks	Lab work & Sessional Marks		L	T	P	
600222	Project Lab-II	-	-	-	90	60	150	-	-	4	4

PROJECT LAB-II 600222

1. Design and fabricate Pulse Amplitude /Pulse Time Modulation and Demodulation.
2. Fabricate Binary Frequency Shift Keying.
3. Implementation of multiplexer and de-multiplexer of digital signals using TDM.

Course Outcome:

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

CO 1. **Implement** modulation and demodulation techniques.

CO 2. **Design** multiplexer and de-multiplexer

Annexure XVI

Item 22

To recommend the scheme structure and Syllabus of Ph.D. Course Work (specific to doctoral research Scholars, if any)

As per Ph.D. New Ordinence Notification No: F5/RGPV/Acad/2019/996 dated 2/5/2015

PhD

Course work Admitted in Academic Session 2022-2023

Subject wise distribution of marks and corresponding credits

S.No.	Subject Name	Maximum Marks Allotted					Total Marks	Contact Periods/ week			Total Credits
		Theory Slot			Practical Slot						
		End sem	Mid sem	Quiz/ Assignment	End Sem	Lab work/ sessional		L	T	P	
1.	Research Methodology	70	20	10	-	-	100	3	1	-	4
2.	Area Specific Subject	70	20	10	-	-	100	3	1	-	4
3.	Swayam NPTEL course*	75	-	25	-	-	100	3	1	-	4
4	Lab	-	-	-	60	40	100	-	-	4	2
Total		215	40	45	60	40	400	9	3	4	14

*** As per availability and recommended by Supervisor, Marks will be provided by NPTEL.**